GENERAL INFORMATION

CCU+™

Critical Connection Undercut Anchoring System

PRODUCT DESCRIPTION

The DEWALT Critical Connection Undercut (CCU+™) anchor is a post-installed structural anchor designed for static, dynamic and seismic loading in the tension zone of both cracked and uncracked concrete. The high capacity CCU+™ anchor can be loaded immediately following installation and is available in zinc plated ASTM A36 (F1554 Grade 36) mild carbon steel and ASTM A193 Grade B7 high strength carbon steel. For exterior applications or where high corrosion resistance is required, the CCU+™ is also available in ASTM A193 Grade 8BM, Class 2 high strength 316 stainless steel.

CCU+ anchors are installed into a fixed depth hole with a cone-shaped cavity at the bottom which is created in a secondary drilling operation using a specialty undercut drill bit supplied by DEWALT. The result is bottom-bearing post-installed anchor which keys into the base material with minimal expansive forces allowing for close edge distance and anchor spacing, similar to a cast-in-place headed stud. The heavy-wall expansion sleeve contributes to load transfer and improved shear capacities particularly for the thrubolt version.

GENERAL APPLICATIONS AND USES

- Structural connections (e.g. beam, column)
- Safety related fastening and assemblies
- Bridge, tunnel and port structure attachments
- Water and wastewater treatment facility units
- Vessel, tank and containment wall anchorage
- Power generation plant / hydro dam anchors
- Industrial machine and equipment mounts
- Utility system bracing, hangers and supports
- Barriers, guards, fencing and railing
- Retrofit anchors for cast-in anchor bolts
- Tension zone / cracked concrete
- Seismic attachments (SDC A - F)

FEATURE AND BENEFITS

+ Load transfers to concrete through bearing not friction (similar to cast-in headed bolts)
+ Provides positive mechanical interlock into base material
+ Consistent predictable behavior and exceptional load capacities
+ Robust design minimizes anchor displacement under load
+ Anchor bearing area is more than two-and-a-half times the net tensile area of the anchor rod
+ Anchor rods can be designed for stretch length and ductile steel behavior for seismic loading
+ Close edge distance, anchor spacing, and slab thickness due to low expansive forces
+ Thrubolt version provides significant increase in shear capacities and variable fixture thickness
+ Length ID code and material ID marking stamped on head of each anchor
+ Undercut cavity is created in seconds with durable undercutting tool
+ DEWALT dust removal drilling system (with HEPA dust extractor) can be used for an OSHA 1926.1153 Table 1 compliant solution
+ CCU+ undercut anchors made in USA at time of publication; product certifications available by request (anchors@DEWALT.com)

APPROVALS AND LISTINGS

- International Code Council, Evaluation Service (ICC-ES), ESR-4810 for cracked and uncracked concrete
- Code compliant with the 2021 IBC/IRC, 2018 IBC/IRC, 2015 IBC/IRC and 2012 IBC/IRC
- Tested in accordance with ACI 355.2/ASTM E488 and ICC-ES AC193 for use in structural concrete under the design provisions of ACI 318 (-19 and -14) Chapter 17 or ACI 318-11 Appendix D
- Evaluated and qualified by an accredited independent testing laboratory for recognition in cracked and uncracked concrete including seismic and wind loading (anchor category 1 for all sizes)
- City of Los Angeles, LABC Supplement (within ESR-4810)
- Florida Building Code, FBC Supplement including HVHZ (within ESR-4810)

GUIDE SPECIFICATIONS

CSI Divisions: 03 16 00 – Concrete Anchors and 05 05 19 – Post-Installed Concrete Anchors. Undercut anchors shall be CCU+ as supplied by DEWALT, Towson, MD. Anchors shall be installed in accordance with published instructions and the Authority Having Jurisdiction.

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CCU+ UNDERCUT PRESET (PS)

CCU+ UNDERCUT THRUBOLT (TB)

THREAD VERSION

- UNC threaded stud (anchor rod)

ANCHOR SIZE RANGE (TYP.)

- 3/8" through 3/4" diameters (anchor rod diameter)

ANCHOR MATERIAL TYPE

- Zinc Plated Carbon Steel
- 316 Stainless Steel

ANCHOR VERSIONS

- Preset (PS)
- Thrubolt (TB)

SUITABLE BASE MATERIALS

- Normal-weight concrete
- Lightweight concrete

TENSION ZONE CRACKED CONCRETE

SEISMIC REGION QUALIFICATION

CODE LISTED
ICC-ES ESR-4810
CONCRETE

DDA
DEWALT DESIGN ASSIST™

DUST X+™
ANCHOR INSTALLATION SYSTEM

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MATERIAL SPECIFICATIONS

Anchor Component	Anchor Designation / Material	
	Mild Carbon Steel I High Strength Carbon Steel	High Strength Stainless Steel
Anchor Rod (Threaded Rod)	ASTM A36 (F1554, Grade 36) I ASTM A193, Grade B7	ASTM A193, Grade B8M, Class 2 (316 SS)
Expansion Sleeve	Carbon Steel	AISI 316 SS
Expansion Cone	Carbon Steel	AISI 316 SS
Hex Nut	3/8" : SAE J955, Grade 8 1/2", 5/8" and 3/4" : ASTM A563, Grade C	3/8" : ASTM F594, 316 SS, Alloy Group 2 1/2", 5/8" and 3/4" : ASTM A194, Grade 8M (S1)
Washer	ASTM F844; Meets ANSI/ASME B18.22.1, Type A plain (wide)	AISI 316 SS; meets ANSI/ASME B18.22.1, Type A plain (wide)
Plating (carbon steel components)	Zinc plating, ASTM B633, SC1 (Fe/Zn 5); min. plating requirement for Mild Service Condition	Not applicable

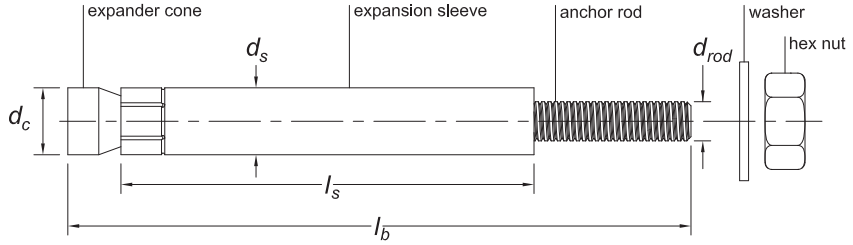
ANCHOR SPECIFICATIONS

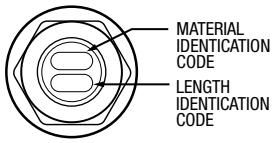
CCU+ Undercut Anchor Nominal Dimensional Characteristics[1,2,3]

