Product Submittal/Substitution Request

TO:

PROJECT:

PROJECT LOCATION:

SPECIFIED ITEM:

Section | Page | Paragraph | Description

PRODUCT SUBMIT TAL / SUBSTITUTION REQUESTED:

DEWALT® Engineered By Powers® Pure50+(tm) -

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® Pure50+(tm) Submittal Section:

Product Pages:

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

Code Reports & Agency Listings:

- ICC–ES Approval: ESR–3576 (Cracked & Uncracked Concrete)

GENERAL INFORMATION

PURE50+™

Epoxy Injection Adhesive Anchoring System

PRODUCT DESCRIPTION

The Pure50+ is a two-component adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment. The Pure50+ is designed for bonding threaded rod and reinforcing bar hardware into drilled holes in solid concrete base materials.

GENERAL APPLICATIONS AND USES

- Bonding threaded rod and reinforcing bar into hardened concrete
- Evaluated for installation and use in dry, wet, and water-filled holes
- Can be installed in a wide range of base material temperatures

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)
+ Oversized hammer-drilled holes in concrete, for short term loading only (contact DEWALT for details)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES) ESR-3576 for cracked and uncracked concrete.
- Code Compliant with the 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 E488, and ICC-ES AC308 for use in concrete (Design according to ACI 318-14 Chapter 17 and 318-11/08 Appendix D)
- 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 Standard 61 for Drinking Water System Components - Health Effects; minimum requirements for material in contact with potable water and water treatment

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 - Concrete Anchors. and 05 05 19 - Post-Installed Concrete Anchors. Adhesive anchoring system shall be Pure50+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and requirements of the Authority Having Jurisdiction.

SECTION CONTENTS

PACKAGING

Coaxial Cartridge

- 9 fl. oz. (265ml) 1:1 mix ratio

Dual (side-by-side Cartridge)

1:1 mix ratio

- 20.5 fl. oz. (610 ml) 1:1 mix ratio
- 50.5 fl. oz. (1500 ml) 1:1 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. 10 reinforcing bar (rebar)

SUITABLE BASE MATERIALS

- Normal-weight Concrete
- Lightweight Concrete

PERMISSIBLE INSTALLATION CONDITIONS (ADHESIVE)

- Dry Concrete
- Water Saturated Concrete
- Water-Filled Holes

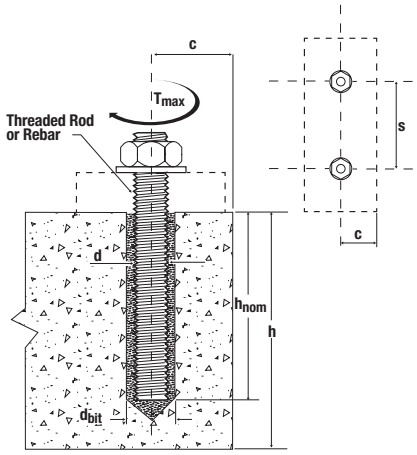
REFERENCE DATA (ASD)

Installation Table for Pure50+ (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 drill hole without resistance.

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:
$[h_{nom} + 1\text{-}1/4"]$ 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

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Pure50+ 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 h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
3/8	7/16	3-3/8	9,725	2,430	9,725	2,430
1/2	9/16	4-1/2	15,240	3,810	17,745	4,435
5/8	11/16 or 3/4	5-5/8	22,870	5,720	28,200	7,050
3/4	7/8	6-3/4	31,765	7,940	36,470	9,120
7/8	1	7-7/8	39,615	9,905	45,745	11,435
1	1-1/8	9	48,750	12,185	66,950	16,740
		10	56,665	14,165	69,305	17,325
1-1/4	1-3/8	11-1/4	76,985	19,245	88,895	22,225

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 greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}].
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water saturated (wet) concrete or in water-filled holes (flooded) require a 15% 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 Pure50+ Installed with Reinforcing Bar into Normal-Weight Concrete (based on bond strength/concrete capacity)[1,2,3,4,5,6,7]

Bar Diameter d in.	Drill Diameter d_{bit} in.	Minimum Embedment Depth h_{ef} in.	Minimum Concrete Compressive Strength			
			3,000 psi		4,000 psi	
			Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)
#3	7/16	3-3/8	9,950	2,490	9,950	2,490
#4	9/16	4-1/2	16,340	4,085	18,045	4,510
#5	11/16 or 3/4	4	16,405	4,100	16,670	4,170
		5-5/8	22,955	5,740	25,345	6,335
#6	7/8	6-3/4	29,690	7,425	35,930	8,985
#8	1-1/8	9	48,465	12,115	65,270	16,320

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 greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
4. The tabulated load values are for applicable for dry concrete. Holes must be drilled with a hammer drill and an ANSI carbide drill bit. Installations in water saturated (wet) concrete or in water-filled holes (flooded) require a 15% 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 Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete, with 1-3/4" Edge Distance (Based on Bond Strength/Concrete Capacity)[1,2,3,4]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)	Ultimate Tension Load Capacity (lbs.)	Ultimate Shear Load Capacity (lbs.)
3/8	3-3/8	6,460	7,200	6,700	7,200	7,100	7,200
1/2	4-1/2	9,625	9,925	9,980	9,925	10,570	9,925
5/8	5-5/8	11,610	12,785	12,040	12,785	12,750	12,785
3/4	6-3/4	12,390	10,360	12,850	10,360	13,615	10,360
1	9	12,390	-	12,850	-	13,615	-

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety.
2. Allowable bond strength/concrete capacity must be checked against allowable steel strength to determine the controlling allowable load.
3. The tabulated data is applicable to single anchors at critical edge distance in uncracked concrete, normal-weight concrete having a compressive strength as listed. Values are for dry concrete in holes 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. Contact DEWALT for more information concerning these installation conditions.
4. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Pure50+ Installed with Threaded Rod into Normal-Weight Concrete with 1-3/4" Edge Distance (Based on Bond Strength / Concrete Capacity)[1,2,3,4,5,6]

Nominal Anchor Diameter (in.)	Minimum Embedment Depth (in.)	Minimum Concrete Compressive Strength - f'c (psi)					
		2,500 psi		3,000 psi		4,000 psi	
		Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)	Allowable Tension Load Capacity (lbs.)	Allowable Shear Load Capacity (lbs.)
3/8	3-3/8	1,615	1,800	1,675	1,800	1,775	1,800
1/2	4 1/2	2,405	2,480	2,495	2,480	2,645	2,480
5/8	5-5/8	2,900	3,195	3,010	3,195	3,190	3,195
3/4	6-3/4	3,100	2,590	3,215	2,590	3,405	2,590
1	9	3,100	-	3,215	-	3,405	-

