Product Submittal/Substitution Request

TO:

PROJECT:

PROJECT LOCATION:

SPECIFIED ITEM:

Section | Page | Paragraph | Description

PRODUCT SUBMIT TAL / SUBSTITUTION REQUESTED:

DEWALT® Engineered By Powers® Pure110+(R) -

The attached submittal package includes the product description, specifications, drawings, and performance data for use in the evaluation of the request.

SUBMITTED BY:

Name: Signature:

Company:

Address:

Date: Telephone: Fax:

FOR USE BY THE ARCHITECT AND/OR ENGINEER

☐ **Approved** ☐ **Approved as Noted** ☐ **Not Approved**

(If not approved, please briefly explain why the product was not accepted.)

By: Date:

Remarks:

Questions or inquiries? Contact us at engineering@powers.com, or call 1.800.524.3244

DEWALT® Pure110+(R) Submittal Section:

Product Pages:

- General Information
- Design Tables
- Installation Instructions
- Ordering Information

Code Reports & Agency Listings:

- ICC–ES Approval: ESR–3298 (Cracked & Uncracked Concrete)

GENERAL INFORMATION

PURE110+®

Epoxy Injection Adhesive Anchoring System
and Post-Installed Reinforcing Bar Connections

PRODUCT DESCRIPTION

The Pure110+ is a two-component, high strength adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The Pure110+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in concrete and masonry base materials and for post-installed reinforcing bar connections.

Pure110+ has the same bond strength at room temperature and at 110ºF.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry and wet holes, including water filled and submerged
- Can be installed in a wide range of base material temperatures
- Cracked and uncracked concrete
- Seismic and wind loading
- Oversized hammer-drilled holes in concrete, for short term loading only (contact DEWALT for details)

FEATURES AND BENEFITS

+ Designed for use with threaded rod and reinforcing bar hardware elements
+ Evaluated and recognized for freeze/thaw performance
+ Cartridge design allows for multiple uses using extra mixing nozzles
+ Mixing nozzles proportion adhesive and provide simple delivery method into drilled holes
+ Evaluated and recognized for long term and short term loading (see performance tables)
+ Same bond strength at room temperature and at 110ºF.

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-3298 for cracked and uncracked concrete
- Code Compliant with 2018 IBC/IRC, 2015 IBC/IRC, 2012 IBC/IRC, 2009 IBC/IRC
- Conforms to requirements of ASTM C 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C (also meets Type III except for elongation)
- Department of Transportation listings – see www.DEWALT.com or contact transportation agency
- Tested in accordance with ACI 355.4, ASTM E 488, and ICC-ES AC308 for use in structural concrete (Design according to ACI 318-14, Chapter 17 and ACI 318-11/08 Appendix D)
- Tested and qualified for use in post-installed reinforcing bar connections
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading
- Compliant with NSF/ANSI 61 for drinking water system components - health effects; minimum requirements for materials in contact with potable water and water treatment

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors, 04 05 19.16 Masonry Anchors and 05 05 19 Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure110+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

TENSION ZONE CRACKED CONCRETE · SEISMIC REGION QUALIFICATION · TESTED AND VALIDATED WaterQuality UNDER INDUSTRY STANDARDS · CODE LISTED ICC-ES ESR-3298 CONCRETE · DDA DEWALT DESIGN ASSIST · DUST X+ ANCHOR INSTALLATION SYSTEM

SECTION CONTENTS

PACKAGING

Coaxial Cartridge

- 9 fl. oz. (265 ml or 16.2 in³)

Dual (side-by-side) Cartridge

- 20.5 fl. oz. (610 ml or 37.8 in³), 1:1 mix ratio
- 50.5 fl. oz. (1500 ml or 92.1 in³), 1:1 mix ratio
- 13 fl. oz. (385 ml or 23.5 in³), 3:1 mix ratio
- 19.5 fl. oz. (585 ml or 35.7 in³), 3:1 mix ratio

STORAGE LIFE & CONDITIONS

Dual cartridge: Two years
Coaxial cartridge: Eighteen months
In a dry, dark environment with temperature ranging from 41°F to 86°F (5°C to 30°C)

ANCHOR SIZE RANGE (TYPICAL)

- 3/8" to 1-1/4" diameter threaded rod
- No. 3 to No. 11 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete
- Grouted Concrete Masonry
- Hollow Concrete Masonry

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry concrete
- Water-saturated concrete (wet)
- Water-filled holes (flooded)
- Underwater concrete (submerged)

REFERENCE DATA (ASD)

Installation Table for Pure110+ (Solid Concrete Base Materials)

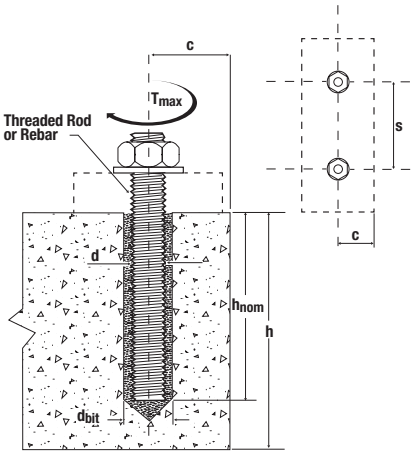
Dimension/Property	Notation	Units	Nominal Anchor Size									
Threaded Rod	-	-	3/8	1/2	-	5/8	3/4	7/8	1	-	1-1/4	-
Reinforcing Bar	-	-	#3	-	#4	#5	#6	#7	#8	#9	-	#10
Nominal anchor diameter	d	in. (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.5)	1.000 (25.4)	1.125 (28.6)	1.250 (31.8)	1.250 (31.8)
Carbide drill bit nominal size[3]	d_{bit}	in.	7/16 ANSI	9/16 ANSI	5/8 ANSI	11/16 or 3/4 ANSI	7/8 ANSI	1 ANSI	1-1/8 ANSI	1-3/8 ANSI	1-3/8 ANSI	1-1/2 ANSI
Minimum embedment	h_{nom}	in. (mm)	2-3/8 (61)	2-3/4 (70)		3-1/8 (80)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Minimum spacing distance	s_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Minimum edge distance	c_{min}	in. (mm)	1-7/8 (48)	2-1/2 (62)		3-1/8 (80)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159
Maximum torque[1]	T_{max}	ft.-lb. (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (223)	200 (270)	280 (379)	280 (379)
Maximum torque (low strength rods)[1,2]		ft.-lb. (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-

1. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
2. These torque values apply to ASTM A 36 / F 1554, Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
3. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drilled hole without resistance.

Installation Table for Pure110+ (Hollow Base Material with Screen Tube)

Dimensions/property	Notation	Units	Nominal Size - Plastic			
			3/8"	1/2"	5/8"	3/4"
Nominal threaded rod diameter	d	in (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.0)
Nominal screen tube diameter	-	in.	3/8	1/2	5/8	3/4
Nominal diameter of drilled hole	d_{bit}	in.	9/16 ANSI	3/4 ANSI	7/8 ANSI	1 ANSI
Maximum torque (only possible after full cure time of adhesive)	T_{max}	ft.-lb. (N-m)	10 (8)	10 (8)	10 (8)	10 (8)

Detail of Steel Hardware Elements used with Injection Adhesive System



Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drilled hole
h = Base material thickness
The greater of:
[h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
h_{nom} = Minimum embedment depth

Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon Steel	A 36 or F1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5.8	3/4 through 1-1/4	58.0	72.5
Stainless Steel	F 593, Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/A193M Grade B8/B8M2, Class 1	3/4 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 3/4 (#3 through #6)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Ultimate and Allowable Load Capacities for Pure110+ Installed with Threaded Rod into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Rod Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength			
			f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
3/8	7/16	3-3/8 (85.7)	10,445 (46.5)	2,610 (11.6)	10,445 (46.5)	2,610 (11.6)
1/2	9/16	4 1/2 (114.3)	17,470 (77.7)	4,370 (19.4)	20,225 (90.0)	5,055 (22.5)
5/8	11/16 or 3/4	5-5/8 (142.9)	23,335 (103.8)	5,835 (26.0)	28,600 (127.2)	7,150 (31.8)
3/4	7/8	6-3/4 (171.5)	36,255 (161.3)	9,065 (40.3)	40,930 (182.1)	10,235 (45.5)
7/8	1	7-7/8 (200.0)	46,275 (205.8)	11,570 (51.5)	52,920 (235.4)	13,230 (58.8)
1	1-1/8	9 (228.6)	57,015 (253.6)	14,255 (63.4)	79,295 (352.7)	19,825 (88.2)
		10 (254.0)	77,445 (344.5)	19,360 (86.1)	82,745 (368.1)	20,685 (92.0)
1-1/4	1-3/8	11-1/4 (285.8)	91,885 (408.7)	22,970 (102.2)	98,170 (436.7)	24,545 (109.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water-saturated concrete (wet) or in water-filled holes (flooded) require a 15% reduction in capacity. Installations in underwater concrete (submerged) require a 30% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Ultimate and Allowable Load Capacities for Pure110+ Installed with Reinforcing Bar into Normal Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Bar Diameter d #	Drill Diameter dbit in.	Minimum Embedment Depth in. (mm)	Minimum Concrete Compressive Strength			
			f'c = 3,000 psi (20.7 MPa)		f'c = 4,000 psi (27.6 MPa)	
			Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)	Ultimate Tension Load Capacity lbs. (kN)	Allowable Tension Load Capacity lbs. (kN)
#3	7/16	3-3/8 (85.7)	11,155 (49.6)	2,790 (12.4)	11,155 (49.6)	2,790 (12.4)
#4	9/16	4-1/2 (114.3)	17,735 (78.9)	4,435 (19.7)	19,200 (85.4)	4,800 (21.4)
#5	11/16 or 3/4	4 (101.6)	16,740 (74.5)	4,185 (18.6)	16,910 (75.2)	4,230 (18.8)
		5-5/8 (142.9)	23,420 (104.2)	5,855 (26.0)	25,705 (114.3)	6,425 (28.6)
#6	7/8	6-3/4 (171.5)	34,266 (152.4)	8,565 (38.1)	40,775 (181.4)	10,195 (45.3)
#8	1-1/8	9 (228.6)	55,140 (245.3)	13,785 (61.3)	72,575 (322.8)	18,145 (80.7)

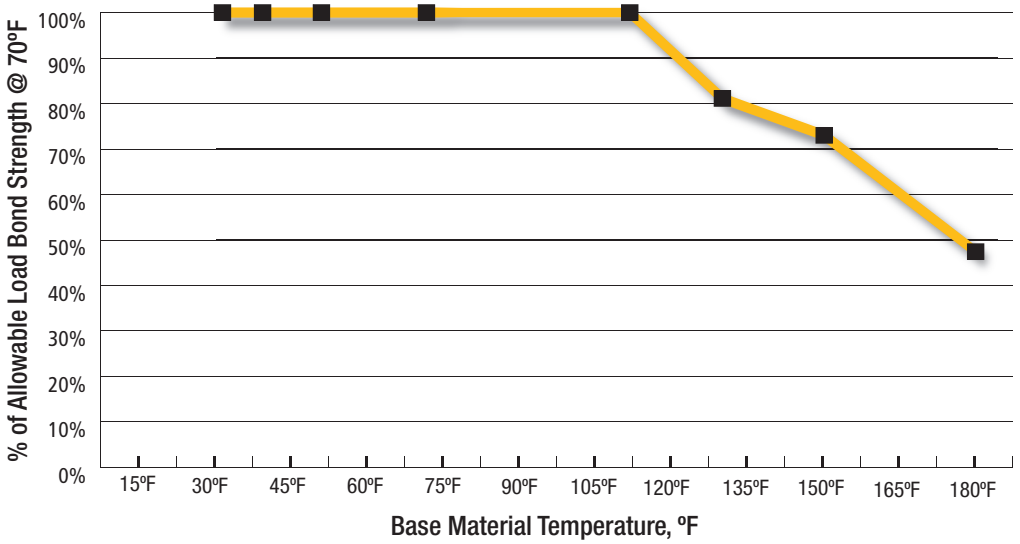
1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is The greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}].
4. The tabulated load values are applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water-saturated concrete (wet) or in water-filled holes (flooded) require a 15% reduction in capacity. Installations in underwater concrete (submerged) require a 30% reduction in capacity. Contact DEWALT for more information concerning these installation conditions.
5. Adhesives experience reductions in capacity at elevated temperatures. See the in-service temperature chart for allowable load capacity reduction factors.
6. Allowable bond strength/concrete capacity must be checked against allowable steel strength in tension to determine the controlling allowable load.
7. Allowable shear capacity is controlled by allowable steel strength for the given conditions.

Allowable Load Capacities for Threaded Rod and Reinforcing Bar (Based on Steel Strength)[1,2,3,4,5]

Nominal Rod Diameter or Rebar Size (in. or #)	Steel Elements - Threaded Rod and Reinforcing Bar																	
	A36 or F1554, Grade 36		A36 or F1554, Grade 55		A 193, Grade B7 or F1554, Grade 105		F 593, CW (SS)		ASTM A615 Grade 40 Rebar		ASTM A615 Grade 60 Rebar		ASTM A706 Grade 60 Rebar		ASTM A615 Grade 75 Rebar		ASTM A706 Grade 80 Rebar	
	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)	Tension lbs. (kN)	Shear lbs (kN)
3/8 or #3	2,115 (9.4)	1,090 (4.8)	2,735 (12.2)	1,410 (6.3)	4,555 (20.3)	2,345 (10.4)	3,645 (16.2)	1,880 (8.4)	2,210 (9.8)	1,125 (5.0)	2,650 (11.8)	1,690 (7.5)	2,650 (11.8)	1,500 (6.7)	2,650 (11.8)	1,875 (8.3)	2,650 (11.8)	1,875 (8.3)
1/2 or #4	3,760 (16.7)	1,935 (8.6)	4,860 (21.6)	2,505 (11.1)	8,100 (36.0)	4,170 (18.5)	6,480 (28.8)	3,340 (14.9)	3,925 (17.5)	2,005 (8.9)	4,710 (21.0)	3,005 (13.4)	4,710 (21.0)	2,670 (11.9)	4,710 (21.0)	3,335 (14.8)	4,710 (21.0)	3,335 (14.8)
5/8 or #5	5,870 (26.1)	3,025 (13.5)	7,595 (33.8)	3,910 (17.4)	12,655 (56.3)	6,520 (29.0)	10,125 (45.0)	5,215 (23.2)	6,135 (27.3)	3,130 (13.9)	7,365 (32.8)	4,695 (20.9)	7,365 (32.8)	4,170 (18.5)	7,365 (32.8)	5,215 (23.2)	7,365 (32.8)	5,215 (23.2)
3/4 or #6	8,455 (37.6)	4,355 (19.4)	10,935 (48.6)	5,635 (25.1)	18,225 (81.1)	9,390 (41.8)	12,390 (55.1)	6,385 (28.4)	8,835 (39.3)	4,505 (20.0)	10,605 (47.2)	6,760 (30.1)	10,605 (47.2)	6,010 (26.7)	10,605 (47.2)	7,510 (33.4)	10,605 (47.2)	7,510 (33.4)
7/8 or #7	11,510 (51.2)	5,930 (26.4)	14,885 (66.2)	7,665 (34.1)	24,805 (110.3)	12,780 (56.8)	16,865 (75.0)	8,690 (38.7)	-	-	14,430 (64.2)	9,200 (40.9)	14,430 (64.2)	8,180 (36.4)	14,430 (64.2)	10,220 (45.5)	14,430 (64.2)	10,220 (45.5)
1 or #8	15,035 (66.9)	7,745 (34.5)	19,440 (86.5)	10,015 (44.5)	32,400 (144.1)	16,690 (74.2)	22,030 (98.0)	11,350 (50.5)	-	-	18,850 (83.8)	12,015 (53.4)	18,850 (83.8)	10,680 (47.5)	18,850 (83.8)	13,350 (59.4)	18,850 (83.8)	13,350 (59.4)
#9	-	-	-	-	-	-	-	-	-	-	23,985 (106.7)	15,290 (68.0)	23,985 (106.7)	13,590 (60.5)	23,985 (106.7)	16,990 (75.6)	23,985 (106.7)	16,990 (75.6)
1-1/4	23,490 (104.5)	12,100 (53.8)	30,375 (135.1)	15,645 (69.6)	50,620 (225.2)	26,080 (116.0)	34,425 (153.1)	17,735 (78.9)	-	-	-	-	-	-	-	-	-	-
#10	-	-	-	-	-	-	-	-	-	-	30,405 (135.2)	19,380 (86.2)	30,405 (135.2)	17,230 (76.6)	30,405 (135.2)	21,535 (95.8)	30,405 (135.2)	21,535 (95.8)

1. AISC defined steel strength (ASD) for threaded rod: Tensile = 0.33 • F_u • A_{nom}, Shear = 0.17 • F_u • A_{nom}
2. For reinforcing bars: The allowable steel tensile strength is based on 20 ksi for Grade 40 and 24 ksi for Grade 60 and higher, applied to the cross sectional area of the bar; allowable steel shear strength = 0.17 • F_u • A_{nom}
3. Allowable load capacities are calculated for the steel element type. Consideration of applying additional safety factors may be necessary depending on the application, such as life safety or overhead.
4. Allowable steel strength in tension must be checked against allowable bond strength/concrete capacity in tension to determine the controlling allowable load.
5. The tabulated load values are applicable to single anchors installed at critical edge and spacing distances and where the minimum member thickness is the greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]

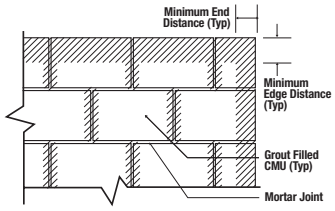
In-Service Temperature Chart For Allowable Load Capacities



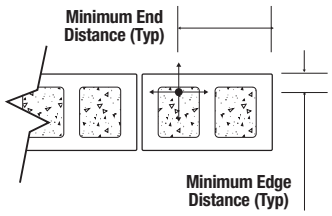
Ultimate and Allowable Load Capacities for Threaded Rod Installed with Pure110+ into Grout-Filled Masonry[1,2,3,4,5,7]

Anchor Installed Into Grouted Masonry Wall Faces								
Nominal Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
3/8	3 (76.2)	7/16 ANSI	12 (304.8)	12 (304.8)	6,005 (26.7)	5,200 (23.1)	1,200 (5.3)	1,040 (4.6)
1/2	4 (101.6)	9/16 ANSI	12 (304.8)	12 (304.8)	8,650 (38.5)	8,845 (39.3)	1,730 (7.7)	1,770 (7.9)
5/8	5 (127)	11/16 ANSI	12 (304.8)	12 (304.8)	12,840 (57.1)	8,430 (37.5)	2,570 (11.4)	1,685 (7.5)
3/4	6 (152.4)	7/8 ANSI	20 (508)	20 (508)	19,560 (87.0)	12,685 (56.4)	3,910 (17.4)	2,540 (11.3)
Anchor Installed in the Tops of Grouted Masonry Walls[6]								
Nominal Diameter d in.	Minimum Embed. h_v in. (mm)	Nominal Drill Bit Diameter in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/2	4 (101.6)	9/16 ANSI	4 (101.6)	1.75 (44.5)	5,135 (22.8)	1,750 (7.8)	1,030 (4.6)	350 (1.6)
5/8	5 (127)	11/16 ANSI	4 (101.6)	2.75 (69.9)	5,360 (23.6)	3,130 (13.9)	1,070 (4.8)	625 (2.8)

1. Tabulated load values are for 3/8" and 1/2" diameter anchors installed in minimum 6" wide, Grade N, Type II, light weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation (f'm ≥ 1,500 psi).
2. Tabulated load values are for 5/8" and 3/4" diameter anchors installed in 8" wide, Grade N, Type II, light weight concrete masonry units conforming to ASTM C 90 that have reached the minimum designated ultimate compressive strength at the time of installation (f'm ≥ 1,500 psi).
3. Anchors must be installed in grouted cells and the minimum edge and end distances must be maintained.
4. Allowable load capacities listed are calculated using an applied safety factor of 5.0 and must be checked against the allowable tension and shear capacities for threaded rod based on steel strength to determine the controlling factor.
5. The tabulated values are applicable for anchors installed into grouted masonry wall faces and masonry wall tops at a critical spacing distance, s_{cr}, between anchors of 3 times the embedment depth.
6. Anchor installations into tops of grouted masonry walls are limited to one per masonry cell.
7. The tabulated values must be adjusted for increased in-service base material temperatures in accordance with the In-Service Temperature chart, as applicable.



Wall Face
Permissible Anchor Locations
(Un-hatched Area)



Top of Wall

Ultimate and Allowable Load Capacities for Threaded Rod Installed with Pure110+ into Hollow Concrete Masonry Walls with Plastic Screen Tubes[1,2,3,4,5]

Nominal Anchor Diameter in.	Minimum Screen Tube Length in.	Minimum End Distance in. (mm)	Minimum Edge Distance in. (mm)	ASTM C-90 Block Type	Ultimate Load	Allowable Load
					Tension lbs. (kN)	Tension lbs. (kN)
3/8	3-1/2	3-3/4 (95.3)	3-3/4 (95.3)	Lightweight	790 (3.5)	160 (0.7)
1/2	3-1/2	3-3/4 (95.3)	3-3/4 (95.3)	Lightweight	1,255 (5.6)	250 (1.1)
5/8	6	3-3/4 (95.3)	3-3/4 (95.3)	Normal-weight[4]	1,545 (6.9)	310 (1.4)
3/4	6	3-3/4 (95.3)	3-3/4 (95.3)	Normal-weight[4]	1,545 (6.9)	310 (1.4)

1. Tabulated load values are for anchors installed in minimum 8" wide, Grade N, Type II, lightweight or normal weight concrete masonry units conforming to ASTM C 90 that have reached a designated ultimate compressive strength at the time of installation (f'm ≥ 1,500 psi). Mortar must be type N, S or M.
2. Allowable loads are calculated using an applied safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
3. Anchor spacing is limited to one per masonry cell.
4. The tabulated load values are applicable to normal-weight concrete masonry units with a minimum face shell thickness of 1-1/2 inches.
5. The tabulated values must be adjusted for increased in-service base material temperatures in accordance with the In-Service Temperature chart, as applicable.

STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

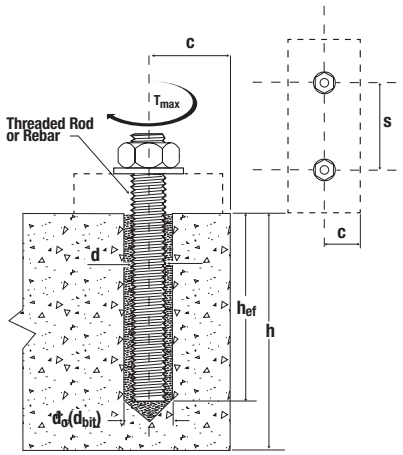
CODE LISTED
ICC-ES ESR-3298

Parameter	Symbol	Units	Fractional Nominal Rod Diameter (Inch) / Reinforcing Bar Size									
			3/8 or #3	1/2	#4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4	#10
Threaded rod outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	-	1.250 (31.8)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)		0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size[6]	d_o (d_{bit})	inch	7/16	9/16	5/8	11/16 or 3/4	7/8	1	1-1/8	1-3/8	1-3/8	1-1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)		3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)		12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)	25 (635)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)			$h_{ef} + 2d_o$						
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)		3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)	6-1/4 (159)
Max. torque[2]	T_{max}	ft-lbs (N-m)	15 (20)	30 (41)		60 (81)	105 (142)	125 (169)	165 (221)	200 (280)	280 (379)	280 (379)
Max. torque[2,3] (low strength rods)	T_{max}	ft-lbs (N-m)	5 (7)	20 (27)		40 (54)	60 (81)	100 (136)	165 (223)	-	280 (379)	-
Minimum edge distance, reduced[5]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)		1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)	2-3/4 (70)
Max. torque, reduced[2]	$T_{max,red}$	ft-lbs (N-m)	7 [5][4]	14 (19)		27 (37)	47 (64)	56 (76)	74 (100)	90 (122)	126 (171)	126 (171)

For pound-inch units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For SI: 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

1. For use with the design provisions of ACI 318-14 Ch.17 or ACI 318-11 Appendix D as applicable, ICC-ES AC308, Section 4.2 and ESR-3298
2. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
3. These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods; ASTM F 1554 Grade 55 carbon steel threaded rods; and ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
4. These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods.
5. For Installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be max torque reduced, $T_{max,red}$.
6. For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.