Anchor Description, Nominal Size and Length (in.)	Anchor Rod Designation (ASTM)	Anchor Version	Rod Diameter, d_{rod} (in.)	Anchor Length, l_b (in.)	Expansion Sleeve		Expander Cone Dia., d_c (in.)	Max. Fixture Thickness, t_{max} (in.)
					Length, l_s (in.)	Diameter d_s (in.)		
3/8 x 6	ASTM A36 or A193, Grade B7	Preset (PS)	3/8	6	4	11/16	11/16	7/8
		Thrubolt (TB)			4-7/8			
	A193, Grade B8M (316 SS)	Preset (PS)	3/8	6	4	11/16	11/16	7/8
		Thrubolt (TB)			4-7/8			
1/2 x 7-1/2	ASTM A36 or A193, Grade B7	Preset (PS)	1/2	7-1/2	5	13/16	13/16	1-1/4
		Thrubolt (TB)			6-1/4			
	A193, Grade B8M (316 SS)	Preset (PS)	1/2	7-1/2	5	13/16	13/16	1-1/4
		Thrubolt (TB)			6-1/4			
1/2 x 8-1/4	ASTM A36 or A193, Grade B7	Preset (PS)	1/2	8-1/4	5	13/16	13/16	2
		Thrubolt (TB)			7			
	A193, Grade B8M (316 SS)	Preset (PS)	1/2	8-1/4	5	13/16	13/16	2
		Thrubolt (TB)			7			
5/8 x 10-3/4	ASTM A36 or A193, Grade B7	Preset (PS)	5/8	10-3/4	7-1/2	1	1	1-5/8
		Thrubolt (TB)			9-1/8			
	A193, Grade B8M (316 SS)	Preset (PS)	5/8	10-3/4	7-1/2	1	1	1-5/8
		Thrubolt (TB)			9-1/8			
5/8 x 11-1/2	ASTM A36 or A193, Grade B7	Preset (PS)	5/8	11-1/2	7-1/2	1	1	2-3/8
		Thrubolt (TB)			9-7/8			
	A193, Grade B8M (316 SS)	Preset (PS)	5/8	11-1/2	7-1/2	1	1	2-3/8
		Thrubolt (TB)			9-7/8			
3/4 x 14	ASTM A36 or A193, Grade B7	Preset (PS)	3/4	14	10	1-1/4	1-1/4	2
		Thrubolt (TB)			12			
	A193, Grade B8M (316 SS)	Preset (PS)	3/4	14	10	1-1/4	1-1/4	2
		Thrubolt (TB)			12			
3/4 x 16	ASTM A36 or A193, Grade B7	Preset (PS)	3/4	16	10	1-1/4	1-1/4	4
		Thrubolt (TB)			14			
	A193, Grade B8M (316 SS)	Preset (PS)	3/4	16	10	1-1/4	1-1/4	4
		Thrubolt (TB)			14			

1. Preset anchors are designed so the top of the expansion sleeve is approximately flush with the base material after setting. Thrubolt anchors are designed so the expansion sleeve can be set through and can engage the fixture. See CCU+ undercut anchor detail and installation specifications.
2. Anchor rod (threaded rod) conforming to ASTM F1554, Grade 105 is strength equivalent to the tabulated ASTM A193, Grade B7 designation.
3. The listed anchor lengths are based on the anchor sizes commercially available at the time of publication; custom lengths can be produced by request. Custom length anchors not long enough to meet the minimum embedment requirements are outside the scope of ICC-ES ESR-4810.

CCU+ Undercut Anchor Assembly





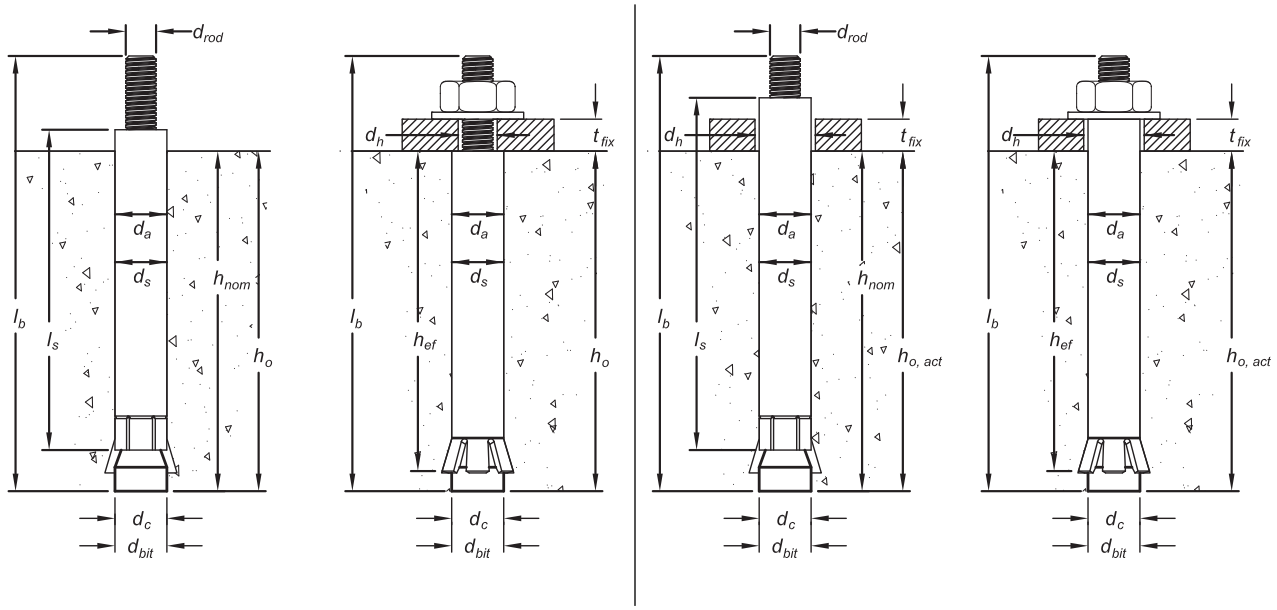
A36 = A36 anchor rod
B7 = A193 Grade B7 anchor rod
SS2 = A193 Gr. B8M (316 SS) anchor rod

Anchor Length Code Identification System

Length ID marking on anchor rod head		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Anchor Length. l_b (inches)	From	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6	6-1/2	7	7-1/2	8	8-1/2	9	9-1/2	10	11	12	13	14	15	16
	Up to but not including	2	2-1/2	3	3-1/2	4	4-1/2	5	5-1/2	6	6-1/2	7	7-1/2	8	8-1/2	9	9-1/2	10	11	12	13	14	15	16	17