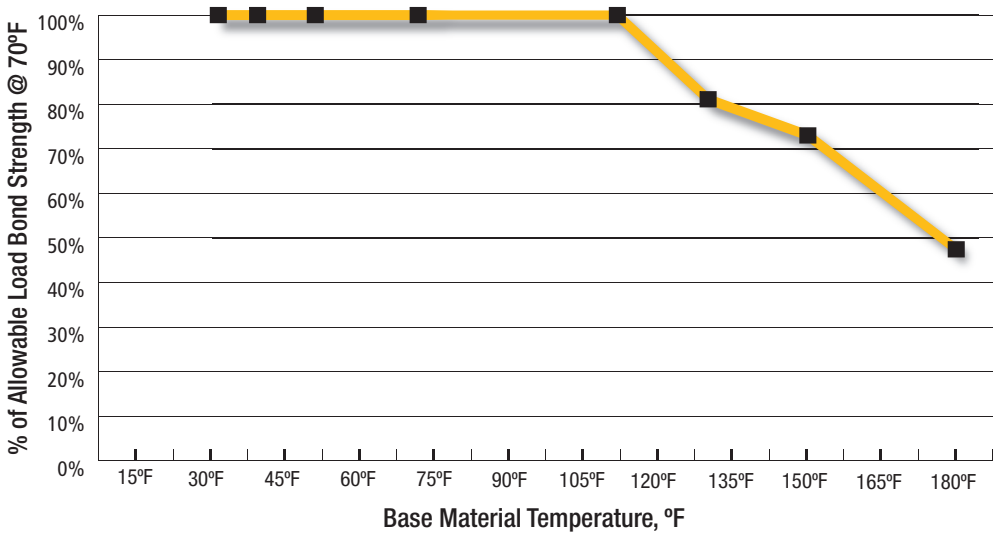
1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths..
3. The tabulated load values are applicable to single anchors where the minimum member thickness is greater of [h_{nom} + 1-1/4"] and [h_{nom} + 2d_{bit}]
4. The tabulated load values are for 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. 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.

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



STRENGTH DESIGN (SD)

Installation Specifications for Threaded Rod and Reinforcing Bar[1]

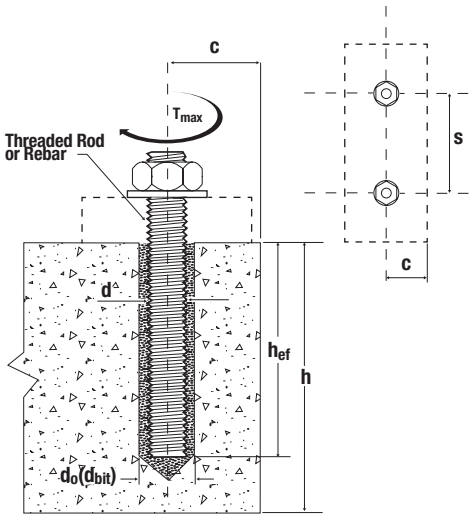
CODE LISTED ICC-ES ESR-3576

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-3576
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 #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

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-3576

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						
ASTM F568 Class 5.8 (ISO 898-1)	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 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 1.9fy 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-3576

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-3576

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: $\tau_{k,uncr} = \frac{k_{uncr} \bullet \sqrt{h_{ef} \bullet f'c}}{\pi \bullet d}$ 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.

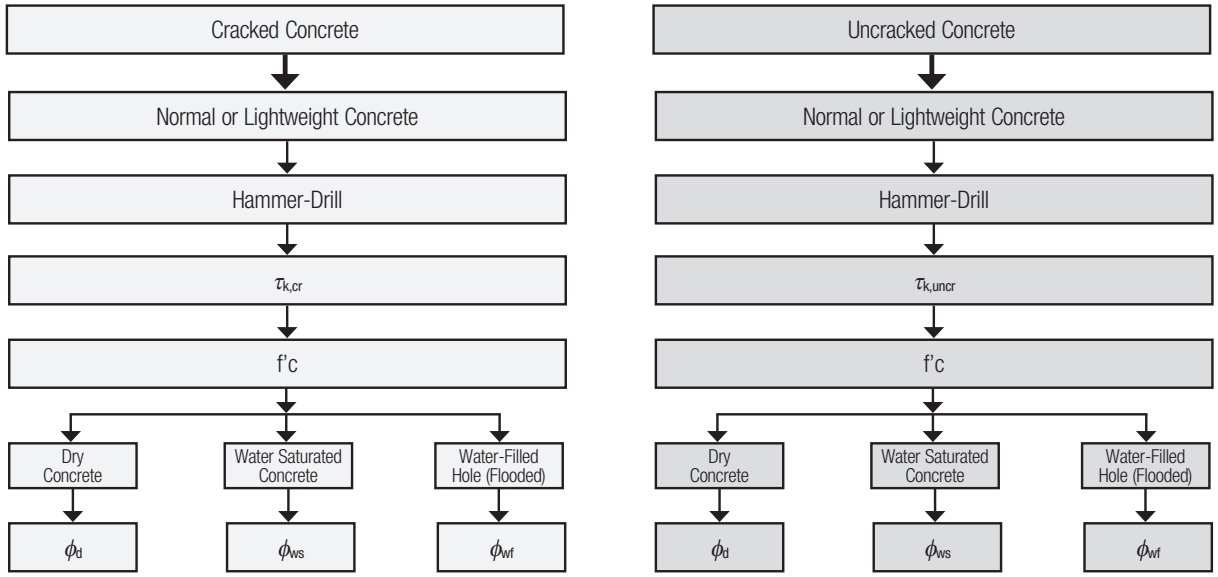
Bond Strength Design Information for Threaded Rods and Reinforcing Bars (For use with load combinations taken from ACI 318-14 Section 5.3)[1]

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
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]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm²)	684 (4.7)	658 (4.5)	632 (4.4)	608 (4.2)	585 (4.0)	562 (3.9)	562 (3.9)	562 (3.9)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,444 (10.0)	1,389 (9.6)	1,335 (9.2)	1,283 (8.8)	1,234 (8.5)	1,184 (8.2)	1,184 (8.2)	1,184 (8.2)
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)	475 (3.3)	457 (3.2)	439 (3.0)	422 (2.9)	406 (2.8)	390 (2.7)	390 (2.7)	390 (2.7)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm²)	1,024 (7.1)	985 (6.8)	947 (6.5)	910 (6.3)	875 (6.0)	840 (5.8)	840 (5.8)	840 (5.8)
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							
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	1							

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 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, and water-filled holes. 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.

FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH



Tension and Shear Design Strength 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]

SD STRENGTH DESIGN TABLES

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 or #3	2-3/8	2,625	2,490	2,740	2,770	2,925	3,150	3,210	3,460	3,430	3,695
	3	3,315	3,700	3,460	4,120	3,695	4,885	4,055	6,210	4,335	7,365
	4-1/2	4,975	6,755	5,190	7,525	5,545	8,920	6,085	11,340	6,500	13,445
	7-1/2	8,295	14,375	8,650	16,010	9,240	18,985	10,145	21,845	10,835	23,340
1/2 or #4	2-3/4	3,555	3,305	3,895	3,755	4,345	4,525	4,770	5,755	5,095	6,825
	4	5,675	6,450	5,915	7,185	6,320	8,520	6,940	10,830	7,415	12,840
	6	8,510	11,750	8,875	13,085	9,480	15,515	10,405	19,725	11,120	23,390
	10	14,180	25,020	14,790	27,875	15,800	33,050	17,345	37,360	18,530	39,915
5/8 or #5	3-1/8	4,310	4,120	4,720	4,680	5,450	5,720	6,430	7,525	6,835	8,920
	5	8,520	9,895	8,885	11,020	9,490	13,065	10,420	16,610	11,130	19,695
	7-1/2	12,780	18,020	13,325	20,070	14,235	23,800	15,630	30,255	16,700	35,870
	12-1/2	21,300	38,395	22,210	42,775	23,730	50,715	26,050	56,105	27,830	59,940
3/4 or #6	3-1/2	5,105	5,015	5,595	5,700	6,460	6,970	7,635	9,255	8,265	11,245
	6	11,465	13,595	12,295	15,315	13,135	18,160	14,420	23,090	15,405	27,375
	9	17,685	25,045	18,440	27,900	19,705	33,080	21,630	42,050	23,110	49,775
	15	29,475	53,355	30,735	59,435	32,840	70,470	36,050	77,645	38,515	82,955
7/8 or #7	3-1/2	5,105	4,930	5,595	5,605	6,460	6,855	7,350	9,100	7,975	11,130
	7	14,445	16,605	15,825	18,865	17,195	22,525	18,875	28,635	20,170	33,950
	10-1/2	23,150	31,060	24,145	34,595	25,795	41,020	28,315	52,150	30,250	61,830
	17-1/2	38,585	66,175	40,240	73,715	42,990	87,400	47,195	101,645	50,420	108,600
1 or #8	4	6,240	6,115	6,835	6,945	7,895	8,495	9,190	11,280	9,980	13,800
	8	17,650	19,750	19,335	22,435	21,550	27,055	23,655	34,395	25,275	40,785
	12	29,015	37,310	30,255	41,560	32,325	49,280	35,485	62,650	37,910	74,280
	20	48,355	79,500	50,425	88,560	53,875	105,005	59,140	127,380	63,185	136,095
#9	4-1/2	7,445	7,110	8,155	8,080	9,420	9,880	11,335	13,125	12,300	16,055
	9	21,060	23,055	23,070	26,190	26,640	32,035	29,940	41,110	31,990	48,745
	13-1/2	36,720	44,600	38,290	49,680	40,910	58,905	44,910	74,885	47,985	88,790
	22-1/2	61,200	94,995	63,820	105,825	68,185	125,475	74,850	159,515	79,970	172,245
1-1/4	5	8,720	8,170	9,555	9,285	11,030	11,355	13,510	15,085	15,190	18,450
	10	24,665	26,380	27,020	29,975	31,200	36,660	36,965	48,050	39,490	56,970
	15	45,315	52,110	47,275	58,060	50,510	68,835	55,445	87,515	59,240	103,760
	25	75,555	111,065	78,790	123,720	84,180	146,695	92,410	186,490	98,730	212,650
#10	5	8,720	8,160	9,555	9,270	11,030	11,335	13,510	15,060	15,020	18,420
	10	24,665	26,430	27,020	30,025	31,200	36,725	36,965	48,135	39,490	57,070
	15	45,315	52,205	47,275	58,165	50,510	68,965	55,445	87,675	59,240	103,955
	25	75,555	111,225	78,790	123,905	84,180	146,910	92,410	186,765	98,730	212,650

☐ - 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-3576.
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-3576 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-3576.
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 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 or #3	2-3/8	1,245	1,340	1,295	1,395	1,385	1,495	1,520	1,640	1,625	1,750
	3	1,570	2,645	1,640	2,945	1,750	3,490	1,920	4,140	2,055	4,425
	4-1/2	2,355	4,825	2,460	5,295	2,625	5,655	2,885	6,210	3,080	6,635
	7-1/2	3,930	8,460	4,095	8,825	4,375	9,425	4,805	10,350	5,135	11,055
1/2 or #4	2-3/4	1,850	2,360	1,925	2,680	2,060	3,235	2,260	4,110	2,415	4,875
	4	2,685	4,605	2,800	5,130	2,995	6,085	3,285	7,080	3,510	7,565
	6	4,030	8,390	4,205	9,055	4,490	9,675	4,930	10,620	5,265	11,345
	10	6,720	14,470	7,005	15,090	7,485	16,120	8,215	17,700	8,780	18,910
5/8 or #5	3-1/8	2,365	2,940	2,500	3,340	2,720	4,085	3,045	5,375	3,235	6,375
	5	4,035	7,065	4,205	7,870	4,495	9,335	4,935	10,625	5,270	11,350
	7-1/2	6,050	12,870	6,310	13,590	6,740	14,515	7,400	15,935	7,905	17,025
	12-1/2	10,085	21,715	10,515	22,645	11,235	24,195	12,330	26,560	13,175	28,375
3/4 or #6	3-1/2	2,805	3,580	2,955	4,070	3,215	4,980	3,620	6,610	3,920	8,035
	6	5,585	9,710	5,825	10,940	6,225	12,970	6,835	14,720	7,300	15,725
	9	8,380	17,890	8,740	18,825	9,335	20,110	10,250	22,075	10,950	23,585
	15	13,970	30,085	14,565	31,370	15,560	33,520	17,085	36,795	18,250	39,310
7/8 or #7	3-1/2	2,720	3,525	2,860	4,000	3,105	4,895	3,485	6,500	3,780	7,950
	7	7,315	11,860	7,630	13,475	8,150	16,090	8,950	19,275	9,560	20,595
	10-1/2	10,975	22,185	11,445	24,650	12,230	26,340	13,425	28,910	14,340	30,890
	17-1/2	18,290	39,400	19,075	41,085	20,380	43,895	22,370	48,185	23,905	51,485
1 or #8	4	3,405	4,365	3,585	4,960	3,890	6,065	4,365	8,060	4,735	9,855
	8	9,180	14,105	9,575	16,025	10,230	19,325	11,230	24,185	11,995	25,840
	12	13,770	26,650	14,360	29,685	15,345	33,050	16,845	36,280	17,995	38,760
	20	22,950	49,435	23,935	51,555	25,575	55,080	28,070	60,465	29,995	64,600
#9	4-1/2	4,205	5,080	4,425	5,770	4,800	7,060	5,380	9,375	5,840	11,465
	9	11,620	16,465	12,115	18,710	12,945	22,880	14,210	29,365	15,185	32,705
	13-1/2	17,430	31,855	18,175	35,485	19,420	41,825	21,315	45,915	22,775	49,055
	22-1/2	29,050	62,570	30,295	65,245	32,365	69,710	35,530	76,525	37,960	81,760
1-1/4	5	5,190	5,835	5,465	6,630	5,925	8,110	6,645	10,775	7,210	13,175
	10	14,345	18,845	14,960	21,410	15,985	26,185	17,545	34,320	18,745	40,375
	15	21,520	37,220	22,440	41,470	23,975	49,170	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935
#10	5	5,135	5,830	5,405	6,620	5,860	8,100	6,570	10,755	7,130	13,155
	10	14,345	18,880	14,960	21,445	15,985	26,230	17,545	34,380	18,745	40,375
	15	21,520	37,290	22,440	41,545	23,975	49,260	26,320	56,685	28,120	60,560
	25	35,865	77,245	37,400	80,550	39,955	86,060	43,865	94,475	46,865	100,935

☐ - 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-3576.
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-3576 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-3576.
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]

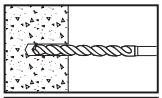
Steel Elements - Threaded Rod and Reinforcing Bar												
Nominal Rod/Rebar Size (in. or No.)	ASTM A36 and ASTM F1554 Grade 36	ASTM F1554 Grade 55	ASTM A193 Grade B7 and ASTM F1554 Grade 105	ASTM A449	ASTM F568M Class 5.8 and ISO 898-1 Class 5.8	ASTM F593 CW Stainless (Types 304 and 316)	ASTM A193 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	-

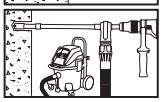
■ - Steel Strength

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.

