ICC-ES Evaluation Report

ESR-3912

Reissued October 2024	*This report also contains:*
	- **City of LA Supplement**
Subject to renewal October 2025	- **FL Supplement w/ HVHZ**

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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:** **MINI-UNDERCUT+™ ANCHORS IN CRACKED AND UNCRACKED CONCRETE (DEWALT)**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2024, 2021, 2018, and 2015 *International Building Code® (IBC)*
- 2024, 2021, 2018, and 2015 *International Residential Code (IRC)*

Main references of this report are for the 2024 IBC and IRC. See Table 6 and Table 7 for applicable sections of the code for previous IBC and IRC editions.

Property evaluated:

Structural

2.0 USES

The DEWALT Mini-Undercut+ anchor is used to anchor building components to the underside (i.e. formed surface) of cracked and uncracked normal-weight concrete and lightweight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa) to resist static, wind and seismic, tension and shear loads. Use of anchors is limited to supporting non-structural components.

The anchors may also be installed in the underside of cracked and uncracked hollow-core concrete slabs having a minimum specified compressive strength, f'_c, of 6,000 psi (41.4 MPa). Use of anchors is limited to supporting non-structural components.

The anchor is an alternative to cast-in-place anchors described in Section 1901.3 of the 2024 IBC. The anchors may be used in structures regulated by the IRC, provided an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 Mini-Undercut+ Anchors:

Mini-Undercut+ anchors are internally threaded undercutting anchors which receive threaded steel inserts such as threaded rods and bolts in $^{3}/_{8}$-inch (9.5 mm) diameter.

Available nominal size is $^{3}/_{8}$-inch (9.5 mm). The anchors are manufactured from carbon steel and comprised of an undercutting sleeve and an internally threaded plow which have a minimum 0.0002-inch (5 μm) zinc plating in accordance with ASTM B633. The Mini-Undercut+ anchor is illustrated in Figure 1.

The anchors must be installed in predrilled holes using a stop drill bit and engaged with a setting tool using a recommended hammer drill (equipment supplied by DEWALT) as noted in Table B of this report. The anchor expands into the sides of the predrilled hole and interlocks with the base material during installation.

3.2 Steel Insert Elements:

Threaded steel insert elements must be threaded into the Mini-Undercut+ anchors to form a connection. The material properties of the steel bolts and threaded rods must comply with minimum ASTM A36 or equivalent.

3.3 Concrete and Hollow-core Concrete Slabs:

Normal-weight and lightweight concrete must comply with Sections 1903 and 1905 of the 2024 IBC. The minimum concrete compressive strength at the time of anchor installation is noted in Section 5.3 of this report. Hollow-core precast concrete slabs must comply with the configuration and dimensions as indicated in Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: Design strength of anchors complying with the 2024 IBC, as well as Section R301.1.3 of the 2024 IRC must be determined in accordance with ACI 318-19 Chapter 17 and this report.

Design parameters provided in Tables 2 and 3 of this report are based on ACI 318-19, unless noted otherwise in Section 4.1.1 through 4.1.11 of this report.

The strength design of anchors must comply with ACI 318-19 Section 17.5.1.2, except as required in ACI 318-19 Section 17.10. Strength reduction factors, ϕ, as given in Tables 2 and 3 of this report, must be used in lieu of ACI 318-19 Section 17.5.3 for load combinations calculated in accordance with Section 1605.1 of the 2024 IBC or Section 5.3 of ACI 318-19. The value of f'_c used in the calculation must be limited to a maximum of 8,000 psi (55.2 MPa), in accordance with ACI 318-19 Section 17.3.1.

4.1.2 Requirements for Static Steel Strength in Tension, N_{sa}: The nominal static steel strength in tension, N_{sa}, of a single anchor must be calculated in accordance with ACI 318-19 Section 17.6.1 for the threaded steel element, $N_{sa,rod}$, as illustrated in Table 5 of this report. The lesser of $\phi N_{sa,rod}$ in Table 5 or ϕN_{sa} provided in Table 2 for the Mini-Undercut+ anchor must be used as the steel strength in tension.

4.1.3 Requirements for Static Concrete Breakout Strength in Tension N_{cb} or N_{cbg}: The nominal concrete breakout strength of a single anchor or a group of anchors in tension, N_{cb} or N_{cbg}, respectively, must be calculated in accordance with ACI 318-19 Section 17.6.2, with modifications as described in this section. The basic concrete breakout strength of a single anchor in tension in cracked concrete, N_b, must be calculated according to ACI 318-19 Section 17.6.2.2, using the values of h_{ef} and k_{cr} as given in Table 2 of this report. The nominal concrete breakout strength in tension in regions where analysis indicates no cracking in accordance with ACI 318-19 Section 17.6.2.5.1(a) must be calculated with the value of k_{uncr} as given in Table 2 of this report and with $\psi_{c,N} = 1.0$.

