ICC-ES Listing Report
ELC-3260

Issued May 2023
Revised June 2023
This listing is subject to renewal May 2024.

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

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

Product Certification System:

The ICC-ES product-certification system includes evaluating reports of tests of standard manufactured product, prepared by accredited testing laboratories and provided by the listee, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the listee's quality system.

Product: Power-Bolt®+ Heavy Duty Sleeve Anchors for Cracked and Uncracked Concrete

Listee: DEWALT

Compliance with the following standards:

Power-Bolt®+ heavy duty sleeve anchors for cracked and uncracked concrete, when applied in accordance with the manufacturer's instructions, conform to the following standards:

- Annex D, Anchorage of CSA A23.3-19, Design of Concrete Structures, CSA Group.

Compliance with the following codes:

Power-Bolt®+ heavy duty sleeve anchors for cracked and uncracked concrete as described in this listing report, are in conformance with CSA A23.3-19, Annex D, as referenced in the applicable section of the following code editions:

- *National Building Code of Canada®* 2020

  Applicable Section: Division B, Part 4, Section 4.3.3.

Description of anchors:

Power-Bolt+ Heavy Duty Sleeve Anchors are torque-controlled, mechanical expansion anchors comprised of a high strength steel bolt, matching steel washer, steel cone, steel expansion wedge (clip), steel sleeve, plastic compression ring and plastic retention nut.

The steel bolt, expansion clip, sleeve and cone are manufactured from medium carbon steel complying with requirements set forth in the approved quality documentation, and have a minimum 0.0002-inch-thick (5 µm) zinc plating in accordance with ASTM B633. The steel washers comply with ASTM F844. The Power-Bolt+ Heavy Duty Sleeve Anchor is illustrated in Figure 1.

The anchor is assembled such that the cone is able to enter the bottom of the tri-segmented expansion clip, which freely rotates around the bolt. The expansion clip longitudinal movement is restrained by the compression ring and sleeve. The anchors are installed in a predrilled hole with a hammer. When torque is applied to the head of the installed anchor bolt, the cone at the other end of the anchor is drawn into the expansion clip, forcing it outward into the sides of the predrilled hole in the base material.

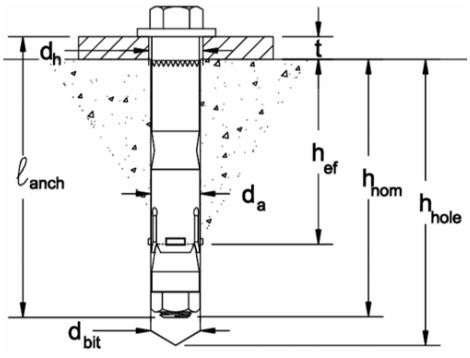


FIGURE 1—POWER-BOLT+ ANCHOR DETAIL

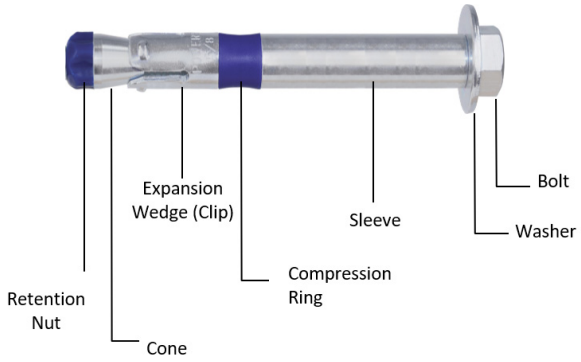


FIGURE 2—POWER-BOLT+ ANCHOR ASSEMBLY

Identification:

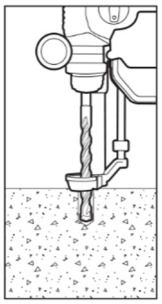
1. The ICC-ES mark of conformity, electronic labeling, or the listing report number (ELC-3260) along with the name, registered trademark, or registered logo of the listee must be included in the product label.