INSTALLATION SPECIFICATIONS

CCU+ Undercut Anchor Detail



CCU+ Undercut Anchor Installation Specifications and Supplemental Information

Anchor Property/ Setting Information		Notation	Units	Nominal Anchor Size / Rod Diameter, d_{rod}											
				3/8 inch			1/2 inch			5/8 inch			3/4 inch		
Anchor Rod Designation		ASTM	-	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)
Outside anchor diameter / expansion sleeve diameter		d_a / d_s	in. (mm)	0.6875 (17.5)			0.8125 (20.6)			1.000 (25.4)			1.25 (31.8)		
Nominal drill bit diameter (ANSI)		d_{bit}	in.	11/16			13/16			1			1-1/4		
Nominal embedment depth[1]		h_{nom}	in. (mm)	4-1/4 (108)			5-3/8 (137)			8 (203)			10-5/8 (270)		
Effective embedment		h_{ef}	in. (mm)	4 (102)			5 (127)			7-1/2 (191)			10 (254)		
Minimum hole depth, preset version (see note 2 for thrubolt version)		h_o	in. (mm)	4-1/4 (108)			5-3/8 (137)			8 (203)			10-5/8 (270)		
Min. concrete member thickness, preset version (see note 3 for thrubolt version)		h_{min}	in. (mm)	6 (152)			7 (178)			9-1/2 (241)			12 (305)		
Minimum edge distance		c_{min}	in. (mm)	2-1/2 (64)			3 (76)			4-1/2 (114)			6 (152)		
Minimum spacing distance		s_{min}	in. (mm)	3 (76)			3-3/4 (95)			5-5/8 (143)			7-1/2 (191)		
Minimum diameter of clearance hole in fixture	Preset (PS) Version	d_h	in. (mm)	7/16 (11.1)			9/16 (14.3)			11/16 (17.5)			13/16 (20.6)		
	Thrubolt (TB) Version			3/4 (19.1)			7/8 (22.2)			1-1/8 (28.6)			1-3/8 (34.9)		
Maximum thickness of fixture		t_{max}	in.	See nominal dimensional characteristics table (this is dependent on the selected anchor)											
Installation torque		T_{inst}	ft.-lbf. (N-m)	11 (15)	37 (50)		29 (40)	70 (95)		70 (95)	118 (160)		118 (160)	221 (300)	
Torque wrench / socket size		-	in.	9/16			7/8			1-1/16			1-1/4		
Nut height		-	in.	21/64			31/64			39/64			47/64		
Washer O.D.		-	in.	1			1-3/8			1-3/4			2		
Effective tensile stress area (anchor rod)		A_{se}	in.^{2} (mm^2)	0.078 (50)			0.142 (91)			0.226 (146)			0.334 (215)		
Minimum specified ultimate strength[4]		f_{uta}	psi (N/mm^2)	58,000 (400)	125,000 (860)	120,000 (827)	58,000 (400)	125,000 (860)	110,000 (758)	58,000 (400)	125,000 (860)	110,000 (758)	58,000 (400)	125,000 (860)	110,000 (758)
Minimum specified yield strength		f_{ya}	psi (N/mm^2)	36,000 (248)	105,000 (723)	95,000 (655)	36,000 (248)	105,000 (723)	95,000 (655)	36,000 (248)	105,000 (723)	95,000 (655)	36,000 (248)	105,000 (723)	95,000 (655)
Strength length of the anchor rod[5]		-	in.	h_{nom} - 11/16 + t_{fix}			h_{nom} - 13/16 + t_{fix}			h_{nom} - 1 + t_{fix}			h_{nom} - 1-1/4 + t_{fix}		
Mean axial stiffness[6]	Uncracked concrete	β_{uncr}	lbf/in.	595,000			1,705,000			356,000			446,000		
	cracked concrete	β_{cr}	lbf/in.	398,000			744,000			445,000			354,000		

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

1. The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor and equal to the hole depth.
2. For thrubolt applications the actual hole depth, $h_{o,act}$ is dependent on the actual fixture thickness, t_{fix}. Actual hole depth for thrubolts is determined by taking the minimum hole depth plus the maximum thickness of fixture for the selected anchor less the actual fixture thickness being fastened to the base material ($h_{o,act} = h_o + t_{max} - t_{fix}$).
3. For thrubolt applications the minimum concrete member thickness, $h_{min,act}$ is dependent on the actual fixture thickness, t_{fix}. Minimum concrete member thickness for thrubolts is determined by taking the minimum concrete member thickness plus the maximum thickness of fixture for the selected anchor less the actual fixture thickness being fastened to the base material ($h_{min,act} = h_{min} + t_{max} - t_{fix}$).
4. The anchor rod for the 3/8-inch stainless steel anchors is manufactured with a minimum specified ultimate strength of 120 ksi (827 N/mm^2).
5. For CCU+ undercut anchors, the anchor rod, d_{rod} replaces the outside anchor diameter, d_a (i.e. expansion sleeve diameter, d_s) for determination of stretch length and stretch length ratio. Stretch lengths of the anchor rod (threaded rod) in anchor assemblies for embedments listed are greater than eight anchor rod diameters, $8d_{rod}$ which meets the prescriptive requirements as given in ACI 318-19 17.10.5.3(a), ACI 318-14 17.2.3.4.3(a) and ACI 318-11 D.3.3.4.3(a).
6. Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

CCU+ Undercut Anchor Installation Accessories and Tools[1,2]

Nominal Anchor Size	Nominal Hole Diameter	Anchor Version	Primary Bit			Undercut Bit		Rotary Hammer Drill	Setting Sleeves	
			HSB	HB	Conventional	HUCB	UCB		Powered	Manual
3/8"	11/16"	Preset (PS)	DFX11380 (SDS-Plus)	DWA54116 (SDS-Plus)	DW5808 4-Cutter (SDS-Max)	DFX21380 (SDS-Plus)	DFX21381 (SDS-Plus)	DCH416 or D25416 (SDS-Plus)	DFX313825 (SDS-Plus)	DFX313805
		Thrubolt (TB)	-							
1/2"	13/16"	Preset (PS)	DFX11120 (SDS-Plus)	DWA54316 (SDS-Plus)	DW5814 4-Cutter (SDS-Max)	DFX21120 (SDS-Plus)	DFX21121 (SDS-Plus)	DCH416 or D25416 (SDS-Plus)	DFX311230 (SDS-Plus)	DFX311210
		Thrubolt (TB)	-							
5/8"	1"	Preset (PS)	DFX11580 (SDS-Max)	DWA58001 (SDS-Max)	DW5852 4-Cutter (SDS-Max)	DFX21580* (SDS-Plus)	DFX21581* (SDS-Plus)	DCH614 or D25614 (SDS-Max)	DFX315835 (SDS-Max)	DFX315815
		Thrubolt (TB)	-							
3/4"	1-1/4"	Preset (PS)	DFX11340 (SDS-Max)	DWA58115 (SDS-Max)	DW5855 4-Cutter (SDS-Max)	DFX21340 (SDS-Max)	DFX21341 (SDS-Max)	DCH614 or D25614 (SDS-Max)	DFX313440 (SDS-Max)	DFX313420
		Thrubolt (TB)	-							

*For rotary hammer drill connector options, designated drill bits can be considered for use with a DW5891 SDS-Max to SDS-Plus adapter.

1. The listed anchor installation accessories and tools are based on DEWALT equipment commercially available at the time of publication.
2. CCU+ dust removal drill bits (e.g. HSB, HB, HUCB) are used with a vacuum dust extractor (e.g. DWV010, DWV012, DCV585).