4.1.4 Requirements for Static Pullout Strength in Tension, N_{pn}: The nominal pullout strength of a single anchor or a group of anchors, in accordance with ACI 318-19 Section 17.6.3, in cracked and uncracked concrete, $N_{p,cr}$ and $N_{p,uncr}$, respectively, is given in Table 2. In lieu of ACI 318-19 Section 17.6.3.3, $\Psi_{c,P} = 1.0$ for all design cases. The nominal pullout strength in cracked concrete may be adjusted by calculation according to Eq-1:

$$N_{p,f'_c} = N_{p,cr}\sqrt{\frac{f'_c}{2{,}500}} \quad \text{(lb, psi)} \qquad \text{(Eq-1)}$$

$$N_{p,f'_c} = N_{p,cr}\sqrt{\frac{f'_c}{17.2}} \qquad \text{(N, MPa)}$$

where f'_c is the specified concrete compressive strength. For hollow-core concrete slabs, the value of 6,000 psi (41.4 MPa) must be substituted for the value of 2,500 psi (17.2 MPa) in the denominator.

Where value for $N_{p,uncr}$ is not provided in Table 2 of this report, the pullout strength in tension need not be considered or evaluated.

4.1.5 Requirements for Static Steel Shear Capacity, V_{sa}: The nominal static steel strength in shear, V_{sa}, of a single anchor must be taken as the threaded steel element strength, $V_{sa,rod}$, given in Table 5 of this report. The lesser of $\phi V_{sa,rod}$ in Table 5 or ϕV_{sa} in Table 3 for the Mini-Undercut+ anchor must be used as the steel strength in shear, and must be used in lieu of the values derived by calculation from ACI 318-19 Eq. 17.7.1.2a or 17.7.1.2b.

4.1.6 Requirements for Static Concrete Breakout Strength in Shear, V_{cb} or V_{cbg}: The nominal concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, respectively, must be calculated in accordance with ACI 318-19 Section 17.7.2, with modifications as described in this section. The basic concrete breakout strength of a single anchor in shear, V_b, must be calculated in accordance with ACI 318-19 Section 17.7.2.2.1, using the value of ℓ_e and d_a given in Table 3 of this report.

For anchors installed in hollow-core concrete slabs, 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 318-19 Section 17.7.2, using the actual member cover thickness of the hollow-core, $h_{min,core}$, in lieu of h_{min}, in the determination of A_{vc}. Minimum member cover thickness for anchors in the hollow-core concrete slabs is given in Table 1 and shown in Figure 4 of this report, as applicable.

4.1.7 Requirements for Static Concrete Pryout Strength in Shear, V_{cp} or V_{cpg}: The nominal concrete pryout strength of a single anchor or group of anchors, V_{cp} or V_{cpg}, respectively, must be calculated in accordance with ACI 318-19 Section 17.7.3, using the value of k_{cp} provided in Table 3, and the value of N_{cb} or N_{cbg} as calculated in Section 4.1.3 of this report.

4.1.8 Requirements for Seismic Design:

4.1.8.1 General: For load combinations including seismic loads, the design must be performed in accordance with ACI 318-19 Section 17.10. Modifications to ACI 318-19 Section 17.10 must be applied under 2024 IBC Section 1905.7.

The nominal steel strength and nominal concrete breakout strength for anchors in tension, and the nominal concrete breakout strength and pryout strength for anchors in shear, must be calculated according to ACI 318-19 Sections 17.6 and 17.7, taking into account the corresponding values in Tables 2 and 3 of this report.

The anchors comply with ACI 318-19 Section 2.3 as brittle steel elements and must be designed in accordance with ACI 318-19 Sections 17.10.4, 17.10.5 or 17.10.6 and 17.10.7.

The $^3/_8$-inch-diameter (9.5 mm) Mini-Undercut+ anchors may be installed in regions designated as IBC Seismic Design Categories A through F.

4.1.8.2 Seismic Tension: The nominal steel strength and nominal concrete breakout strength for anchors in tension must be calculated according to ACI 318-19 Sections 17.6.1 and 17.6.2, as described in Sections 4.1.2 and 4.1.3 of this report. In accordance with ACI 318-19 Section 17.6.3.2.1, the appropriate value for nominal pullout strength in tension for seismic loads, $N_{p,eq}$, described in Table 2 of this report, must be used in lieu of N_p. $N_{p,eq}$, and may be adjusted by calculations for concrete compressive strength in accordance with Eq-1 of this report.

4.1.8.3 Seismic Shear: The nominal concrete breakout strength and pryout strength for anchors in shear must be calculated according to ACI 318-19 Sections 17.7.2 and 17.7.3, as described in Sections 4.1.6 and 4.1.7 of this report. In accordance with ACI 318-19 Section 17.7.1.2, the appropriate value for nominal steel strength in shear for seismic loads, $V_{sa,eq}$, described in Table 3 of this report, must be used in lieu of V_{sa}.

4.1.9 Requirements for the Interaction of Tensile and Shear Forces: The effects of combined tensile and shear forces must be determined in accordance with ACI 318-19 Section 17.8.