Detail of Steel Hardware Elements used with Injection Adhesive System



Threaded Rod and Deformed Reinforcing Bar Material Properties

Steel Description (General)	Steel Specification (ASTM)	Nominal Anchor Size (inch)	Minimum Yield Strength, f_y (ksi)	Minimum Ultimate Strength, f_u (ksi)
Carbon rod	A 36 or F 1554 Grade 36	3/8 through 1-1/4	36.0	58.0
	F 1554 Grade 55		55.0	75.0
	A 449	3/8 through 1	92.0	120.0
		1-1/4	81.0	105.0
	A 193, Grade B7 or F 1554, Grade 105	3/8 through 1-1/4	105.0	125.0
	F 568M Class 5 8	3/4 through 1-1/4	58.0	72.5
Stainless rod	F 593 Condition CW	3/8 through 5/8	65.0	100.0
		3/4 through 1-1/4	45.0	85.0
	A 193/193M Grade B8/B8M, Class 1	3/8 through 1-1/4	30.0	75.0
	A 193/A193M Grade B8/B8M2, Class 2B	3/8 through 1-1/4	75.0	95.0
Grade 40 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	40.0	60.0
Grade 60 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	60.0	90.0
	A 706, A 767		60.0	80.0
Grade 75 Reinforcing Bar	A 615, A 767	3/8 through 1-1/4 (#3 through #10)	75.0	100.0

Steel Tension and Shear Design for Threaded Rod in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3298

Design Information		Symbol	Units	Nominal Rod Diameter[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A 36 and ASTM F 1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F 1554 Grade 55	Nominal strength as governed by steel strength(for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		vsa	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B7 and ASTM F 1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	-[5]
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	-[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80	0.80	0.80	0.80	0.80	0.80	-[5]
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM F 593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A 193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20,715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A 193 Grade B8/ B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable, except where noted. Nuts and washers must be appropriate for the rod. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements
4. In accordance with AACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to 1.9fy or 57,000 psi (393 MPa).
5. The referenced standard includes rod diameters up to and including 1-inch (24 mm).

Steel Tension and Shear Design for Reinforcing Bars in Normal Weight Concrete (For use with load combinations taken from ACI 318-14 Section 5.3)

CODE LISTED
ICC-ES ESR-3298

Design Information		Symbol	Units	Nominal Reinforcing Bar Size (Rebar)[1]							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch² (mm²)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A 615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A 615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$		0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A 615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A 615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70	0.70	0.80	0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

1. Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
2. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b), as applicable.
3. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4. Values correspond to brittle steel elements.

Concrete Breakout Design Information for Threaded Rod and Reinforcing Bars (For use with loads combinations taken from ACI 318-14 Section 5.3)[1]

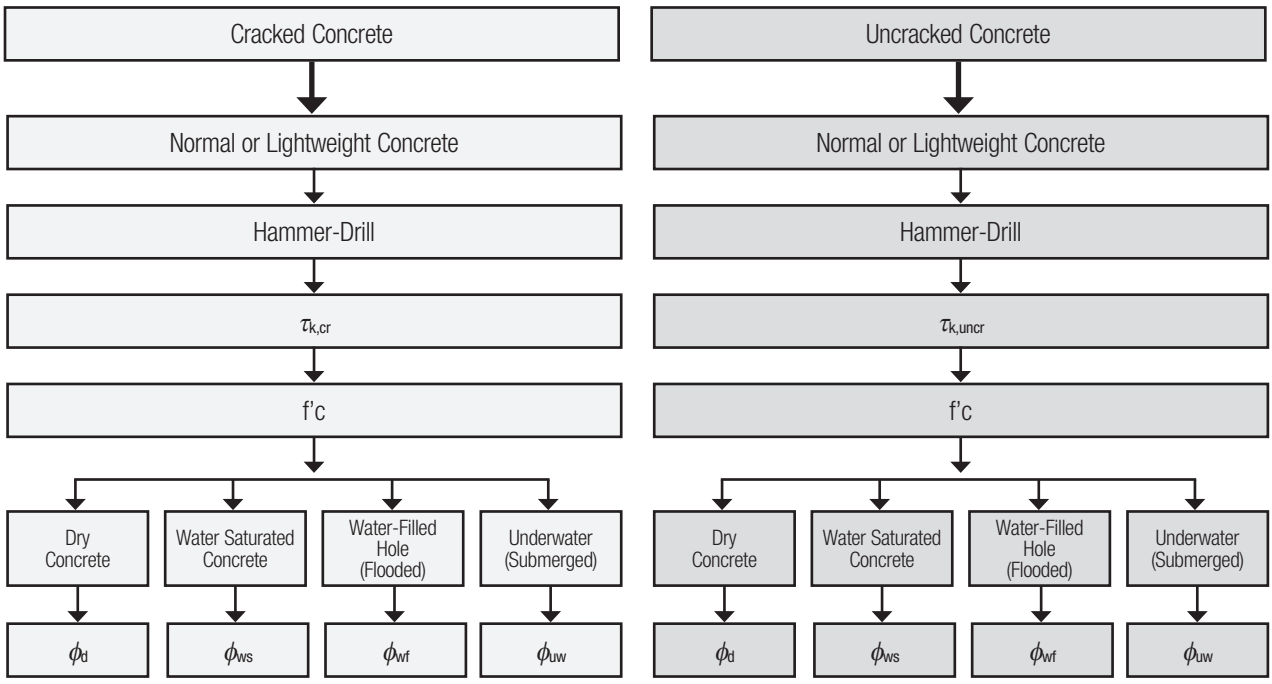
CODE LISTED ICC-ES ESR-3298

Design Information	Symbol	Units	Nominal Rod Diameter (inch) / Reinforcing Bar Size							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1-1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	4-1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	22-1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/8 (111)	5 (127)	5-5/8 (143)	6-1/4 (159)
Minimum edge distance[2]	c_{min}	inch (mm)	5*d* where *d* is nominal outside diameter of the anchor							
Minimum edge distance, reduced[2]	$c_{min,red}$	inch (mm)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	1-3/4 (45)	2-3/4 (70)	2-3/4 (70)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1-1/4 (h_{ef} + 30)		$h_{ef} + 2d_o$ where d_o is hole diameter;					
Critical edge distance—splitting (for uncracked concrete only)[3]	c_{ac}	inch	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{1160})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
		(mm)	$c_{ac} = h_{ef} \cdot (\frac{\tau_{uncr}}{8})^{0.4} \cdot [3.1\text{-}0.7 \frac{h}{h_{ef}}]$							
Strength reduction factor for tension, concrete failure modes, Condition B[4]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[4]	ϕ	-	0.70							

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

1. Additional setting information is described in the installation instructions.
2. For installation between the minimum edge distance, c_{min}, and the reduced minimum edge distance, $c_{min,red}$, the maximum torque applied must be reduced (multiplied) by a factor of 0.45.
3. $\tau_{k,uncr}$ need not be taken as greater than: $\tau_{k,uncr} = \frac{k_{uncr} \cdot \sqrt{h_{ef} \cdot f'c}}{\pi \cdot d}$ and $\frac{h}{h_{ef}}$ need not be taken as larger than 2.4.
4. Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.4.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Bond Strength Design Information for Threaded Rods and Reinforcing Bars[1,2]

CODE LISTED
ICC-ES ESR-3298

Design Information		Symbol	Units	Nominal Rod Diameter (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)

Design Information		Symbol	Units	Nominal Bar Size							
				#3	#4	#5	#6	#7	#8	#9	#10
Minimum embedment		$h_{ef,min}$	inch (mm)	2-3/8 (60.0)	2-3/4 (70.0)	3-1/8 (79.0)	3-1/2 (89.0)	3-1/2 (89.0)	4 (102.0)	4-1/2 (114.0)	5 (127.0)
Maximum embedment		$h_{ef,max}$	inch (mm)	7-1/2 (191.0)	10 (254.0)	12-1/2 (318.0)	15 (381.0)	17-1/2 (445.0)	20 (508.0)	22-1/2 (572.0)	25 (635.0)
110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[3,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
110°F (43°C) Maximum Long-Term Service Temperature; 176°F (80°C) Maximum Short-Term Service Temperature[4,5]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in cracked concrete, short-term loading only[9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)
Permissible installation conditions[7]	Dry concrete	Anchor Category		1							
		ϕ_d		0.65							
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category		2							
		ϕ_{ws}, ϕ_{wf}		0.55							
	Underwater (submerged)	Anchor Category		2				3			
		ϕ_{uw}		0.55				0.45			
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$		1.00							

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For pound-inch units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

1. Bond strength values correspond to a normal-weight concrete compressive strength f'c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'c / 2{,}500)^{0.23}$ [For SI: $(f'c / 17.2)^{0.23}$].
2. The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.
3. The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.
4. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.
5. Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term elevated concrete base material service temperatures are roughly constant over significant periods of time.
6. Characteristic bond strengths are for sustained loads including dead and live loads.
7. Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation.
8. Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.
9. For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.

Tension and Shear Design Strength for Threaded Rod Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in.)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,070	4,380	4,345	4,680
	3	4,055	4,010	4,380	4,530	4,680	5,370	5,140	6,830	5,490	8,095
	4-1/2	6,305	7,420	6,575	8,270	7,020	9,805	7,710	12,465	8,235	14,775
	7-1/2	10,505	15,800	10,955	17,600	11,705	20,865	12,845	26,530	13,725	29,565
1/2	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	8,680	11,845	9,275	14,045
	6	10,645	12,850	11,105	14,315	11,865	16,970	13,020	21,575	13,915	25,585
	10	17,745	27,370	18,505	30,485	19,770	36,150	21,705	45,955	23,190	49,945
5/8	3-1/8	4,310	4,120	4,720	4,680	5,450	5,725	6,675	7,600	7,710	9,295
	5	8,720	10,005	9,555	11,365	11,030	13,900	13,040	18,205	13,935	21,585
	7-1/2	15,995	19,745	16,680	22,000	17,820	26,080	19,565	33,160	20,900	39,315
	12-1/2	26,660	42,065	27,800	46,860	29,700	55,560	32,605	70,225	34,835	75,030
3/4	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	19,415	30,030
	9	21,060	26,855	23,070	30,510	24,835	36,285	27,260	46,130	29,125	54,695
	15	37,145	58,530	38,740	65,200	41,390	77,305	45,435	97,855	48,540	104,550
7/8	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,610	37,355
	10-1/2	26,540	32,800	29,070	37,265	32,755	45,135	35,955	57,380	38,415	68,035
	17-1/2	49,000	72,810	51,095	81,105	54,590	96,165	59,930	122,255	64,025	137,905
1	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	46,095	69,560	49,250	82,475
	20	62,815	88,270	65,505	98,330	69,985	116,585	76,825	148,215	82,080	175,735
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,600	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	38,210	48,690	44,125	59,555
	15	45,315	52,110	49,640	59,200	57,320	72,410	69,260	95,655	74,000	113,420
	25	94,380	121,400	98,420	135,235	105,155	160,345	115,435	203,845	123,330	241,695

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Threaded Rod Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (in. or #)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
3/8	2-3/8	2,020	1,835	2,215	2,085	2,445	2,555	2,685	2,890	2,865	3,085
	3	2,770	2,865	2,890	3,235	3,085	3,835	3,390	4,875	3,620	5,785
	4-1/2	4,155	5,300	4,335	5,905	4,630	7,005	5,085	8,900	5,430	10,555
	7-1/2	6,925	11,285	7,225	12,570	7,715	14,905	8,470	18,245	9,050	19,495
1/2	2-3/4	2,520	2,360	2,760	2,680	3,185	3,280	3,905	4,355	4,425	5,325
	4	4,420	4,785	4,840	5,435	5,490	6,650	6,025	8,460	6,435	10,030
	6	7,390	9,180	7,705	10,225	8,230	12,125	9,035	15,410	9,655	18,275
	10	12,315	19,550	12,840	21,775	13,720	25,820	15,060	32,435	16,090	34,655
5/8	3-1/8	3,050	2,940	3,345	3,340	3,860	4,090	4,730	5,430	5,460	6,640
	5	6,175	7,145	6,765	8,120	7,815	9,930	9,415	13,005	10,055	15,415
	7-1/2	11,350	14,105	12,040	15,715	12,860	18,630	14,120	23,685	15,085	28,080
	12-1/2	19,240	30,045	20,065	33,470	21,435	39,685	23,530	50,455	25,140	54,150
3/4	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	12,580	17,925	14,480	21,450
	9	14,920	19,185	16,340	21,795	18,520	25,920	20,330	32,950	21,720	39,070
	15	27,705	41,805	28,890	46,570	30,870	55,220	33,885	70,200	36,205	77,975
7/8	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	18,305	26,680
	10-1/2	18,800	23,430	20,590	26,620	23,780	32,240	27,675	40,985	29,565	48,595
	17-1/2	37,710	52,005	39,325	57,935	42,015	68,690	46,120	87,325	49,275	103,540
1	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	22,365	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	35,580	49,685	38,615	58,910
	20	49,255	63,050	51,365	70,235	54,875	83,275	60,240	105,870	64,360	125,525
1-1/4	5	6,175	5,835	6,765	6,630	7,815	8,110	9,570	10,775	11,050	13,175
	10	17,470	18,845	19,140	21,410	22,100	26,185	27,065	34,780	31,255	42,540
	15	32,095	37,220	35,160	42,285	40,600	51,720	49,725	68,325	57,415	81,015
	25	69,060	86,715	75,655	96,595	85,745	114,530	94,125	145,605	100,565	172,640

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Uncracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (#)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	2,855	2,570	3,125	2,920	3,610	3,575	4,070	4,380	4,345	4,680
	3	4,055	4,010	4,380	4,530	4,680	5,370	5,140	6,830	5,490	8,095
	4-1/2	6,305	7,420	6,575	8,270	7,020	9,805	7,710	12,465	8,235	14,775
	7-1/2	10,505	15,800	10,955	17,600	11,705	20,865	12,845	26,530	13,725	29,565
#4	2-3/4	3,555	3,305	3,895	3,755	4,500	4,590	5,510	6,095	6,365	7,455
	4	6,240	6,700	6,835	7,610	7,895	9,310	8,680	11,845	9,275	14,045
	6	10,645	12,850	11,105	14,315	11,865	16,970	13,020	21,575	13,915	25,585
	10	17,745	27,370	18,505	30,485	19,770	36,150	21,705	45,955	23,190	49,945
#5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,725	6,675	7,600	7,710	9,295
	5	8,720	10,005	9,555	11,365	11,030	13,900	13,040	18,205	13,935	21,585
	7-1/2	15,995	19,745	16,680	22,000	17,820	26,080	19,565	33,160	20,900	39,315
	12-1/2	26,660	42,065	27,800	46,860	29,700	55,560	32,605	70,225	34,835	75,030
#6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,910	9,255	9,135	11,320
	6	11,465	13,595	12,560	15,445	14,500	18,895	17,760	25,095	19,415	30,030
	9	21,060	26,855	23,070	30,510	24,835	36,285	27,260	46,130	29,125	54,695
	15	37,145	58,530	38,740	65,200	41,390	77,305	45,435	97,855	48,540	104,550
#7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,910	9,100	9,135	11,130
	7	14,445	16,605	15,825	18,865	18,275	23,075	22,380	30,650	25,610	37,355
	10-1/2	26,540	32,800	29,070	37,265	32,755	45,135	35,955	57,380	38,415	68,035
	17-1/2	49,000	72,810	51,095	81,105	54,590	96,165	59,930	122,255	64,025	137,905
#8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,665	11,280	11,160	13,800
	8	17,650	19,750	19,335	22,435	22,325	27,440	27,340	36,450	31,570	44,580
	12	32,425	39,005	35,520	44,315	41,015	54,200	46,095	69,560	49,250	82,475
	20	62,815	88,270	65,505	98,330	69,985	116,585	76,825	148,215	82,080	175,735
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,535	13,125	13,320	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	32,625	42,550	37,675	52,040
	13-1/2	38,690	45,540	42,380	51,740	48,940	63,280	57,165	82,475	61,075	97,785
	22-1/2	77,895	104,620	81,230	116,545	86,790	138,185	95,270	175,670	101,790	208,290
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,600	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	38,210	48,780	44,125	59,660
	15	45,315	52,205	49,640	59,310	57,320	72,545	69,260	95,835	74,000	113,625
	25	94,380	121,580	98,420	135,435	105,155	160,580	115,435	204,145	123,330	242,050

☐ - Concrete Breakout Strength ☐ - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in uncracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension and Shear Design Strength for Reinforcing Bar Installed in Cracked Concrete (Bond or Concrete Strength) Drilled with a Hammer-Drill and Carbide Bit in a Dry Hole Condition 110°F (43°C) Maximum Long-Term Service Temperature; 140°F (60°C) Maximum Short-Term Service Temperature[1,2,3,4,5,6,7,8,9]

Nominal Rod/Rebar Size (#)	Embed. Depth h_{ef} (in.)	Minimum Concrete Compressive Strength									
		f'c = 2,500 (psi)		f'c = 3,000 (psi)		f'c = 4,000 (psi)		f'c = 6,000 (psi)		f'c = 8,000 (psi)	
		ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)	ϕN_{cb} or ϕN_a Tension (lbs.)	ϕV_{cb} or ϕV_{cp} Shear (lbs.)
#3	2-3/8	2,020	1,835	2,215	2,085	2,445	2,555	2,685	2,890	2,865	3,085
	3	2,770	2,865	2,890	3,235	3,085	3,835	3,390	4,875	3,620	5,785
	4-1/2	4,155	5,300	4,335	5,905	4,630	7,005	5,085	8,900	5,430	10,555
	7-1/2	6,925	11,285	7,225	12,570	7,715	14,905	8,470	18,245	9,050	19,495
#4	2-3/4	2,520	2,360	2,760	2,680	3,185	3,280	3,905	4,355	4,295	5,325
	4	4,420	4,785	4,840	5,435	5,325	6,650	5,845	8,460	6,245	10,030
	6	7,170	9,180	7,475	10,225	7,985	12,125	8,765	15,410	9,365	18,275
	10	11,945	19,550	12,455	21,775	13,310	25,820	14,610	31,470	15,610	33,620
#5	3-1/8	3,050	2,940	3,345	3,340	3,860	4,090	4,730	5,430	5,380	6,640
	5	6,175	7,145	6,765	8,120	7,815	9,930	8,755	13,005	9,355	15,415
	7-1/2	10,740	14,105	11,200	15,715	11,965	18,630	13,135	23,685	14,035	28,080
	12-1/2	17,900	30,045	18,665	33,470	19,945	39,685	21,890	47,155	23,390	50,380
#6	3-1/2	3,620	3,580	3,965	4,070	4,575	4,980	5,605	6,610	6,470	8,085
	6	8,120	9,710	8,895	11,035	10,270	13,495	12,580	17,925	13,475	21,450
	9	14,920	19,185	16,130	21,795	17,230	25,920	18,915	32,950	20,210	39,070
	15	25,775	41,805	26,880	46,570	28,720	55,220	31,525	67,900	33,680	72,545
#7	3-1/2	3,620	3,525	3,965	4,000	4,575	4,895	5,605	6,500	6,470	7,950
	7	10,230	11,860	11,210	13,475	12,945	16,485	15,850	21,895	18,305	26,680
	10-1/2	18,800	23,430	20,590	26,620	23,455	32,240	25,745	40,985	27,505	48,595
	17-1/2	35,085	52,005	36,585	57,935	39,090	68,690	42,910	87,325	45,845	98,740
#8	4	4,420	4,365	4,840	4,960	5,590	6,065	6,845	8,060	7,905	9,855
	8	12,500	14,105	13,695	16,025	15,815	19,600	19,365	26,035	22,365	31,845
	12	22,965	27,860	25,160	31,655	29,050	38,715	33,625	49,685	35,925	58,910
	20	45,825	63,050	47,785	70,235	51,055	83,275	56,045	105,870	59,880	125,525
#9	4-1/2	5,275	5,080	5,780	5,770	6,670	7,060	8,170	9,375	9,435	11,465
	9	14,920	16,465	16,340	18,710	18,870	22,880	23,110	30,390	26,685	37,170
	13-1/2	27,405	32,530	30,020	36,955	34,665	45,200	42,455	58,910	45,470	69,845
	22-1/2	57,995	74,730	60,480	83,245	64,615	98,700	70,930	125,480	75,785	148,775
#10	5	6,175	5,830	6,765	6,620	7,815	8,100	9,570	10,755	11,050	13,155
	10	17,470	18,880	19,140	21,445	22,100	26,230	27,065	34,840	31,255	42,615
	15	32,095	37,290	35,160	42,365	40,600	51,815	49,725	68,455	56,135	81,160
	25	69,060	86,840	74,665	96,740	79,775	114,700	87,570	145,820	93,560	172,890

- Concrete Breakout Strength - Bond Strength/Pryout Strength

1. Tabular values are provided for illustration and are applicable for single anchors installed in cracked normal-weight concrete with minimum slab thickness, $h_a = h_{min}$, and with the following conditions:
   - c_{a1} is greater than or equal to the critical edge distance, c_{ac}
   - c_{a2} is greater than or equal to 1.5 times c_{a1}.
2. Calculations were performed according to ACI 318-14 Ch.17 and ICC-ES AC308. The load level corresponding to the failure mode listed [Concrete breakout strength, bond strength/pryout strength] must be checked against the tabulated steel strength of the corresponding threaded rod or rebar size and type, the lowest load level controls.
3. Strength reduction factors (ϕ) for concrete breakout strength are based on ACI 318-14 Section 5.3 for load combinations. Condition B was assumed.
4. Strength reduction factors (ϕ) for bond strength are determined from reliability testing and qualification in accordance with ICC-ES AC308 and are tabulated in this product information and in ESR-3298.
5. Tabular values are permitted for static loads only, seismic loading is not considered with these tables. Periodic special inspection must be performed where required by code, see ESR-3298 for applicable information.
6. For anchors subjected to tension resulting from sustained loading a supplemental check must be performed according to ACI 318-14 17.3.1.2.
7. For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 Ch.17.
8. Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-14 Ch.17, ICC-ES AC308 and information included in this product supplement. For other design conditions including seismic considerations please see ACI 318-14 Ch.17 and ICC-ES AC308 and ESR-3298.
9. Long term concrete temperatures are roughly constant over significant periods of time. Short-term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Tension Design of Steel Elements (Steel Strength)[1,2]

Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)	ϕN_{sa} Tension (lbs.)
3/8 or #3	3,370	4,360	7,265	6,975	3,655	5,040	3,315	5,525	7,150	7,425	6,600	4,950
1/2 or #4	6,175	7,980	13,300	12,770	6,690	9,225	6,070	10,110	13,000	13,500	12,000	9,000
5/8 or #5	9,835	12,715	21,190	20,340	10,650	14,690	9,660	16,105	20,150	20,925	18,600	13,950
3/4 or #6	14,550	18,815	31,360	30,105	15,765	18,480	14,300	23,830	28,600	29,700	26,400	19,800
7/8 or #7	20,085	25,970	43,285	41,930	21,760	25,510	19,735	32,895	39,000	40,500	36,000	-
1 or #8	26,350	34,070	56,785	54,515	28,545	33,465	25,895	43,160	51,350	53,325	47,400	-
#9	-	-	-	-	-	-	-	-	65,000	67,500	60,000	-
1-1/4 or #10	42,160	54,510	90,850	76,315	-	53,540	41,430	69,050	82,550	85,725	76,200	-

■ - Steel Strength

1. Steel tensile design strength according to ACI 318-14 Ch.17, $\phi N_{sa} = \phi \bullet A_{se,N} \bullet f_{uta}$
2. The tabulated steel design strength in tension must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Shear Design of Steel Elements (Steel Strength)[1,2]

Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	ASTM A615 Grade 75 Rebar	ASTM A615 Grade 60 Rebar	ASTM A706 Grade 60 Rebar	ASTM A615 Grade 40 Rebar
	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)	ϕV_{sa} Shear (lbs.)
3/8 or #3	1,755	2,265	3,775	3,625	2,025	2,790	1,725	2,870	3,960	3,860	3,430	2,575
1/2 or #4	3,210	4,150	6,915	6,640	3,705	5,110	3,155	5,255	7,200	7,020	6,240	4,680
5/8 or #5	5,115	6,610	11,020	10,575	5,900	8,135	5,025	8,375	11,160	10,880	9,670	7,255
3/4 or #6	7,565	9,785	16,305	15,655	8,730	10,235	7,435	12,390	15,840	15,445	13,730	10,295
7/8 or #7	10,445	13,505	22,505	21,805	12,050	14,130	10,265	17,105	21,600	21,060	18,720	-
1 or #8	13,700	17,715	29,525	28,345	15,810	18,535	13,465	22,445	28,440	27,730	24,650	-
#9	-	-	-	-	-	-	-	-	36,000	35,100	31,200	-
1-1/4 or #10	21,920	28,345	47,240	39,685	-	29,655	21,545	35,905	45,720	44,575	39,625	-

■ - Steel Strength

1. Steel shear design strength according to ACI 318-14 Ch.17, $\phi V_{sa} = \phi \bullet 0.60 \bullet A_{se,V} \bullet f_{uta}$
2. The tabulated steel design strength in shear must be checked against the bond strength/concrete capacity design strength to determine the controlling failure mode, the lowest load level controls.