2. In addition, the Power-Bolt+ Heavy Duty Sleeve Anchors are identified by dimensional characteristics and packaging. A length letter code is stamped on each bolt head along with the letters “PB,” and these are visible after installation. Table 2 summarizes the length code identification system. A plus sign “+”also appears with the letters “PB” on all anchors. Packages are identified with the product name, type and size and the company name (DEWALT).

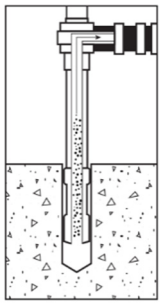
3. The report holder’s contact information is the following:

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

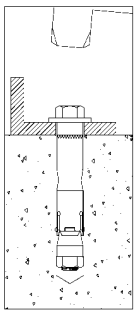
Installation: Installation parameters are provided in Table 1 and Figure 1. The Power-Bolt+ heavy duty sleeve anchors must be installed in accordance with the manufacturer's published installation instructions as shown in Figure 3 of this report. Anchors must be installed in holes drilled into the concrete using carbide-tipped masonry drill bits complying with ANSI B212.15. The nominal drill bit diameter must be equal to that of the anchor. The minimum drilled hole depth is given in Table 1. Prior to anchor installation, the dust and debris must be removed from the predrilled hole using a hand pump, compressed air or a vacuum. The anchor must be hammered into the predrilled hole until the proper nominal embedment depth is achieved. The bolt must be tightened until the torque values, T_{inst}, specified in Table 1 of this report are achieved.



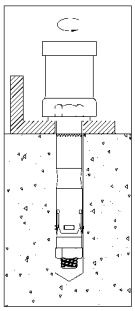
1.) Using the proper drill bit size, drill a hole into the base material to the required depth. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



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

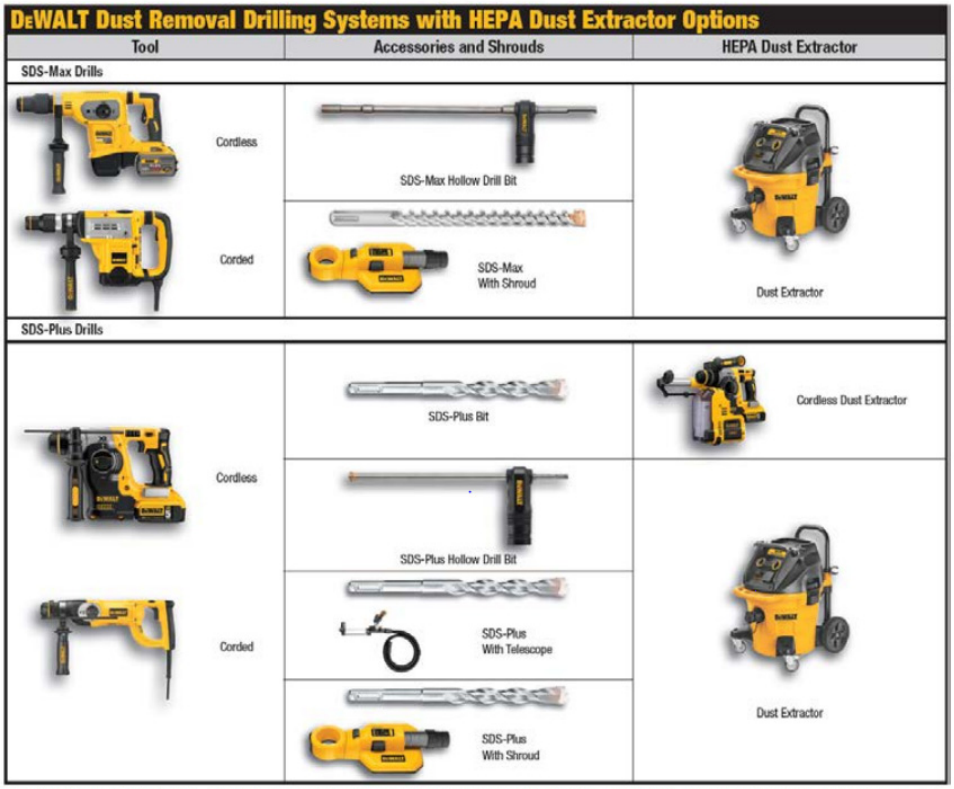


3.) Drive anchor through the fixture into the hole. Be sure the anchor is driven to the minimum required embedment depth, h_{nom}.