4.1.10 Requirements for Critical Edge Distance, c_{ac}: In applications where $c < c_{ac}$ and supplemental reinforcement to control splitting of the concrete is not present, the concrete breakout strength in tension for uncracked concrete, calculated according to ACI 318-19 Section 17.6.2, must be further multiplied by the factor $\psi_{cp,N}$ as given by Eq 2:

$$\psi_{cp,N} = \frac{c}{c_{ac}} \quad \text{(Eq-2)}$$

whereby the factor $\psi_{cp,N}$ need not be taken less than $\frac{1.5h_{ef}}{c_{ac}}$. For all other cases, $\psi_{cp,N} = 1.0$. In lieu of using ACI 318-19 Section 17.9.5, values of c_{ac} provided in Table 2 of this report must be used, as applicable

4.1.11 Requirements for Minimum Member Thickness, Minimum Anchor Spacing and Minimum Edge Distance: In lieu of ACI 318-19 Section 17.9.2, the values of s_{min} and c_{min} as given in Table 1 of this report must be used. In lieu of ACI 318-19 Section 17.9.4, minimum member thicknesses, h_{min}, as given in Table 1 of this report must be used.

4.1.12 Lightweight Concrete: For the use of anchors in lightweight concrete the modification factor λ_a equal to 0.8λ is applied to all values of $\sqrt{f'_c}$ affecting N_n and V_n.

The value of λ must be determined in accordance with ACI 318-19.

4.2 Allowable Stress Design (ASD):

4.2.1 General: Design values for use with allowable stress design load combinations calculated in accordance with Section 1605.1 of the 2024 IBC must be established using the following equations:

$T_{allowable,ASD} = \phi N_n / \alpha$ (Eq-3)

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

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 318-19 Chapter 17 and 2024 IBC Section 1905.7, and Section 4.1 of this report, as applicable.

ϕV_n = Lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318-19 Chapter 17 and 2024 IBC Section 1905.7, and Section 4.1 of this report, as applicable.

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 nonductile failure modes and required over-strength.

Limits on edge distance, anchor spacing and member thickness as given in Table 1 of this report must apply.

4.2.2 Interaction of Tensile and Shear Forces: The interaction must be calculated and consistent with ACI 318-19 Section 17.8, as follows:

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

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

For all other cases: $\frac{T_{applied}}{T_{allowable,\ ASD}} + \frac{V_{applied}}{V_{allowable,\ ASD}} \leq 1.2$ (Eq-5)

4.3 Installation:

Installation parameters are provided in Table 1 and Figures 1A, 2, 3 and 4 of this report. Anchor locations must comply with this report and plans and specifications approved by the code official. The Mini-Undercut+ anchor must be installed according to manufacturer’s printed installation instructions and this report. Anchors must be installed in holes drilled into concrete using carbide-tipped masonry drill bits complying with ANSI B212.15-1994. The stop drill bit size and drilled hole depth must be in accordance with Table 1. The anchors must be installed in drilled holes with a powered hammer drill and fitted with a Mini-Undercut+ setting tool supplied by DEWALT. The allowable ranges of installation parameters for the Mini-Undercut+ anchors are given in Table 1. The anchors must be driven until the shoulder of the Mini-Undercut+ anchor is flush with the surface of the concrete. The minimum thread engagement of a threaded rod or bolt insert element assembly into the Mini-Undercut+ anchor must be full anchor depth.

4.4 Special Inspection:

Periodic special inspection is required, in accordance with Section 1705.1.1 and Table 1705.3 of the 2024 IBC. The special inspector must make periodic inspections during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, drill bit size and type, anchor spacing, edge distances, concrete thickness, anchor embedment, and adherence to the installation instructions. The special inspector must be present as often as required in accordance with the “statement of special inspection.”

5.0 CONDITIONS OF USE:

The Mini-Undercut+ anchors described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The anchors must be installed in accordance with the manufacturer's printed installation instructions and this report. In case of conflict, this report governs.

5.2 Anchor sizes, dimensions and minimum embedment depths are as set forth in this report.

5.3 The anchors must be limited to installation in the formed surface of cracked and uncracked normal-weight and lightweight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa), and cracked and uncracked hollow-core concrete slabs with the configuration and dimensions as indicated in Figure 4 having a minimum specified compressive strength, f'_c, of 6,000 psi (41.4 MPa).

5.4 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55.1 MPa).

5.5 The concrete must have attained its minimum design strength prior to installation of the anchors.

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

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

5.8 Anchor spacing and edge distance, as well as minimum member thickness, must comply with Table 1 and Figures 2 and 4 of this report.

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

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

5.11 Anchors may be installed in regions of concrete where cracking has occurred or where analysis indicates cracking may occur ($f_t > f_r$), subject to the conditions of this report.

5.12 Anchors may be used to resist short-term loading due to wind or seismic forces (Seismic Design Categories A through F under the IBC), subject to the conditions of this report.

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

- The anchors are used to resist wind or seismic forces only.
- Anchors are used to support nonstructural elements.

5.14 Special inspection must be provided in accordance with Section 4.4 of this report.

5.15 Use of anchors is limited to supporting non-structural components.

5.16 Use of anchors is limited to dry, interior locations.

5.17 Anchors are manufactured under an approved quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193), dated July 2024, which incorporates requirements in ACI 355.2-19 / 355.2-07, for use in cracked and uncracked concrete; including but not limited to reference, reliability and service-condition tests in cracked and uncracked concrete.

6.2 Reports of tension and shear tests of anchors in hollow-core concrete slabs in accordance with applicable sections as referenced in Section 6.1 of this report.