INSTALLATION INSTRUCTIONS (SOLID BASE MATERIALS)

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.

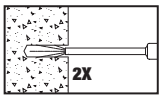
- Precaution: Use suitable eye and skin protection. Avoid inhalation of dust during drilling and/or removal.

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).

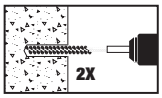
GO TO STEP 3 FOR HOLES DRILLED WITH DUSTX+™ EXTRACTION SYSTEM (NO FURTHER HOLE CLEANING IS REQUIRED).
OTHERWISE GO TO STEP 2A FOR HOLE CLEANING INSTRUCTIONS.

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



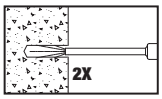
2a- Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of two times (2x).

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



2b- Determine wire brush diameter (see installation specifications) 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 it does not come into contact with the sides of the drilled hole, the brush is too small and must be replaced.



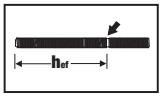
2c- Repeat Step 2a- again by blowing the hole clean a minimum of two times (2x).

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

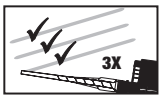
PREPARING

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 - 104°F (10°C - 40°C) when in use; for overhead applications cartridge temperature must be between 50ºF - 90ºF (10ºC - 30ºC). Review published 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.



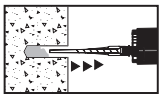
4- Prior to inserting the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.



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 **GRAY** color.

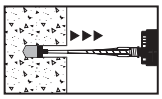
- Review and note the published working and cure times (reference gel time and curing time table) prior to injection of the mixed adhesive into the cleaned anchor hole.

INSTALLATION



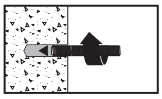
6- Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must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

WITH PISTON PLUG:

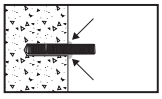


- Piston plugs (see adhesive piston plug table) must be used with and attached to the mixing nozzle and extension tube for horizontal installations where embedment is greater than 8 inches and overhead installations in concrete with anchor rod from 5/8" to 1-1/4" diameter and rebar size #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure.

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

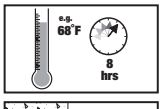


7- The anchor should be free of dirt, grease, oil or other foreign material. Push clean threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Observe the gel (working) time.



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 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.

REFERENCE INSTALLATION TABLES

Gel (working) Time and Curing Table

Temperature of base material		Gel (working) time	Full curing time
°F	°C		
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

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 Pure50+[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		

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.

Adhesive Piston Plugs[1,2,3]

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. A flexible plastic extension tube (Cat. #08281 or 08297) or equivalent approved by DEWALT must be used with piston plugs.

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.

ORDERING INFORMATION

Pure50+ Cartridges

Cat No.	Description	Std. Ctn.	Pallet
08600	Pure50+ 9 fl. oz Quik-Shot cartridge	12	432
08605	Pure50+ 20.5 fl. oz. cartridge	12	540
08651	Pure50+ 50.5 fl. oz. cartridge	8	216

One Pure50+ mixing nozzle is packaged with each cartridge.
Pure50+ mixing nozzles must be used to ensure complete and proper mixing of the adhesive.

Cartridge System Mixing Nozzles

Cat. No.	Description	Std. Pkg.	Std. Ctn.
08294	Extra mixing nozzle (with 8" extension) for Pure50+ 20.5 fl. oz.	2	24
08609	High flow mixing nozzle (with 8" extension)	2	24
08281	Mixing nozzle extension, 8" long	2	24
08297	Mixing nozzle extension, 20" long	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	Quik-Shot 20v Battery powered dispensing tool	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. 20v Battery powered dispensing tool	1	-
08459	20.5 fl. oz. Pneumatic tool	1	-
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
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
52703	Adhesives cleaning kit includes 4 wire brushes (08284, 08285, 08286, 08287), Steel brush extension (08282), SDS-Plus adapter (08283), Standard drill adapter (08296), Hand pump/dust blower (08280), glove and safety glasses	1

Adhesive Piston Plugs for Adhesive Anchors

Cat No.	Description	ANSI Drill Bit Dia.	Std. Bag
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
08307	1-1/4" Plug	1-1/4"	10
08305	1-3/8" Plug	1-3/8"	10
08309	1-1/2" Plug	1-1/2"	10

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"

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

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"

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

DUST X+ ANCHOR INSTALLATION SYSTEM

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ESR-3576

Reissued 07/2018
Revised 11/2018
This report is subject to renewal 07/2019.

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:

PURE50+ EPOXY ADHESIVE ANCHOR SYSTEM IN CRACKED AND UNCRACKED CONCRETE (DEWALT / POWERS)

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

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ICC-ES Evaluation Report

ESR-3576

Reissued July 2018
Revised November 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

ADDITIONAL LISTEE:

POWERS FASTENERS

EVALUATION SUBJECT:

PURE50+™ EPOXY ADHESIVE ANCHOR 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)

Property evaluated:

Structural

2.0 USES

The Pure50+ epoxy adhesive anchors are used to resist static, wind or earthquake (IBC Seismic Design Categories A through F) tension and shear loads 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).

The anchor system complies with anchors 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 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.

3.0 DESCRIPTION

3.1 General:

The Pure50+ Epoxy Adhesive Anchor System is comprised of a two-component epoxy adhesive filled in cartridges, static mixing nozzles, dispensing tools, hole cleaning equipment and adhesive injection accessories. Product names for the report holder and the additional listees are presented in the following table.

COMPANY NAME	PRODUCT NAME
DEWALT	Pure50+™
Powers Fasteners	Pure50+™

The Pure50+ epoxy adhesive may be used with continuously threaded steel rods or deformed steel reinforcing bars.

The adhesive and steel anchor elements are installed in pre-drilled holes into concrete. The primary components of the Pure50+ Epoxy Adhesive Anchor 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 3 of this report.