Development Lengths for Common Reinforcing Bar Connections[1,2,3,6]

Design Information	Symbol	Reference Standard	Units	Nominal Rebar Size (US)								
				#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal rebar diameter	d_b	ASTM A615/A706, Grade 60 (fy = 60 ksi)	in. (mm)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.128 (28.6)	1.27 (32.3)	1.41 (35.8)
Nominal rebar area	A_b		in^2 (mm^2)	0.11 (71)	0.2 (127)	0.31 (198)	0.44 (285)	0.6 (388)	0.79 (507)	1 (645)	1.27 (817)	1.56 (1006)
Development length in f'c = 2,500 psi concrete[4,5]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	in. (mm)	12 (305)	14.4 (366)	18 (457)	21.6 (549)	31.5 (800)	36 (914)	40.6 (1031)	45.7 (1161)	50.8 (1290)
Development length in f'c = 3,000 psi concrete[4,5]			in. (mm)	12 (305)	13.1 (334)	16.4 (417)	19.7 (501)	28.8 (730)	32.9 (835)	37.1 (942)	41.7 (1060)	46.3 (1177)
Development length in f'c = 4,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	14.2 (361)	17.1 (434)	24.9 (633)	28.5 (723)	32.1 (815)	36.2 (920)	40.1 (1019)
Development length in f'c = 6,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	13.9 (354)	20.3 (516)	23.2 (590)	26.2 (666)	29.5 (750)	32.8 (832)
Development length in f'c = 8,000 psi concrete[4,5]			in. (mm)	12 (305)	12 (305)	12 (305)	12.1 (307)	17.6 (443)	20.1 (511)	22.7 (577)	25.6 (649)	28.4 (721)

For SI: 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa; for pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

1. Calculated development lengths in accordance with ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3, as applicable, for reinforcing bars are valid for static, wind, and earthquake loads.
2. Calculated development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable. The value of f 'c used to calculate development lengths shall not exceed 2,500 psi for post-installed reinforcing bar applications in SDC's C, D, E and F.
3. For Class B splices, minimum length of lap for tension lap splices is $1.3l_d$ in accordance with ACI 318-14 25.5.2 and ACI 318-11 12.15.1, as applicable.
4. For lightweight concrete, $\lambda = 0.75$; therefore multiply development lengths by 1.33 (increase development length by 33 percent), unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d), as applicable, are met to permit alternate values of λ (e.g for sand-lightweight concrete, $\lambda = 0.85$; therefore multiply development lengths by 1.18). Refer to ACI 318-14 19.2.4 or ACI 318-11 8.6.1, as applicable.
5. $\left(\frac{c_b + K_{tr}}{d_b}\right) = 2.5$, $\psi_t = 1.0$, $\psi_e = 1.0$, $\psi_s = 0.8$ for $d_b \le$ #6,1.0 for $d_b >$ #6. Refer to ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4, as applicable.
6. Calculations may be performed for other steel grades and concrete compressive strengths per ACI 318-14 Chapter 25 or ACI 318-11 Chapter 12, as applicable.

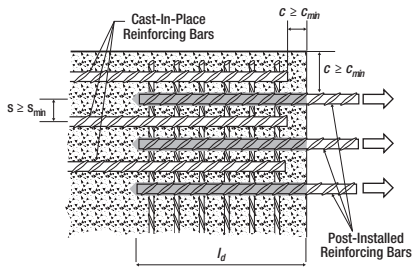
Installation Parameters for Common Post-Installed Reinforcing Bar Connections

Parameter	Symbol	Units	Nominal Rebar Size (US)								
			#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal hole diameter[1]	d_o	in.	7/16	5/8	3/4	7/8	1	11/8	1-3/8	1-1/2	1-3/4
Effective embedment	h_{ef}	in.	2-3/8 to 7-1/2	2-3/4 to 10	3-1/8 to 12-1/2	3-1/2 to 15	3-1/2 to 17-1/2	4 to 20	4-1/2 to 22-1/2	5 to 25	5-1/2 to 27-1/2
Nominal hole diameter[1]	d_o	in.	1/2	5/8	3/4	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4
Effective embedment	h_{ef}	in.	7-1/2 to 22-1/2	10 to 30	12-1/2 to 37-1/2	15 to 45	17-1/2 to 52-1/2	20 to 60	22-1/2 to 67-1/2	25 to 75	27-1/2 to 82-1/2

For SI: 1 inch = 25.4 mm,; for pound-inch units: 1 mm = 0.03937 inches.

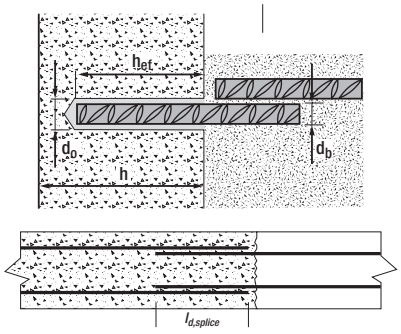
1. For any case, it must be possible for the reinforcing bar (rebar) to be inserted into the cleaned hole without resistance.
2. Consideration should be given regarding the commercial availability of carbide drill bits (including hollow drill bits) and diamond core bits, as applicable, with lengths necessary to achieve effective embedments for post-installed reinforcing bar connections.

Installation Detail for Post-Installed Reinforcing Bar Connection



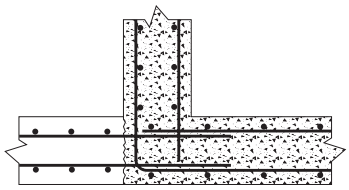
Development Length

c = edge distance
s = spacing

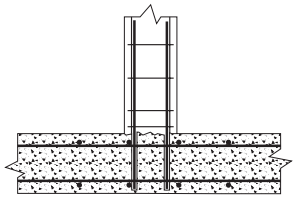


d_b = nomial bar diameter
d_o = nominal hole diameter
h_{ef} = effective embedment
h = member thickness

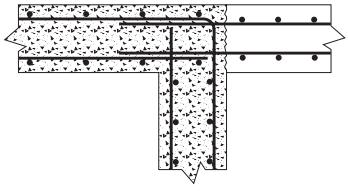
Examples of Development Length Application Details for Post-Installed Reinforcing Bar Connections Provided for Illustrator



Tension Lap Splice with Existing Reinforcement for Footing and Foundation Extensions



Tension Development of Column, Cap or Wall Dowels



Tension Lap Splice with Existing Flexural Reinforcement For Slab and Beam Extensions

Hole Cleaning Tools and Accessories for Post-Installed Rebar Connections[1,2,3,4,5,6,7]

Rebar Size (No.)	Drill Bit Size (inch)	Brush Size (inch)	Brush Length (inches)	Wire Brush (Cat. No.)	Plug Size (inch)	Piston Plug (Cat. No.)
3	7/16	7/16	6-3/4	08284	N/A	N/A
	1/2	1/2	6-3/4	08285	N/A	N/A
4	5/8	5/8	6-3/4	08275	N/A	N/A
5	3/4	3/4	7-7/8	08278	3/4	PFC1691520
6	7/8	7/8	7-7/8	08287	7/8	PFC1691530
	1	1	11-7/8	08288	1	PFC1691540
7	1	1	11-7/8	08288	1	PFC1691540
	1-1/8	1-1/8	11-7/8	08289	1-1/8	PFC1691550
8	1-1/8	1-1/8	11-7/8	08289	1-1/8	PFC1691550
	1-1/4	1-1/4	11-7/8	08290	1-1/4	PFC1691555
9	1-3/8	1-3/8	11-7/8	08290	1-3/8	PFC1691560
10	1-1/2	1-1/2	11-7/8	08291	1-1/2	PFC1691570
11	1-3/4	1-3/4	11-7/8	08299	1-3/4	PFC1691580

1. If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.
2. Holes may be drilled with hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow bits) or core-drill, i.e. core drill with a diamond core drill bit.
3. For any case, it must be possible for the reinforcing bar to be inserted into the cleaned hole without resistance.
4. A brush extension (Cat.#08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.
5. Brush adaptors for power tool connections are available for drill chuck (Cat.#08296) and SDS (Cat.#08283).
6. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used if the bottom or back of the anchor hole is not reached with the mixing nozzle only.
7. All overhead (i.e upwardly inclined) installations require the use of piston plugs during where one is tabulated together with the anchor size (see table). N/A = Not applicable. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches. A flexible extension tube (Cat.#08297) or flexible extension hose (Cat.#PFC1640600) or equivalent approved by DEWALT must be used with piston plugs.


Wire Brush


Brush Extension


Drill Chuck Adapter


SDS Adapter


Premium Piston Plug


Compressed Air Nozzle


DustX+™ System

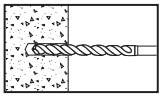
DUSTX+ ANCHOR INSTALLATION SYSTEM

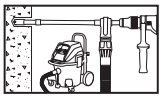
INSTALLATION INSTRUCTIONS FOR ADHESIVE ANCHORS (SOLID BASE MATERIALS)

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

Dry Concrete: cured concrete that, at the time of adhesive anchor installation, has not been exposed to water for the preceding 14 days.
Water-Saturated Concrete (wet): cured concrete that, at the time of adhesive anchor installation, has been exposed to water over a sufficient length of time to have the maximum possible amount of absorbed water into the concrete pore structure to a depth equal to the anchor embedment depth.
Water-Filled Holes (flooded): cured concrete that is water-saturated and where the drilled hole contains standing water at the time of anchor installation.
Underwater Concrete (submerged): cured concrete that is water-saturated and covered with water at the time of anchor installation.

DRILLING





1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

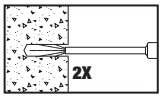
- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

**GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED).
OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.**

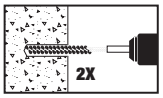
**IN THE CASE OF AN UNDERWATER (SUBMERGED) INSTALLATION CONDITION
GO TO STEP 2UW-I FOR SEPARATE SPECIFIC HOLE CLEANING INSTRUCTIONS.**

HOLE CLEANING DRY OR WET/WATER-SATURATED HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)



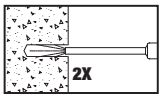
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of two times (2x).

- Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).



2b- Determine wire brush diameter (see hole cleaning equipment selection table) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).
A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).

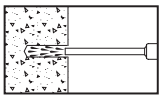


2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

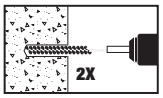
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

NEXT GO TO STEP 3.

HOLE CLEANING UNDERWATER INSTALLATION (FLUSH, BRUSH 2X, FLUSH)

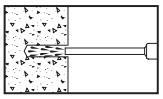


2uw-i- Starting from the bottom or back of the drilled anchor hole, rinse/flush the hole clean with air/water (air/water line pressure) until clear water comes out.



2uw-ii- Determine brush diameter (see hole cleaning equipment selection table) for the drilled hole and attach the brush with adaptor to a rotary drill tool. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length.

- The wire brush diameter must be checked periodically during use. The brush should resist insertion into the drilled hole, if not, the brush is too small and must be replaced with proper brush diameter (i.e. new wire brush).

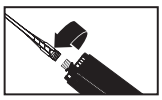


2uw-iii- Repeat Step 2a- again by rinse/flushing the hole clean with air/water.

- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

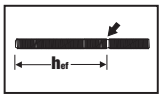
NEXT GO TO STEP 3.

PREPARING

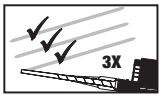


3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge temperature must be between 50ºF - 90ºF (10ºC - 32ºC) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68ºF (20ºC) when in use. Review published gel (working) and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For permitted range of the base material temperature, see published gel and curing times.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



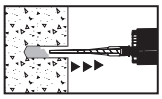
4- Prior to inserting the anchor rod or rebar into the drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesives must be properly mixed to achieve published properties. For new cartridges and nozzles, prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **RED** color.

- Review and note the published gel (working) and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

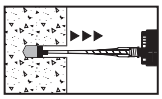
INSTALLATION



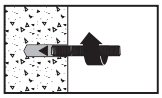
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only.

- Piston plugs (see installation specifications) must be used with and attached to the mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations in concrete with anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.
- The use of piston plugs is also recommended for underwater installations for anchor rod 5/8" to 1-1/4" diameter and rebar size #5 to #10.

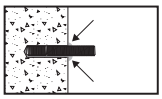
WITH PISTON PLUG:



Attention! Do not install anchors overhead without proper training and installation hardware provided by the DEWALT. Contact DEWALT for details prior to use.

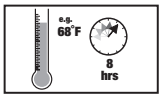


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



8- Ensure that the anchor element is installed to the specific embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive. For all installations the anchor element must be restrained from movement throughout the specified curing period, (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustment to the position of the anchor element may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

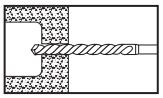
- Do not disturb, torque or load the anchor until it is fully cured.

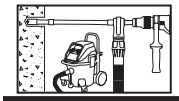
10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (reference gel time and curing table) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS FOR ADHESIVE ANCHORS (HOLLOW BASE MATERIALS)

DRILLING



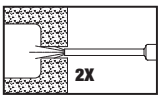


1- Drill a hole into the base material with a rotary drill tool to the size and embedment for the required screen size (see installation specifications for threaded rod in hollow concrete base material with screen tube supplied by DEWALT). Holes drilled in hollow concrete masonry units may be drilled with a rotary hammer-drill. The tolerances of the drill bit used should meet the requirements of ANSI B212.15.

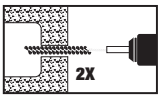
- Precaution: Wear suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

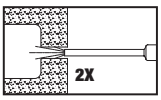
HOLE CLEANING (BLOW 2X, BRUSH 2X, BLOW 2X)



2- Starting from the bottom or back of the anchor hole, blow the hole clean with a hand pump (min. volume 25 fl.oz. supplied by DEWALT) or compressed air nozzle a minimum of two times (2x).



- Determine the wire brush diameter (see installation specifications) and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x). A brush extension (supplied by DEWALT, Cat #08282) should be used for holes drilled deeper than the listed brush length.
- The wire brush should be checked periodically during use. The brush should resist insertion into the drilled hole and come into contact with the sides of the drilled hole. If not the brush is too small and must be replaced.

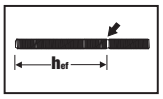


- Finally, blow the hole clean again a minimum of two times (2x)
- When finished the hole should be clean and free of dust, debris, ice, grease, oil or other foreign material.

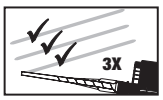
PREPARING

3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge temperature must be between 50°F - 110°F (10°C - 43°C) when in use. For best experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use. Review gel (working) time and curing time table. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures.

- Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.
- Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published working time of the adhesive.



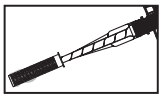
4- Prior to inserting the anchor rod into the filled screen tube, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



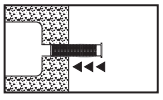
5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent RED color. Do not attach a used nozzle when changing to a new cartridge.

- Review and note the published working and cure times (see gel time and curing time table) prior to injection of the mixed adhesive into the screen tube.

INSTALLATION

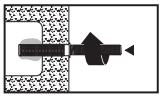


6- Select a screen tube of suitable length (supplied by DEWALT). Fill the screen tube full with adhesive starting from the bottom or back of the tube. Slowly withdraw the mixing nozzle as the screen fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the screen tube is not reached with the mixing nozzle only.



7- Insert the screen tube filled with adhesive into the cleaned anchor hole.

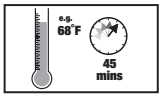
- Note: Overfilling the screen tube is acceptable but not required.



8- Prior to inserting the anchor rod into the screen tube inspect it to ensure that it is free of dirt, grease, oil or other foreign material.

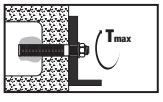
- Push the threaded rod into the screen tube while turning slightly to ensure positive distribution of the adhesive until back of the tube is reached.
- Note: In cases where the drilled hole size is larger than specified due to rotary drilling (e.g. an elongated opening), the annular space between the screen tube and the hole at the base material surface must be filled with adhesive.

CURING AND FIXTURE



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load.

- Do not disturb, torque or load the anchor until it is fully cured (see gel time and curing time table).



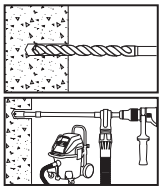
10- After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (see installation specifications for threaded rod in hollow base material) by using a calibrated torque wrench.

- Take care not to exceed the maximum torque for the selected anchor.

INSTALLATION INSTRUCTIONS (POST-INSTALLED REBAR)

HAMMER DRILLING

DRILLING



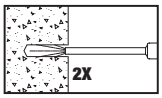
1- Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (reference installation specifications for threaded rod and reinforcing bar). The tolerances of the carbide drill bits, including hollow bits, must meet ANSI Standard B212.15.

- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.
- Note! In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

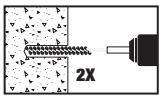
Drilling in dry base materials is recommended when using hollow drill bits (vacuum must be on).

GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED). OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

HOLE CLEANING DRY OR WET HOLES (BLOW 2X, BRUSH 2X, BLOW 2X)

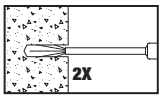


2a- Starting from the bottom or back of the drilled hole, blow the hole clean a minimum of two times (2x). Use a compressed air nozzle (min. 90 psi) for all sizes of reinforcing bar (rebar).



2b- Determine brush diameter (see hole cleaning accessories for post-installed rebar selection table) for the drilled hole and brush the hole by hand or attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).

- A brush extension (supplied by DEWALT) must be used for drill hole depth than the listed brush length. The wire brush diameter must be checked periodically during use; The brush should resist insertion into the drilled hole, if not the brush is too small and must be replaced with the proper brush diameter (i.e. new wire brush).



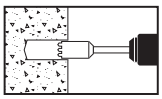
2c- Repeat Step 2a again by blowing the hole clean a minimum of two times (2x).

When finished the hole should be clean and free of dust, debris, oil or other foreign material.

NEXT GO TO STEP 3.

CORE DRILLING

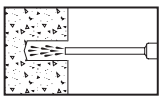
DRILLING



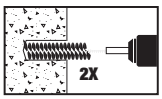
1- Drill a hole into the base material with a core drill tool to the size and embedment required by the selected steel hardware element

Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

HOLE CLEANING (RINSE, BRUSH 2X, RINSE, BLOW 2X)

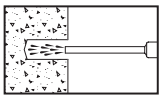


2a- Starting from the bottom or back of the drilled hole, rinse/flush the hole clean with air/water (air/water line pressure) until clear water comes out.

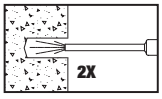


2b- Determine brush diameter (see hole cleaning accessories for post-installed rebar selection table) for drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of two times (2x).

- A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length. The wire brush diameter must be checked periodically during use The brush should resist insertion into the drilled hole, if not the brush is small and must be replaced with the proper brush diameter (i.e. new wire brush).

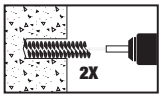


2c- Repeat Step 2a again by rinse/flush the hole clean with water.

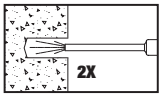


2d- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum if two times (2x). Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar)

When finished the hole should be clean and free of water, debris, oil or other foreign material.



2e- Repeat Step 2b again by brushing the hole with a wire brush a minimum if two times (2x).



2f- Repeat Step 2d again by blowing the hole clean a minimum if two times (2x).

When finished the hole should be clean and free of water, debris, oil or other foreign material.

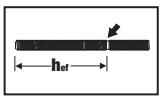
NEXT GO TO STEP 3.

PREPARING

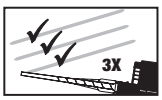
3- Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Review published gel (working) and cure times. Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; except for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best experience, the suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For the permitted range of the base material temperature see published gel and cure times.

Attach a supplied mixing nozzle to the cartridge. Unless otherwise noted do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.

- Note: Always use a new mixing nozzle with new cartridge of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.



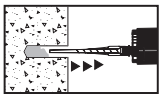
4- Prior to inserting the rebar into the filled drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



5- Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent **RED** color.

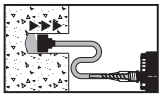
Review and note the published gel (working) and cure times prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



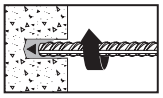
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A flexible extension tube (Cat.# 08297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only (see hole cleaning tools and accessories for post-installed rebar table).

WITH PISTON PLUG:

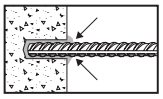


Note: Piston plugs must be used with and attached to mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations with rebar sizes as indicated in the hole cleaning tools and accessories for post-installed rebar table. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

Attention! Do not install anchors overhead or upwardly inclined without installation hardware supplied by DEWALT and also receiving proper training and/or certification. Contact DEWALT for details prior to use.

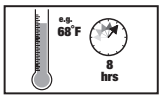


7- The reinforcing bar should be free of dirt, grease, oil or other foreign material. Push clean rebar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



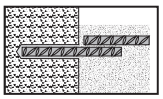
8- Ensure that the reinforcing bar is installed to the specified embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the rebar, remove excess adhesive. For all installations the rebar must be restrained from movement throughout the specified curing period, (as necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the rebar may be performed during the gel (working) time only.

CURING AND LOADING



9- Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (reference gel time and curing time table).

- Do not disturb, torque or load the anchor until it is fully cured.



10- After full curing of the rebar connection, new concrete can be poured (placed) to the installed rebar connection.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
41	5	120 minutes	48 hours
50	10	90 minutes	24 hours
68	20	25 minutes	8 hours
86	30	20 minutes	8 hours
95	35	15 minutes	6 hours
104	40	12 minutes	4 hours
110	43	10 minutes	4 hours

Linear interpolation for intermediate base material temperature is possible.

Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best adhesive dispensing experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use.

Hole Cleaning Equipment Selection Table for Pure110+ Adhesive Anchors[1,2,3]

Rod Diameter (inch)	Rebar Size (No.)	ANSI Drill Bit Diameter[1] (inch)	Brush Length, L (inches)	Steel Wire Brush[2,3] (Cat. #)	Blowout Tool	Number of cleaning actions
Solid Base Material						
3/8	#3	7/16	6-3/4	08284	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	9/16	6-3/4	08285		
-	#4	5/8	6-3/4	08275		
5/8	#5	11/16	7-7/8	08286		
		3/4	7-7/8	08278		
3/4	#6	7/8	7-7/8	08287		
7/8	#7	1	11-7/8	08288		
1	#8	1-1/8	11-7/8	08289		
1-1/4	#9	1-3/8	11-7/8	08290		
-	#10	1-1/2	11-7/8	08291		
Hollow Base Material (with plastic screen tube)						
3/8	-	9/16	6-3/4	08285	Compressed air nozzle only, Cat #8292 (min. 90 psi)	2x blowing 2x brushing 2x blowing
1/2	-	3/4	7-7/8	08278		
5/8	-	7/8	7-7/8	08287		
3/4	-	1	11-7/8	08288		

1. For any case, it must be possible for the steel anchor element to be inserted into the cleaned hole without resistance.
2. An SDS-plus adaptor (Cat. #08283) or Jacobs chuck style adaptor (Cat. #08296) is required to attach a steel wire brush to the drill tool.
3. A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

Piston Plugs for Adhesive Anchors[1,2,3,4]

Plug Size (inch)	ANSI Drill Bit Diameter (inch)	Piston Plug (Cat. #)	Piston Plug
Solid Base Materials			
11/16	11/16	08258	
3/4	3/4	08259	
7/8	7/8	08300	
1	1	08301	
1-1/8	1-1/8	08303	
1-1/4	1-1/4	08307	
1-3/8	1-3/8	08305	
1-1/2	1-1/2	08309	

1. All overhead installations require the use of piston plugs where one is tabulated together with the anchor size.
2. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
3. The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size.
4. A flexible plastic extension tube (Cat. #08281 or #08297) or equivalent approved by DEWALT must be used with piston plugs.

ORDERING INFORMATION

Pure110+ Cartridges

Cat. No.	Description	Std. Box	Std. Ctn.	Pallet
08310SD	Pure110+ 9 fl. oz. Quik-Shot cartridge (1:1 mix ratio)	12	24	432
08321SD	Pure110+ 20.5 fl. oz. dual cartridge (1:1 mix ratio)	12	-	540
08351SD	Pure110+ 50.5 fl. oz. dual cartridge (1:1 mix ratio)	5	-	
08313SD	Pure110+ 13 fl. oz. dual cartridge (3:1 mix ratio)	12	-	540
08320SD	Pure110+ 19.5 fl. oz. dual cartridge (3:1 mix ratio)	12	-	540
One Pure110+ mixing nozzle is packaged with each cartridge. Pure110+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.				