6.3 Quality-control documentation in accordance with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) dated January 2019.

7.0 IDENTIFICATION

7.1 The Mini-Undercut+ anchors have only one size and one type, which is identified in the field by their unique dimensional characteristics and packaging. Packages are identified with the company name (DEWALT), anchor name, part number, type, size, and the evaluation report number (ESR-3912).

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

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

TABLE A—INSTALLATION AND DESIGN INDEX[1]

Product Name	Installation Specifications	Tension Design Data		Shear Design Data	
		Concrete	Hollow-core Concrete Slabs	Concrete	Hollow-core Concrete Slabs
Mini-Undercut+	Table 1	Table 2	Table 2	Table 3	Table 3

Concrete Type	Concrete State	Anchor Nominal Size	Seismic Design Categories[2]
Normal-weight	Cracked	$^3/_8$-inch	A through F
	Uncracked	$^3/_8$-inch	A and B

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

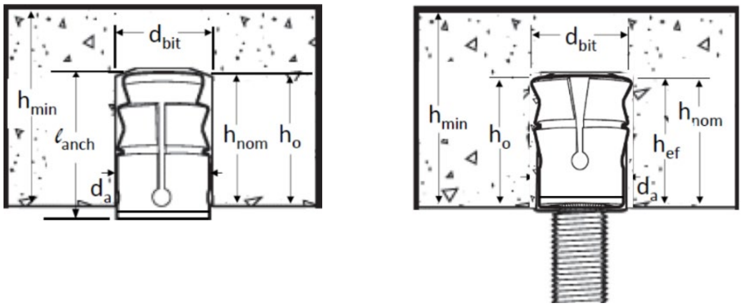
[1] Reference ACI 318-19 Section 17.5.2. The controlling strength is decisive from all appropriate failure modes (i.e. steel, concrete breakout, pullout, pryout, as applicable) and design assumptions.

[2] See Section 4.1.8 for requirements for seismic design, where applicable.

TABLE B—MINI-UNDERCUT+ SYSTEM

SDS Stop Drill Bits	Mini-Undercut+ Anchor	SDS Setting Tool	DEWALT Recommended SDS Hammer-Tools
PPA2431720	PFM2111820	PFM2101720	DCH273, DCH133, D25133, D25262, DCH263, D25263[1]

[1] Refer to Table 1 for requirements of approximate tool impact power.



d_{bit}
h_{min}
ℓ_{anch}
h_{nom}
h_o
d_a
d_{bit}
h_{min}
h_o
h_{nom}
h_{ef}
d_a

FIGURE 1A—MINI- UNDERCUT+ ANCHOR DETAIL
Before (Left Picture) and After (Right Picture) Anchor Setting

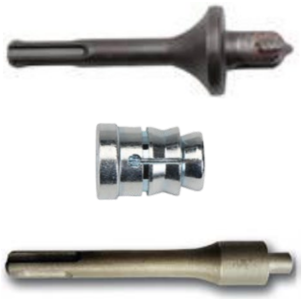
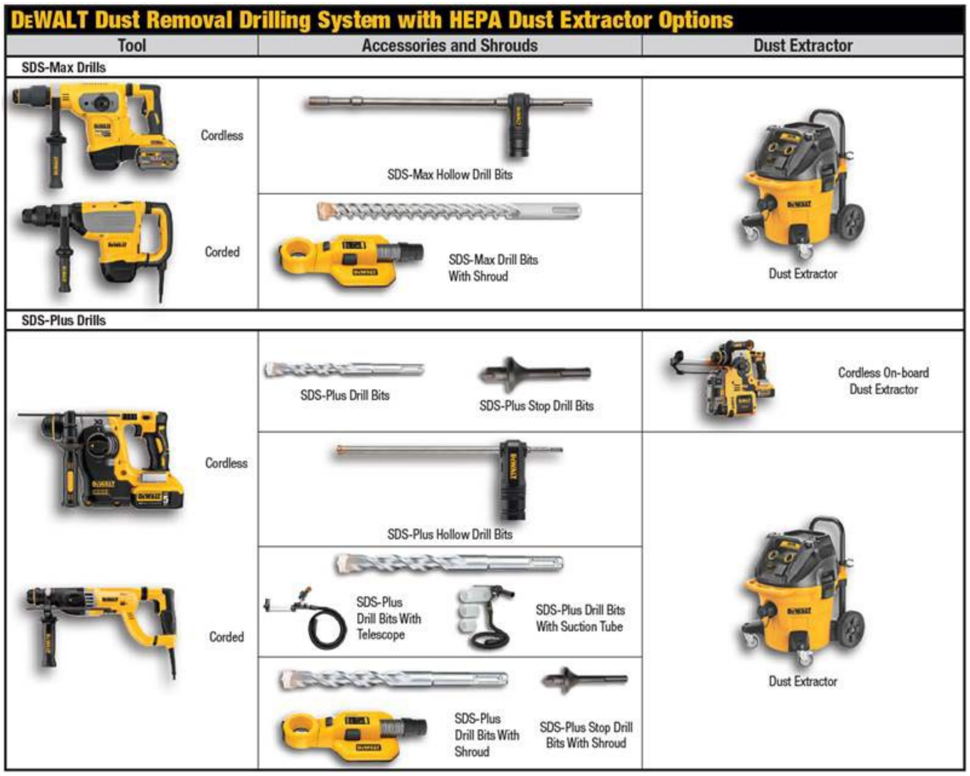


FIGURE 1B—SDS STOP DRILL BIT (Top Picture), MINI-UNDERCUT+ ANCHOR (Center Picture) AND SETTING TOOL (Bottom Picture)

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.