3.2 Materials:

3.2.1 Pure50+ Epoxy Adhesive: Pure50+ epoxy adhesive is an injectable two-component epoxy. The two components are separated by means of a labeled 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. A nozzle extension tube is also packaged with the cartridge. The Pure50+ epoxy adhesive is available in 9-ounce (265 mL), 20.5-ounce (610 mL) and 50.5-ounce (1500 mL). 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 MPII, as illustrated in Figure 3.

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. 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. After drilling with the DustX+ system, no further hole clearning is required. See Figure A for illustration of the Dust+ extraction system.

3.2.3 Dispensers: Pure50+ epoxy adhesive must be dispensed with manual, 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 Table 4 and Figure 3 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. Specifications for grades of threaded rod, including the mechanical properties and corresponding nuts and washers, are described in Table 2 of this report. Carbon steel threaded rods may be furnished with a minimum 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 hot dip galvanized zinc coating complying with ASTM A153, Class C or D. The stainless steel threaded rods must comply with Table 2 of this report. 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 are deformed reinforcing bars (rebars) as described in Table 3 of this report. Table 5 and Figure 3 of this report 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 2.3 or ACI 318-11 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.

3.3 Concrete:

Normal-weight 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).

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: The design strength of anchors 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 anchors under the 2012 and 2009 IBC, as well as the 2012 and 2009 IRC, must be determined in accordance with ACI 318-11 and this report. See Table 1 for design use and table index.

The strength design of anchors 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 7 of this report. 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 and 5 for the anchor element types included in this report.

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, 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 1. 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 are a function of the bond stress ($\tau_{\kappa;cr}$, $\tau_{\kappa;uncr}$), concrete state (cracked, uncracked), concrete type (normal weight, lightweight), drilling method (hammer-drill), concrete compressive strength (f'_c) and installation conditions (dry concrete, water-saturated concrete, water-filled holes).

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	CONCRETE TYPE	DRILLING METHOD	BOND STRESS	CONCRETE 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}
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}

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}.

Strength reduction factors for determination of the bond strength are given in Table 7 of this report. The adjustments to the bond strength may be taken for increased concrete compressive strength as also 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 and 5 of this report for the anchor element types included in this report. See Table 1 for design use and table index.

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 of this report. The basic concrete breakout strength of a single anchor in shear, 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 values of d given in Tables 4 and 5 of this report for the corresponding anchor steel in lieu of d_a. In addition, h_{ef} must be substituted for ℓ_e. In no case must 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 MPa), in accordance with ACI 318-14 17.2.7 or ACI 318-11 D.3.7.

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 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	$0.45 \cdot T_{max}$
1-1/4 in. (31.8 mm)	2.75 in. 70 mm)	5d	$0.45 \cdot T_{max}$

For values of T_{max}, see Table 8 and Figure 3 of this report.

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.

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

(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 C, D, E or F under the IBC or IRC, anchors 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: Anchors 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 Allowable Stress Design (ASD):

4.2.1 General: For anchors designed using load combinations in accordance with IBC Section 1605.3 (Allowable Stress Design), loads must be established using the equations below:

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

and

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

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 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 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 for member thickness, edge distance and spacing, described in this report must apply. An example of allowable stress design values for various diameters, illustrative purposes is shown in Table 9 of this report.

4.2.2 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:

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

4.3 Installation:

Installation parameters are illustrated in Table 8 of this report. 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 locations must comply with this report and the plans and specifications approved by the code official. Installation of the Pure50+ Epoxy Adhesive Anchor System must be in accordance with the manufacturer's printed installation instructions (MPII) included in each unit package as described in Figure 3 of this report.

The adhesive anchor system may be used for upwardly inclined orientation applications (e.g. overhead). Upwardly included and horizontal orientation applications are to be installed using piston plugs for the $^5/_8$-inch through $1^1/_4$-inch diameter threaded steel rods and No. 5 through No. 10 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 included and horizontal orientation installation for the $^3/_8$-inch and $^1/_2$-inch diameter threaded steel rods, and No. 3 and No. 4 steel reinforcing bars may be injected directly to the end of the hole using a mixing nozzle with a hole depth $h_0 \leq 10$" (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.

4.4 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, and Section 1704.15 and Table 1704.4 of the 2009 IBC and this report, as applicable. The special inspector must be on the jobsite initially during anchor installation to verify the anchor type, anchor dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor 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 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.

4.5 Compliance with NSF/ANSI Standard 61:

The Pure50+ Epoxy Adhesive Anchor System complies 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 Pure50+ Epoxy Adhesive Anchor System described in this report complies 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 Pure50+ epoxy adhesive anchors must be installed in accordance with this report and the manufacturer's printed installation instructions (MPII) as attached to each cartridge and described in Figure 3 of this report.

5.2 The anchors described in this report must be installed in cracked or uncracked normal-weight 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 MPa).

5.4 Anchors must be installed in concrete base materials in holes predrilled in accordance with the installation instructions provided in Figure 3 of this report.

5.5 Loads applied to the anchors 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 Pure50+ epoxy adhesive anchors 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, as applicable.

5.8 Pure50+ epoxy adhesive anchors are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchor, subject to the conditions of this report.

5.9 Strength design values must be established in accordance with Section 4.1 of this report.

5.10 Allowable stress design values must be established in accordance with Section 4.2 of this report.

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

5.12 Prior to anchor 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.

5.13 Anchors are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, Pure50+ epoxy adhesive anchors are permitted for installation in fire-resistive construction provided that at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.
- Anchors 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.
- Anchors are used to support non-structural elements.

5.14 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchors 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.

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

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

5.17 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.

5.18 Periodic special inspection must be provided in accordance with Section 4.4 of this report. Continuous special inspection for anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads must be provided in accordance with Section 4.4 of this report.

5.19 Installation of anchors 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.

5.20 Pure50+ 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 direction, tests at elevated temperatures, tests for resistance to alkalinity, tests for resistance to sulfur and tests for seismic tension and shear.

7.0 IDENTIFICATION

The Pure50+ 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 and corresponding product name as set forth in Section 3.1 of this report, and the evaluation report number (ESR-3576). Threaded rods, nuts, washers and deformed reinforcing bars are standard steel anchor elements and must conform to applicable national specifications as set forth in Table 2 and 3 of this report.

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

DEWALT
701 EAST JOPPA ROAD
TOWSON, MD 21286
(800) 524-2344
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).

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

TABLE 1—DESIGN USE AND REPORT TABLE INDEX

DESIGN STRENGTH[1]		THREADED ROD	DEFORMED REINFORCING BAR
Steel	N_{sa}, V_{sa}	Table 4	Table 5
Concrete	N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	Table 6	Table 6
Bond[2]	N_a, N_{ag}	Table 7	Table 7

CONCRETE TYPE	CONCRETE STATE	THREADED ROD DIAMETER (inch)	REINFORCING BAR SIZE (No.)	DRILLING METHOD[3]	MINIMUM EMBEDMENT	MAXIMUM EMBEDMENT	SEISMIC DESIGN CATEGORIES[4]
Normal-weight and lightweight	Cracked	$^3/_8$, $^1/_2$, $^5/_8$, $^3/_4$, $^7/_8$, 1 and $1^1/_4$	3, 4, 5, 6, 7, 8, 9, 10	Hammer-drill	See Table 7	See Table 7	A through F
	Uncracked	$^3/_8$, $^1/_2$, $^5/_8$, $^3/_4$, $^7/_8$, 1 and $1^1/_4$	3, 4, 5, 6, 7, 8, 9, 10	Hammer-drill	See Table 7	See Table 7	A through F

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 ACI 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 of post-installed adhesive anchors.
[2]See Section 4.1.4 of this report for bond strength determination.
[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, where applicable.