Cartridge System Mixing Nozzles and Nozzle Extensions

Cat. No.	Description	Std. Pkg.	Std. Ctn.
PFC1641600	Mixing nozzle (with 8" extension) for Pure110+ Quik-Shot	2	24
08609	Extra high flow mixing nozzle (with 8" extension) for Pure110+ dual cartridge	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 18" long	1	12
PFC1640600	Flexible Extension Hose, 25 ft.	1	12

Dispensing Tools for Injection Adhesive

Cat. No.	Description	Std. Box	Std. Ctn.
08437	Manual caulking gun for Quik-Shot	1	12
08479	High performance caulking gun for Quik-Shot	1	12
DCE560D1	Cordless 20v Battery powereed dispensing tool for Quik-Shot	1	-
08409	20.5 fl. oz. Standard metal manual tool	1	10
08421	20.5 fl. oz. High performance manual tool	1	10
DCE591D1	20.5 fl. oz. cordless 20v Battery powered dispensing tool	1	-
08413	20.5 fl. oz. Pneumatic tool	1	-
08298	13 fl. oz. + 19.5 fl. oz. Manual tool (3:1 mix ratio)	1	6
DCE593D1	13 fl. oz + 19.5 fl. oz. cordless 20v Battery powered dispensing tool (3:1 mix ratio)	1	-
08497SD	13 fl. oz. + 19.5 fl. oz Pneumatic tool (3:1 mix ratio)	1	6
08438	50.5 fl. oz. Pneumatic tool	1	-

Hole Cleaning Tools and Accessories

Cat No.	Description	Std. Box
08284	Wire brush for 7/16" or 1/2" ANSI hole, 6-3/4" length	1
08285	Wire brush for 9/16" ANSI hole, 6-3/4" length	1
08275	Wire brush for 5/8" ANSI hole, 6-3/4" length	1
08286	Wire brush for 11/16" ANSI hole, 7-7/8" length	1
08278	Wire brush for 3/4" ANSI hole, 7-7/8" length	1
08287	Wire brush for 7/8" ANSI hole, 7-7/8" length	1
08288	Wire brush for 1" ANSI hole, 11-7/8" length	1
08289	Wire brush for 1-1/8" ANSI hole, 11-7/8" length	1
08276	Wire brush for 1-1/4" ANSI hole, 11-7/8" length	1
08290	Wire brush for 1-3/8" ANSI hole, 11-7/8" length	1
08291	Wire brush for 1-1/2" ANSI hole, 11-7/8" length	1
08273	Wire brush for 1-5/8" ANSI hole, 11-7/8" length	1
08299	Wire brush for 1-3/4" ANSI hole, 11-7/8" length	1
08283	SDS-plus adapter for steel brushes	1
08296	Standard drill adapter for steel brushes (e.g. Jacobs Chuck)	1
08282	Steel brush extension, 12" length	1
08292	Air compressor nozzle with extension, 18" length	1

Piston Plugs for Adhesive Anchors

Cat. No.	Description	ANSI Drill Bit Dia.	Qty.
08258	11/16" Plug	11/16"	10
08259	3/4" Plug	3/4"	10
08300	7/8" Plug	7/8"	10
08301	1" Plug	1"	10
08303	1-1/8" Plug	1-1/8"	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

Piston Plugs for Post-Installed Rebar Connections

Cat. No.	Description	ANSI Drill Bit Dia.	Qty.
PFC1691520	3/4" Plug	3/4	10
PFC1691530	7/8" Plug	7/8	10
PFC1691540	1" Plug	1	10
PFC1691550	1-1/8" Plug	1-1/8	10
PFC1691555	1-1/4" Plug	1-1/4	10
PFC1691560	1-3/8" Plug	1-3/8	10
PFC1691570	1-1/2" Plug	1-1/2	10
PFC1691580	1-3/4" Plug	1-3/4	10

Plastic Screen Tubes

Cat. No.	Description	ANSI Drill Diameter	Standard Carton
08310	3/8" x 3-1/2" Plastic Screen	9/16"	25
08311	3/8" x 6" Plastic Screen	9/16"	25
08313	3/8" x 8" Plastic Screen	9/16"	25
08315	1/2" x 3-1/2" Plastic Screen	3/4"	25
08317	1/2" x 6" Plastic Screen	3/4"	25
08321	5/8" x 6" Plastic Screen	7/8"	25
08323	3/4" x 6" Plastic Screen	1"	10
For availability of stainless steel screen tubes, Contact DEWALT			

SDS Max 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5806	5/8"	8"	13-1/2"
DW5809	5/8"	16"	21-1/2"
DW5807	5/8"	31"	36"
DW5808	11/16"	16"	21-1/2"
DW5810	3/4"	8"	13-1/2"
DW5812	3/4"	16"	21-1/2"
DW5813	3/4"	31"	36"
DW5814	13/16"	16"	21-1/2"
DW5815	7/8"	8"	13-1/2"
DW5816	7/8"	16"	21-1/2"
DW5851	7/8"	31"	36"
DW5817	27/32"	16"	21-1/2"
DW5818	1"	8"	13-1/2"
DW5819	1"	16"	22-1/2"
DW5852	1"	24"	29"
DW5820	1"	31"	36"
DW5821	1-1/8"	10"	15"
DW5822	1-1/8"	18"	22-1/2"
DW5853	1-1/8"	24"	29"
DW5854	1-1/8"	31"	36"
DW5824	1-1/4"	10"	15"
DW5825	1-1/4"	18"	22-1/2"

SDS+ Full Head Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5502	3/16"	2"	4-1/2"
DW5503	3/16"	4"	6-1/2"
DW5504	3/16"	5"	8-1/2"
DW5506	3/16"	10"	12"
DW5512	7/32"	8"	10"
DW5517	1/4"	4"	6"
DW5518	1/4"	6"	8-1/2"
DW55200	1/4"	10"	12"
DW5521	1/4"	12"	14"
DW5524	5/16"	4"	6"
DW5526	5916"	10"	12"
DW5527	3/8"	4"	6-1/2"
DW5529	3/8"	8"	10"
DW55300	3/8"	10"	12"
DW5531	3/8"	16"	18"
DW5537	1/2"	4"	6"
DW5538	1/2"	8"	10-1/2"
DW5539	1/2"	10"	12"
DW5540	1/2"	16"	18"

SDS+ 4-Cutter Carbide Drill Bits

Cat. No.	Diameter	Usable Length	Overall Length
DW5471	5/8"	8"	10"
DW5472	5/8"	16"	18"
DW5474	3/4"	8"	10"
DW5475	3/4"	16"	18"
DW5477	7/8"	8"	10"
DW5478	7/8"	16"	18"
DW5479	1"	8"	10"
DW5480	1"	16"	18"
DW5481	1-1/8"	8"	10"
DW5482	1-1/8"	6"	18"

Dust Extraction

Cat. No.	Description
DWV012	10 Gallon Wet/Dry Hepa/Rrp Dust Extractor DWV9402 Fleece bag (5 pack) for DEWALT dust extractors DWV9316 Replacement Anti-Static Hose DWV9320 Replacement HEPA Filter Set (Type 1)
DWH050K	Dust Extraction with two interchangeable drilling heads
DCB1800B	1800 Watt Portable Power Station & Parallel Battery Charger Bare Unit

Hollow Drill Bits

	Cat. No.	Diameter	Overall Length	Usable Length	Recommended Hammer
SDS+	DWA54012	1/2"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54916	9/16"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54058	5/8"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
	DWA54034	3/4"	14-1/2"	9-3/4"	DCH133 / DCH273 / DCH293
SDS Max	DWA58058	5/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58958	5/8"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58116	11/16"	24-3/4"	15-3/4"	DCH481 / D25603K
	DWA58034	3/4"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58934	3/4"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58078	7/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58001	1"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58901	1"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58118	1-1/8"	23-5/8"	15-3/4"	DCH481 / D25603K
	DWA58918	1-1/8"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58114	1-1/4"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58138	1-3/8"	47-1/4"	39-3/8"	DCH481 / D25603K
	DWA58112	1-1/2"	47-1/4"	39-3/8"	DCH481 / D25603K

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DIVISION: 03 00 00—CONCRETE
SECTION: 03 16 00—CONCRETE ANCHORS
DIVISION: 05 00 00—METALS
SECTION: 05 05 19—POST-INSTALLED CONCRETE ANCHORS

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

PURE110+® EPOXY ADHESIVE ANCHOR SYSTEM AND POST-INSTALLED REINFORCING BAR CONNECTION SYSTEM IN CRACKED AND UNCRACKED CONCRETE (DEWALT / POWERS)

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

DEWALT

ADDITIONAL LISTEE:

POWERS FASTENERS

EVALUATION SUBJECT:

PURE110+® EPOXY ADHESIVE ANCHOR SYSTEM AND POST-INSTALLED REINFORCING BAR CONNECTION SYSTEM IN CRACKED AND UNCRACKED CONCRETE (DEWALT / POWERS)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012, and 2009 *International Building Code®* (IBC)
- 2018, 2015, 2012, and 2009 *International Residential Code®* (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-3298 LABC and LARC Supplement.

For evaluation for compliance with the *National Building Code of Canada®* (NBCC), see listing report ELC-3298.

Property evaluated:

Structural

2.0 USES

The Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System are used as anchorage in cracked and uncracked normal-weight concrete or lightweight concrete with a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1] to resist static, wind or earthquake (IBC Seismic Design Categories A through F) tension and shear loads.

The anchor system complies with anchors as described in Section 1901.3 of the 2018 and 2015 IBC, Section 1909 of the 2012 IBC and is an alternative to cast-in-place and post-installed anchors described in Section 1908 of the 2012 IBC, and Sections 1911 and 1912 of the 2009 IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC. The post-installed reinforcing bar connection system is an alternative to cast-in-place reinforcing bars governed by ACI 318 and IBC Chapter 19.

3.0 DESCRIPTION

3.1 General:

The Pure110+ Epoxy Adhesive System is comprised of a two-component epoxy adhesive filled in cartridges, static mixing nozzles, dispensing tools, hole cleaning equipment and adhesive injection accessories. The Pure110+ epoxy adhesive system may be used with continuously threaded steel rods or deformed steel reinforcing bars to form the Pure110+ Epoxy Adhesive Anchor System (see Table 1A and Figure 1 of this report) or with deformed steel reinforcing bars to form the Pure110+ Epoxy Adhesive Post-Installed Reinforcing Bar Connection System (see Table 1B, Figure 1 and Figure 3 of this report). Product names for the report holder and the additional listee are presented in the following table.

COMPANY NAME	PRODUCT NAME
DEWALT	Pure110+®
	(Pure110-PRO outside North America)
Powers Fasteners	Pure110+®
	(Pure110-PRO outside North America)

The adhesive and steel anchor elements (continuously threaded steel rods or deformed steel reinforcing bars) are installed in pre-drilled holes into concrete. The primary components of the Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System, including the epoxy adhesive cartridge, static mixing nozzle, the nozzle extension tube, dispensing tool and typical steel anchor elements, are shown in Figure 2 of this report. Manufacturer's printed installation instructions (MPII) and parameters, included with each adhesive unit package, are shown in Figure 4.

3.2 Materials:

3.2.1 Pure110+ Epoxy Adhesive: Pure110+ epoxy adhesive is an injectable two-component epoxy. The two components are separated by means of a labelled dual-cylinder cartridge. The two components combine and react when dispensed through a static mixing nozzle,

supplied by DEWALT, which is attached to the cartridge. The Pure110+ epoxy adhesive is available in 9-ounce (265 mL), 13-ounce (385 mL), 19.5-ounce (585 mL), 20.5-ounce (610 mL) and 50.5-ounce (1500 mL) cartridges. Each cartridge label is marked with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to an unopened cartridge when stored in accordance with the manufacturer's printed installation instructions (MPII) as illustrated in Figure 4 of this report.

3.2.2 Hole Cleaning Equipment: Standard hole cleaning equipment and dust extraction system equipment (i.e. suction, vacuum) are available from the report holder.

3.2.2.1 Standard Hole Cleaning: Standard hole cleaning equipment used after drilling is comprised of steel wire brushes supplied by DEWALT and a compressed air nozzle (applicable for both post-installed adhesive anchor system and post-installed reinforcing bar connection system). Standard hole cleaning equipment is shown in Figure 4.

3.2.2.2 DustX+™ Extraction System: The DustX+™ extraction system automatically cleans the holes during drilling using hollow drill bits with a carbide head meeting the requirements of ANSI B212.15 and a DEWALT DWV012 / DWV902M vacuum equipped with an automatic filter cleaning system or equivalent approved by DEWALT (applicable for post-installed adhesive anchors and post-installed reinforcing bar connections). After drilling with the DustX+™ system, no further hole cleaning is required. See Figure A for illustration of the DustX+™ extraction system.

3.2.3 Dispensers Pure110+ epoxy adhesive must be dispensed with manual dispensers, pneumatic dispensers, or electric powered dispensers supplied by DEWALT.

3.2.4 Steel Anchor Elements:

3.2.4.1 Threaded Steel Rods: Threaded steel rods must be clean and continuously threaded (all-thread) in diameters as described in Tables 4 and 8 of this report. The embedded portions of threaded rods must be clean, straight, and free of mill scale, rust and other coatings (other than zinc) that may impair the bond with the adhesive. Threaded rods, matching nuts and washers must comply with the requirements including specifications, grades, and mechanical properties prescribed in Table 2 of this report. Carbon steel threaded rods may be furnished with a 0.0002-inch-thick (0.005 mm) zinc electroplated coating complying with ASTM B633, SC1; or a minimum 0.0021-inch-thick (0.053 mm) mechanically deposited zinc coating complying with ASTM B695, Class 55; or a hot dip galvanized zinc coating complying with ASTM A153, Class C or D. Steel grades and material types (carbon, stainless) of the washers and nuts must be matched to the threaded rods. Threaded steel rods must be straight and free of indentations or other defects along their length. The embedded end may be either flat cut or cut on the bias to a chisel point.

3.2.4.2 Steel Reinforcing Bars: Steel reinforcing bars must be deformed reinforcing bars (rebars) as described in Table 3 of this report. Tables 1A, 5, 6, 7, 9, 10 and 11 summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be clean, straight, and free of mill scale, rust and other coatings (other than zinc) that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in ACI 318-14 26.6.3.1 (b) or ACI 318-11 7.3.2, as applicable, with the additional condition that the bars must be bent cold, and heating of the reinforcing bars to facilitate field bending is not permitted.

3.2.4.3 Ductility: In accordance with ACI 318-14 Section 2.3 or ACI 318-11 Appendix D.1, as applicable, in order for a steel anchor element to be considered ductile, the tested elongation must be at least 14 percent and the reduction of area must be at least 30 percent. Steel elements with a tested elongation of less than 14 percent or a reduction of area less than 30 percent, or both, are considered brittle. Values for various steel materials are provided in Tables 2 and 3 of this report. Where values are nonconforming or unstated, the steel element must be considered brittle.

3.2.5 Steel Reinforcing Bars for Use in Post-Installed Reinforcing Bar Connection System: Steel reinforcing bars used in post-installed reinforcing bar connections must be deformed bars (rebar) as depicted in Figure 3. Tables 1B and 13 summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust, mud, oil, and other coatings (other than zinc) that may impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in ACI 318-14 26.6.3.1(b) or ACI 318-11 7.3.2, as applicable, with the additional condition that the bars must be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

3.3 Concrete:

Normalweight concrete and lightweight concrete must comply with Sections 1903 and 1905 of the IBC, as applicable. The specified compressive strength of the concrete must be from 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) [minimum of 24 MPa is required under ADIBC Appendix L, Section 5.1.1].

4.0 DESIGN AND INSTALLATION

4.1 Strength Design of Pure110+ Epoxy Adhesive Post-installed Adhesive Anchor System:

4.1.1 General: The design strength of anchor system under the 2018 and 2015 IBC, as well as the 2018 and 2015 IRC must be determined in accordance with ACI 318-14 and this report. The design strength of anchor system under the 2012 and 2009 IBC, as well the 2012 and 2009 IRC, must be determined in accordance with ACI 318-11 and this report.

The strength design of anchor system must comply with ACI 318-14 17.3.1 or ACI 318-11 D.4.1, as applicable, except as required in ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable.

Design parameters are provided in Table 4 through Table 11. Strength reduction factors, ϕ, as given in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, must be used for load combinations calculated in accordance with Section 1605.2 of the IBC, ACI 318-14 5.3, or ACI 318-11 9.2, as applicable. Strength reduction factors, ϕ, as described in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C.

4.1.2 Static Steel Strength in Tension: The nominal static steel strength of a single anchor in tension, N_{sa}, in accordance with ACI 318-14 17.4.1.2 or ACI 318-11 D.5.1.2, as applicable, and the associated strength reduction factors, ϕ, in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are provided in Tables 4, 5, 8 and 9 of this report for the corresponding steel anchor element. See Table 1A for index of design tables.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal static concrete breakout strength of a single anchor or group of anchors in tension, N_{cb} or N_{cbg}, must be calculated in accordance with ACI 318-14 17.4.2 or

ACI 318-11 D.5.2, as applicable, with the following addition:

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable, using the selected values of $k_{c,cr}$ and $k_{c,uncr}$ as provided in the tables of this report. Where analysis indicates no cracking in accordance with ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, N_b must be calculated using $k_{c,uncr}$ and $\Psi_{c,N}$ = 1.0. See Table 1A. For anchors in lightweight concrete see ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable. The value of f'_c used for calculation must be limited to 8,000 psi (55 MPa) in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable. Additional information for the determination of nominal bond strength in tension is given in Section 4.1.4 of this report.

4.1.4 Static Bond Strength in Tension: The nominal static bond strength of a single adhesive anchor or group of adhesive anchors in tension, N_a or N_{ag}, must be calculated in accordance with ACI 318-14 17.4.5 or ACI 318-11 D.5.5, as applicable. Bond strength values ($\tau_{k,cr}$, $\tau_{k,uncr}$) are a function of the concrete service temperature, concrete state (cracked, uncracked), concrete type (normal weight, lightweight), drilling method (hammer-drill, i.e. rotary impact drill or rock drill with a carbide bit), concrete compressive strength (f'_c) and installation conditions (dry concrete, water-saturated concrete, water-filled holes, underwater). Special inspection level is qualified as periodic for all anchors except as noted in Section 4.4 of this report. The selection of continuous special inspection level, with an onsite proof loading program, is not necessary and does not provide a benefit of a lower anchor category or an increase in the associated strength reduction factors for design. The following table summarizes the requirements.

CONCRETE STATE	COCRETE TYPE	DRILLING METHOD	BOND STRENGTH	CONCRETE COMPRESSIVE STRENGTH	PERMISSIBLE INSTALLATION CONDITIONS	ASSOCIATED STRENGTH REDUCTION FACTOR
Cracked	Normal weight or lightweight	Hammer-drill	$\tau_{k,cr}$	f'_c	Dry concrete	ϕ_d
					Water-saturated concrete	ϕ_{ws}
					Water-filled hole (flooded)	ϕ_{wf}
					Underwater (submerged)	ϕ_{uw}
Uncracked	Normal weight or lightweight	Hammer-drill	$\tau_{k,uncr}$	f'_c	Dry concrete	ϕ_d
					Water-saturated concrete	ϕ_{ws}
					Water-filled hole (flooded)	ϕ_{wf}
					Underwater (submerged)	ϕ_{uw}

Figure 1 of this report presents a flowchart for the establishment of the bond strength. The bond strength values in this report, correspond to concrete compressive strength f'_c equal to 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c, between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.23}$ [For **SI:** $(f'_c / 17.2)^{0.23}$]. Where applicable, the modified bond strength values must be used in lieu of $\tau_{k,cr}$ and $\tau_{k,uncr}$ in ACI 318-14 Equations (17.4.5.1d) and (17.4.5.2) or ACI 318-11 Equations (D-21) and (D-22), as applicable. The resulting nominal bond strength must be multiplied by the associated strength reduction factor ϕ_{nn}.

Figure 1 of this report presents a bond strength design selection flowchart. Strength reduction factors for determination of the bond strength are given in Tables 7 and 11 of this report (see Table 1A for an index of design tables). Adjustments to the bond strength may also be taken for increased concrete compressive strength as noted in the footnotes to the corresponding tables.

4.1.5 Static Steel Strength in Shear: The nominal static steel strength of a single anchor in shear as governed by the steel, V_{sa}, in accordance with ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, and strength reduction factors, ϕ, in accordance with ACI 318-14 17.2.3 or ACI 318-11 D.4.3, as applicable, are given in Tables 4, 5, 8 and 9 of this report for the anchor element types included in this report.

4.1.6 Static Concrete Breakout Strength in Shear: The nominal concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, must be calculated in accordance with ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, based on information given in Table 6 and 10 of this report. The basic concrete breakout strength in shear of a single anchor in cracked concrete, V_b, must be calculated in accordance with ACI 318-14 17.5.2.2 or ACI 318-11 D.6.2.2, as applicable, using the value of d given in Tables 4, 5, 8 and 9 of this report in lieu of d_a. In addition, h_{ef} must be substituted for ℓ_e. In no case shall ℓ_e exceed 8d. For anchors in lightweight concrete see ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable. The value of f'_c must be limited to a maximum of 8,000 psi (55.2 MPa), in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable.

4.1.7 Static Concrete Pryout Strength in Shear: The nominal static pryout strength of a single anchor or group of anchors in shear, V_{cp} or V_{cpg}, shall be calculated in accordance with ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable.

4.1.8 Interaction of Tensile and Shear Forces: For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-14 17.6 or ACI 318-11 D.7, as applicable.

4.1.9 Minimum Member Thickness h_{min}, Anchor Spacing s_{min}, Edge Distance c_{min}: In lieu of ACI 318-14 17.7.1 and 17.7.3 or ACI 318-11 D.8.1 and D.8.3, as applicable, values of s_{min} and c_{min} described in this report must be observed for anchor design and installation. The minimum member thicknesses, h_{min}, described in this report must be observed for anchor design and installation. For adhesive anchors that will remain untorqued, ACI 318-14 17.7.4 or ACI 318-11 D.8.4, as applicable, applies.

For anchors that will be torqued during installation, the maximum torque, T_{max}, must be reduced for edge distances of less than five anchor diameters (5d). T_{max} is subject to the edge distance, c_{min}, and anchor spacing, s_{min}, and must comply with the following requirements:

MAXIMUM TORQUE SUBJECT TO EDGE DISTANCE			
NOMINAL ANCHOR SIZE, d	MIN. EDGE DISTANCE, c_{min}	MIN. ANCHOR SPACING, s_{min}	MAXIMUM TORQUE, T_{max}
All sizes	5d	5d	T_{max}
$^3/_8$ in. to 1 in. (9.5 mm to 25.4 mm)	1.75 in. (45 mm)	5d	0.45·T_{max}
$1^1/_4$ in. (31.8 mm)	2.75 in. (70 mm)		
10 mm to 27 mm (0.39 in. to 1.06 in.)	45 mm (1.75 in.)	5d	0.45·T_{max}
28 mm to 32 mm (1.1 in. to 1.26 in.)	70 mm (2.75 in.)		

For values of T_{max}, see Table 12 and Figure 4.

4.1.10 Critical Edge Distance c_{ac} and $\psi_{cp,Na}$: The modification factor $\psi_{cp,Na}$, must be determined in accordance with ACI 318-14 17.4.5.5 or ACI 318-11 D.5.5.5, as applicable, except as noted below:

For all cases where $c_{Na}/c_{ac} < 1.0$, $\psi_{cp,Na}$ determined from ACI 318-14 Eq. 17.4.5.5b or ACI 318-11 Eq. D-27, as applicable, need not be taken less than c_{Na}/c_{ac}. For all other cases, $\psi_{cp,Na}$ shall be taken as 1.0.

The critical edge distance, c_{ac} must be calculated according to Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11, in lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable.

$$c_{ac}=h_{ef}\left(\frac{\tau_{k,\,uncr}}{1160}\right)^{0.4}\cdot\left[3.1-0.7\frac{h}{h_{ef}}\right]$$

(Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11)

where

$\left[\frac{h}{h_{ef}}\right]$ need not be taken as larger than 2.4; and where

$\tau_{k,uncr}$ = the characteristic bond strength stated in the tables of this report whereby $\tau_{k,uncr}$ need not be taken as larger than:

$$\tau_{k,uncr}=\frac{k_{uncr}\sqrt{h_{ef}f_c'}}{\pi\cdot d_a} \qquad \text{Eq. (4-1)}$$

4.1.11 Design Strength in Seismic Design Categories C, D, E and F: In structures assigned to Seismic Design Category (SDC) C, D, E or F under the IBC or IRC, anchor system must be designed in accordance with ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, except as described below.

The nominal steel shear strength, V_{sa}, must be adjusted by $\alpha_{V,seis}$ as given in Tables 4 and 5 for the corresponding anchor steel. The nominal bond strength τ_{kcr} need not be adjusted by $\alpha_{N,seis}$ since $\alpha_{N,seis}$ = 1.0.

As an exception to ACI 318-11 D.3.3.4.2: Anchor system designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy ACI 318-11 D.3.3.4.3(d).

Under ACI 318-11 D.3.3.4.3(d), in lieu of requiring the anchor design tensile strength to satisfy the tensile strength requirements of ACI 318-11 D.4.1.1, the anchor design tensile strength shall be calculated from ACI 318-11 D.3.3.4.4.

The following exceptions apply to ACI 318-11 D.3.3.5.2:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or non-bearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3 need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

   1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.

   1.2. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).

   1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

   1.4. Anchor bolts are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

   1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

   1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3 need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

   2.1. The maximum nominal anchor diameter is $^5/_8$ inch (16 mm).

   2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

   2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

   2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

   2.5. The track is 33 to 68 mil designation thickness.

   Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.

3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching a sill plate or track to foundation or foundation stem wall need not satisfy ACI 318-11 D.3.3.5.3(a) through (c) when the design strength of the anchors is determined in accordance with ACI 318-11 D.6.2.1(c).

4.2 Strength Design of Pure110+ Epoxy Adhesive Post-Installed Reinforcing Bar Connections:

4.2.1 General: The design of straight post-installed deformed reinforcing bars must be determined in accordance with ACI 318 rules for cast-in place reinforcing bar development and splices and this report. Examples of typical applications for the use of post-installed reinforcing bars are illustrated in Figure 3 of this report.

4.2.2 Determination of bar development length l_d: Values of l_d must be determined in accordance with the ACI 318 development and splice length requirements for straight cast-in place reinforcing bars.

Exceptions:

1. For uncoated and zinc-coated (galvanized) post-installed reinforcing bars, the factor Ψ_e shall be taken as 1.0. For all other cases, the requirements in ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (b) shall apply.