DEWALT Dust Removal Drilling System with HEPA Dust Extractor Options
Tool
Accessories and Shrouds
Dust Extractor
SDS-Max Drills
Cordless
SDS-Max Hollow Drill Bits
Corded
SDS-Max Drill Bits With Shroud
Dust Extractor
SDS-Plus Drills
SDS-Plus Drill Bits
SDS-Plus Stop Drill Bits
Cordless On-board Dust Extractor
Cordless
SDS-Plus Hollow Drill Bits
SDS-Plus Drill Bits With Telescope
SDS-Plus Drill Bits With Suction Tube
Corded
SDS-Plus Drill Bits With Shroud
SDS-Plus Stop Drill Bits With Shroud
Dust Extractor

FIGURE 1C—EXAMPLES DEWALT DUST REMOVAL DRILLING SYSTEMS WITH HEPA DUST EXTRACTORS FOR ILLUSTRATION

TABLE 1—MINI-UNDERCUT+ ANCHOR INSTALLATION SPECIFICATIONS AND SUPPLEMENTAL INFORMATION[1,2,3]

Anchor Property / Setting Information		Symbol	Units	Nominal Anchor Size / Threaded Rod Diameter (inch)
				$^{3}/_{8}$
Nominal outside anchor diameter		d_a	in.	0.625
Internal thread diameter (UNC)		d	in.	$^{3}/_{8}$
Nominal stop drill bit diameter (ANSI)		d_{bit}	in.	$^{5}/_{8}$
Minimum nominal embedment depth		h_{nom}	in.	$^{3}/_{4}$
Effective embedment		h_{ef}	in.	0.75
Hole depth in base material		h_o	in.	$^{3}/_{4}$
Overall anchor length (prior to setting)		ℓ_{anch}	in.	$^{15}/_{16}$
Approximate tool impact power (hammer-drill)		-	J	2.1 to 3
Minimum concrete member thickness		h_{min}	in.	$2^{1}/_{2}$
Minimum cover thickness in hollow core concrete slabs (see Figure 4)		$h_{min,core}$	in.	$1^{1}/_{2}$
Minimum edge distance		c_{min}	in.	$2^{1}/_{2}$
Minimum spacing distance		s_{min}	in.	3
Minimum diameter of hole clearance in fixture for steel insert element (following anchor installation)		d_h	in.	$^{7}/_{16}$
Approximate depth of internal thread		-	in.	$^{13}/_{32}$
Max. tightening torque for threaded steel insert element (following anchor installation, as applicable; see Figure 2)		T_{max}	ft.-lb.	5
Effective tensile stress area (anchor body)		A_{se}	in.^{2}	0.044
Minimum specified ultimate strength		f_{uta}	psi	95,000
Minimum specified yield strength		f_{ya}	psi	76,000
Mean axial stiffness[4]	Uncracked concrete	β_{uncr}	lbf/in.	50,400
	Cracked concrete	β_{cr}	lbf/in.	29,120

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

[1] The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19 Chapter 17.
[2] For installation detail for anchors in hollow-core concrete slabs, see Figure 4.
[3] The embedment depth, h_{nom}, is measured from the outside surface of the concrete member to the embedded end of the anchor, see Figure 1A.
[4] Mean values shown, actual stiffness varies considerably depending on concrete strength, loading and geometry of application.

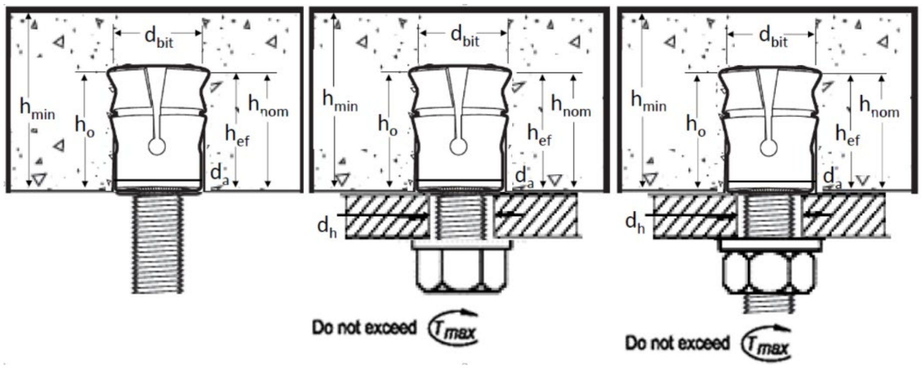
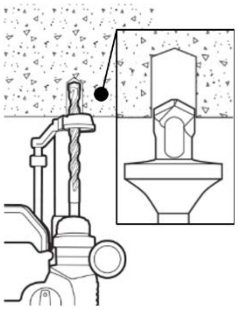
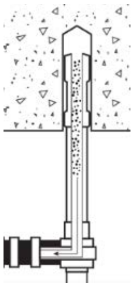