4.) Tighten the anchor with a torque wrench by applying the required installation torque, T_{inst}. (See Table1.)

FIGURE 3—POWER-BOLT+ INSTALLATION INSTRUCTIONS



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

FIGURE 4—EXAMPLES OF DEWALT DUST REMOVAL DRILLING SYSTEMS WITH HEPA DUST EXTRACTORS FOR ILLUSTRATION

Anchor setting information:

TABLE 1—POWER-BOLT+ ANCHOR INSTALLATION SPECIFICATIONS AND SUPPLEMENTAL INFORMATION[1,3]

Anchor Property / Setting Information		Notation	Units	Nominal Anchor Diameter			
				$^1/_2$-inch	$^5/_8$-inch	$^3/_4$-inch	
Anchor diameter		d_a	mm (in.)	12.7 (0.500)	15.9 (0.625)	19.1 (0.750)	
Internal bolt diameter (UNC)		-	mm (in.)	9.5 ($^3/_8$)	11.1 ($^7/_{16}$)	14.3 ($^9/_{16}$)	
Minimum diameter of hole clearance in fixture		d_h	mm (in.)	14.3 ($^9/_{16}$)	17.5 ($^{11}/_{16}$)	21.6 ($^{13}/_{16}$)	
Nominal drill bit diameter		d_{bit}	in.	$^1/_2$ ANSI	$^5/_8$ ANSI	$^3/_4$ ANSI	
Minimum nominal embedment depth		h_{nom}	mm	83	95	111	
Effective embedment depth		h_{ef}	mm	67	76	89	
Minimum hole depth		h_{hole}	mm	95	108	127	
Minimum member thickness		h_{min}	mm	127	165	178	
Minimum overall anchor length[2]		ℓ_{anch}	mm	89	102	133	
Minimum edge distance		c_{min}	mm	83	114	152	203
Minimum spacing distance		s_{min}	mm	114	152	152	127
Installation torque		T_{inst}	N-m	54	81	149	
Torque wrench/socket size		-	in.	5/8	3/4	15/16	
Bolt head height		-	mm	7.1	7.9	9.5	
Effective tensile stress area (internal bolt)		$A_{se,N}$	mm^2	50.0	68.6	117.4	
Effective shear stress area		$A_{se,V}$	mm^2	69.0	93.7	153.0	
Minimum specified ultimate tensile strength		f_{uta}	N/mm^2	1,034	1,034	1,034	
Minimum specified yield strength		f_{ya}	N/mm^2	896	896	896	
Mean axial stiffness[4]	Uncracked concrete	β_{uncr}	kN/mm	63	150	44	
	Cracked concrete	β_{cr}	kN/mm	11	16	5	

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

[1]The information presented in this table is to be used in conjunction with the design criteria of CSA A23.3-19 Annex D.
[2]The listed minimum overall anchor length is based on anchor sizes commercially available at the time of publication compared with the requirements to achieve the minimum nominal embedment depth and possible fixture attachment.
[3]The maximum fixture thickness, t_{max} for the selected anchor can be determined by taking the length of the selected anchor and subtracting the nominal embedment into the base material.
[4]Mean values shown, actual stiffness varies considerable depending on concrete strength, loading and geometry of application.

TABLE 2—POWER-BOLT+ ANCHOR LENGTH CODE IDENTIFICATION SYSTEM

Length ID marking on bolt head		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Overall anchor length, ℓ_{anch}, (mm)	From	38	51	64	76	89	102	114	127	140	152	165	178	191	203	216	229	241	254	279	305
	Up to but not including	51	64	76	89	102	114	127	140	152	165	178	191	203	216	229	241	254	279	305	330

For **SI:** 1 inch = 25.4 mm.