CCU+ Dust Removal Drill Bits

Hollow Stop Bit (HSB)

Hollow Bit (HB)

Hollow Undercut Bit (HUCB)

CCU+ Customary Drill Bits

Conventional Bit

Undercut Blt (UCB)

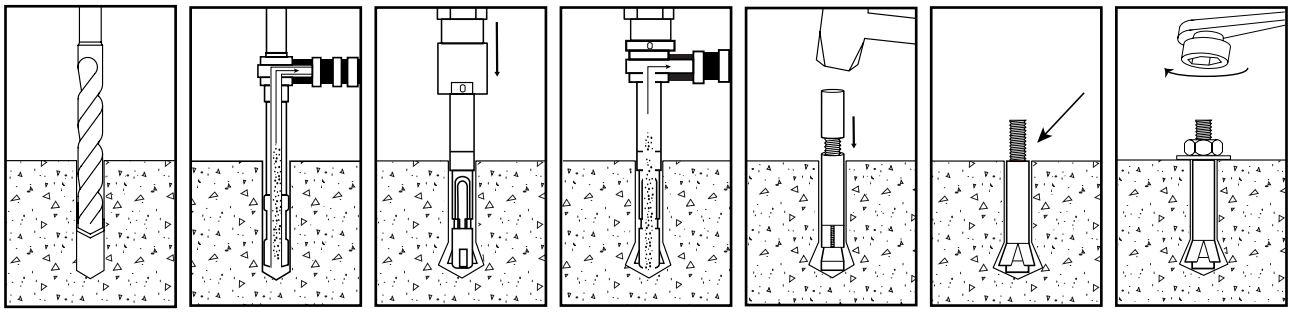
CCU+ Setting Sleeves

Powered Setting Sleeve

Manual Setting Sleeve

INSTALLATION INSTRUCTIONS

CCU+ Undercut Anchor Installation Instructions



1. Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.
2. Remove dust and debris from the hole during drilling (e.g. hollow stop bit, hollow bit, dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling. Note: removing dust and debris after drilling is not required for overhead (ceiling) installations.
3. Insert the proper size undercut bit to the bottom of the hole. Start the rotary hammer (begin at a slow speed) and undercut the hole. Undercutting is complete when the stopper sleeve on the undercut bit is fully compressed (i.e. the gap is closed).
4. Remove dust and debris from the hole during undercutting (hollow undercut bit) or following undercutting (e.g. suction, forced air). Note: removing dust and debris after drilling is not required for overhead (ceiling) installations.
5. Insert anchor into the hole. Place setting sleeve over anchor rod and drive expansion sleeve over expander cone. Use the proper size powered setting sleeve or manual setting sleeve.
6. Verify that the setting mark is visible on the anchor rod (threaded rod) at or above the expansion sleeve.
7. Apply the proper installation torque to tighten the connection.

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STRENGTH DESIGN INFORMATION

Design Information For Carbon Steel and Stainless Steel CCU+ Undercut Anchors[1,2,8]

Anchor Property / Setting Information		Notation	Units	Nominal Anchor Size / Rod Diameter, d_{rod} (in.)											
				3/8			1/2			5/8			3/4		
Anchor category		-	-	1			1			1			1		
Anchor rod designation		ASTM	-	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)	A36	A193, Gr. B7	A193, Gr. B8M (316 SS)
Outside diameter of anchor		d_a	in. (mm)	0.6875 (17.5)			0.8125 (20.6)			1.000 (25.4)			1.25 (31.8)		
Nominal embedment depth		h_{nom}	in. (mm)	4-1/4 (108)			5-3/8 (137)			8 (203)			10-5/8 (270)		
Effective embedment depth		h_{ef}	in. (mm)	4 (102)			5 (127)			7-1/2 (190)			10 (254)		
STEEL STRENGTH IN TENSION (ACI 318-19 17.6.1, ACI 318-14 17.4.1 or ACI 318-11 D.5.1), STEEL STRENGTH IN SHEAR (ACI 318-19 17.7.1, ACI 318-14 17.5.1 or ACI 318-11 D.6.1), AND STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-19 17.10.3, ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)															
Steel strength in tension		N_{sa}	lb. (kN)	4,525 (20.1)	9,750 (43.4)	9,360 (41.6)	8,235 (36.6)	17,750 (79.0)	15,620 (69.5)	13,110 (58.3)	28,250 (125.7)	24,860 (110.6)	19,370 (86.2)	41,750 (185.7)	36,740 (163.4)
Reduction factor, steel strength in tension[3,4]		ϕ	-	0.75											
Preset (PS)	Steel strength in shear	V_{sa}	lb. (kN)	2,260 (10.1)	4,875 (21.7)	5,110 (22.7)	4,120 (18.3)	8,875 (39.5)	8,850 (39.4)	6,555 (29.1)	14,125 (62.8)	14,600 (64.9)	9,685 (43.1)	20,875 (92.9)	22,340 (99.4)
	Steel strength in shear, seismic	$V_{sa,eq}$	lb. (kN)	1,585 (7.0)	4,390 (19.5)	4,600 (20.5)	2,885 (12.8)	7,990 (35.5)	8,145 (36.2)	4,590 (20.4)	12,715 (56.6)	13,140 (58.5)	6,780 (30.2)	18,790 (83.6)	20,105 (89.4)
Thrubolt (TB)	Steel strength in shear	V_{sa}	lb. (kN)	2,260 (10.1)	14,200 (63.2)	15,555 (79.2)	4,120 (18.3)	18,715 (83.3)	24,205 (107.7)	6,555 (29.1)	28,980 (128.9)	38,795 (172.6)	9,685 (43.1)	41,640 (185.2)	57,725 (256.9)
	Steel strength in shear, seismic	$V_{sa,eq}$	lb. (kN)	1,585 (7.0)	12,790 (56.9)	10,895 (48.5)	2,885 (12.8)	16,840 (74.9)	19,365 (86.1)	4,590 (20.4)	26,080 (116.0)	31,345 (139.4)	6,780 (30.2)	33,315 (148.2)	46,180 (205.4)
Reduction factor, steel strength in shear[3,4]		ϕ	-	0.65											
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-19 17.6.2, ACI 318-14 17.4.2 or ACI 318-11 D.5.2)															
Critical edge distance (uncracked concrete)[7]		c_{ac}	in. (mm)	6 (152)			7-1/2 (191)			11-1/4 (241)			15 (305)		
Effectiveness factor, uncracked concrete		k_{uncr}	-	30			30			30			30		
Effectiveness factor, cracked concrete		k_{cr}	-	24			24			24			24		
Modification factor for cracked and uncracked concrete[5]		$\psi_{c,N}$	-	1.0 (see note 5)			1.0 (see note 5)			1.0 (see note 5)			1.0 (see note 5)		
Reduction factor, concrete breakout strength in tension[4]		ϕ	-	0.65 (Condition B, no supplementary reinforcement) or 0.75 (Condition A, supplementary reinforcement present)											
PULLOUT STRENGTH IN TENSION (ACI 318-19 17.6.3, ACI 318-14 17.4.3 or ACI 318-11 D.5.3) AND PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-19 17.10.3, ACI 318-14 17.2.3.3 or ACI 318-11 D.3.3.3)															
Characteristic pullout strength, uncracked concrete (2,500 psi)		$N_{p,uncr}$	lb. (kN)	See note 6			See note 6			See note 6			See note 6		
Characteristic pullout strength, cracked concrete (2,500 psi)		$N_{p,cr}$	lb. (kN)	See note 6			See note 6			See note 6			See note 6		
Characteristic pullout strength, seismic (2,500 psi)		$N_{p,eq}$	lb. (kN)	See note 6			See note 6			See note 6			See note 6		
Reduction factor, pullout strength in tension[4]		ϕ	-	0.65 (Condition B)											
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-19 17.7.2, ACI 318-14 17.5.2 or ACI 318-11 D.6.2) AND PRYOUT STRENGTH IN SHEAR (ACI 318-19 17.7.3, ACI 318-14 17.5.3 or ACI 318-11 D.6.3)															
Load bearing length of anchor		ℓ_e	in. (mm)	4 (102)			5 (127)			7-1/2 (190)			10 (254)		
Coefficient for pryout strength		k_{cp}	-	2.0			2.0			2.0			2.0		
Reduction factor, concrete breakout strength in shear[4]		ϕ	-	0.70 (Condition B, no supplementary reinforcement) or 0.75 (Condition A, supplementary reinforcement present)											
Reduction factor, pryout strength in shear[4]		ϕ	-	0.70 (Condition B)											

For SI: 1 inch = 25.4 mm, 1 ksi = 6.895 MPa (N/mm²), 1 lbf = 0.0044 kN, 1 in² = 645 mm².