2. When using alternate methods to calculate the development length (e.g., anchor theory), the applicable factors for post-installed anchors generally apply.

4.2.3 Minimum Member Thickness, h_{min}, Minimum Concrete Cover, $c_{c,min}$, Minimum Concrete Edge Distance, $c_{b,min}$, Minimum Spacing, $s_{b,min}$,: For post-installed reinforcing bars, there is no limit on the minimum member thickness. In general, all requirements on concrete cover and spacing applicable to straight

cast-in bars designed in accordance with ACI 318 shall be maintained. For post-installed reinforcing bars installed at embedment depths, h_{ef}, larger than $20d_b$ ($h_{ef} > 20d_b$), the minimum concrete cover shall be as follows:

REBAR SIZE	MINIMUM CONCRETE COVER, $c_{c,min}$
$d_b \le$ No. 6 (16 mm)	$1\ ^1/_8$ in. (29 mm)
No. 6 < $d_b \le$ No. 11 (16 mm < $d_b \le$ 36 mm)	$1^9/_{16}$ in. (40 mm)

The following requirements apply for minimum concrete edge and spacing for $h_{ef} > 20\ d_b$:

Required minimum edge distance for post-installed reinforcing bars (measured from the center of the bar):

$c_{b,min} = d_0/2 + c_{c,min}$

Required minimum center-to-center spacing between post-installed bars:

$s_{b,min} = d_0 + c_{c,min}$

Required minimum center-to-center spacing from existing (parallel) reinforcing:

$s_{b,min} = d_b/2$ *(existing reinforcing)* $+ d_0/2 + c_{c,min}$

All other requirements applicable to straight cast-in place bars designed in accordance with ACI 318 shall be maintained.

4.2.4 Design Strength in Seismic Design Categories C, D, E and F: In structures assigned to SDC C, D, E or F under the IBC or IRC, design of straight post-installed reinforcing bars must take into account the provisions of ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable.

4.3 Allowable Stress Design (ASD):

4.3.1 General: For anchor system designed using load combinations in accordance with IBC Section 1605.3 (Allowable Stress Design), allowable loads must be established using Eq. (4-2) and Eq. (4-3):

$$T_{allowable,ASD} = \phi N_n / \alpha \qquad \text{Eq. (4-2)}$$

and

$$V_{allowable,ASD} = \phi V_n / \alpha \qquad \text{Eq. (4-3)}$$

where

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN).

$V_{allowable,ASD}$ = Allowable shear load (lbf or kN).

ϕN_n = Lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318-14 Chapter 17 or ACI 318 (-11, -08) Appendix D, as applicable, and 2018 and 2015 IBC Section 1905.1.8, 2012 IBC Errata Section 1905.1.9, or 2009 IBC Section 1908.1.9, as applicable, and Section 4.1 of this report, as applicable (lbf or kN).

ϕV_n = Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318-14 Chapter 17 or ACI 318 (-11, -08) Appendix D, as applicable, and 2018 and 2015 IBC Section 1905.1.8, 2012 IBC Errata Section 1905.1.9, or 2009 IBC Section 1908.1.9, as applicable, and Section 4.1 of this report, as applicable (lbf or kN).

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α must include all applicable factors to account for non-ductile failure modes and required over-strength.

The requirements described in this report for member thickness, edge distance and spacing, must apply.

4.3.2 Interaction of Tensile and Shear Forces: Interaction must be calculated in accordance with ACI 318-14 17.6 or ACI 318 (-11, -08) D.7, as applicable, as follows:

For shear loads $V \le 0.2\ V_{allowable,ASD}$, the full allowable load in tension shall be permitted.

For tension loads $T \le 0.2\ T_{allowable,ASD}$, the full allowable load in shear shall be permitted.

For all other cases:

$$\frac{T}{T_{allowable,ASD}} + \frac{V}{V_{allowable,ASD}} \le 1.2 \qquad \text{Eq. (4-4)}$$

4.4 Installation:

Installation parameters are illustrated in Table 12 of this report for post-installed adhesive anchor system and Table 14 for post-installed reinforcing bar connection system. Installation must be in accordance with ACI 318-14 17.8.1 and 17.8.2 or ACI 318-11 D.9.1 and D.9.2, as applicable. Anchor and post-installed reinforcing bar locations must comply with this report and the plans and specifications approved by the code official. Installation of the Pure110+ Epoxy Adhesive Anchor System and Post-installed Reinforcing Bar Connection System must be in accordance with the Manufacturer's printed installation instructions (MPII) included in each unit package as reproduced in Figure 4 of this report.

The adhesive anchor system may be used for upwardly inclined orientation applications (e.g. overhead). Upwardly inclined and horizontal orientation applications are to be installed using piston plugs for the $^5/_8$-inch through $1^1/_4$-inch (M16 through M30) diameter threaded steel rods and No. 5 through No. 10 (14 mm through 32 mm) steel reinforcing bars, installed in the specified hole diameter, and attached to the mixing nozzle and extension tube supplied by DEWALT as described in Figure 4 in this report. Upwardly inclined and horizontal orientation installation for the $^3/_8$-inch and $^1/_2$-inch (M10 and M12) diameter threaded steel rods, and No. 3 and No. 4 (10 mm and 12 mm) steel reinforcing bars may be injected directly to the end of the hole using extension tubing attached to the mixing nozzle with a hole depth $h_0 \le$ 10" (250 mm).

Installation of anchors in horizontal or upwardly inclined (overhead) orientations shall be fully restrained from movement throughout the specified curing period through the use of temporary wedges, external supports, or other methods. Where temporary restraint devices are used, their use shall not result in impairment of the anchor shear resistance.

4.5 Special Inspection:

Periodic special inspection must be performed where required in accordance with Section 1705.1.1 and Table 1705.3 of the 2018, 2015 and 2012 IBC, Section 1704.15 and Table 1704.4 of the 2009 IBC and this report. The special inspector must be on the jobsite initially during adhesive anchor or post-installed reinforcing bar connection installation to verify anchor or post-installed reinforcing bar type and dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, adhesive anchor or post-installed reinforcing bar connection embedment, tightening torque and adherence

to the manufacturer's printed installation instructions (MPII). The special inspector must verify the initial installations of each type and size of adhesive anchor or post-installed reinforcing bar connection by construction personnel on the site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation requires an initial inspection. For ongoing installations over an extended period, the special inspector must make regular inspections to confirm correct handling and installation of the product.

Continuous special inspection of adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads must be performed in accordance with ACI 318-14 17.8.2.4, 26.7.1(h) and 26.13.3.2 (c) or ACI 318-11 D.9.2.4, as applicable.

Under the IBC, additional requirements as set forth in Section 1705 of the 2018, 2015 or 2012 IBC and Sections 1705, 1706 or 1707 of the 2009 IBC must be observed, where applicable.

4.6 Compliance with NSF/ANSI Standard 61:

The Pure110+ Epoxy Adhesive Anchor System and Post-installed Reinforcing Bar Connections comply with the requirements of NSF/ANSI Standard 61, as referenced in Section 605 of the 2018, 2015, 2012 and 2009 *International Plumbing Code*® (IPC), and is certified for use in water distribution systems and may have a maximum exposed surface area to volume ratio of 216 square inches per 1000 gallons (3785 L) for water treatment applications.

5.0 CONDITIONS OF USE:

The Pure110+ Epoxy Adhesive Anchor System and Post-installed Reinforcing Bar Connection System described in this report comply with or is a suitable alternative to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System must be installed in accordance with the Manufacturer's printed installation instructions (MPII) as attached to each cartridge and reproduced in Figure 4 of this report.

5.2 The Adhesive Anchor System and Post-installed Reinforcing Bar Connection System described in this report must be installed in cracked or uncracked normalweight concrete or lightweight concrete having a specified compressive strength, f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

5.3 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.2 MPa). Steel anchor elements must be installed in concrete base materials in holes predrilled in accordance with the instructions provided in Figure 4 of this report.

5.4 The concrete shall have attained its minimum design strength prior to installation of the Adhesive Anchor System and Post-installed Reinforcing Bar Connection System.

5.5 Loads applied to the Adhesive Anchor System and Post-installed Reinforcing Bar Connection System must be adjusted in accordance with Section 1605.2 of the IBC for strength design and in accordance with Section 1605.3 of the IBC for allowable stress design.

5.6 Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System are recognized for use to resist short and long-term loads, including wind and earthquake, subject to the conditions of this report.

5.7 In structures assigned to Seismic Design Categories C, D, E, and F under the IBC or IRC, anchor strength must be adjusted in accordance with Section 4.1.11 of this report, and post-installed reinforcing bars must comply with Section 4.2.4 of this report.

5.8 Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchors or post-installed reinforcing bar, subject to the conditions of this report.

5.9 Adhesive anchor strength design values must be established in accordance with Section 4.1 of this report.

5.10 Post-installed reinforcing bar connection development and splice length is established in accordance with Section 4.2 of this report.

5.11 Allowable stress design values must be established in accordance with Section 4.3 of this report.

5.12 Minimum anchor spacing and edge distance, as well as minimum member thickness, must comply with the values described in this report.

5.13 Post-installed reinforcing bar connection spacing, minimum member thickness, and cover distance must be in accordance with the provisions of ACI 318 for cast-in place bars and Section 4.2.3 of this report.

5.14 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.15 Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, Pure110+ epoxy adhesive anchors and post-installed reinforcing bar connections are permitted for installation in fire-resistive construction provided that at least one of the following conditions is fulfilled:

- Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System are used to resist wind or seismic forces only.
- Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System that support gravity load-bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System are used to support non-structural elements.

5.16 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchor system and post-installed reinforcing bar connection system subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under such conditions is beyond the scope of this report.

5.17 Use of zinc-plated carbon steel threaded rods or steel reinforcing bars for adhesive anchors is limited to dry, interior locations.

5.18 Use of hot-dipped galvanized carbon steel and stainless steel threaded rods for adhesive anchors is permitted for exterior exposure or damp environments.

5.19 Steel anchoring materials in contact with preservative-treated wood and fire-retardant-treated wood must be of zinc-coated carbon steel or stainless steel. The minimum coating weights for zinc-coated steel must comply with ASTM A153.

5.20 Periodic special inspection must be provided in accordance with Section 4.5 of this report. Continuous special inspection of adhesive anchor system and post-installed reinforcing bar connection system installed in horizontal or upwardly inclined orientations to resist sustained tension loads must be provided in accordance with Section 4.5 of this report.

5.21 Pure110+ epoxy Adhesive Anchors System and Post-installed Reinforcing Bar Connection System may be used to resist tension and shear forces in floor, wall and overhead installations into concrete with a temperature between 41°F and 104°F (5°C and 40°C). For overhead and upwardly inclined applications, cartridge temperature must be between 50°F and 90°F (10°C and 32°C) Overhead and upward inclined installations require the use of piston plugs and extension tubing during injection and the adhesive anchor or post-installed reinforcing bar connection system must be supported until fully cured (e.g. wedges or other suitable means). See the MPII in Figure 4 of this report for detailed installation requirements, including required installation equipment, procedures, and temperatures.

5.22 Installation of adhesive anchor system and post-installed reinforcing bar connection system in horizontal or upwardly inclined orientations to resist sustained tension loads must be performed by personnel certified by an applicable certification program in accordance with ACI 318-14 17.8.2.2 or 17.8.2.3 or ACI 318-11 D.9.2.2 or D.9.2.3, as applicable.

5.23 The Pure110+ epoxy adhesive is manufactured under an approved quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED:

Data in accordance with the ICC-ES Acceptance Criteria for Post-installed Adhesive Anchors in Concrete (AC308), dated October 2017 (editorially revised March 2018), which incorporates requirements in ACI 355.4-11 for use in cracked and uncracked concrete; including, but not limited to, tests under freeze/thaw conditions, tests under sustained load, tests for installation including installation direction, tests at elevated temperatures, tests for resistance to alkalinity, tests for resistance to sulfur, tests for seismic tension and shear, and tests for post-installed reinforcing bar connections.

7.0 IDENTIFICATION

The Pure110+ epoxy adhesive and additional listee product name described in Section 3.1 of this report are identified by packaging labeled with the lot number; expiration date; company name (DEWALT); and the evaluation report number (ESR-3298). Threaded rods, nuts, washers and deformed reinforcing bars are standard steel anchor elements and must conform to applicable national or international specifications as set forth in Tables 2 and 3 of this report.

7.1 The report holder's contact information is the following:

DEWALT
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 524-3244
www.DEWALT.com
anchors@DEWALT.com

7.2 The additional listee's contact information is the following:

POWERS FASTENERS
701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286
(800) 524-3244
www.powers.com
engineering@powers.com

The DEWALT drilling systems shown below collect and remove dust with a HEPA dust extractor during the hole drilling operation in dry base materials using hammer-drills (see step 1 of the manufacturer's published installation instructions - MPII).

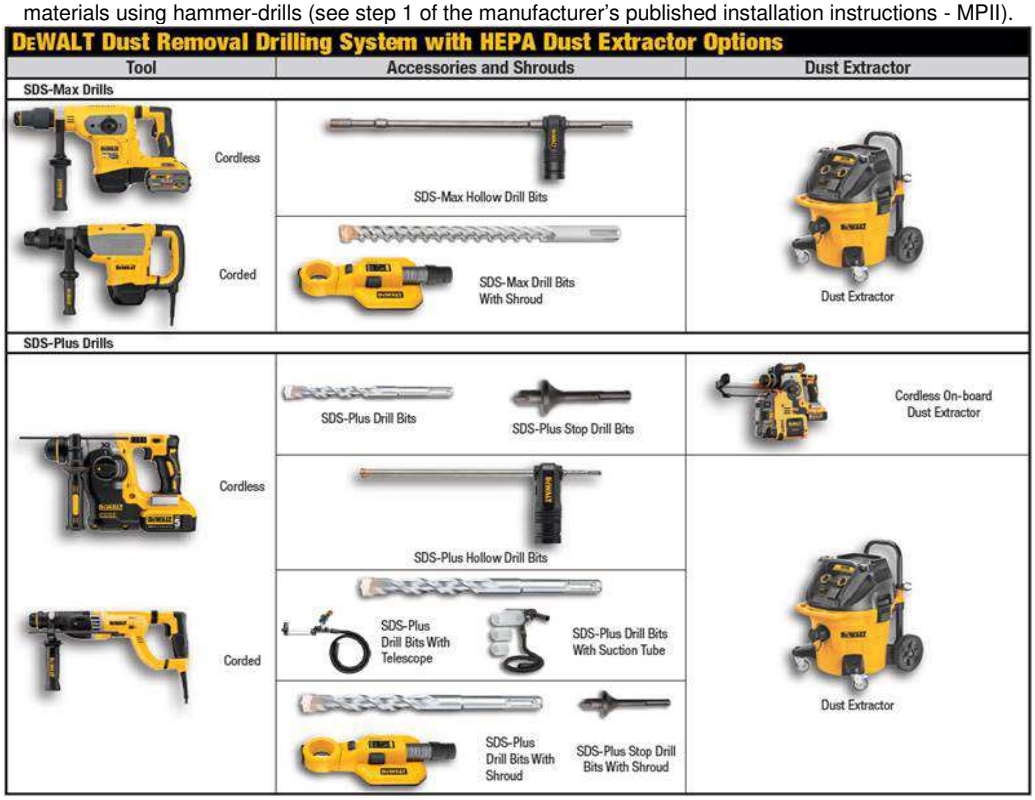


FIGURE A—EXAMPLES DEWALT DUST REMOVAL DRILLING SYSTEMS WITH HEPA DUST EXTRACTORS FOR ILLUSTRATION

TABLE 1A—DESIGN USE AND REPORT TABLE INDEX FOR POST-INSTALLED ADHESIVE ANCHORS

POST-INSTALLED ADHESIVE ANCHORS – TREADED RODS AND REINFORCING BARS (Tables 4 to 11 and Figure 1)					
DESIGN STRENGTH[1]		**THREADED ROD (FRACTIONAL)**	**DEFORMED REINFORCING BAR (FRACTIONAL)**	**THREADED ROD (METRIC)**	**DEFORMED REINFORCING BAR (METRIC)**
Steel	N_{sa}, V_{sa}	Table 4	Table 5	Table 8	Table 9
Concrete	N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	Table 6	Table 6	Table 10	Table 10
Bond[2]	N_a, N_{ag}	Table 7	Table 7	Table 11	Table 11

Concrete Type	**Concrete State**	**Threaded Rod Diameter (inch)**	**Reinforcing Bar Size (No.)**	**Drilling Method[3]**	**Minimum and Maximum Embedment**	**Seismic Design Categories[4]**
Normal-weight and lightweight	Cracked	$^3/_8$, $^1/_2$, $^5/_8$, $^3/_4$, $^7/_8$, 1, $1^1/_4$	3, 4, 5, 6, 7, 8, 9, 10	Hammer-drill	See Table 7	A through F
	Uncracked	$^3/_8$, $^1/_2$, $^5/_8$, $^3/_4$, $^7/_8$, 1, $1^1/_4$	3, 4, 5, 6, 7, 8, 9, 10	Hammer-drill	See Table 7	A and B
Concrete Type	**Concrete State**	**Threaded Rod Diameter (mm)**	**Reinforcing Bar Size (Ø)**	**Drilling Method[3]**	**Minimum and Maximum Embedment**	**Seismic Design Categories[4]**
Normal-weight and lightweight	Cracked	10, 12, 16, 20, 24, 27, 30	10, 12, 14, 16, 20, 25, 28, 32	Hammer-drill	See Table 11	A through F
	Uncracked	10, 12, 16, 20, 24, 27, 30	10, 12, 14, 16, 20, 25, 28, 32	Hammer-drill	See Table 11	A and B

For **SI:** 1 inch = 25.4 mm. For **pound-inch** units: 1 mm = 0.03937 inch.

[1]Reference ACI 318-14 17.3.1.1 or 318-11 D.4.1.1, as applicable for post-installed adhesive anchors. The controlling strength is decisive from all appropriate failure modes (i.e. steel, concrete, bond) and design assumptions.
[2]See Section 4.1.4 of this report for bond strength determination of post-installed adhesive anchors.
[3]Hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow drill bits).
[4]See Section 4.1.11 for requirements for seismic design of post-installed adhesive anchors, where applicable.

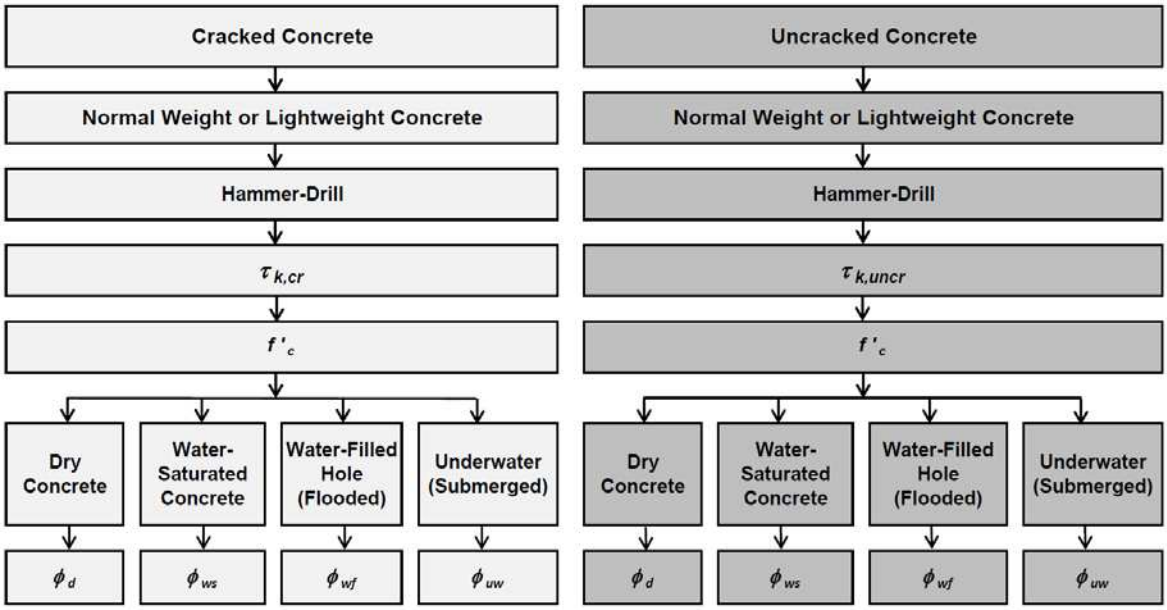


FIGURE 1—FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH FOR POST-INSTALLED ADHESIVE ANCHORS

TABLE 1B—DESIGN USE AND REPORT TABLE INDEX FOR POST-INSTALLED REINFORCING BAR CONNECTIONS[1]

POST-INSTALLED REINFORCING BARS (Table 13 and Figure 3)[5]			
Concrete Type	**Reinforcing Bar Size**	**Drilling Method[2]**	**Seismic Design Categories[3]**
Normal-weight and lightweight	#3, #4, #5, #6, #7, #8, #9, #10, #11	Hammer-drill or core-drill	A through F
	Ø10, Ø12, Ø14, Ø16, Ø20, Ø25, Ø28, Ø32, Ø34, Ø36	Hammer-drill or core-drill	A through F
	10M, 15M, 20M, 25M, 30M, 35M	Hammer-drill or core-drill	A through F

For **SI:** 1 inch = 25.4 mm. For **pound-inch** units: 1 mm = 0.03937 inch.

[1]Determination of development length for post-installed reinforcing bar connections.
[2]Hammer-drill, i.e. rotary impact drills or rock drills with a carbide drill bit (including hollow drill bits); core-drill, i.e. core drill with a diamond core drill bit.
[3]See Section 4.2.4 for requirements for seismic design of post-installed reinforcing bar connections, where applicable.

TABLE 2—SPECIFICATIONS AND PROPERTIES OF COMMON THREADED CARBON AND STAINLESS STEEL ROD MATERIALS[1]

THREADED ROD SPECIFICATION		UNITS	MIN. SPECIFIED ULTIMATE STRENGTH, f_{uta}	MIN. SPECIFIED YIELD STRENGTH 0.2 PERCENT OFFSET, f_{ya}	$\frac{f_{uta}}{f_{ya}}$	ELONGATION MINIMUM PERCENT[11]	REDUCTION OF AREA MIN. PERCENT	NUT SPECIFICATION[12]
Carbon Steel	ASTM A36[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 55	psi (MPa)	75,000 (517)	55,000 (380)	1.36	23	40	
	ASTM F1554[3] Grade 105	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15	45	ASTM A194 / A563 Grade DH
	ASTM A193[4] Grade B7	psi (MPa)	125,000 (860)	105,000 (720)	1.19	16	50	
	ASTM A449[5] ($^3/_8$ to 1 inch dia.)	psi (MPa)	120,000 (828)	92,000 (635)	1.30	14	35	ASTM A194 / A563 Grade DH
	ASTM A449[5] ($1^1/_4$ inch dia.)	psi (MPa)	105,000 (720)	81,000 (560)	1.30	14	35	
	ASTM F568M[6] Class 5.8 (equivalent to ISO 898-1)	psi (MPa)	72,500 (500)	58,000 (400)	1.25	10	35	ASTM A563 Grade DH DIN 934 (8-A2K)[13]
	ISO 898-1[7] Class 5.8	MPa (psi)	500 (72,500)	400 (58,000)	1.25	22	-[14]	DIN 934 Grade 6
	ISO 898-1[7] Class 8.8	MPa (psi)	800 (116,000)	640 (92,800)	1.25	12	52	DIN 934 Grade 8
Stainless Steel	ASTM F593[8] CW1 ($^3/_8$ to $^5/_8$ inch dia.)	psi (MPa)	100,000 (690)	65,000 (450)	1.54	20	-[14]	ASTM F594 Alloy Group 1, 2 or 3
	ASTM F593[8] CW2 ($^3/_4$ to $1^1/_4$ inch dia.)	psi (MPa)	85,000 (590)	45,000 (310)	1.89	25	-[14]	
	ASTM A193/A193M[9] Grade B8/B8M, Class 1	psi (MPa)	75,000 (515)	30,000 (205)	2.50	30	50	ASTM A194/A194M
	ASTM A193/A193M[9] Grade B8/B8M2, Class 2B	psi (MPa)	95,000 (655)	75,000 (515)	1.27	25	40	
	ISO 3506-1[10] A4-70 and HCR-70 (M8 – M24)	MPa (psi)	700 (101,500)	450 (65,250)	1.56	40	-[14]	ISO 4032
	ISO 3506-1[10] A4-50 and HCR-50 (M27 – M30)	MPa (psi)	500 (72,500)	210 (30,450)	2.38	40	-[14]	

For **SI:** 1 inch = 25.4 mm, 1 psi = 0.006897 MPa. For **pound-inch** units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

[1]Pure110+ epoxy adhesive may be used in conjunction with all grades of continuously threaded carbon or stainless steels (all-thread) that comply with this table and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series. Tabulated values correspond to anchor diameters included in this report. See Section 3.2.4.3 of this report for ductility of steel anchor elements.