Ultimate Limit States Design:

Design resistance of anchors for compliance with the 2020 NBCC must be determined in accordance with CSA A23.3-19 Annex D, and this listing report.

Design parameters provided in Tables 3 and 4 of this listing report are based on the 2020 NBCC (CSA A23.3-19). The limit states design of anchors must comply with CSA A23.3-19 D.5.1, except as required in CSA A23.3-19 D.4.3.1.

Material resistance factors must be ϕ_c = 0.65 and ϕ_s = 0.85 in accordance with CSA A23.3-19 Sections 8.4.2 and 8.4.3, and resistance modification factor, R, as given in CSA A23.3-19 Section D.5.3, and noted in Tables 3 and 4 of this listing report, must be used for load combinations calculated in accordance with Division B, Part 4, Section 4.1.3 of the 2020 NBCC, or Annex C of CSA A23.3-19. The nominal steel strength N_{sa} or V_{sa}, in Tables 3 and 4 of this listing report must be multiplied by ϕ_s and R to determine the factored resistance N_{sar} or V_{sar}. The nominal pullout strengths $N_{p,uncr}$, $N_{p,cr}$ or $N_{p,eq}$ in Table 3 of this listing report must be multiplied by ϕ_c and R to determine the factored resistance $N_{cpr,uncr}$, $N_{cpr,cr}$, or $N_{cpr,eq}$, respectively.

TABLE 3—TENSION DESIGN INFORMATION FOR POWER-BOLT+ ANCHOR IN CONCRETE[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Diameter (in.)		
			$^1/_2$	$^5/_8$	$^3/_4$
Anchor category	1, 2 or 3	-	1	1	1
STEEL STRENGTH IN TENSION					
Steel strength in tension[8]	N_{sa}	kN	43.1	59.1	121.4
Reduction factor for steel strength[3]	R	-	0.80		0.70
CONCRETE BREAKOUT STRENGTH IN TENSION[7]					
Effective embedment	h_{ef}	mm	67	76	89
Effectiveness factor for uncracked concrete	k_{uncr}	-	11.3	11.3	10
Effectiveness factor for cracked concrete	k_{cr}	-	7	7	7
Modification factor for cracked and uncracked concrete[4]	$\Psi_{c,N}$	-	1.0 (see note 4)	1.0(see note 4)	1.0 (see note 4)
Critical edge distance (uncracked concrete only)	c_{ac}	mm	203	152	203
Resistance modification factor for tension, concrete failure modes, Condition B[3]	R	-	1.00		
PULLOUT STRENGTH IN TENSION[7]					
Characteristic pullout strength, uncracked concrete (17.2 MPa)[5]	$N_{p,uncr}$	kN	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
Characteristic pullout strength, cracked concrete (17.2 MPa)[5]	$N_{p,cr}$	kN	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]
PULLOUT STRENGTH IN TENSION FOR SEISMIC APPLICATIONS[7]					
Characteristic pullout strength, seismic (17.2 MPa)[5]	$N_{p,eq}$	(kN)	Not Applicable[6]	Not Applicable[6]	Not Applicable[6]

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 CSA A23.3-19 Annex D; for anchors resisting seismic load combinations the additional requirements of CSA A23.3-19 D4.3 shall apply.
[2]Installation must comply with the manufacturer's published installation instructions.
[3] All values of R for use with the load combinations of Division B, Part 4, Section 4.1.3 of the 2020 NBCC, CSA A23.3-19 Annex C. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-19 D.5.3(c), is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used. The anchors are ductile steel elements as defined in CSA A23.3-19 D.2, except for the $^3/_4$-inch-diameter, which is considered a brittle steel element for the purposes of design.
[4]For all design cases use $\Psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.
[5]For all design cases use $\Psi_{c,P}$ = 1.0. For the calculation of N_{pn}, see CSA A23.3-19 D.6.3.
[6]Pullout strength does not control design of the indicated anchors and does not need to be calculated for indicated size and embedment.
[7]Anchors are permitted to be used in lightweight concrete in accordance with CSA A23.3-19 D.4.
[8]In accordance with CSA A23.3-19 D.6.1.2 and Eq. D.2, the nominal steel strength in tension is calculated using a limited value of f_{uta} of 860 MPa.