1. The data in this table is intended to be used with the design provisions of ACI 318 (-19 or -14) Chapter 17 or ACI 318-11 Appendix D, as applicable; for anchors resisting seismic load combinations the additional requirements of ACI 318-19 17.10, ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable, shall apply.
2. Installation must comply with manufacturer's printed installation instructions and details.
3. The anchors are considered ductile steel elements as defined by ACI 318 (-19 or -14) 2.3 or ACI 318-11 D.1, as applicable. See anchor installation specifications and supplemental information table for the determination of stretch length, as applicable.
4. The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. For installations where supplementary reinforcement is present, the strength reduction factors described in ACI 318-19 17.5.3, ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c), as applicable, may be used for Condition A.
5. Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\psi_{c,N} = 1.0$.
6. Pullout strength does not control design of indicated anchors and does not need to be calculated for indicated anchor size and embedment.
7. In lieu of ACI 318-19 17.6.2, ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, the modification factor $\psi_{cp,N} = 1.0$ for all cases. In accordance with ACI 318-19 17.9.5, ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable, tension tests in accordance with ACI 355.2 have determined splitting failure under external load does not govern the resistance of the CCU+ undercut anchors, i.e. $c_{ac} = 1.5h_{ef}$. Therefore, this calculation is not required for design. For reference, values of c_{ac}, critical edge distance determined by $c_{ac} = 1.5h_{ef}$ are provided.
8. For the use of anchors in lightweight concrete, the modification factor λ_a equal to 1.0λ is applied to all values of $(f'c)^{0.5}$ affecting N_n and V_n.
9. For ACI 318-19 (2021 IBC), ACI 318-14 (2018 and 2015 IBC), and ACI 318-11 (2012 IBC), λ shall be determined in accordance with the corresponding version of ACI 318: for sand-lightweight concrete, $\lambda = 0.85$; for all-lightweight concrete, $\lambda = 0.75$.

DESIGN STRENGTH TABLES (SD)

Tension and Shear Design Strengths for Carbon Steel CCU+ Preset Version (PS) Installed in Cracked Concrete[1,2,3,4,5,6,8]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tens ion (lbs.)		ϕV_n Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	3,395	6,835	1,470	3,170	3,395	7,315	1,470	3,170	3,395	7,315	1,470	3,170	3,395	7,315	1,470	3,170
1/2	5-3/8	6,175	9,555	2,680	5,770	6,175	11,030	2,680	5,770	6,175	13,315	2,680	5,770	6,175	13,315	2,680	5,770
5/8	8	9,835	17,550	4,260	9,180	9,835	20,265	4,260	9,180	9,835	21,190	4,260	9,180	9,835	21,190	4,260	9,180
3/4	10-5/8	14,530	27,020	6,295	13,570	14,530	31,200	6,295	13,570	14,530	31,315	6,295	13,570	14,530	31,315	6,295	13,570

- Anchor Pullout/Pryout Strength Controls - Concrete Breakout Strength Controls - Steel Strength Controls

Tension and Shear Design Strengths for Carbon Steel CCU+ Preset Version (PS) Installed in Uncracked Concrete[1,2,3,4,5,6,7]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	3,395	7,315	1,470	3,170	3,395	7,315	1,470	3,170	3,395	7,315	1,470	3,170	3,395	7,315	1,470	3,170
1/2	5-3/8	6,175	11,940	2,680	5,770	6,175	13,315	2,680	5,770	6,175	13,315	2,680	5,770	6,175	13,315	2,680	5,770
5/8	8	9,835	21,190	4,260	9,180	9,835	21,190	4,260	9,180	9,835	21,190	4,260	9,180	9,835	21,190	4,260	9,180
3/4	10-5/8	14,530	31,315	6,295	13,570	14,530	31,315	6,295	13,570	14,530	31,315	6,295	13,570	14,530	31,315	6,295	13,570

- Anchor Pullout/Pryout Strength Controls - Concrete Breakout Strength Controls - Steel Strength Controls

Tension and Shear Design Strengths for Carbon Steel CCU+ Thrubolt Version (TB) Installed in Cracked Concrete[1,2,3,4,5,6,7,8]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	3,395	6,835	1,470	4,650	3,395	7,315	1,470	5,370	3,395	7,315	1,470	6,580	3,395	7,315	1,470	7,595
1/2	5-3/8	6,175	9,555	2,680	6,845	6,175	11,030	2,680	7,905	6,175	13,315	2,680	9,685	6,175	13,315	2,680	11,180
5/8	8	9,835	17,550	4,260	11,965	9,835	20,265	4,260	13,815	9,835	21,190	4,260	16,920	9,835	21,190	4,260	18,835
3/4	10-5/8	14,530	27,020	6,295	17,930	14,530	31,200	6,295	20,705	14,530	31,315	6,295	25,355	14,530	31,315	6,295	27,065

- Anchor Pullout/Pryout Strength Controls - Concrete Breakout Strength Controls - Steel Strength Controls

Tension and Shear Design Strengths for Carbon Steel CCU+ Thrubolt Version (TB) Installed in Uncracked Concrete[1,2,3,4,5,6,7]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)		ϕN_n Tension (lbs.)		ϕV_n Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	3,395	7,315	1,470	6,510	3,395	7,315	1,470	7,520	3,395	7,315	1,470	9,210	3,395	7,315	1,470	9,230
1/2	5-3/8	6,175	11,940	2,680	9,585	6,175	13,315	2,680	11,070	6,175	13,315	2,680	12,165	6,175	13,315	2,680	12,165
5/8	8	9,835	21,190	4,260	16,750	9,835	21,190	4,260	18,835	9,835	21,190	4,260	18,835	9,835	21,190	4,260	18,835
3/4	10-5/8	14,530	31,315	6,295	25,100	14,530	31,315	6,295	27,065	14,530	31,315	6,295	27,065	14,530	31,315	6,295	27,065

- Anchor Pullout/Pryout Strength Controls - Concrete Breakout Strength Controls - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = 1.5*h_{min}$, and with the following conditions:
   - $c_{a1} \geq 1.5h_{ef}$
   - $c_{a2} \geq 1.5c_{a1}$.
2- Calculations were performed following methodology in ACI 318-19, Chapter 17. The load level corresponding to the failure mode listed (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.
3- Strength reduction factors (ø) are in accordance with ACI 318-19 Section 17.5.3; it is assumed that supplementary reinforcement not present. Strength reduction factors for steel strength are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements.
4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.
5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-19 Chapter 17, Section 17.8.
6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-19 Chapter 17 and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-19 Chapter 17.
7- The tabulated design strengths may be converted to allowable stress design values. Divide by conversion factor calculated as a weighted average of the load factors for the controlling load combination.
8- For seismic design in accordance with ACI 318, the tabulated tension design strengths in cracked concrete for concrete breakout must be multiplied by a factor of 0.75.