[2]*Standard Specification for Carbon Structural Steel.*

[3]*Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.*

[4]*Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.*

[5]*Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.*

[6]*Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.*

[7]*Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs*

[8]*Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.*

[9]*Standard Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.*

[10] *Mechanical properties of fasteners made of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs*

[11]Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4*d* and ISO 898, which is based on 5*d*; *d* = nominal diameter.

[12]Nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod. Material types of the nuts and washers must be matched to the threaded rods.

[13]Nuts for metric rods.

[14]Minimum percent reduction of area not reported in the referenced standard.

TABLE 3—SPECIFICATIONS AND PROPERTIES OF COMMON STEEL REINFORCING BARS[1]

REINFORCING SPECIFICATION	UNITS	MINIMUM SPECIFIED ULTIMATE STRENGTH, f_{uta}	MINIMUM SPECIFIED YIELD STRENGTH, f_{ya}
ASTM A615[2], A767[4], Grade 75	psi (MPa)	100,000 (690)	75,000 (520)
ASTM A615[2], A767[4], Grade 60	psi (MPa)	90,000 (620)	60,000 (420)
ASTM A706[3], A767[4], Grade 60	psi (MPa)	80,000 (550)	60,000 (420)
ASTM A615[2], A767[4], Grade 40	psi (MPa)	60,000 (420)	40,000 (280)
DIN 488[5] BSt 500	MPa (psi)	550 (80,000)	500 (72,500)
CAN/CSA G30.18[6], Grade 400	MPa (psi)	540 (78,300)	400 (58,000)

For **SI:** 1 psi = 0.006897 MPa. For **pound-inch** units: 1 MPa = 145.0 psi.

[1]Adhesive must be used with specified deformed reinforcing bars. Tabulated values correspond to bar sizes included in this report.

[2]*Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.* Grade 40 and Grade 60 bars furnished to specification are considered ductile elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3(a)6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2(a) and (b), as applicable. Grade 75 bars furnished to specification are considered brittle elements unless evidence is otherwise shown to the satisfaction of the registered design professional and code official in accordance with Section 3.2.4.3 of this report.

[3]*Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.* Bars furnished to specification are considered ductile elements.

[4]*Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.* Bars furnished to specification are considered brittle elements unless evidence is otherwise shown to the satisfaction of the registered design professional and code official in accordance with Section 3.2.4.3 of this report.

[5]*Reinforcing steel; reinforcing steel bars; dimensions and masses.* Bars furnished to this specification are considered brittle elements unless evidence is otherwise shown to the satisfaction of the registered design professional and code official in accordance with Section 3.2.4.3 of this report.

TABLE 4—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER[1] (inch)						
				3/8	1/2	5/8	3/4	3/8	1	1 1/4
Threaded rod nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.250 (31.8)
Threaded rod effective cross-sectional area		A_{se}	inch² (mm²)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ASTM A36 and ASTM F1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	4,495 (20.0)	8,230 (36.6)	13,110 (58.3)	19,400 (86.3)	26,780 (119.1)	35,130 (156.3)	56,210 (250.0)
		V_{sa}	lbf (kN)	2,695 (12.0)	4,940 (22.0)	7,860 (35.0)	11,640 (51.8)	16,070 (71.4)	21,080 (93.8)	33,725 (150.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM F1554 Grade 55	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,810 (25.9)	10,640 (47.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.0)	72,680 (323.3)
		V_{sa}	lbf (kN)	3,485 (15.5)	6,385 (28.4)	10,170 (45.2)	15,050 (67.0)	20,775 (92.4)	27,255 (121.2)	43,610 (194.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A193 Grade B7 and ASTM F1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,685 (43.1)	17,735 (78.9)	28,250 (125.7)	41,810 (186.0)	57,710 (256.7)	75,710 (336.8)	121,135 (538.8)
		V_{sa}	lbf (kN)	5,815 (25.9)	10,640 (7.3)	16,950 (75.4)	25,085 (111.6)	34,625 (154.0)	45,425 (202.1)	72,680 (323.3)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,300 (41.4)	17,025 (75.7)	27,120 (120.6)	40,140 (178.5)	55,905 (248.7)	72,685 (323.3)	101,755 (452.6)
		V_{sa}	lbf (kN)	5,580 (24.8)	10,215 (45.4)	16,270 (72.4)	24,085 (107.1)	33,540 (149.2)	43,610 (194.0)	61,050 (271.6)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33,475 (148.9)	43,915 (195.4)	[5]
		V_{sa}	lbf (kN)	3,370 (15.0)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,350 (117.2)	[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						[5]
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM F593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	28,430 (126.5)	39,245 (174.6)	51,485 (229.0)	82,370 (366.4)
		V_{sa}	lbf (kN)	4,650 (20.7)	8,515 (37.9)	13,560 (60.3)	17,060 (75.9)	23,545 (104.7)	30,890 (137.4)	49,425 (219.8)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	lbf (kN)	4,420 (19.7)	8,090 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
		V_{sa}	lbf (kN)	2,650 (11.8)	4,855 (21.6)	7,730 (34.4)	11,440 (50.9)	15,790 (70.2)	20715 (92.1)	33,145 (147.4)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	7,365 (32.8)	13,480 (60.0)	21,470 (95.5)	31,775 (141.3)	43,860 (195.1)	57,545 (256.0)	92,065 (409.5)
		V_{sa}	lbf (kN)	4,420 (19.7)	8,085 (36.0)	12,880 (57.3)	19,065 (84.8)	26,315 (117.1)	34,525 (153.6)	55,240 (245.7)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1]Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2(b) or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable, except where noted. Nuts and washers must be appropriate for the rod. See Table 2 for nut specifications.

[2]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to ductile steel elements.

[3]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to brittle steel elements.

[4]In accordance with ACI 318-14 17.4.1.2 and 17.5.1.2 or ACI 318-11 D.5.1.2 and D.6.1.2, as applicable, the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to $1.9f_y$ or 57,000 psi (393 MPa).

[5]The referenced standard includes rod diameters up to and including 1-inch (24 mm).

TABLE 5—STEEL DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL REINFORCING BAR SIZE (REBAR)[1]							
				#3	#4	#5	#6	#7	#8	#9	#10
Rebar nominal outside diameter		d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	1.250 (32.3)
Rebar effective cross-sectional area		A_{se}	inch^2 (mm^2)	0.110 (71.0)	0.200 (129.0)	0.310 (200.0)	0.440 (283.9)	0.600 (387.1)	0.790 (509.7)	1.000 (645.2)	1.270 (819.4)
ASTM A615 Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	11,000 (48.9)	20,000 (89.0)	31,000 (137.9)	44,000 (195.7)	60,000 (266.9)	79,000 (351.4)	100,000 (444.8)	127,000 (564.9)
		V_{sa}	lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	60,000 (266.9)	76,200 (338.9)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Strength reduction factor for tension[3]	ϕ	-	0.65							
	Strength reduction factor for shear[3]	ϕ	-	0.60							
ASTM A615 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	90,000 (400.3)	114,300 (508.4)
		V_{sa}	lbf (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	54,000 (240.2)	68,580 (305.0)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A706 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	lbf (kN)	8,800 (39.1)	16,000 (71.2)	24,800 (110.3)	35,200 (156.6)	48,000 (213.5)	63,200 (281.1)	80,000 (355.9)	101,600 (452.0)
		V_{sa}	lbf (kN)	5,280 (23.5)	9,600 (42.7)	14,880 (66.2)	21,120 (94.0)	28,800 (128.1)	37,920 (168.7)	48,000 (213.5)	60,960 (271.2)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							
ASTM A615 Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	Lbf (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	In accordance with ASTM A615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	Lbf (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Strength reduction factor for tension[2]	ϕ	-	0.75							
	Strength reduction factor for shear[2]	ϕ	-	0.65							

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf.

[1]Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable.

[2]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to ductile steel elements. In accordance with ACI 318-14 17.2.3.4.3(a)(vi) or ACI 318-11 D.3.3.4.3 (a) 6, as applicable, deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of ACI 318-14 20.2.2.4 and 20.2.2.5 or ACI 318-11 21.1.5.2 (a) and (b) as applicable.

[3]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to brittle steel elements.

TABLE 6—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD AND REINFORCING BARS[1]

DESIGN INFORMATION	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch) / REINFORCING BAR SIZE							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1 1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	- (SI)	17 (7.1)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	- (SI)	24 (10.0)							
Minimum embedment	$h_{ef,min}$	inch (mm)	2 3/8 (60)	2 3/4 (70)	3 1/8 (79)	3 1/2 (89)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7 1/2 (191)	10 (254)	12 1/2 (318)	15 (381)	17 1/2 (445)	20 (508)	22 1/2 (572)	25 (635)
Minimum anchor spacing	s_{min}	inch (mm)	1 7/8 (48)	2 1/2 (64)	3 1/8 (79)	3 3/4 (95)	4 3/8 (111)	5 (127)	5 5/8 (143)	6 1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	5d where d is nominal outside diameter of the anchor; or see Section 4.1.9 of this report for design with reduced minimum edge distances down to the following values:							
			1 3/4 (45)						2 3/4 (70)	
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1 1/4 (h_{ef} + 30)		h_{ef} + 2d_o where d_o is hole diameter; for installation parameters see Table 12 of this report					
Critical edge distance—splitting (for uncracked concrete only)	c_{ac}	nch (mm)	See Section 4.1.10 of this report							
Strength reduction factor for tension, concrete failure modes, Condition B[2] (concrete breakout)	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, Condition B[2] (concrete breakout and pryout)	ϕ	-	0.70							

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf.

[1]Additional setting information is described in the installation instructions, Figure 4 of this report.
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4.

TABLE 7—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED RODS AND REINFORCING BARS[1]

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1 1/4
Minimum embedment		$h_{ef,min}$	inch (mm)	2 3/8 (60)	2 3/4 (70)	3 1/8 (79)	3 1/2 (89)	3 1/2 (89)	4 (102)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7 1/2 (191)	10 (254)	12 1/2 (318)	15 (381)	17 1/2 (445)	20 (508)	25 (635)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		psi (N/mm²)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)	1,206 (8.3)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,479 (10.2)
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		psi (N/mm²)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)	882 (6.1)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,073 (7.4)

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL REINFORCING BAR SIZE							
				#3	#4	#5	#6	#7	#8	#9	#10
Minimum embedment		$h_{ef,min}$	inch (mm)	2 3/8 (60)	2 3/4 (70)	3 1/8 (79)	3 1/2 (89)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 (127)
Maximum embedment		$h_{ef,max}$	inch (mm)	7 1/2 (191)	10 (254)	12 1/2 (318)	15 (381)	17 1/2 (445)	20 (508)	22 1/2 (572)	25 (635)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		psi (N/mm²)	1,206 (8.3)	1,170 (8.1)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)	1,122 (7.7)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		psi (N/mm²)	1,829 (12.6)	1,738 (12.0)	1,671 (11.5)	1,617 (11.1)	1,567 (10.8)	1,538 (10.6)	1,507 (10.4)	1,479 (10.2)
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		psi (N/mm²)	882 (6.1)	848 (5.8)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)	814 (5.6)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		psi (N/mm²)	1,334 (9.2)	1,262 (8.7)	1,218 (8.4)	1,175 (8.1)	1,146 (7.9)	1,117 (7.7)	1,102 (7.6)	1,073 (7.4)

Permissible installation conditions[7]	Dry concrete	Anchor Category		1							
		ϕ_d		0.65							
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category		2							
		ϕ_{ws}, ϕ_{wf},		0.55							
	Underwater (submerged)	Anchor Category		2				3			
		ϕ_{uw}		0.55				0.45			
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$		1.0							

For **SI:** 1 inch = 25.4 mm, 1 psi = 0.006894 MPa. For **pound-inch** units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi.

[1]Bond strength values correspond to a normal-weight concrete compressive strength f'_c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.23}$ [For **SI:** $(f'_c / 17.2)^{0.23}$]. See Section 4.1.4 of this report for bond strength determination.

[2]The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.

[3]The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.

[4]Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.

[5]Short-term base material service temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term base material service temperatures are roughly constant over significant periods of time.

[6]Characteristic bond strengths are for sustained loads including dead and live loads.

[7]Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation. For installation instructions see Figure 4 of this report.

[8]Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

[9]For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable. See Section 4.1.11 of this report for requirements for seismic design.

TABLE 8—STEEL DESIGN INFORMATION FOR METRIC THREADED RODS

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER[1] (mm)						
				10	**12**	**16**	**20**	**24**	**27**	**30**
Threaded rod nominal outside diameter		d	mm (inch)	10 (0.39)	12 (0.47)	16 (0.63)	20 (0.79)	24 (0.94)	27 (1.06)	30 (1.18)
Threaded rod effective cross-sectional area		A_{se}	mm² (inch²)	58.0 (0.090)	84.3 (0.131)	157 (0.243)	245 (0.380)	353 (0.547)	459 (0.711)	561 (0.870)
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN (lbf)	29.0 (6,520)	42.0 (9,475)	78.5 (17,645)	122.5 (27,540)	176.5 (39,680)	229.5 (51,595)	280.5 (63,060)
		V_{sa}	kN (lbf)	17.4 (3,910)	25.5 (5,685)	47.0 (10,590)	73.5 (16,525)	106.0 (23,805)	137.5 (30,956)	168.5 (37,835)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ISO 898-1 Class 8.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN (lbf)	46.5 (10,430)	67.5 (15,160)	125.5 (28,235)	196.0 (44,065)	282.5 (63,485)	367.0 (82,550)	449.0 (100,895)
		V_{sa}	kN (lbf)	27.9 (6,270)	40.5 (9,095)	75.5 (16,940)	117.5 (26,440)	169.5 (38,090)	220.5 (49,530)	269.5 (60,535)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ISO 3506-1 Stainless Grades A4 and HCR	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN (lbf)	40.6 (9,125)	59.0 (13,265)	109.9 (24,705)	171.5 (38,555)	247.1 (55,550)	229.5 (51,595)	280.5 (63,060)
		V_{sa}	kN (lbf)	24.4 (5,475)	35.4 (7,960)	65.9 (14,825)	102.9 (23,135)	148.3 (33,330)	137.7 (30,955)	168.3 (37,835)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[3]	ϕ	-	0.65						
	Strength reduction factor for shear[3]	ϕ	-	0.60						
ASTM A193M Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	kN (lbf)	22.8 (5,125)	33.1 (7,450)	61.7 (13,870)	96.3 (21,645)	138.7 (21,645)	180.4 (40,455)	220.5 (49,465)
		V_{sa}	kN (lbf)	13.7 (3,075)	19.9 (4,470)	37.0 (8,325)	57.8 (12,990)	83.2 (18,715)	108.2 (24,335)	132.3 (29,740)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						
ASTM A193M Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN (lbf)	38.0 (8,540)	55.2 (12,415)	102.8 (23,120)	160.5 (36,080)	231.2 (51,980)	300.6 (67,590)	367.5 (82,610)
		V_{sa}	kN (lbf)	22.8 (5,125)	33.1 (7,450)	61.7 (13,870)	96.3 (21,645)	138.7 (21,645)	180.4 (40,455)	220.5 (49,465)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Strength reduction factor for tension[2]	ϕ	-	0.75						
	Strength reduction factor for shear[2]	ϕ	-	0.65						

For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf. For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N.

[1]Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with ACI 318-11 Eq. (D-2) and Eq. (D-29) except where noted. Nuts and washers must be appropriate for the rod. See Table 2 for nut specifications.

[2]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to ductile steel elements.

[3]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, ACI 318-14 5.3 or ACI 318-11 9.2, as applicable are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to brittle steel elements.

[4]In accordance with ACI 318 D.5.1.2 and D.6.1.2 the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to $1.9f_y$ or 393 MPa (57,000 psi).

TABLE 9—STEEL DESIGN INFORMATION FOR METRIC REINFORCING BARS[1]

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL REINFORCING BAR SIZE (Ø)							
				Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Rebar nominal outside diameter		d	mm (inch)	10.0 (0.394)	12.0 (0.472)	14.0 (0.551)	16.0 (0.630)	20.0 (0.787)	25.0 (0.984)	28.0 (1.102)	32.0 (1.260)
Rebar effective cross-sectional area		A_{se}	mm² (inch²)	78.5 (0.122)	113.1 (0.175)	153.9 (0.239)	201.1 (0.312)	314.2 (0.487)	490.9 (0.761)	615.8 (0.954)	804.2 (1.247)
DIN 488 BSt 500	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN (lbf)	43.0 (9,710)	62.0 (13,985)	84.5 (19,035)	110.5 (24,860)	173.0 (38,845)	270.0 (60,695)	338.5 (76,135)	442.5 (99,440)
		V_{sa}	kN (lbf)	26.0 (5,825)	37.5 (8,390)	51.0 (11,420)	66.5 (14,915)	103.0 (23,305)	162.0 (36,415)	203.0 (45,680)	265.5 (59,665)
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Strength reduction factor for tension[2]	ϕ	-	0.65							
	Strength reduction factor for shear[2]	ϕ	-	0.60							

For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf. For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N.

[1]Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable.
[2]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC or ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.4. Values correspond to brittle steel elements.

TABLE 10—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD AND REINFORCING BARS[1]

DESIGN INFORMATION	SYMBOL	UNITS	NOMINAL ROD DIAMETER / REINFORCING BAR SIZE											
			M10 or Ø10	M12	Ø12	Ø14	M16 or Ø16	M20 or Ø20	M24	Ø25	M27	Ø28	M30	Ø32
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI -	17 (7.1)											
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI -	24 (10.0)											
Minimum embedment	$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	70 (2.8)	70 (2.8)	80 (3.2)	90 (3.6)	96 (3.8)	100 (3.9)	108 (4.3)	112 (4.4)	120 (4.7)	128 (5.0)
Maximum embedment	$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	240 (14.8)	280 (11.0)	320 (12.6)	400 (15.8)	480 (18.8)	500 (19.6)	540 (21.4)	560 (22.0)	600 (23.6)	640 (25.2)
Minimum anchor spacing	s_{min}	mm (inch)	50 (2.0)	60 (2.4)	60 (2.4)	70 (3.7)	80 (3.2)	100 (4.0)	120 (4.8)	125 (4.9)	135 (5.3)	140 (5.5)	150 (5.9)	160 (6.3)
Minimum edge distance	c_{min}	mm (inch)	$5d$ where d is nominal outside diameter of the anchor; or see Section 4.1.9 of this report for design with reduced minimum edge distances down to the following values:											
			45 (1.75)								70 (2.75)			
Minimum member thickness	h_{min}	mm (inch)	h_{ef} + 30 (h_{ef} + 1 1/4)	h_{ef} + $2d_o$ where d_o is hole diameter; for installation parameters see Table 12 of this report										
Critical edge distance—splitting (for uncracked concrete only)	c_{ac}	mm (inch)	See Section 4.1.10 of this report											
Strength reduction factor for tension, concrete failure modes, Condition B[2]	ϕ	-	0.65											
Strength reduction factor for shear, concrete failure modes, Condition B[2]	ϕ	-	0.70											

For **pound-inch** units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf. For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N.

[1]Additional setting information is described in the installation instructions, Figure 4 of this report.
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, are used in accordance with ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ must be determined in accordance with ACI 318-11 D.4.5.

TABLE 11—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED RODS AND REINFORCING BARS[1]

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER						
				M10	M12	M16	M20	M24	M27	M30
Minimum embedment		$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	80 (3.2)	90 (3.6)	96 (3.8)	108 (4.3)	120 (4.7)
Maximum embedment		$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	320 (12.6)	400 (15.8)	480 (18.8)	540 (21.4)	600 (23.6)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm^2 (psi)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm^2 (psi)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)	8.3 (1205)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm^2 (psi)	12.5 (1813)	12.1 (1755)	11.5 (1668)	11.1 (1610)	10.7 (1552)	10.5 (1523)	10.3 (1494)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm^2 (psi)	12.5 (1813)	12.1 (1755)	11.5 (1668)	11.1 (1610)	10.7 (1552)	10.5 (1523)	10.3 (1494)
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm^2 (psi)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm^2 (psi)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)	6.1 (882)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm^2 (psi)	9.1 (1320)	8.8 (1276)	8.4 (1218)	8.1 (1175)	7.8 (1131)	7.7 (1117)	7.5 (1088)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm^2 (psi)	9.1 (1320)	8.8 (1276)	8.4 (1218)	8.1 (1175)	7.8 (1131)	7.7 (1117)	7.5 (1088)

DESIGN INFORMATION		SYMBOL	UNITS	REINFORCING BAR SIZE						
				Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Minimum embedment		$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	70 (2.8)	80 (3.2)	90 (3.6)	100 (3.9)	112 (4.4)	128 (5.0)
Maximum embedment		$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	280 (11.0)	320 (12.6)	400 (15.8)	500 (19.6)	560 (22.0)	640 (25.2)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm^2 (psi)	8.3 (1205)	8.1 (1171)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm^2 (psi)	8.3 (1205)	8.1 (1171)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)	7.7 (1120)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm^2 (psi)	12.5 (1813)	12.1 (1755)	11.8 (1711)	11.5 (1668)	11.1 (1610)	10.6 (1537)	10.4 (1508)	10.2 (1479)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm^2 (psi)	12.5 (1813)	12.1 (1755)	11.8 (1711)	11.5 (1668)	11.1 (1610)	10.6 (1537)	10.4 (1508)	10.2 (1479)
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm^2 (psi)	6.1 (882)	5.9 (848)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm^2 (psi)	6.1 (882)	5.9 (848)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)	5.6 (814)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm^2 (psi)	9.1 (1320)	8.8 (1276)	8.6 (1247)	8.4 (1218)	8.1 (1175)	7.8 (1131)	7.6 (1102)	7.4 (1073)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm^2 (psi)	9.1 (1320)	8.8 (1276)	8.6 (1247)	8.4 (1218)	8.1 (1175)	7.8 (1131)	7.6 (1102)	7.4 (1073)

Permissible installation conditions[7]	Dry concrete	Anchor Category	1		
		ϕ_d	0.65		
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category	2		
		ϕ_{ws}, ϕ_{wf},	0.55		
	Underwater (submerged)	Anchor Category	2	3	
		ϕ_{uw}	0.55	0.45	
Reduction factor for seismic tension		$\alpha_{N,seis}$	1.0		

For **pound-inch** units: 1 mm = 0.03937 inch, 1 MPa = 145.0 psi. For **SI:** 1 inch = 25.4 mm, 1 psi = 0.006894 MPa.

[1]Bond strength values correspond to normal-weight concrete compressive strength f'_c = 2,500 psi (17.2 MPa). For concrete compressive strength, f'_c between 2,500 psi and 8,000 psi (17.2 MPa and 55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 2{,}500)^{0.23}$ [For **SI:** $(f'_c / 17.2)^{0.23}$]. See Section 4.1.8 of this report for bond strength determination.

[2]The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable.

[3]The maximum short-term service temperature may be increased to 162°F (72°C) provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category B.

[4]Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1, Temperature Category A.

[5]Short-term elevated concrete temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

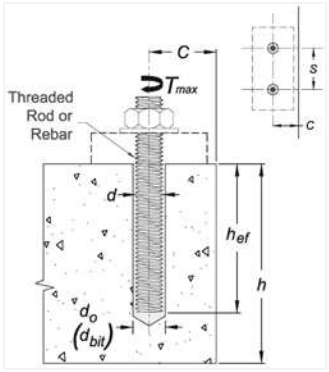
[6]Characteristic bond strengths are for sustained loads including dead and live loads.

[7]Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation. For installation instructions see Figure 4 of this report.

[8]Bond strength values for uncracked concrete are applicable for structures assigned to Seismic Design Categories A and B only.

[9]For structures assigned to Seismic Design Categories C, D, E or F, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable. See Section 4.1.11 of this report for requirements for seismic design.