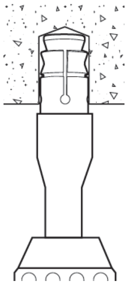
FIGURE 2—MINI-UNDERCUT+ ANCHOR INSTALLED WITH STEEL INSERT ELEMENT



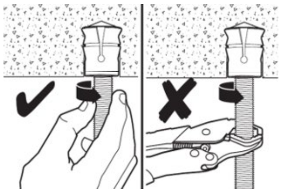
***1.)** Using the required stop drill bit, drill a hole into the base material to the required depth using the shoulder of the drill bit as a guide. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15.*



***2.)** Remove dust and debris from the hole during drilling (e.g. dust extractor) or following drilling (e.g. suction, forced air) to extract loose particles created by drilling.*



***3.)** Attach the required SDS setting tool to the hammer-drill. Mount the open end of the anchor onto the setting tool. Drive the anchor into the hole until the shoulder of the anchor is flush with the base material.*



***4.)** Thread rod or bolt by hand until full depth (snug tight) into the Mini-Undercut+. Do not further tighten threaded element with adjustable wrench or similar tool. Do not exceed the max. tightening torque.*

FIGURE 3—MINI-UNDERCUT+ ANCHOR INSTALLATION INSTRUCTIONS IN THE UNDERSIDE FORMED SURFACE OF CONCRETE

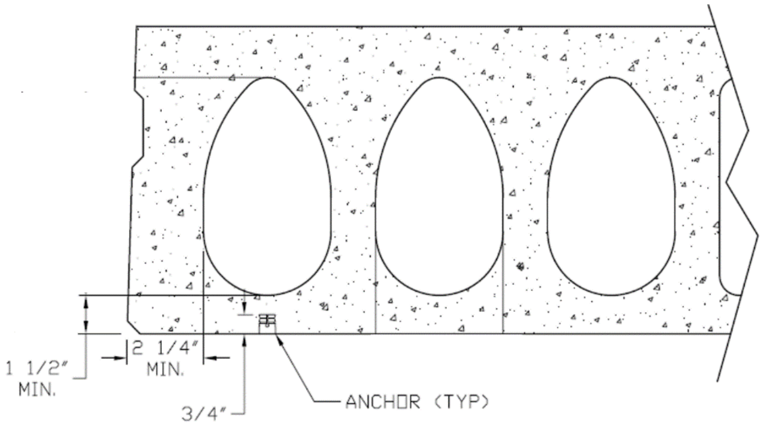


FIGURE 4—MINI-UNDERCUT+ INSTALLATION DETAIL FOR ANCHORS IN THE UNDERSIDE OF HOLLOW-CORE CONCRETE SLABS

TABLE 2—TENSION DESIGN INFORMATION FOR MINI-UNDERCUT+ ANCHORS IN THE UNDERSIDE OF CONCRETE AND THE UNDERSIDE OF HOLLOW CORE CONCRETE SLABS[1,2,3,4,5,6,7]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (in.)
			$^3/_8$ inch
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in.	$^3/_4$
Effective embedment	h_{ef}	in.	0.75
STEEL STRENGTH IN TENSION (ACI 318-19 Section 17.6.1)			
Steel strength in tension	N_{sa}	Lb	4,180
Reduction factor, steel strength	ϕ	-	0.65
CONCRETE BREAKOUT STRENGTH IN TENSION (ACI 318-19 Section 17.6.2)			
Effectiveness factor for uncracked concrete	k_{uncr}	-	24
Effectiveness factor for cracked concrete	k_{cr}	-	17
Modification factor for cracked and uncracked concrete	$\Psi_{c,N}$	-	1.0 (see note 5)
Critical edge distance (uncracked concrete only)	c_{ac}	in.	2.5
Reduction factor, concrete breakout strength	ϕ	-	0.40
PULLOUT STRENGTH IN TENSION (ACI 318-19 Section 17.6.3)			
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb	See note 7
Pullout strength, cracked concrete	$N_{p,cr}$	lb	455
Reduction factor, pullout strength	ϕ	-	0.40
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS (ACI 318-19 Section 17.10.3)[8]			
Characteristic pullout strength, seismic	$N_{p,eq}$	lb	410
Reduction factor, pullout strength, seismic	ϕ	-	0.40

For **SI**: 1 inch = 25.4 mm, 1 ksi = 6.894 N/mm^2; 1 lbf = 0.0044 kN.

[1] The data in this table is intended to be used with the design provisions of ACI 318-19 Chapter 17; for anchors resisting seismic load combinations the additional requirements of ACI 318-19 Section 17.10 must apply.

[2] Installation must comply with manufacturer's printed installation instructions and details.

[3] All values of ϕ are applicable with the load combinations of 2024 IBC Section 1605.1 or ACI 318-19 Section 5.3. For concrete failure modes, no increase for ACI 318-19 Section 17.5.3 is permitted.

[4] The steel strength shown in this table is for the Mini-Undercut+ anchors only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable. See Table 5 for steel design information for threaded rod elements.

[5] Select the appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) and use $\psi_{c,N}$ = 1.0.