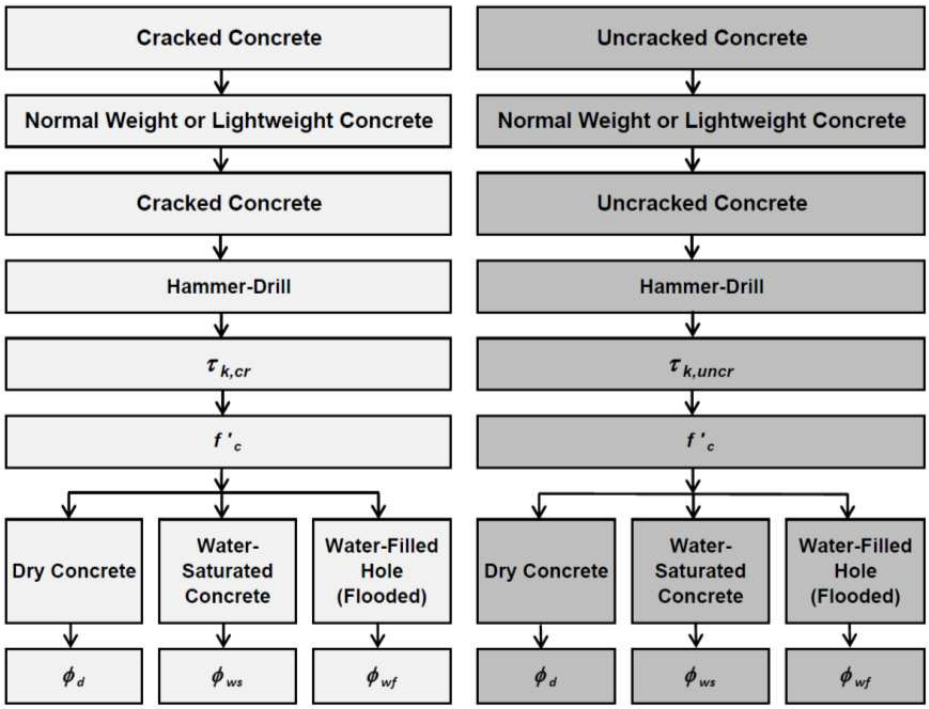


FIGURE 1—FLOW CHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH

TABLE 2—SPECIFICATIONS AND PHYSICAL 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[9]	REDUCTION OF AREA MIN. PERCENT	NUT SPECIFICATION[10]
Carbon Steel	ASTM A36[2] and F1554[3] Grade 36	psi (MPa)	58,000 (400)	36,000 (248)	1.61	23	40 (50 for A 36)	ASTM A194 / A563 Grade A
	ASTM F1554[3] Grade 105 and ASTM A193[4] Grade B7	psi (MPa)	125,000 (862)	105,000 (724)	1.19	15 (16 for A 193)	45 (50 for A 193)	ASTM A194 / A563 Grade DH
	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
Stainless Steel	ASTM F593[7] CW1 ($^3/_8$ to $^5/_8$ inch dia.)	psi (MPa)	100,000 (690)	65,000 (450)	1.54	20	-[11]	ASTM F594 Alloy Group 1, 2 or 3
	ASTM F593[7] CW2 ($^3/_4$ to $1^1/_4$ inch dia.)	psi (MPa)	85,000 (590)	45,000 (310)	1.89	25	-[11]	
	ASTM A193/A193M[8] Grade B8/B8M, Class 1	psi (MPa)	75,000 (515)	30,000 (205)	2.50	30	50	ASTM A194/A194M
	ASTM A193/A193M[8] Grade B8/B8M2, Class 2B	psi (MPa)	95,000 (655)	75,000 (515)	1.27	25	40	

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]Pure50+ epoxy adhesive may be used in conjunction with all grades of continuously threaded carbon or stainless steels (all-thread) that comply with this report and 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]*Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.*
[8]*Standard Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.*
[9]Based on 2-inch (50 mm) gauge length except ASTM A193, which are based on a gauge length of 4d and ISO 898, which is based on 5d.
[10]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.
[11]Minimum percent reduction of area not reported in the referenced standard.

TABLE 3—SPECIFICATIONS AND PHYSICAL 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)

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.

TABLE 4—STEEL DESIGN INFORMATION FOR THREADED ROD

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 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	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 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	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 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	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 F568M[6] Class 5.8 (ISO 898-1)	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 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	0.70	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 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	0.70	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 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	0.70	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. 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 26.12.3.1(a) and 26.11.1.2(c) 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 REINFORCING BARS

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}	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	0.70	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 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	0.70	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 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	0.70	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 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	0.70	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 318-11 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 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)	5*d* 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)	$1^3/_4$ (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; for installation parameters see Table 8 of this report					
Critical edge distance—splitting (for uncracked concrete only)	c_{ac}	inch (mm)	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 **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 3 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 THREADED RODS AND REINFORCING BARS[1,2]

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
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]	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	psi (N/mm^2)	684 (4.7)	658 (4.5)	632 (4.4)	608 (4.2)	585 (4.0)	562 (3.9)	562 (3.9)	562 (3.9)
	Characteristic bond strength in cracked concrete, short-term loading only[9]			752 (5.2)	724 (5.0)	695 (4.8)	668 (4.6)	643 (4.4)	618 (4.3)	618 (4.3)	618 (4.3)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm^2)	1,444 (10.0)	1,389 (9.6)	1,335 (9.2)	1,283 (8.8)	1,234 (8.5)	1,184 (8.2)	1,184 (8.2)	1,184 (8.2)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]			1,588 (10.9)	1,528 (10.5)	1,469 (10.1)	1,411 (9.7)	1,357 (9.4)	1,303 (9.0)	1,303 (9.0)	1,303 (9.0)
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/mm^2)	475 (3.3)	457 (3.2)	439 (3.0)	422 (2.9)	406 (2.8)	390 (2.7)	390 (2.7)	390 (2.7)
	Characteristic bond strength in cracked concrete, short-term loading only[9]			523 (3.6)	503 (3.5)	483 (3.3)	464 (3.2)	447 (3.1)	429 (3.0)	429 (3.0)	429 (3.0)
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	psi (N/mm^2)	1,024 (7.1)	985 (6.8)	947 (6.5)	910 (6.3)	875 (6.0)	840 (5.8)	840 (5.8)	840 (5.8)
	Characteristic bond strength in uncracked concrete, short-term loading only[8]			1,126 (7.8)	1,084 (7.5)	1042 (7.2)	1,001 (6.9)	963 (6.6)	924 (6.4)	924 (6.4)	924 (6.4)
Permissible installation conditions[6]	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							
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 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.