Tension and Shear Design Strengths for Stainless Steel CCU+ Preset Version (PS) Installed in Cracked Concrete[1,2,3,4,5,6,7,8]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	6,835	3,320	7,020	3,320	7,020	3,320	7,020	3,320
1/2	5-3/8	9,555	5,755	11,030	5,755	11,715	5,755	11,715	5,755
5/8	8	17,550	9,490	18,645	9,490	18,645	9,490	18,645	9,490
3/4	10-5/8	27,020	14,520	27,555	14,520	27,555	14,520	27,555	14,520

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Stainless Steel CCU+ Preset Version (PS) Installed in Uncracked Concrete[1,2,3,4,5,6,7]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	7,020	3,320	7,020	3,320	7,020	3,320	7,020	3,320
1/2	5-3/8	11,715	5,755	11,715	5,755	11,715	5,755	11,715	5,755
5/8	8	18,645	9,490	18,645	9,490	18,645	9,490	18,645	9,490
3/4	10-5/8	27,555	14,520	27,555	14,520	27,555	14,520	27,555	14,520

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Stainless Steel CCU+ Thrubolt Version (TB) Installed in Cracked Concrete[1,2,3,4,5,6,7,8]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	6,835	4,650	7,020	5,370	7,020	6,580	7,020	7,595
1/2	5-3/8	9,555	6,845	11,030	7,905	11,715	9,685	11,715	11,180
5/8	8	17,550	11,965	18,645	13,815	18,645	16,920	18,645	19,540
3/4	10-5/8	27,020	17,930	27,555	20,705	27,555	25,355	27,555	29,280

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

Tension and Shear Design Strengths for Stainless Steel CCU+ Thrubolt Version (TB) Installed in Uncracked Concrete[1,2,3,4,5,6,7]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth hnom (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)	ϕN_n Tension (lbs.)	ϕV_n Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	7,020	6,510	7,020	7,520	7,020	9,210	7,020	10,110
1/2	5-3/8	11,715	9,585	11,715	11,070	11,715	13,555	11,715	15,655
5/8	8	18,645	16,750	18,645	19,345	18,645	23,690	18,645	25,215
3/4	10-5/8	27,555	25,100	27,555	28,985	27,555	35,500	27,555	37,520

□ - Anchor Pullout/Pryout Strength Controls ■ - Concrete Breakout Strength Controls ■ - Steel Strength Controls

1- Tabular values are provided for illustration and are applicable for single anchors installed in normal-weight concrete with minimum slab thickness, $h_a = 1.5*h_{min}$, and with the following conditions:
   - $c_{a1} \geq 1.5h_{ef}$
   - $c_{a2} \geq 1.5c_{a1}$.
2- Calculations were performed following methodology in ACI 318-19, Chapter 17. The load level corresponding to the failure mode listed (e.g. For tension: steel, concrete breakout and pullout; For shear: steel, concrete breakout and pryout). Furthermore, the capacities for concrete breakout strength in tension and pryout in shear are calculated using the effective embedment values, h_{ef}, for the selected anchors as noted in the design information tables. Please also reference the installation specifications for more information.
3- Strength reduction factors (ø) are in accordance with ACI 318-19 Section 17.5.3; it is assumed that supplementary reinforcement not present. Strength reduction factors for steel strength are taken as 0.75 for tension and 0.65 for shear; values correspond to ductile steel elements.
4- Tabular values are permitted for static loads only, seismic loading is not considered with these tables.
5- For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318-19 Chapter 17, Section 17.8.
6- Interpolation is not permitted to be used with the tabular values. For intermediate base material compressive strengths, please see ACI 318-19 Chapter 17 and information contained in this product supplement. For other design conditions including seismic considerations please see ACI 318-19 Chapter 17.
7- The tabulated design strengths may be converted to allowable stress design values. Divide by conversion factor calculated as a weighted average of the load factors for the controlling load combination.
8- For seismic design in accordance with ACI 318, the tabulated tension design strengths in cracked concrete for concrete breakout must be multiplied by a factor of 0.75.

PERFORMANCE DATA (ASD)

Converted Allowable Loads for Carbon Steel CCU+ Preset Version (PS) Installed in Cracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	2,425	4,880	1,050	2,265	2,425	5,225	1,050	2,265	2,425	5,225	1,050	2,265	2,425	5,225	1,050	2,265
1/2	5-3/8	4,410	6,825	1,915	4,120	4,410	7,880	1,915	4,120	4,410	9,510	1,915	4,120	4,410	9,510	1,915	4,120
5/8	8	7,025	12,535	3,045	6,555	7,025	14,475	3,045	6,555	7,025	15,135	3,045	6,555	7,025	15,135	3,045	6,555
3/4	10-5/8	10,380	19,300	4,495	9,695	10,380	22,285	4,495	9,695	10,380	22,370	4,495	9,695	10,380	22,370	4,495	9,695

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Carbon Steel CCU+ Preset Version (PS) Installed in Uncracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	2,425	5,225	1,050	2,265	2,425	5,225	1,050	2,265	2,425	5,225	1,050	2,265	2,425	5,225	1,050	2,265
1/2	5-3/8	4,410	8,530	1,915	4,120	4,410	9,510	1,915	4,120	4,410	9,510	1,915	4,120	4,410	9,510	1,915	4,120
5/8	8	7,025	15,135	3,045	6,555	7,025	15,135	3,045	6,555	7,025	15,135	3,045	6,555	7,025	15,135	3,045	6,555
3/4	10-5/8	10,380	22,370	4,495	9,695	10,380	22,370	4,495	9,695	10,380	22,370	4,495	9,695	10,380	22,370	4,495	9,695

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Carbon Steel CCU+ Thrubolt Version (TB) Installed in Cracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	2,425	4,880	1,050	3,320	2,425	5,225	1,050	3,835	2,425	5,225	1,050	4,700	2,425	5,225	1,050	5,425
1/2	5-3/8	4,410	6,825	1,915	4,890	4,410	7,880	1,915	5,645	4,410	9,510	1,915	6,920	4,410	9,510	1,915	7,985
5/8	8	7,025	12,535	3,045	8,545	7,025	14,475	3,045	9,870	7,025	15,135	3,045	12,085	7,025	15,135	3,045	13,455
3/4	10-5/8	10,380	19,300	4,495	12,805	10,380	22,285	4,495	14,790	10,380	22,370	4,495	18,110	10,380	22,370	4,495	19,330