TABLE 12—INSTALLATION PARAMETERS FOR THREADED RODS AND REINFORCING BARS FOR POST-INSTALLED ADHESIVE ANCHORS



PARAMETER	SYMBOL	UNITS	FRACTIONAL NOMINAL ROD DIAMETER (inch) / REINFORCING BAR SIZE								
			3/8 or #3	1/2 #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1 1/4	#10
Threaded rod outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	-	1.250 (31.8)	-
Rebar nominal outside diameter	d	inch (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.125 (28.7)	-	1.250 (31.8)
Carbide drill bit nominal size[6]	d_{bit} (d_o)	inch	7/16	9/16 5/8	11/16 or 3/4 5	7/8	1	1 1/8	1 3/8	1 3/8	1 1/2
Minimum embedment	$h_{ef,min}$	inch (mm)	2 3/8 (60)	2 3/4 (70)	3 1/8 (79)	3 1/2 (89)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 (127)	5 (127)
Maximum embedment	$h_{ef,max}$	inch (mm)	7 1/2 (191)	10 (254)	12 1/2 (318)	15 (381)	17 1/2 (445)	20 (508)	22 1/2 (572)	25 (635)	25 (635)
Minimum member thickness	h_{min}	inch (mm)	h_{ef} + 1 1/4 (h_{ef} + 30)		h_{ef} + 2d_o						
Minimum anchor spacing	s_{min}	inch (mm)	1 7/8 (48)	2 1/2 (64)	3 1/8 (79)	3 3/4 (95)	4 3/8 (111)	5 (127)	5 5/8 (143)	6 1/4 (159)	6 1/4 (159)
Minimum edge distance	c_{min}	inch (mm)	1 7/8 (48)	2 1/2 (64)	3 1/8 (79)	3 3/4 (95)	4 3/8 (111)	5 (127)	5 5/8 (143)	6 1/4 (159)	6 1/4 (159)
Max. torque[1]	T_{max}	ft-lbs	15	30	60	105	125	165	200	280	280
Max. torque[1,2] (low strength rods)	T_{max}	ft-lbs	5	20	40	60	100	165	-	280	-
Minimum edge distance, reduced[4]	$c_{min,red}$	inch (mm)	1 3/4 (45)	1 3/4 (45)	1 3/4 (45)	1 3/4 (45)	1 3/4 (45)	1 3/4 (45)	2 3/4 (70)	2 3/4 (70)	2 3/4 (70)
Max. torque, reduced[1]	$T_{max,red}$	ft-lbs	7 [5][3]	14	27	47	56	74	90	126	126

PARAMETER	SYMBOL	UNITS	METRIC NOMINAL ROD DIAMETER / REINFORCING BAR SIZE											
			M10	Ø10	M12	Ø12	Ø14	M16	Ø16	M20	Ø20	M24	Ø25	M27	Ø28	M30	Ø32
Threaded rod outside diameter	d	mm (inch)	10 (0.39)		12 (0.47)		-	16 (0.63)		20 (0.79)		24 (0.94)	-	27 (1.06)	-	30 (1.18)	-
Rebar nominal outside diameter	d	mm (inch)	10.0 (0.394)		12.0 (0.472)		14.0 (0.551)	16.0 (0.630)		20.0 (0.787)		-	25.0 (0.984)	-	28.0 (1.102)	-	32.0 (1.260)
Carbide drill bit nominal size[6]	d_{bit} (d_o)	mm	12	14	14	16	18	18	20	24	25	28	32	32	35	35	38
Minimum embedment	$h_{ef,min}$	mm (inch)	60 (2.4)		70 (2.8)		70 (2.8)	80 (3.2)		90 (3.6)		96 (3.8)	100 (3.9)	108 (4.3)	112 (4.4)	120 (4.7)	128 (5.0)
Maximum embedment	$h_{ef,max}$	mm (inch)	200 (7.8)		240 (14.8)		280 (11.0)	320 (12.6)		400 (15.8)		480 (18.8)	500 (19.6)	540 (21.4)	560 (22.0)	600 (23.6)	640 (25.2)
Minimum member thickness	h_{min}	mm (inch)	h_{ef} + 30 (h_{ef} + 1 1/4)				h_{ef} + 2d_o										
Minimum anchor spacing	s_{min}	mm (inch)	50 (2.0)		60 (2.4)		70 (3.7)	80 (3.2)		100 (4.0)		120 (4.8)	125 (4.9)	135 (5.3)	140 (5.5)	150 (5.9)	160 (6.3)
Minimum edge distance	c_{min}	mm (inch)	50 (2.0)		60 (2.4)		70 (3.7)	80 (3.2)		100 (4.0)		120 (4.8)	125 (4.9)	135 (5.3)	140 (5.5)	150 (5.9)	160 (6.3)
Max. torque[1]	T_{max}	N-m	20		40		60	80		120		160	160	180	180	200	300
Max. torque[1,3] (low strength rod)	T_{max}	N-m	7		20		-	40		100		160	-	180	-	200	-
Minimum edge distance, reduced[4]	$c_{min,red}$	mm (inch)	45 (1 3/4)		45 (1 3/4)		45 (1 3/4)	45 (1 3/4)		45 (1 3/4)		45 (1 3/4)	45 (1 3/4)	45 (1 3/4)	70 (2 3/4)	70 (2 3/4)	70 (2 3/4)
Max. torque, reduced[1]	$T_{max,red}$	N-m	9 [7][3]		18		27	36		54		72	72	81	81	90	135

For **pound-inch** units: 1 mm = 0.03937 inch, 1 N-m = 0.7375 ft-lbf. For **SI:** 1 inch = 25.4 mm, 1 ft-lbf = 1.356 N-m.

[1]Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
[2]These torque values apply to ASTM A36 / F1554 Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
[3]These torque values apply to ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rod only.
[4]See Section 4.1.9 of this report for requirements of anchors installed at reduced edge distances.
[5]Either drill bit size listed is acceptable for threaded rod 5/8-inch diameter and rebar size No. 5.
[6]For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.
[7]The DEWALT DustX+ extraction system can be used to automatically clean holes drilled in concrete with a hammer-drill; drilling in dry concrete is required.

FIGURE 2—PURE110+ EPOXY ADHESIVE ANCHOR SYSTEM INCLUDING TYPICAL STEEL ANCHOR ELEMENTS

TABLE 13 —DEVELOPMENT LENGTHS FOR COMMON REINFORCING BAR CONNECTIONS PROVIDED FOR ILLUSTRATION[1,2,3,7,8]

FRACTIONAL REINFORCING BARS											
DESIGN INFORMATION	**SYMBOL**	**REFERENCE STANDARD**	**UNITS**	**NOMINAL REBAR SIZE (US)**								
				#3	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**
Nominal rebar diameter	d_b	ASTM A615/A706, Grade 60 (f_y = **60 ksi**)	in. (mm)	0.375 (9.5)	0.500 (12.7)	0.625 (15.9)	0.750 (19.1)	0.875 (22.2)	1.000 (25.4)	1.128 (28.6)	1.270 (32.3)	1.410 (35.8)
Nominal rebar area	A_b		in^2 (mm^2)	0.11 (71)	0.20 (127)	0.31 (198)	0.44 (285)	0.60 (388)	0.79 (507)	1.00 (645)	1.27 (817)	1.56 (1006)
Development length in f'_c = **2,500 psi** concrete[4,5]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	in. (mm)	12.0 (305)	14.4 (366)	18.0 (457)	21.6 (549)	31.5 (800)	36.0 (914)	40.6 (1031)	45.7 (1161)	50.8 (1290)
Development length in f'_c = **3,000 psi** concrete[4,5]			in. (mm)	12.0 (305)	13.1 (334)	16.4 (417)	19.7 (501)	28.8 (730)	32.9 (835)	37.1 (942)	41.7 (1060)	46.3 (1177)
Development length in f'_c = **4,000 psi** concrete[4,5]			in. (mm)	12.0 (305)	12.0 (305)	14.2 (361)	17.1 (434)	24.9 (633)	28.5 (723)	32.1 (815)	36.2 (920)	40.1 (1019)
Development length in f'_c = **6,000 psi** concrete[4,5]			in. (mm)	12.0 (305)	12.0 (305)	12.0 (305)	13.9 (354)	20.3 (516)	23.2 (590)	26.2 (666)	29.5 (750)	32.8 (832)
Development length in f'_c = **8,000 psi** concrete[4,5]			in. (mm)	12.0 (305)	12.0 (305)	12.0 (305)	12.1 (307)	17.6 (443)	20.1 (511)	22.7 (577)	25.6 (649)	28.4 (721)

METRIC REINFORCING BARS												
DESIGN INFORMATION	**SYMBOL**	**REFERENCE STANDARD**	**UNITS**	**NOMINAL REBAR SIZE (EU)**								
				Ø10	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø24**	**Ø25**	**Ø28**	**Ø32**	**Ø34**	**Ø36**
Nominal rebar diameter	d_b	DIN 488, BSt 500 (BS 4449: 2005) (f_y = **72.5 ksi**)	mm (in)	10 (0.394)	12 (0.472)	14.0 (0.551)	16 (0.630)	20 (0.787)	24 (0.945)	25 (0.984)	28 (1.102)	32 (1.260)	34 (1.339)	36 (1.417)
Nominal rebar area	A_b		mm^2 (in^2)	78.5 (0.12)	113 (0.18)	154 (0.23)	201 (0.31)	314 (0.49)	452 (0.70)	491 (0.76)	616 (0.96)	804 (1.25)	908 (1.41)	1018 (1.58)
Development length in f'_c = **2,500 psi** concrete[4,6]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	mm (in)	348 (13.7)	417 (16.4)	487 (19.2)	556 (21.9)	870 (34.2)	1044 (41.1)	1087 (42.8)	1217 (47.9)	1392 (54.8)	1479 (58.2)	1566 (61.6)
Development length in f'_c = **3,000 psi** concrete[4,6]			mm (in)	318 (12.5)	381 (15.0)	445 (17.5)	508 (20.0)	794 (31.3)	953 (37.5)	992 (39.1)	1112 (43.8)	1271 (50.0)	1351 (53.2)	1429 (56.3)
Development length in f'_c = **4,000 psi** concrete[4,6]			mm (in)	305 (12.0)	330 (13.0)	385 (15.2)	439 (17.3)	688 (27.1)	825 (32.5)	859 (33.8)	963 (37.9)	1100 (43.3)	1170 (46.0)	1238 (48.7)
Development length in f'_c = **6,000 psi** concrete[4,6]			mm (in)	305 (12.0)	305 (12.0)	314 (12.4)	359 (14.2)	562 (22.1)	674 (26.4)	702 (27.6)	786 (30.9)	899 (35.4)	955 (37.6)	1011 (39.8)
Development length in f'_c = **8,000 psi** concrete[4,6]			mm (in)	305 (12.0)	305 (12.0)	305 (12.0)	311 (12.3)	486 (29.1)	584 (23.0)	608 (23.9)	681 (26.8)	778 (30.6)	827 (32.6)	875 (34.5)

DESIGN INFORMATION	**SYMBOL**	**REFERENCE STANDARD**	**UNITS**	**NOMINAL REBAR SIZE (CA)**					
				10M	**15M**	**20M**	**25M**	**30M**	**35M**
Nominal rebar diameter	d_b	CAN/CSA G30.18, Grade 400 (f_y = **58 ksi**)	mm (in)	11.3 (0.445)	16.0 (0.630)	19.5 (0.768)	25.2 (0.992)	29.9 (1.177)	35.7 (1.406)
Nominal rebar area	A_b		mm^2 (in^2)	100 (0.16)	200 (0.31)	300 (0.46)	500 (0.77)	700 (1.09)	1000 (1.56)
Development length in f'_c = **2,500 psi** concrete[4,6]	l_d	ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3 as applicable	mm (in)	315 (12.4)	445 (17.5)	678 (26.7)	876 (34.5)	1041 (41.0)	1242 (48.9)
Development length in f'_c = **3,000 psi** concrete[4,6]			mm (in)	305 (12.0)	407 (16.0)	620 (24.4)	800 (31.5)	950 (37.4)	1135 (44.7)
Development length in f'_c = **4,000** psi concrete[4,6]			mm (in)	305 (12.0)	353 (13.9)	536 (21.1)	693 (27.3)	823 (32.4)	983 (38.7)
Development length in f'_c = **6,000 psi** concrete[4,6]			mm (in)	305 (12.0)	305 (12.0)	438 (17.3)	566 (22.3)	672 (26.4)	802 (31.6)
Development length in f'_c = **8,000 psi** concrete[4,6]			mm (in)	305 (12.0)	305 (12.0)	379 (14.9)	490 (19.3)	582 (22.9)	695 (27.4)

For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa; for **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

[1]Calculated development lengths in accordance with Section 4.2.2 of this report and ACI 318-14 25.4.2.3 or ACI 318-11 12.2.3, as applicable, for reinforcing bars are valid for static, wind, and earthquake loads.

[2]Calculated development lengths in SDC C through F must comply with ACI 318-14 Chapter 18 or ACI 318-11 Chapter 21, as applicable, and Section 4.2.4 of this report. Post-installed reinforcing bars may be installed into holes drilled with a hammer-drill (i.e. rotary impact drills or rock drills with a carbide drill bit, including hollow drill bits) or a core-drill (i.e. core drill with a diamond core drill bit).

[3]For Class B splices, minimum length of lap for tension lap splices is 1.3l_d in accordance with ACI 318-14 25.5.2 and ACI 318-11 12.15.1, as applicable.

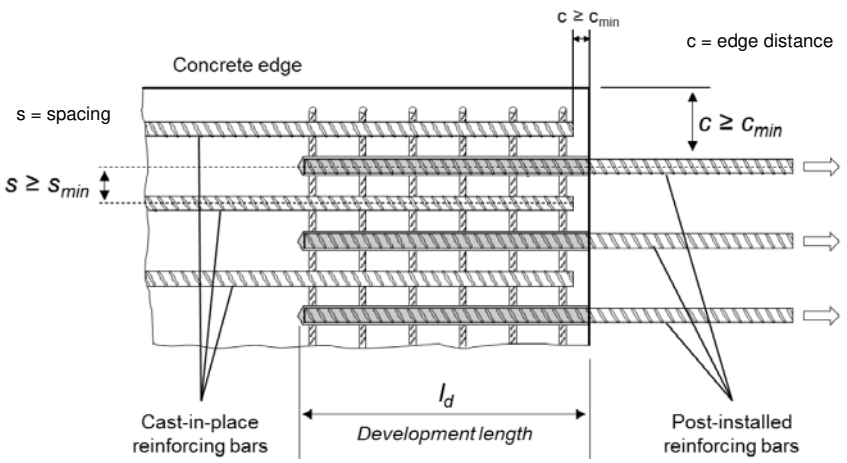
[4]For lightweight concrete, λ = 0.75; therefore multiply development lengths by 1.33 (increase development length by 33 percent), unless the provisions of ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4 (d), as applicable, are met to permit alternate values of λ (e.g for sand-lightweight concrete, λ = 0.85; therefore multiply development lengths by 1.18). Refer to ACI 318-14 19.2.4 or ACI 318-11 8.6.1, as applicable.

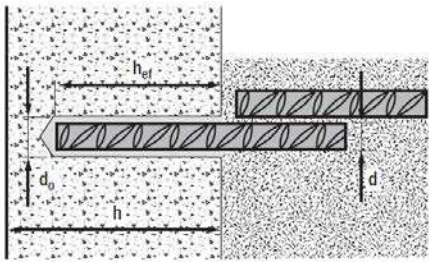
[5] $\left(\frac{c_b+K_{tr}}{d_b}\right)$ = 2.5, ψ_t=1.0, ψ_e=1.0, ψ_s=0.8 for $d_b \leq$ #6,1.0 for $d_b >$ #6. Refer to ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4, as applicable.

[6] $\left(\frac{c_b+K_{tr}}{d_b}\right)$ = 2.5, ψ_t=1.0, ψ_e=1.0, ψ_s=0.8 for $d_b \leq$ 19 mm, 1.0 for $d_b >$ 19 mm. Refer to ACI 318-14 25.4.2.4 or ACI 318-11 12.2.4, as applicable.

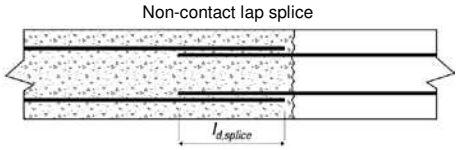
[7]Minimum f'_c of 24 MPa is required under ADIBC Appendix L, Section 5.1.1.

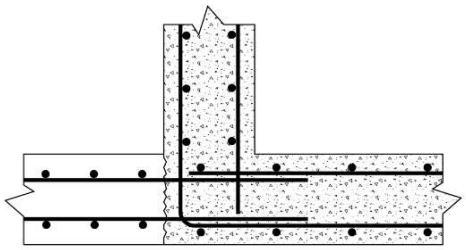
[8]Calculations may be performed for other steel grades and concrete compressive strengths per ACI 318-14 Chapter 25 or ACI 318-11 Chapter 12, as applicable.



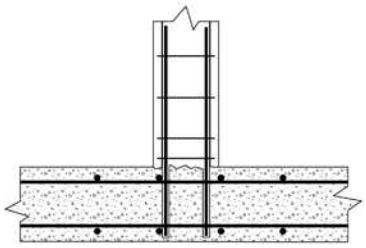


d_b = nomial bar diameter, d_o = nominal hole diameter
h_{ef} = effective embedment, h = member thickness

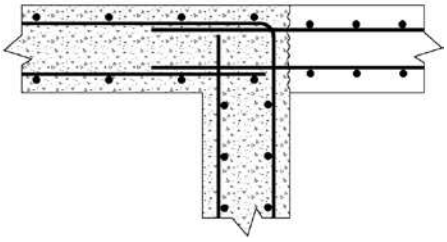




TENSION LAP SPLICE WITH EXISTING REINFORCEMENT FOR FOOTING AND FOUNDATION EXTENSIONS



TENSION DEVELOPMENT OF COLUMN, CAP OR WALL DOWELS



TENSION LAP SPLICE WITH EXISTING FLEXURAL REINFORCEMENT FOR SLAB AND BEAM EXTENSIONS

FIGURE 3—INSTALLATION DETAIL FOR POST-INSTALLED REINFORCING BAR CONNECTIONS (Top Pictures), EXAMPLES OF DEVELOPMENT LENGTH APPLICATION DETAILS FOR POST-INSTALLED REINFORCING BAR CONNECTIONS PROVIDED FOR ILLUSTRATION (Bottom Pictures)

TABLE 14—INSTALLATION PARAMETERS FOR COMMON POST-INSTALLED REINFORCING BAR CONNECTIONS[4]

FRACTIONAL REINFORCING BARS											
PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (US)								
			#3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal hole diameter[1,3]	d_o	in.	$^7/_{16}$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_8$	$1^3/_8$	$1^1/_2$	$1^3/_4$
Effective embedment[2,3]	h_{ef}	in.	$2^3/_8$ to $7^1/_2$	$2^3/_4$ to 10	$3^1/_8$ to $12^1/_2$	$3^1/_2$ to 15	$3^1/_2$ to $17^1/_2$	4 to 20	$4^1/_2$ to $22^1/_2$	5 to 25	$5^1/_2$ to $27^1/_2$
Nominal hole diameter[1,3]	d_o	in.	$^1/_2$	$^5/_8$	$^3/_4$	1	$1^1/_8$	$1^1/_4$	$1^3/_8$	$1^1/_2$	$1^3/_4$
Effective embedment[2,3]	h_{ef}	in.	$7^1/_2$ to $22^1/_2$	10 to 30	$12^1/_2$ to $37^1/_2$	15 to 45	$17^1/_2$ to $52^1/_2$	20 to 60	$22^1/_2$ to $67^1/_2$	25 to 75	$27^1/_2$ to $82^1/_2$

METRIC REINFORCING BARS												
PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (EU)									
			Ø10	Ø12	Ø14	Ø16	Ø20	Ø24	Ø25	Ø28	Ø32	Ø34	Ø36
Nominal hole diameter[1]	d_o	mm	14	16	18	20	25	32	32	35	40	42	45
Effective embedment[2]	h_{ef}	mm	60 to 600	70 to 720	75 to 840	90 to 1200	95 to 1440	100 to 1500	100 to 1500	112 to 1680	128 to 1920	136 to 2040	144 to 2160

PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (CA)					
			10M	15M	20M	25M	30M	35M
Nominal hole diameter[1]	d_o	in.	$^9/_{16}$	$^3/_4$	1	$1^1/_4$	$1^1/_2$	$1^3/_4$
Effective embedment[2]	h_{ef}	mm	70 to 678	80 to 960	90 to 1170	100 to 1512	120 to 1794	140 to 2100

For **SI**: 1 inch ≡ 25.4 mm,; for **pound-inch** units: 1 mm = 0.03937 inches.

[1]For any case, it must be possible for the reinforcing bar (rebar) to be inserted into the cleaned drill hole without resistance.
[2]Consideration should be given regarding the commercial availability of carbide drill bits (including hollow drill bits) and diamond core drill bits, as applicable, with lengths necessary to achieve the effective embedments for post-installed reinforcing bar connections.
[4]For fractional reinforcing bars where the effective embedment is listed for two nominal hole diameters, either nominal hole diameter may be used.
[4]The DEWALT DustX+ extraction system can be used to automatically clean holes drilled in concrete with a hammer-drill; drilling in dry concrete is required.

Pure110+ Instruction Card

DESCRIPTION:
Pure110+ is a high strength, 100% solids epoxy adhesive which is formulated for use in anchoring and rebar connection applications by trained professionals. Refer to installation instructions and SDS for additional detailed information.

PRECAUTION:
Safety glasses and dust masks should be used when drilling holes into concrete, stone and masonry. Wear gloves and safety glasses when handling and dispensing adhesive. Do not sand the adhesive and create silica dust which could be inhaled. Avoid skin and eye contact. Use a NIOSH-approved chemical mask to avoid respiratory discomfort if working indoors or in a confined area, or if sensitive to adhesive odors. Wash hands or other affected body parts with soap and water if skin contact occurs. Flush eyes with plenty of water and seek immediate medical attention if eye contact occurs. Move to fresh air if adhesive odor begins to cause discomfort.

IMPORTANT! Before using, read and review Safety Data Sheet (SDS).
This product contains crystalline silica and as supplied does not pose a dust hazard. IARC classifies crystalline silica (quartz sand) as a Group I carcinogen based upon evidence among workers in industries where there has been long-term and chronic exposure (via inhalation) to silica dust; e.g. mining, quarry, stone crushing, refractory brick and pottery workers. This product does not pose a dust hazard; therefore, this classification is not relevant. However, if reacted (fully cured) product is further processed (e.g. sanded, drilled) be sure to wear proper respiratory and eye protection to avoid health risk.

HANDLING AND STORAGE:
Store in a cool, dry, well ventilated area at temperatures between 41°F (5°C) and 86°F (30°C). Do not freeze. Store and keep away from flame, heat and light. Keep partially used containers closed when not in use. Protect from damage.

Note expiration date on product label before use. Do not use expired product. Partially used cartridges may be stored with hardened adhesive in the attached mixing nozzle. **Note:** if the cartridge is reused, attach a new mixing nozzle and discard initial quantity of anchor adhesive as described in installation instructions.

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[I.] Pure110+ epoxy system selection table

Dispensers			Cartridges			Mixing nozzles
Tool	Size	Cat.#	Type	Size	Cat.#	Cat.#
Manual	Caulking	08437	Quik-shot (coaxial)	9 fl.oz.	08310SD	PFC1640600
Cordless		DCE560D1				
Manual	13 fl.oz.	08298	Dual tube	13 fl.oz.	08313SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	19.5 fl.oz.	08298	Dual tube	19.5 fl.oz.	08320SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	20.5 fl.oz.	08409	Dual tube	20.5 fl.oz.	08321SD	08609
Pneumatic		08413				
Cordless		DCE591D1				
Pneumatic	50.5 fl.oz.	08438	Dual tube	50.5 fl.oz.	08351SD	08609

[II.] Gel (working) times and curing times for adhesive

Temperature of base material		Gel (working) time	Full curing time
41°F	5°C	120 minutes	48 hours
50°F	10°C	90 minutes	24 hours
68°F	20°C	25 minutes	8 hours
86°F	30°C	20 minutes	8 hours
95°F	35°C	15 minutes	6 hours
104°F	40°C	12 minutes	4 hours
110°F	43°C	10 minutes	4 hours

Linear interpolation for intermediate base material temperatures is possible.

[III.] Hole cleaning tools and accessories for Adhesive Anchors[1,2,3,4,5,6,7]

Fractional anchor sizes									Metric anchor sizes							
Rod dia. (inch)	Rebar size (No.)	Drill bit size (inch)	Brush size (inch)	Brush length (inches)	Wire brush (Cat. #)	Plug size (inch)	Piston plug (Cat. #)		Rod dia. (mm)	Rebar size (Ø)	Drill bit size (inch)	Brush size (mm)	Brush length (mm)	Wire brush (Cat. #)	Plug size (mm)	Piston plug (Cat. #)
3/8	3	7/16	7/16	$6^3/_4$	08284	N/A	N/A	Wire brush	10	-	12	12	170	DFC1670100	N/A	N/A
1/2	-	9/16	9/16	$6^3/_4$	08285	N/A	N/A	Brush extension	12	10	14	14	170	DFC1670150	N/A	N/A
-	4	5/8	5/8	$6^3/_4$	08275	N/A	N/A	Drill chuck adaptor	-	12	16	16	200	DFC1670200	N/A	N/A
5/8	5	11/16	11/16	$7^7/_8$	08286	11/16	08258	SDS adaptor	16	14	18	18	200	DFC1670250	18	08259
		3/4	3/4	$7^7/_8$	08278	3/4	08259		-	16	20	20	300	DFC1670300	20	08259
3/4	6	7/8	7/8	$7^7/_8$	08287	7/8	08300	Compressed air nozzle	20	20	25	25	300	DFC1670400	25	08301
7/8	7	1	1	$11^7/_8$	08288	1	08301		24	-	28	28	300	DFC1670450	28	08303
1	8	$1^1/_8$	$1^1/_8$	$11^7/_8$	08289	$1^1/_8$	08303		27	25	32	32	300	DFC1670500	32	08307
$1^1/_4$	9	$1^3/_8$	$1^3/_8$	$11^7/_8$	08290	$1^3/_8$	08305	Std. piston plug	30	28	35	35	300	DFC1670550	35	08305
-	10	$1^1/_2$	$1^1/_2$	$11^7/_8$	08291	$1^1/_2$	08309		-	32	38	38	300	DFC1670600	38	08309

[1]If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.
[2]Holes are drilled with hammer-drill (i.e. rotary impact drills or rock drills with a carbide drill bit, including the use of hollow drill bits).
[3]For any case, it must be possible for the anchor to be inserted into the cleaned drill hole without resistance.
[4]A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.
[5]Brush adaptors for power tool connections are available for drill chuck (Cat.# 08296) and SDS (Cat.# 08283).
[6]A plastic extension tube (Cat# 08281 or 8297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used if the bottom or back of the anchor hole is not reached with the mixing nozzle only.
[7]All overhead (i.e upwardly inclined) installations require the use of piston plugs where one is tabulated together with the anchor size (see table). N/A = Not applicable.
All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with piston plugs.
The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size.