[3]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.

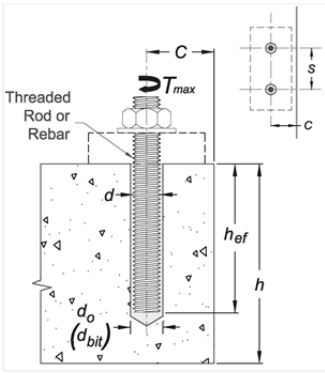
[6]Characteristic bond strengths are for sustained loads including dead and live loads.

[7]Permissible installation conditions include dry concrete, water-saturated concrete and water-filled holes. 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 5 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—INSTALLATION PARAMETERS FOR THREADED ROD AND REINFORCING BARS



PARAMETER	SYMBOL	UNITS	FRACTIONAL 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	#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	d_o (d_{bit})	inch	7/16	9/16	5/8 or 11/16[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[3]	$c_{min,red}$	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][4]	14	27	47	56	74	90	126	126

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 and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
[3]See Section 4.1.9 of this report for requirements of anchors installed at reduced edge distances.
[4]This torque valve applies to ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rod only.
[5]Either drill bit size is acceptable for this threaded rod diameter and rebar size. See MPII for additional details.

FIGURE 2—PURE50+ EPOXY ADHESIVE ANCHOR SYSTEM INCLUDING TYPICAL STEEL ANCHOR ELEMENTS

TABLE 9—EXAMPLE OF PURE50+ EPOXY ADHESIVE ANCHOR ALLOWABLE STRESS DESIGN (ASD) VALUES FOR ILLUSTRATIVE PURPOSES [1,2,3,4,6,9,10,13,14,16]

NOMINAL ANCHOR ROD DIAMETER OR REBAR SIZE, *d* (inch) / (No.)	EFFECTIVE EMBED.[5] h_{ef} (inches)	CONCRETE STRENGTH[12] f'_c (psi)	EFFECTIVE-NESS FACTOR FOR UNCRACKED CONCRETE k_{uncr}	CHARACTERISTIC BOND STRENGTH $\tau_{k,uncr}$ (psi)		NOMINAL STRENGTH IN TENSION N_n (pounds)		STRENGTH REDUCTON FACTOR ϕ[15]		ALLOWABLE TENSION LOAD[11] $\phi N_n / \alpha$ (pounds)	
				110°F LT, 140°F ST[7]	110°F LT, 176°F ST[8]	110°F LT, 140°F ST[7]	110°F LT, 176°F ST[8]	110°F LT, 140°F ST[7]	110°F LT, 176°F ST[8]	110°F LT, 140°F ST[7]	110°F LT, 176°F ST[8]
ASTM A193 Grade B7 Threaded Rod											
3/8	2 3/8	2,500	24	1,444	1,024	4,040	2,865	0.65 (bond)	0.65 (bond)	1,775	1,255
	7 1/2	2,500	24	1,444	1,024	9,688	9,048	0.75 (steel)	0.65 (bond)	4,910	3,975
1/2	2 3/4	2,500	24	1,389	985	5,472	4,255	0.65 (conc)	0.65 (bond)	2,400	1,870
	10	2,500	24	1,389	985	17,738	15,472	0.75 (steel)	0.65 (bond)	8,990	6,795
5/8	3 1/8	2,500	24	1,335	947	6,629	5,811	0.65 (conc)	0.65 (bond)	2,910	2,550
	12 1/2	2,500	24	1,335	947	28,250	23,243	0.75 (steel)	0.65 (bond)	14,320	10,210
3/4	3 1/2	2,500	24	1,283	910	7,857	7,504	0.65 (conc)	0.65 (bond)	3,450	3,295
	15	2,500	24	1,283	910	45,345	32,162	0.65 (bond)	0.65 (bond)	19,915	14,125
7/8	3 1/2	2,500	24	1,234	875	7,857	7,857	0.65 (conc)	0.65 (conc)	3,450	3,450
	17 1/2	2,500	24	1,234	875	59,362	42,092	0.65 (bond)	0.65 (bond)	26,070	18,485
1	4	2,500	24	1,184	840	9,600	9,600	0.65 (conc)	0.65 (conc)	4,215	4,215
	20	2,500	24	1,184	840	74,393	52,779	0.65 (bond)	0.65 (bond)	32,670	23,180
1 1/4	5	2,500	24	1,184	840	13,416	13,416	0.65 (conc)	0.65 (conc)	5,890	5,890
	25	2,500	24	1,184	840	116,239	82,467	0.65 (bond)	0.65 (bond)	51,050	36,220
ASTM A706 Grade 60 Reinforcing Bar											
3	2 3/8	2,500	24	1,444	1,024	4,040	2,865	0.65 (bond)	0.65 (bond)	1,775	1,255
	7 1/2	2,500	24	1,444	1,024	8,800	9,048	0.75 (steel)	0.65 (bond)	4,460	3,975
4	2 3/4	2,500	24	1,389	985	5,472	4,255	0.65 (conc)	0.65 (bond)	2,400	1,870
	10	2,500	24	1,389	985	16,000	15,472	0.75 (steel)	0.55 (bond)	8,110	6,795
5	3 1/8	2,500	24	1,335	947	6,629	5,811	0.65 (conc)	0.65 (bond)	2,550	2,550
	12 1/2	2,500	24	1,335	947	24,800	23,243	0.65 (steel)	0.65 (bond)	12,570	10,210
6	3 1/2	2,500	24	1,283	910	7,857	7,504	0.65 (conc)	0.65 (bond)	3,295	3,295
	15	2,500	24	1,283	910	35,200	32,162	0.75 (steel)	0.65 (bond)	17,840	14,125
7	3 1/2	2,500	24	1,234	875	7,857	7,857	0.65 (conc)	0.65 (conc)	3,450	3,450
	17 1/2	2,500	24	1,234	875	48,000	42,092	0.75 (steel)	0.65 (bond)	24,325	18,485
8	4	2,500	24	1,184	840	9,600	9,600	0.65 (conc)	0.65 (conc)	4,215	4,215
	20	2,500	24	1,184	840	63,200	52,779	0.75 (steel)	0.65 (bond)	32,025	23,180
9	4 1/2	2,500	24	1,184	840	11,455	11,455	0.65 (conc)	0.65 (conc)	5,030	5,030
	22 1/2	2,500	24	1,184	840	80,000	66,798	0.75 (steel)	0.65 (bond)	40,540	29,340
10	5	2,500	24	1,184	840	13,146	13,146	0.65 (conc)	0.65 (conc)	5,890	5,890
	25	2,500	24	1,184	840	116,239	82,467	0.65 (bond)	0.65 (bond)	51,050	36,220

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006894 MPa. For **pound-inch** units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