TABLE 4—SHEAR DESIGN INFORMATION FOR POWER-BOLT+ ANCHOR IN CONCRETE[1,2]

Design Characteristic	Notation	Units	Nominal Anchor Diameter (in.)		
			$^1/_2$	$^5/_8$	$^3/_4$
Anchor category	1, 2 or 3	-	1	1	1
STEEL STRENGTH IN SHEAR					
Steel strength in shear[5]	V_{sa}	kN	26.7	59.7	65.9
Resistance modification factor for steel strength, shear[3]	R	-	0.75		0.65
STEEL STRENGTH IN SHEAR FOR SEISMIC APPLICATIONS					
Steel strength in shear, seismic[5]	$V_{sa,eq}$	kN	20.3	33.0	65.9
Resistance modification factor for steel strength, shear, seismic[3]	R	-	0.75		0.65
CONCRETE BREAKOUT STRENGTH IN SHEAR[4]					
Load bearing length of anchor	ℓ_e	mm	25	32	38
Nominal anchor diameter	d_a	mm	12.7	15.9	19.1
Resistance modification factor for concrete failure (Condition B)[3]	R	-	1.00		
PRYOUT STRENGTH IN SHEAR[4]					
Coefficient for pryout strength	k_{cp}	-	2.0	2.0	2.0
Effective embedment	h_{ef}	mm	67	76	89
Resistance modification factor for pryout strength (Condition B)[3]	R	-	1.00		

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 CSA A23.3-19 Annex D; for anchors resisting seismic load combinations the additional requirements of CSA A23.3-19 D4.3 shall apply.
[2]Installation must comply with the manufacturer's published installation instructions.
[3] All values of R for use with the load combinations of Division B, Part 4, Section 4.1.3 of the 2020 NBCC, CSA A23.3-19 Annex C. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-19 D.5.3(c) is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the strength reduction factors associated with Condition A may be used. The anchors are ductile steel elements as defined in CSA A23.3-19 D.2, except for the $^3/_4$-inch-diameter, which is considered a brittle steel element for the purposes of design.
[4]Anchors are permitted to be used in lightweight concrete in accordance with CSA A23.3-19 D.4.
[5]Tabulated values for steel strength in shear, including values listed for seismic applications, are based on test results in accordance with ACI 355.2, as referenced in CSA A23.3-19, section D.4.3.4.

Conditions of listing:

1. The listing report addresses only conformance with the standards and code sections noted above.
2. Approval of the product's use is the sole responsibility of the local code official.
3. The listing report applies only to the materials tested and as submitted for review by ICC-ES.
4. Anchor sizes, dimensions, minimum embedment depths and other installation parameters are as set forth in this listing report.
5. Anchors must be limited to use in concrete with a specified strength, f′c, from 17.2 to 58.6 MPa. Anchors must be installed in cracked and uncracked normal-weight concrete and lightweight concrete having a specified compressive strength, f'_c, of 17.2 MPa to 58.6 MPa
6. The values of f′c used for calculation purposes must not exceed 55.2 MPa.
7. Limit states design values must be established in accordance with this listing report.
8. The use of fatigue or shock loading for these anchors under such conditions is beyond the scope of this listing report.
9. Anchors may be used to resist short-term loading due to wind or seismic forces in locations designed according to NBCC 2020.
10. Where not otherwise prohibited in the code as referenced in CSA A23.3-19, Power-Bolt®+ heavy Duty sleeve anchors are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:
    a. The anchors are used to resist wind or seismic forces only.
    b. Anchors that support a fire-resistance-rated envelope or a fire-resistance-rated membrane are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
    c. Anchors are used to support nonstructural elements.
11. Use of carbon steel anchors is limited to dry, interior locations.