[6] For calculation of N_{pn} see Section 4.1.4 of this report. For all design cases, $\psi_{c,P}$ = 1.0. The characteristic pullout strength for concrete compressive strengths greater than 2,500 psi for anchors may be increased by multiplying the value in the table by $(f'_c / 2{,}500)^{0.5}$ for psi or $(f'_c / 17.2)^{0.5}$. For hollow-core concrete slabs the characteristic pullout strength for concrete compressive strengths greater than 6,000 psi for anchors may be increased by multiplying the value in the table by $(f'_c / 6{,}000)^{0.5}$ for psi or $(f'_c / 41.4)^{0.5}$.

[7] Pullout strength does not control the design of indicated anchors. Do not calculate pullout strength for the indicated anchor size and embedment.

[8] Reported values for characteristic pullout strength in tension for seismic applications are based on test results per ACI 355.2, Section 9.5 and must be used for design.

TABLE 3—SHEAR DESIGN INFORMATION FOR MINI-UNDERCUT+ ANCHORS IN THE UNDERSIDE OF CONCRETE AND THE UNDERSIDE OF HOLLOW CORE CONCRETE SLABS[1,2,3,4]

Design Characteristic	Notation	Units	Nominal Anchor Size / Threaded Rod Diameter (in.)
			$^3/_8$ inch
Anchor category	1, 2 or 3	-	1
Nominal embedment depth	h_{nom}	in.	$^3/_4$
Effective embedment	h_{ef}	in.	0.75
STEEL STRENGTH IN SHEAR (ACI 318-19 Section 17.7.1)[5]			
Steel strength in shear	V_{sa}	lb	985
Reduction factor, steel strength	ϕ	-	0.60
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS (ACI 318-19 Section 17.10.3)[6]			
Steel strength in shear, seismic	$V_{sa,eq}$	lb	895
Reduction factor, steel strength in shear, seismic	ϕ	-	0.60
CONCRETE BREAKOUT STRENGTH IN SHEAR (ACI 318-19 Section 17.7.2)			
Load bearing length of anchor in shear	ℓ_e	in.	0.75
Nominal outside anchor diameter	d_a	in.	0.625
Reduction factor, concrete breakout strength	ϕ	-	0.45
PRYOUT STRENGTH IN SHEAR (ACI 318-19 Section 17.7.3)			
Coefficient for pryout strength	k_{cp}	-	1.0
Reduction factor, pryout strength	ϕ	-	0.45

For **SI**: 1 inch = 25.4 mm, 1 lbf = 0.0044 kN.

[1] The data in this table is intended to be used with the design provisions of ACI 318-19 Chapter 17; for anchors resisting seismic load combinations the additional requirements of ACI 318-19 Section 17.10 must apply

[2] Installation must comply with manufacturer's printed installation instructions and details.

[3] All values of ϕ are applicable with the load combinations of 2024 IBC Section 1605.1 or ACI 318-19 Section 5.3. For concrete failure modes, no increase for ACI 318-19 Section 17.5.3 supplementary reinforcement present is permitted.

[4] The strength shown in this table is for the Mini-Undercut+ anchors only. Design professional is responsible for checking threaded rod strength in tension, shear, and combined tension and shear, as applicable. See Table 5 for steel design information for threaded rod elements.

[5] Reported values for steel strength in shear are based on test results per ACI 355.2, Section 9.4 (in cracked concrete) and must be used for design in lieu of the calculated results using equation 17.7.1.2b.

[6] Reported values for steel strength in shear for the Mini-Undercut+ anchors are for seismic applications and based on test results in accordance with ACI 355.2, Section 9.6 and must be used for design.

TABLE 4—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON CARBON STEEL THREADED ROD ELEMENTS

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	REDUCTION OF AREA MIN. PERCENT	RELATED NUT SPECIFICATION[3]
Carbon Steel	ASTM A36/A36M[1] and F1554[2] Grade 36	psi	58,000	36,000	1.61	23	40 (50 for A36)	ASTM A194 / A563 Grade A

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] *Standard Specification for Carbon Structural Steel.*

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

[3] Where nuts are applicable, nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable.

TABLE 5—STEEL DESIGN INFORMATION FOR THREADED ROD ELEMENTS USED WITH MINI-UNDERCUT+ ANCHORS[1,2,3,4]

DESIGN INFORMATION		SYMBOL	UNITS	$^3/_8$-inch
Threaded rod nominal outside diameter		d_{rod}	in.	0.375
Threaded rod effective cross-sectional area		A_{se}	in^2	0.078
Nominal tension strength of threaded rod as governed by steel strength	ASTM A36 or F1554, Grade 36	$N_{sa,rod}$	lb	4,525
Nominal tension strength of threaded rod as governed by steel strength, seismic		$N_{sa,rod,eq}$	lb	4,525
Nominal shear strength of threaded rod as governed by steel strength	ASTM A36 or F1554, Grade 36	$V_{sa,rod}$	lb	2,695
Nominal shear strength of threaded rod as governed by steel strength, seismic		$V_{sa,rod,eq}$	lb	1,900

For **SI:** 1 inch = 25.4 mm, 1 pound = 0.00445 kN, 1 in^2 = 645.2 mm^2. For **pound-inch** unit: 1 mm = 0.03937 inches.