[1]Single anchor with static tension load only; ASTM A193 Grade B7 threaded rod and ASTM A706 Grade 60 reinforcing bar.
[2]Vertical downward installation direction.
[3]Special inspection interval = Periodic.
[4]Installation temperature = 50°F (10°C) to 104°F (40°C) for base material; 50°F (10°C) to 104°F (40°C) for cartridge adhesive.
[5]Embedment = $h_{ef,min}$ and $h_{ef,max}$ for each diameter.
[6]Concrete determined to remain uncracked for the life of the anchorage.
[7]Long-term service temperature = 110°F (43°C), short-term service temperature = 140°F (60°C).
[8]Long-term service temperature = 110°F (43°C), short-term service temperature = 176°F (80°C).
[9]Load combinations are based on ACI 318-14 5.3 or ACI 318-11 9.2, as applicable, with no seismic loading considered.
[10]Thirty percent (30%) dead load and seventy percent (70%) live load; controlling load combination 1.2*D* + 1.6*L*.
[11]Calculation of weighted average for the conversion factor, α = 1.2(0.3) + 1.6(0.7) = 1.48.
[12]f'_c = 2,500 psi compressive strength (normal-weight concrete).
[13]$c_{a1} = c_{a2} > c_{ac}$.
[14]$h \geq h_{min}$.
[15]Strength reduction factor from controlling nominal strength in tension [i.e. steel, concrete (conc), bond] decisive from design assumptions.
[16]Hammer-drilled holes in dry concrete.

Pure50+ Instruction Card

DESCRIPTION:
Pure50+ is a high strength, 100% solids epoxy adhesive which is formulated for use in anchoring applications 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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[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.	08600	PFC1640600
Cordless		DCE560D1				
Manual	20.5 fl.oz.	08409	Dual tube	20.5 fl.oz.	08605	08294 or 08609
Pneumatic		08413				
Cordless		DCE591D1				
Pneumatic	50.5 fl.oz.	08438	Dual tube	50.5 fl.oz.	08651	08294 or 08609

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

Temperature of base material		Gel (working) time	Full curing time
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		16	14	18	18	200	DFC1670250	18	08259
		3/4	3/4	7 7/8	08278	3/4	08259	SDS adaptor	-	16	20	20	300	DFC1670300	20	08259
3/4	6	7/8	7/8	7 7/8	08287	7/8	08300		20	20	25	25	300	DFC1670400	25	08301
7/8	7	1	1	11 7/8	08288	1	08301	Compressed air nozzle	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		30	28	35	35	300	DFC1670550	35	08305
-	10	1 1/2	1 1/2	11 7/8	08291	1 1/2	08309	Std. piston plug	-	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.

[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

[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.

FIGURE 3—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)

Pure50+ Instruction Card (continued)

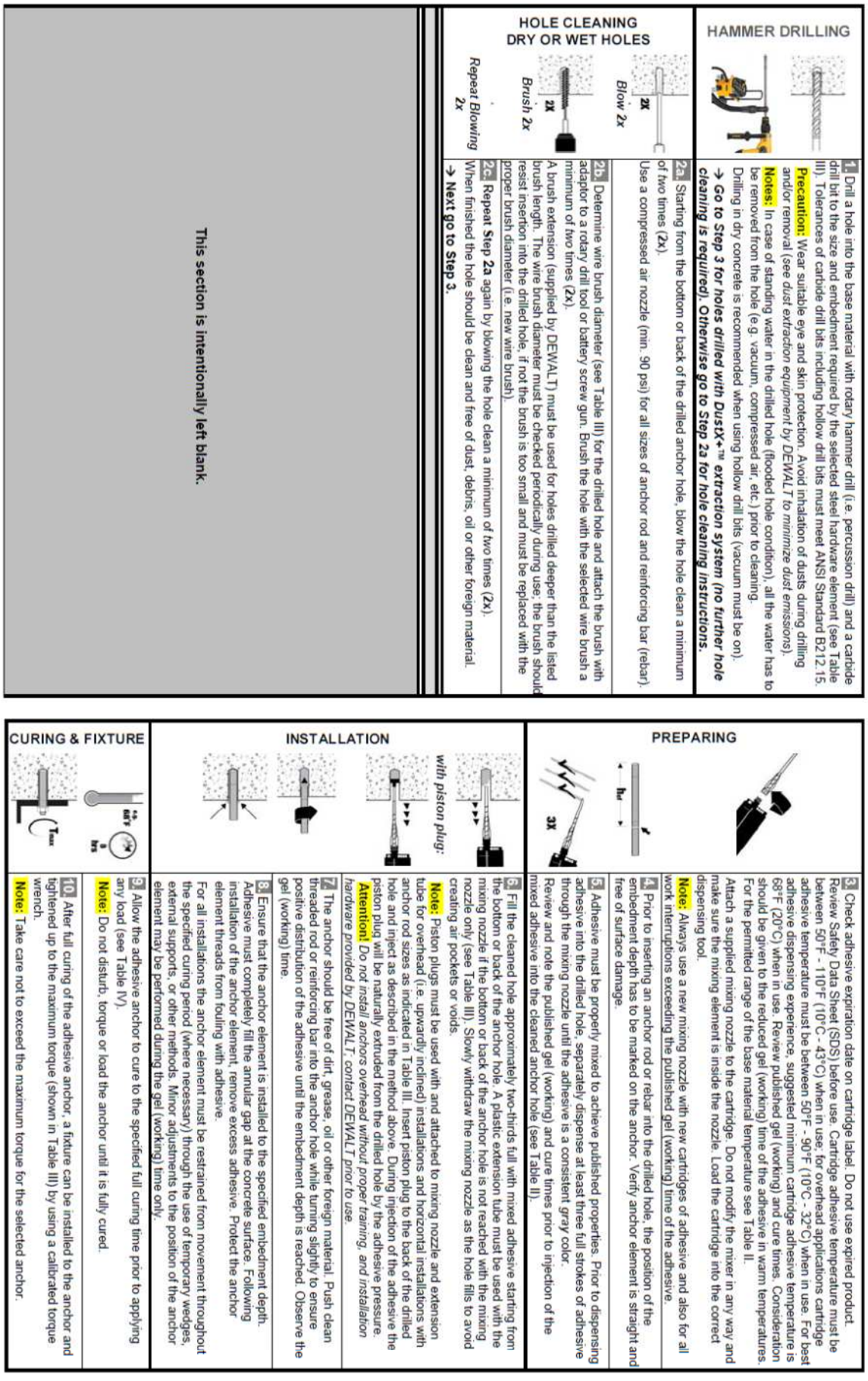

FIGURE 3—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)

ICC-ES Evaluation Report

ESR-3576 FBC Supplement

Reissued July 2018
Revised November 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:

PURE50+ EPOXY ADHESIVE ANCHOR 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 Pure50+ Epoxy Adhesive Anchor System in Cracked and Uncracked Concrete, recognized in ICC-ES master evaluation report ESR-3576, 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 Pure50+ Epoxy Adhesive Anchor System in Cracked and Uncracked Concrete, described in Sections 2.0 through 7.0 of the master evaluation report ESR-3576, 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 Pure50+ epoxy adhesive anchors 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 and revised November 2018.