[IV.] Installation parameters - Specifications for installation of threaded rods and reinforcing bars for Adhesive Anchors

Anchor property / Setting information	Nominal threaded rod / reinforcing bar size								
	3/8" or #3	1/2" | #4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8	#9	$1^1/_4$"	#10
d = Threaded rod outside diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	-	1.250	-
d = Nominal rebar diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	1.125	-	1.250
d_{bit} (d_o) = Nominal ANSI drill bit size (in.)	$^7/_{16}$	$^9/_{16}$ | $^5/_8$	$^{11}/_{16}$ or $^3/_4$	$^7/_8$	1	$1^1/_8$	$1^3/_8$	$1^3/_8$	$1^1/_2$
$h_{ef,min}$ = Minimum embedment (inches)	$2^3/_8$	$2^3/_4$	$3^1/_8$	$3^1/_2$	$3^1/_2$	4	$4^1/_2$	5	5
$h_{ef,max}$ = Maximum embedment (inches)	$4^1/_2$	10	$12^1/_2$	15	$17^1/_2$	20	$22^1/_2$	25	25
h_{min} = Minimum member thickness (inches)	$h_{ef} + 1^1/_4$		$h_{ef} + 2d_o$, where d_o is hole diameter						
s_{min} = Minimum spacing (inches)	$1^7/_8$	$2^1/_2$	$3^1/_8$	$3^3/_4$	$4^3/_8$	5	$5^5/_8$	$6^1/_4$	$6^1/_4$
c_{min} = Minimum edge distance (inches)	$1^7/_8$	$2^1/_2$	$3^1/_8$	$3^3/_4$	$4^3/_8$	5	$5^5/_8$	$6^1/_4$	$6^1/_4$
T_{max} = Maximum torque (ft.-lb.)[1]	15	33	60	105	125	165	165	280	280
T_{max} = Maximum torque (ft.-lb.) for A36/Grade 36 and Grade 55 carbon steel rods and Grade B8/B8M (Class 1) stainless rods[2]	5	20	40	60	100	165	-	280	-
$c_{min,red}$ = Minimum edge distance, reduced (inches)	$1^3/_4$	$1^3/_4$	$1^3/_4$	$1^3/_4$	$1^3/_4$	$1^3/_4$	$2^3/_4$	$2^3/_4$	$2^3/_4$
$T_{max,red}$ = Maximum torque (ft.-lb.), reduced edge[1]	7 [5][3]	14	27	47	56	74	90	126	126

Anchor property / Setting information	Nominal threaded rod / reinforcing bar size													
	M10 | Ø10	M12 | Ø12	Ø14	M16 | Ø16	M20 | Ø20	M24	Ø25	M27	Ø28	M30	Ø32		
d = Threaded rod outside diameter (mm)	10	12	-	16	20	24	-	27	-	30	-			
d = Nominal rebar diameter (mm)	10	12	14	16	20	-	25	-	28	-	32			
d_{bit} (d_o) = Nominal ISO drill bit size (mm)	12 | 14	14 | 16	18	18 | 20	24 | 25	28	32	32	35	35	38		
$h_{ef,min}$ = Minimum embedment (mm)	60	70	70	80	90	96	100	108	112	120	128			
$h_{ef,max}$ = Maximum embedment (mm)	200	240	280	320	400	480	500	540	560	600	640			
h_{min} = Minimum member thickness (mm)	$h_{ef} + 1^1/_4$	$h_{ef} + 2d_o$, where d_o is hole diameter												
s_{min} = Minimum spacing (mm)	50	60	70	80	100	120	125	135	140	150	160			
c_{min} = Minimum edge distance (mm)	50	60	70	80	100	120	125	135	140	150	160			
T_{max} = Maximum torque (N-m)[1]	20	40	60	80	120	160	160	180	180	200	300			
T_{max} = Maximum torque (N-m), Grade B8/B8M SS[1,3]	7	20	-	40	100	160	-	180	-	200	-			
$c_{min,red}$ = Minimum edge distance (mm), reduced	45	45	45	45	45	45	45	45	70	70	70			
$T_{max,red}$ = Maximum torque (N-m), reduced edge[1]	9 [7][3]	18	27	36	54	72	72	81	81	90	135			

[1]Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
[2]These torque values apply to ASTM A 36 / F 1554 Grade 36 carbon steel threaded rods; ASTM F 1554 Grade 55 carbon steel threaded rods; and ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rods or equivalent. Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
[3]These torque values apply to ASTM A 193 Grade B8/B8M (Class 1) stainless steel threaded rod only.

Pure110+ Instruction Card (continued)

SELECT HAMMER DRILLING AS SUITABLE FOR APPLICATION

FOLLOW STEPS #1 THROUGH #10 FOR RECOMMENDED INSTALLATION

HAMMER DRILLING

1. Drill a hole into the base material with rotary hammer drill (i.e. percussion drill) and a carbide drill bit to the size and embedment required by the selected steel hardware element (see Table III). Tolerances of carbide drill bits including hollow drill bits must meet ANSI Standard B212.15.

Precaution: Wear suitable eye and skin protection. Avoid inhalation of dusts during drilling and/or removal (see *dust extraction equipment by DEWALT to minimize dust emissions*).

Notes: In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Drilling in dry concrete is recommended when using hollow drill bits (vacuum must be on).

→ ***Go to Step 3 for holes drilled with DustX+™ extraction system (no further hole cleaning is required). Otherwise go to Step 2a for hole cleaning instructions.***

→ ***In the case of an underwater (submerged) installation condition go to Step 2uw-i for separate specific hole cleaning instructions.***

HOLE CLEANING DRY OR WET HOLES

2a. Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of *two* times (**2x**).
Use a compressed air nozzle (min. 90 psi) for all sizes of anchor rod and reinforcing bar (rebar).

Blow 2x

2b. Determine wire brush diameter (see Table III) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of *two* times (**2x**).
A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length. The wire brush diameter must be checked periodically during use; the brush should resist insertion into the drilled hole, if not the brush is too small and must be replaced with the proper brush diameter (i.e. new wire brush).

Brush 2x

2c. **Repeat Step 2a** again by blowing the hole clean a minimum of *two* times (**2x**).
When finished the hole should be clean and free of dust, debris, oil or other foreign material.

→ **Next go to Step 3.**

Repeat Blowing 2x

HOLE CLEANING UNDERWATER INSTALLATION

2uw-i. Starting from the bottom or back of the drilled anchor hole, rinse/flush the hole clean with air/water (air/water line pressure) until clear water comes out.

Rinse

2uw-ii. Determine wire brush diameter (see Table III) for the drilled hole and attach the brush with adaptor to a rotary drill tool. Brush the hole with the selected wire brush a minimum of *two* times (**2x**).
A brush extension (supplied by DEWALT) must be used for holes drilled deeper than the listed brush length. The wire brush diameter must be checked periodically during use; The brush should resist insertion into the drilled hole, if not the brush is too small and must be replaced with the proper brush diameter (i.e. new wire brush).

Brush 2x

2uw-ii. **Repeat Step 2uw-i** again by rinse/flushing the hole clean with air/water.
When finished the hole should be clean and free of dust, debris, oil or other foreign material.

→ **Next go to Step 3.**

Repeat Rinsing

This section is intentionally left blank.

PREPARING

3. Check adhesive expiration date on cartridge label. Do not use expired product. Review Safety Data Sheet (SDS) before use. Cartridge adhesive temperature must be between 50°F - 110°F (10°C - 43°C) when in use; for overhead applications cartridge adhesive temperature must be between 50°F - 90°F (10°C - 32°C) when in use. For best adhesive dispensing experience, suggested minimum cartridge adhesive temperature is 68°F (20°C) when in use. Review published gel (working) and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures. For the permitted range of the base material temperature see Table II.
Attach a supplied mixing nozzle to the cartridge. Do not modify the mixer in any way and make sure the mixing element is inside the nozzle. Load the cartridge into the correct dispensing tool.

Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.

4. Prior to inserting an anchor rod or rebar into the drilled hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.

5. Adhesive must be properly mixed to achieve published properties. Prior to dispensing adhesive into the drilled hole, separately dispense at least three full strokes of adhesive through the mixing nozzle until the adhesive is a consistent ***red*** color.
Review and note the published gel (working) and cure times prior to injection of the mixed adhesive into the cleaned anchor hole (see Table II).

INSTALLATION

6. Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. A plastic extension tube must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only (see Table III). Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids.

with piston plug:

Note: Piston plugs must be used with and attached to mixing nozzle and extension tube for overhead (i.e. upwardly inclined) installations and horizontal installations with anchor rod sizes as indicated in Table III. Insert piston plug to the back of the drilled hole and inject as described in the method above. During injection of the adhesive the piston plug will be naturally extruded from the drilled hole by the adhesive pressure. The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size (see Table III).

Attention! *Do not install anchors overhead without proper training, and installation hardware provided by DEWALT; contact DEWALT prior to use.*

7. The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.

8. Ensure that the anchor element is installed to the specified embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive.
For all installations the anchor element must be restrained from movement throughout the specified curing period (where necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the anchor element may be performed during the gel (working) time only.

CURING & FIXTURE

9. Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (see Table IV).

Note: Do not disturb, torque or load the anchor until it is fully cured.

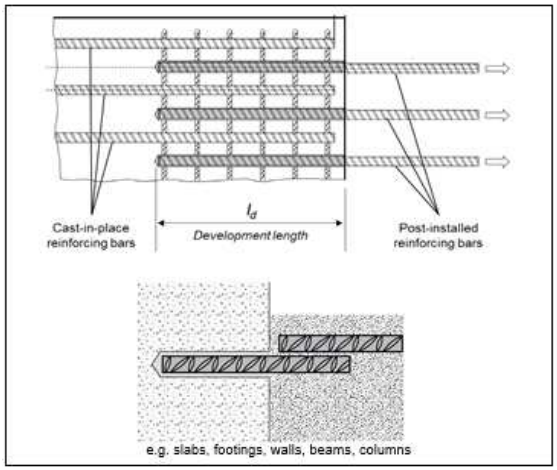
10. After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (shown in Table III) by using a calibrated torque wrench.

Note: Take care not to exceed the maximum torque for the selected anchor.

Installation instructions for Adhesive Anchors in solid base material – For any application not covered by this document please contact DEWALT

FIGURE 4—MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS (MPII) (Continued)

Pure110+ Post-installed Rebar Connections



[V.] Pure110+ epoxy system selection table

Dispensers			Cartridges			Mixing nozzles
Tool	Size	Cat.#	Type	Size	Cat.#	Cat.#
Manual	Caulking	08437	Quik-shot (coaxial)	9 fl.oz.	08310SD	PFC1640600
Cordless		DCE560D1				
Manual	13 fl.oz.	08298	Dual tube	13 fl.oz.	08313SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	19.5 fl.oz.	08298	Dual tube	19.5 fl.oz.	08320SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	20.5 fl.oz.	08409	Dual tube	20.5 fl.oz.	08321SD	08609
Pneumatic		08413				
Cordless		DCE591D1				
Pneumatic	50.5 fl.oz.	08438	Dual tube	50.5 fl.oz.	08351SD	08609

[VI.] Gel (working) times and curing times for adhesive

Temperature of base material		Gel (working) time	Full curing time
41°F	5°C	120 minutes	48 hours
50°F	10°C	90 minutes	24 hours
68°F	20°C	25 minutes	8 hours
86°F	30°C	20 minutes	8 hours
95°F	35°C	15 minutes	6 hours
104°F	40°C	12 minutes	4 hours
110°F	43°C	10 minutes	4 hours

Linear interpolation for intermediate base material temperatures is possible.

[VII.] Hole cleaning tools and accessories for Post-installed Rebar Connections[1,2,3,4,5,6,7]

Fractional reinforcing bar sizes							Wire brush	Metric reinforcing bar sizes											
Rebar size (No.)	Drill bit size (inch)	Brush size (inch)	Brush length (inches)	Wire brush (Cat.#)	Plug size (inch)	Piston plug (Cat.#)		Rebar size (Ø)	(M)	Drill bit size (mm)	(inch)	Brush size (mm)	(inch)	Brush length (mm)	Wire brush (Cat.#)		Plug size (mm)	(inch)	Piston plug (Cat.#)
							Brush extension												
3	7/16	7/16	$6^3/_4$	08284	N/A	N/A		10	10	14	9/16	14	9/16	170	DFC1670150	08285	N/A		N/A
	1/2	1/2	$6^3/_4$	08285	N/A	N/A	Drill chuck adaptor	12	-	16	-	16	-	200	DFC1670200	-	16	-	N/A
4	5/8	5/8	$6^3/_4$	08275	5/8	N/A	SDS adaptor	14	-	18	-	18	-	200	DFC1670250	-	18	-	N/A
5	3/4	3/4	$7^7/_8$	08278	3/4	PFC1691520		-	15	-	3/4	-	3/4	200	-	08278	-	3/4	PFC1691520
6	7/8	7/8	$7^7/_8$	08287	7/8	PFC1691530	Rebar connection premium piston plug	16	-	20	-	20	-	300	DFC1670300	-	20	-	PFC1691520
	1	1	$11^7/_8$	08288	1	PFC1691540		20	20	25	1	25	1	300	DFC1670400	08288	25	1	PFC1691540
7	1	1	$11^7/_8$	08288	1	PFC1691540		24	-	32	-	32	-	300	DFC1670500	-	32	-	PFC1691555
	$1^1/_8$	$1^1/_{16}$	$11^7/_8$	08289	$1^1/_8$	PFC1691550	Compressed air nozzle	25	25	32	$1^1/_4$	32	$1^1/_4$	300	DFC1670500	08290	32	$1^1/_4$	PFC1691555
8	$1^1/_8$	$1^1/_{16}$	$11^7/_8$	08289	$1^1/_8$	PFC1691550		28	-	35	-	35	-	300	DFC1670550	-	35	-	PFC1691560
	$1^1/_4$	$1^1/_4$	$11^7/_8$	08276	$1^1/_4$	PFC1691555		-	30	-	$1^1/_2$	-	$1^1/_2$	300	-	08291	-	$1^1/_2$	PFC1691570
9	$1^3/_8$	$1^3/_8$	$11^7/_8$	08290	$1^3/_8$	PFC1691560		32	-	40	-	40	-	300	DFC1670600	-	40	-	PFC1691570
10	$1^1/_2$	$1^1/_2$	$11^7/_8$	08291	$1^1/_2$	PFC1691570		34	-	42	-	42	-	300	DFC1670605	-	42	-	PFC1691575
11	$1^3/_4$	$1^3/_4$	$11^7/_8$	08299	$1^3/_4$	PFC1691580		-	35	-	$1^3/_4$	-	$1^3/_4$	300	-	08299	-	$1^3/_4$	PFC1691580
							DustX+™ system	36	-	45	-	45	-	300	DFC1670610	-	45	-	PFC1691580

[1]If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.

[2]Holes are drilled with hammer-drilling (i.e. rotary impact drills or rock drills with a carbide drill bit, including the use of hollow drill bits) or core-drilling (i.e. core drill with a diamond core drill bit).

[3]For any case, it must be possible for the reinforcing bar to be inserted into the cleaned hole without resistance.

[4]A brush extension (Cat.# 08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.

[5]Brush adaptors for power tool connections are available for drill chuck (Cat.# 08298) and SDS (Cat.# 08283).

[6]A flexible extension tube (Cat.# 08297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used with the mixing nozzle if the bottom or back of the anchor hole is not reached with the mixing nozzle only.

[7]All overhead (i.e upwardly inclined) installations require the use of piston plugs during where one is tabulated together with the anchor size (see table). N/A = Not applicable. All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches. A flexible extension tube (Cat.# 08297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used with piston plugs.

[VIII.] Installation parameters - Specifications for installation of reinforcing bars for Post-installed Rebar Connections

FRACTIONAL REINFORCING BARS

PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (US) #3	#4	#5	#6	#7	#8	#9	#10	#11
Nominal hole diameter[1]	d_o	in.	$^7/_{16}$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_8$	$1^3/_8$	$1^1/_2$	$1^3/_4$
Effective embedment[2]	h_{ef}	in.	$2^3/_8$ to $7^1/_2$	$2^3/_4$ to 10	$3^1/_8$ to $12^1/_2$	$3^1/_2$ to 15	$3^1/_2$ to $17^1/_2$	4 to 20	$4^1/_2$ to $22^1/_2$	5 to 25	$5^1/_2$ to $27^1/_2$
Nominal hole diameter[1]	d_o	in.	$^1/_2$	$^5/_8$	$^3/_4$	1	$1^1/_8$	$1^1/_4$	$1^3/_8$	$1^1/_2$	$1^3/_4$
Effective embedment[2]	h_{ef}	in.	$7^1/_2$ to $22^1/_2$	10 to 30	$12^1/_2$ to $37^1/_2$	15 to 45	$17^1/_2$ to $52^1/_2$	20 to 60	$22^1/_2$ to $67^1/_2$	25 to 75	$27^1/_2$ to $82^1/_2$

METRIC REINFORCING BARS

PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (EU) Ø10	Ø12	Ø14	Ø16	Ø20	Ø24	Ø25	Ø28	Ø32	Ø34	Ø36
Nominal hole diameter[1]	d_o	mm	14	16	18	20	25	32	32	35	40	42	45
Effective embedment[2]	h_{ef}	mm	60 to 600	70 to 720	75 to 840	90 to 1200	95 to 1440	100 to 1500	100 to 1500	112 to 1680	128 to 1920	136 to 2040	144 to 2160

PARAMETER	SYMBOL	UNITS	NOMINAL REBAR SIZE (CA) 10M	15M	20M	25M	30M	35M
Nominal hole diameter[1]	d_o	mm	$^9/_{16}$	$^3/_4$	1	$1^1/_4$	$1^1/_2$	$1^3/_4$
Effective embedment[2]	h_{ef}	mm	70 to 678	80 to 960	90 to 1170	100 to 1512	120 to 1794	140 to 2100

For **SI**: 1 inch ≡ 25.4 mm.; for **pound-inch** units: 1 mm = 0.03937 inches.

[1]For any case, it must be possible for the reinforcing bar (rebar) to be inserted into the cleaned drill hole without resistance.

[2]Consideration should be given regarding the commercial availability of carbide drill bits (including hollow drill bits) and diamond core drill bits, as applicable, with lengths nessessary to achieve the effective embedments for post-installed reinforcing bar connections.

FIGURE 4—MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS (MPII) (Continued)

Pure110+ Post-installed Rebar Connections (cont.)

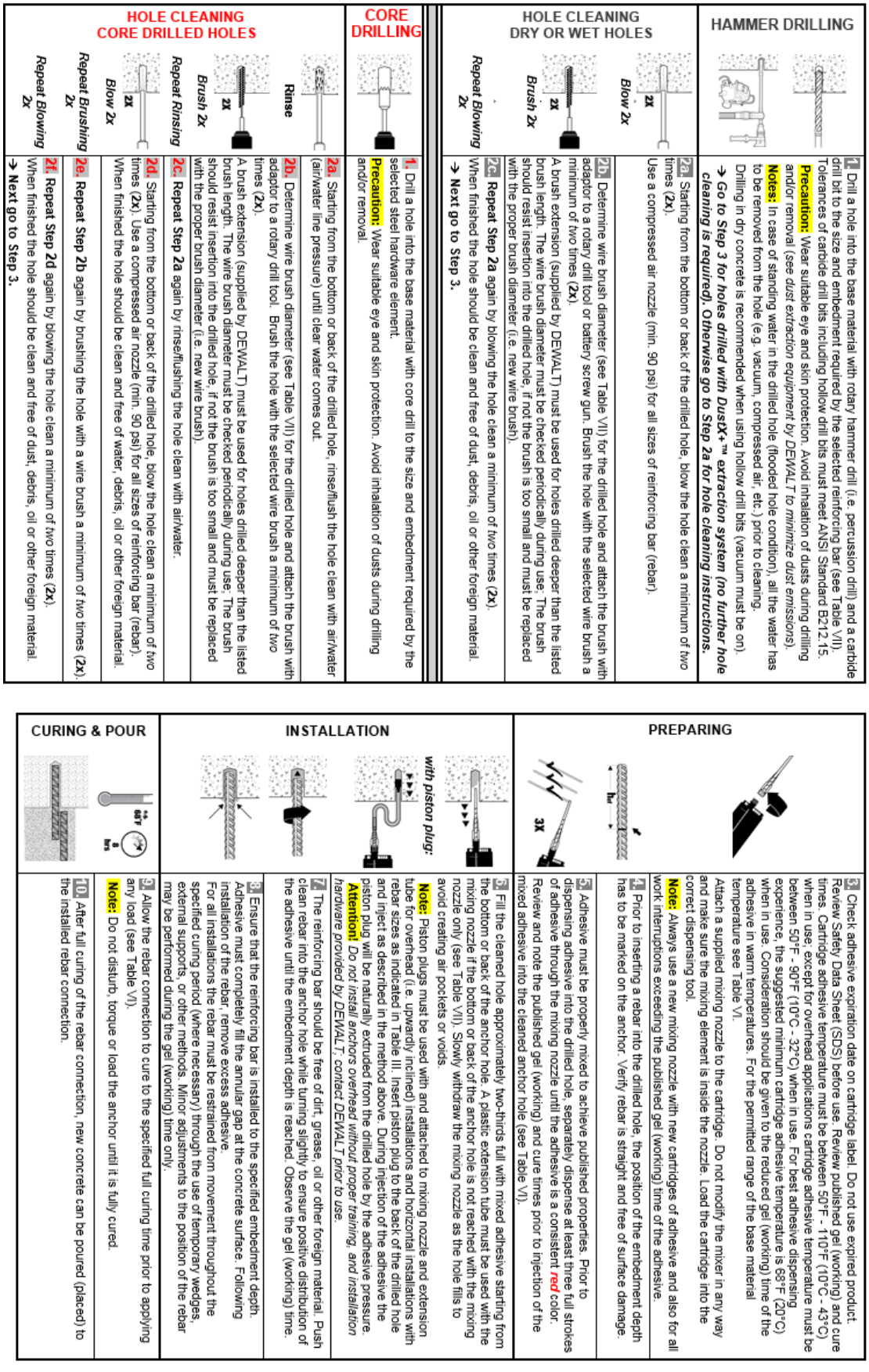


FIGURE 4—MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS (MPII) (Continued)

ICC-ES Evaluation Report ESR-3298 LABC and LARC Supplement

Reissued July 2018
Revised December 2018
This report is subject to renewal July 2019.

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

PURE110+® EPOXY ADHESIVE ANCHOR SYSTEM AND POST-INSTALLED REINFORCING BAR CONNECTION SYSTEM IN CRACKED AND UNCRACKED CONCRETE (DEWALT / POWERS)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System in cracked and uncracked concrete, described in ICC-ES master evaluation report ESR-3298, have also been evaluated for compliance with the codes noted below as adopted by Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2017 *City of Los Angeles Building Code* (LABC)
- 2017 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System in cracked and uncracked concrete, described in Sections 2.0 through 7.0 of the master evaluation report ESR-3298, comply with LABC Chapter 19, and LARC, and are subjected to the conditions of use described in this report.

3.0 CONDITIONS OF USE

The Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the master evaluation report ESR-3298.
- The design, installation, conditions of use and labeling of the Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connection System are in accordance with the 2015 *International Building Code®* (2015 IBC) provisions noted in the master evaluation report ESR-3298.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable and strength design values listed in the master evaluation report and tables are for the connection of the steel anchors and post-installed reinforcing bars to the concrete. The connection between the steel anchors or post-installed reinforcing bars and the connected members shall be checked for capacity (which may govern).

This supplement expires concurrently with the master report, reissued July 2018, revised December 2018.

ICC-ES Evaluation Report

ESR-3298 FBC Supplement

Reissued July 2018
Revised December 2018
This report is subject to renewal July 2019.

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

DEWALT

EVALUATION SUBJECT:

PURE110+® EPOXY ADHESIVE ANCHOR SYSTEM AND POST-INSTALLED REINFORCING BAR CONNECTION SYSTEM IN CRACKED AND UNCRACKED CONCRETE (DEWALT / POWERS)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connections in Cracked and Uncracked Concrete, recognized in ICC-ES master evaluation report ESR-3298, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2017 *Florida Building Code—Building*
- 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Pure110+ Epoxy Adhesive Anchor System and Post-Installed Reinforcing Bar Connections in Cracked and Uncracked Concrete**,** described in Sections 2.0 through 7.0 of the master evaluation report ESR-3298, complies with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2015 *International Building Code®* provisions noted in the master report.

Use of the Pure110+ epoxy adhesive anchors and Post-Installed Reinforcing Bar Connections with stainless steel threaded rod materials and reinforcing bars has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*.,

For products falling under Florida Rule 9N-3, verification that the report holder's quality-assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report, reissued July 2018, revised December 2018.