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Carbon Steel CCU+ Thrubolt Version (TB) Installed in Uncracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength															
		f'c = 3,000 psi				f'c = 4,000 psi				f'c = 6,000 psi				f'c = 8,000 psi			
		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)		$T_{allowable,ASD}$ Tension (lbs.)		$V_{allowable,ASD}$ Shear (lbs.)	
		A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7	A36	A193, Gr. B7
3/8	4-1/4	2,425	5,225	1,050	4,650	2,425	5,225	1,050	5,370	2,425	5,225	1,050	6,580	2,425	5,225	1,050	6,595
1/2	5-3/8	4,410	8,530	1,915	6,845	4,410	9,510	1,915	7,905	4,410	9,510	1,915	8,690	4,410	9,510	1,915	8,690
5/8	8	7,025	15,135	3,045	11,965	7,025	15,135	3,045	13,455	7,025	15,135	3,045	13,455	7,025	15,135	3,045	13,455
3/4	10-5/8	10,380	22,370	4,495	17,930	10,380	22,370	4,495	19,330	10,380	22,370	4,495	19,330	10,380	22,370	4,495	19,330

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Stainless Steel CCU+ Preset Version (PS) Installed in Cracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	4,880	2,370	5,015	2,370	5,015	2,370	5,015	2,370
1/2	5-3/8	6,825	4,110	7,880	4,110	8,370	4,110	8,370	4,110
5/8	8	12,535	6,780	13,320	6,780	13,320	6,780	13,320	6,780
3/4	10-5/8	19,300	10,370	19,680	10,370	19,680	10,370	19,680	10,370

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Stainless Steel CCU+ Preset Version (PS) Installed in Uncracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	5,015	2,370	5,015	2,370	5,015	2,370	5,015	2,370
1/2	5-3/8	8,370	4,110	8,370	4,110	8,370	4,110	8,370	4,110
5/8	8	13,320	6,780	13,320	6,780	13,320	6,780	13,320	6,780
3/4	10-5/8	19,680	10,370	19,680	10,370	19,680	10,370	19,680	10,370

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Stainless Steel CCU+ Thrubolt Version (TB) Installed in Cracked Concrete[1,2]

Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	4,880	3,320	5,015	3,835	5,015	4,700	5,015	5,425
1/2	5-3/8	6,825	4,890	7,880	5,645	8,370	6,920	8,370	7,985
5/8	8	12,535	8,545	13,320	9,870	13,320	12,085	13,320	13,955
3/4	10-5/8	19,300	12,805	19,680	14,790	19,680	18,110	19,680	20,915

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

Converted Allowable Loads for Stainless Steel CCU+ Thrubolt Version (TB) Installed in Uncracked Concrete[1,2]

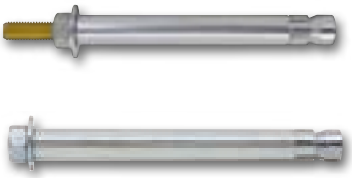
Nominal Anchor Size / Rod Diameter (in.)	Nominal Embed. Depth h_{nom} (in.)	Minimum Concrete Compressive Strength							
		f'c = 3,000 psi		f'c = 4,000 psi		f'c = 6,000 psi		f'c = 8,000 psi	
		$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)	$T_{allowable,ASD}$ Tension (lbs.)	$V_{allowable,ASD}$ Shear (lbs.)
		A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)	A193, Gr. B8M (316 SS)
3/8	4-1/4	5,015	4,650	5,015	5,370	5,015	6,580	5,015	7,220
1/2	5-3/8	8,370	6,845	8,370	7,905	8,370	9,680	8,370	11,180
5/8	8	13,320	11,965	13,320	13,820	13,320	16,920	13,320	18,010
3/4	10-5/8	19,680	17,930	19,680	20,705	19,680	25,355	19,680	26,800

1. Allowable load values are calculated using a conversion factor, α, from the Factored Design Strength Tables and conditions shown previously.
2. Tabulated allowable load values assume 50% dead load and 50% live load, with controlling load combination 1.2D + 1.6L. Calculated weighted average for the conversion factor α : 1.2(0.5) + 1.6(0.5) = 1.4.

ORDERING INFORMATION

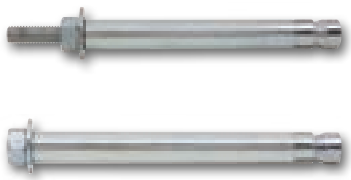
Carbon Steel CCU+ Undercut Anchors (ASTM A36 Anchor Rod)[1,2,3]

Cat. No.	Anchor Description, Nominal Size and Length (in.)	Anchor Version	Drill Hole Dia. (in.)	Max. Fixture Thickness, (in.)	Pack Qty.
DFM1311050	3/8 x 6	Preset (PS)	11/16	7/8	20
DFM1311550		Thrubolt (TB)			20
DFM1311100	1/2 x 7-1/2	Preset (PS)	13/16	1-1/4	12
DFM1311600		Thrubolt (TB)			12
DFM1311150	1/2 x 8-1/4	Preset (PS)	13/16	2	12
DFM1311650		Thrubolt (TB)			12
DFM1311200	5/8 x 10-3/4	Preset (PS)	1	1-5/8	10
DFM1311700		Thrubolt (TB)			10
DFM1311250	5/8 x 11-1/2	Preset (PS)	1	2-3/8	10
DFM1311750		Thrubolt (TB)			10
DFM1311300	3/4 x 14	Preset (PS)	1-1/4	2	6
DFM1311800		Thrubolt (TB)			6
DFM1311350	3/4 x 16	Preset (PS)	1-1/4	4	6
DFM1311850		Thrubolt (TB)			6



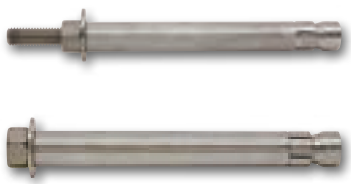
Carbon Steel CCU+ Undercut Anchors (ASTM A193, Grade B7 Anchor Rod)[1,2,3]

Cat. No.	Anchor Description, Nominal Size and Length (in.)	Anchor Version	Drill Hole Dia. (in.)	Max. Fixture Thickness, (in.)	Pack Qty.
DFM1371050	3/8 x 6	Preset (PS)	11/16	7/8	20
DFM1371550		Thrubolt (TB)			20
DFM1371100	1/2 x 7-1/2	Preset (PS)	13/16	1-1/4	12
DFM1371600		Thrubolt (TB)			12
DFM1371150	1/2 x 8-1/4	Preset (PS)	13/16	2	12
DFM1371650		Thrubolt (TB)			12
DFM1371200	5/8 x 10-3/4	Preset (PS)	1	1-5/8	10
DFM1371700		Thrubolt (TB)			10
DFM1371250	5/8 x 11-1/2	Preset (PS)	1	2-3/8	10
DFM1371750		Thrubolt (TB)			10
DFM1371300	3/4 x 14	Preset (PS)	1-1/4	2	6
DFM1371800		Thrubolt (TB)			6
DFM1371350	3/4 x 16	Preset (PS)	1-1/4	4	6
DFM1371850		Thrubolt (TB)			6



Stainless Steel CCU+ Undercut Anchors (ASTM A193, Grade B8M, Class 2 Anchor Rod - 316 SS)[1,2,3]