[1] Values provided for steel element material types, or equivalent, based on minimum specified strengths; $N_{sa,rod}$ and $V_{sa,rod}$ calculated in accordance with equations 17.7.1.2a and 17.7.1.2b in ACI 318-19. $V_{sa,rod,eq}$ must be taken as $0.7V_{sa,rod}$.

[2] ϕN_{sa} must be the lower of the $\phi N_{sa,rod}$ or ϕN_{sa} for static steel strength in tension; for seismic loading $\phi N_{sa,eq}$ must be the lower of the $\phi N_{sa,rod,eq}$ or $\phi N_{sa,eq}$.

[3] ϕV_{sa} must be the lower of the $\phi V_{sa,rod}$ or $\phi V_{sa,}$ for static steel strength in tension; for seismic loading $\phi V_{sa,eq}$ must be the lower of the $\phi V_{sa,rod,eq}$ or $\phi V_{sa,eq}$.

[4] Strength reduction factors must be taken from ACI 318-19 Section 17.5.3 for steel elements. Strength reduction factors for load combinations in accordance with ACI 318-19 Section 5.3 governed by steel strength of ductile steel elements must be taken as 0.75 for tension and 0.65 for shear. The value of ϕ applies when the load combinations of 2024 IBC Section 1605.1 or ACI 318-19 Section 5.3 are used in accordance with ACI 318-19 Section 17.5.3.

TABLE 6— APPLICABLE SECTIONS OF THE IBC UNDER EACH EDITION OF THE IBC

2024 IBC	2021 IBC	2018 IBC	2015 IBC
Section 1605.1		Section 1605.2 or 1605.3	
Section 1705.1.1 and Table 1705.3			
Section 1901.3			
Sections 1903 and 1905			
Section 1905.7	Section 1905.1.8		

TABLE 7— APPLICABLE SECTIONS OF ACI 318 UNDER EACH EDITION OF THE IBC

2024 IBC	2021 IBC	2018 IBC	2015 IBC
ACI 318-19		**ACI 318-14**	
2.3		2.3	
5.3		5.3	
Chapter 17		Chapter 17	
17.3.1		17.2.7	
17.5.1.2		17.3.1	
17.5.2		17.3.1.1	
17.5.3		17.3.3	
17.6		17.4	
17.6.1		17.4.1	
17.6.2		17.4.2	
17.6.2.2		17.4.2.2	
17.6.2.5.1(a)		17.4.2.6	
17.6.3		17.4.3	
17.6.3.2.1		17.4.3.2	
17.6.3.3		17.4.3.6	
17.7		17.5	
17.7.1		17.5.1	
17.7.1.2		17.5.1.2	
Eq. 17.7.1.2a		Eq. 17.5.1.2a	
Eq. 17.7.1.2b		Eq. 17.5.1.2b	
17.7.2		17.5.2	
17.7.2.2.1		17.5.2.2	
17.7.3		17.5.3	
17.8		17.6	
17.9.2		17.7.1 and 17.7.3	
17.9.4		17.7.5	
17.9.5		17.7.6	
17.10		17.2.3	
17.10.3		17.2.3.3	
17.10.4, 17.10.5, 17.10.6, 17.10.7		17.2.3.4, 17.2.3.5, 17.2.3.6, 17.2.3.7	

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ICC-ES Evaluation Report

ESR-3912 LABC and LARC Supplement

Reissued October 2024

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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:

MINI-UNDERCUT+™ ANCHORS IN CRACKED AND UNCRACKED CONCRETE (DEWALT)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that DEWALT Mini-Undercut+™ anchors in cracked and uncracked concrete, described in ICC-ES evaluation report ESR-3912, have also been evaluated for compliance with the codes noted below as adopted by Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The DEWALT Mini-Undercut+™ anchors in cracked and uncracked concrete, described in Sections 2.0 through 7.0 of the evaluation report ESR-3912, comply with LABC Chapter 19, and LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The DEWALT Mini-Undercut+™ anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-3912.
- The design, installation, conditions of use and labeling of the anchors are in accordance with the 2021 International Building Code® (IBC) provisions noted in the evaluation report ESR-3912.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable and strength design values listed in the evaluation report and tables are for the connection of the anchors to the concrete. The connection between the anchors and the connected members shall be checked for capacity (which may govern).

This supplement expires concurrently with the evaluation report, reissued October 2024.

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ESR-3912 FL Supplement w/ HVHZ

Reissued October 2024

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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:

MINI-UNDERCUT+™ ANCHORS IN CRACKED AND UNCRACKED CONCRETE (DEWALT)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the DEWALT Mini-Undercut+ anchor in cracked and uncracked concrete, described in ICC-ES evaluation report ESR-3912, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The DEWALT Mini-Undercut+ anchor, described in Sections 2.0 through 7.0 of the evaluation report ESR-3912, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*. The design requirements must be determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-3912 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of the DEWALT Mini-Undercut+ anchor 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* with the following condition:

a) For connections subject to uplift, the connection must be designed for no less than 700 pounds (3114 N).

For products falling under Florida Rule 61G20-3, 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 evaluation report, reissued October 2024.

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