Cat. No.	Anchor Description, Nominal Size and Length (in.)	Anchor Version	Drill Hole Dia. (in.)	Max. Fixture Thickness, (in.)	Pack Qty.
DFM1361050	3/8 x 6	Preset (PS)	11/16	7/8	20
DFM1361550		Thrubolt (TB)			20
DFM1361100	1/2 x 7-1/2	Preset (PS)	13/16	1-1/4	12
DFM1361600		Thrubolt (TB)			12
DFM1361150	1/2 x 8-1/4	Preset (PS)	13/16	2	12
DFM1361650		Thrubolt (TB)			12
DFM1361200	5/8 x 10-3/4	Preset (PS)	1	1-5/8	10
DFM1361700		Thrubolt (TB)			10
DFM1361250	5/8 x 11-1/2	Preset (PS)	1	2-3/8	10
DFM1361750		Thrubolt (TB)			10
DFM1361300	3/4 x 14	Preset (PS)	1-1/4	2	6
DFM1361800		Thrubolt (TB)			6
DFM1361350	3/4 x 16	Preset (PS)	1-1/4	4	6
DFM1361850		Thrubolt (TB)			6



Notes for Anchor Ordering Information Tables:

1. Standard preset anchors are designed so the top of the expansion sleeve is approximately flush with the base material after setting. Thrubolt anchors are designed so the expansion sleeve can be set through and can engage the fixture. See CCU+ undercut anchor detail and installation specifications.
2. Undercut drill bits and setting sleeves are required for installation. See the available anchor installation accessories and tools commercially available from DEWALT at the time of publication.
3. The listed anchor lengths are based on the anchor sizes commercially available at the time of publication; custom lengths can be produced by request.

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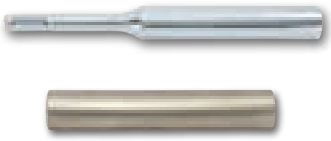
Setting Sleeves

Powered Cat. No.	Manual Cat. No.	Approximate Usable Sleeve Length, (in.)	Matching Nominal Anchor Size, (in.)	Pack Qty.
DFX313825 (SDS-Plus)	-	2-3/4	3/8 (11/16 O.D.)	1
-	DFX313805	5		1
DFX311230 (SDS-Plus)	-	3-3/4	1/2 (13/16 O.D.)	1
-	DFX311210	5		1
DFX315835 (SDS-Max)	-	4-3/4	5/8 (1 O.D.)	1
-	DFX315815	5-1/4		1
DFX313440 (SDS-Max)	-	6-1/2	3/4 (1-1/4 O.D.)	1
-	DFX313420	7		1

Note: powered or manual setting sleeves are required for the installation of CCU+ undercut anchors; see installation instructions.
Manual setting sleeves may be stacked to create longer usable setting sleeve lengths.
O.D. = outside diameter



Rotary Hammer Drills

Cat. No.	Nominal Drill Bit Diameter (in.)	Approximate Impact Energy (J)	Pack Qty.
DCH416 or D25416 (SDS-Plus)	11/16	4.5	1
	13/16		
DCH614 or D25614 (SDS-Max)	1	10.5	1
	1-1/4		

Drill Chuck Adapter

Cat. No.	Shank Type	Pack Qty.
DW5891	SDS-Max to SDS-Plus Adapter	1

Hollow Stop Bits (HSB)

Cat. No.	Nominal Drill Bit Diameter, (in.)	Max. Drilling Depth, (in.)	Shank Type	Pack Qty.
DFX11380	11/16	4-1/4	SDS-Plus	1
DFX11120	13/16	5-3/8	SDS-Plus	1
DFX11580	1	8	SDS-Max	1
DFX11340	1-1/4	10-5/8	SDS-Max	1

Stop drill bits create a drilled hole to the specified depth for standard preset version CCU+ Undercut anchors.
For thrubolt applications, see CCU+ undercut anchor detail and installation specifications.
HSB dust removal drill bits are used with a vacuum dust extractor (e.g. DWV010, DWV012, DCV585).

Hollow Bits (HB)

Cat. No.	Nominal Drill Bit Diameter, (in.)	Usable Length, (in.)	Shank Type	Pack Qty.
DWA54116	11/16	9-3/4	SDS-Plus	1
DWA54316	13/16	9-3/4	SDS-Plus	1
DWA58001	1	15-3/4	SDS-Max	1
DWA58115	1-1/4	15-3/4	SDS-Max	1

HB dust removal drill bits are used with a vacuum dust extractor (e.g. DWV010, DWV012, DCV585).

Conventional Bits (4-Cutter)

Cat. No.	Nominal Drill Bit Diameter, (in.)	Usable Length, (in.)	Shank Type	Pack Qty.
DW5808	11/16	16	SDS-Max	1
DW5814	13/16	16	SDS-Max	1
DW5852	1	24	SDS-Max	1
DW5855	1-1/4	24	SDS-Max	1

Hollow Undercut Bits (HUCB)

Cat. No.	Nominal Drill Bit Diameter, (in.)	Max. Hole Depth, (in.)	Shank Type	Pack Qty.
DFX21380	11/16	6	SDS-Plus	1
DFX21120	13/16	8	SDS-Plus	1
DFX21580*	1	11	SDS-Plus*	1
DFX21340	1-1/4	15-1/4	SDS-Max	1

*For rotary hammer drill connector options, a DW5891 SDS-Max to SDS-Plus adapter can be considered.
HUCB dust removal drill bits are used with a vacuum dust extractor (e.g. DWV010, DWV012, DCV585).
Note: HUCB or UCB are required for the installation of CCU+ undercut anchors; see installation instructions.

Undercut Bits (UCB)

Cat. No.	Nominal Drill Bit Diameter, (in.)	Max. Hole Depth, (in.)	Shank Type	Pack Qty.
DFX21381	11/16	6	SDS-Plus	1
DFX21121	13/16	8	SDS-Plus	1
DFX21581*	1	11	SDS-Plus*	1
DFX21341	1-1/4	15-1/4	SDS-Max	1

*For rotary hammer drill connector options, a DW5891 SDS-Max to SDS-Plus adapter can be considered.
Note: HUCB or UCB are required for the installation of CCU+ undercut anchors; see installation instructions.

Replacement Cutter Blades for Undercut Bits

Cat. No.	Nominal Drill Bit Diameter, (in.)	For Use With		Pack Qty.
		HUCB	UCB	
DFX213825	11/16	DFX21380	DFX21381	1
DFX211230	13/16	DFX21120	DFX21121	1
DFX215835	1	DFX21580	DFX21581	1
DFX213440	1-1/4	DFX21340	DFX21341	1

Replacement cutter blades can be used with both hollow undercut drill bits (HUCB) and undercut drill bits (UCB) as indicated.

Replacement Bow Jaws for Undercut Bits

Cat. No.	Nominal Drill Bit Diameter, (in.)	For Use With		Pack Qty.
		HUCB	UCB	
DFX213807	11/16	DFX21380	-	1
DFX213805		-	DFX21381	1
DFX211212	13/16	DFX21120	-	1
DFX211210		-	DFX21121	1
DFX215817	1	DFX21580	-	1
DFX215815		-	DFX21581	1
DFX213422	1-1/4	DFX21340	-	1
DFX213420		-	DFX21341	1

Vacuums

Cat. No.	Description	Pack Qty.
DWV010	8 Gallon HEPA/RRP Dust Extractor	1
DWV012	10 Gallon Wet/Dry HEPA/RRP Dust Extractor	1
DCV585	Flexvolt 60V Max Dust Extratcor (Tool only)	1