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ICC-ES Listing Report
ELC-3298

Reissued May 2023
Revised August 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: Pure110+® Epoxy Adhesive Anchor System in Cracked and Uncracked Concrete

Listee: DEWALT

Compliance with the following standards:

- Annex D, Anchorage, of CSA A23.3-14, Design of Concrete Structures, CSA Group.

Compliance with the following codes:

Pure110+® epoxy adhesive anchor system in cracked and uncracked concrete, as described in this listing report, are in conformance with CSA A23.3-14, Annex D, as referenced in the applicable section of the following code editions:

- *National Building Code of Canada*® 2015
  Applicable Section: Division B, Part 4, Section 4.3.3.

Description of adhesive anchor system:

The Pure110+ epoxy adhesive anchor system comprised of a two-component epoxy adhesive filled in cartridges, static mixing nozzles, dispensing tools, hole cleaning equipment, and adhesive injection accessories. The Pure110+ epoxy adhesive may be used with continuously threaded steel rods or deformed steel reinforcing bars. The primary components of the Pure110+ epoxy adhesive anchor system, including the epoxy adhesive cartridge, static mixing nozzle, the nozzle extension tube, dispensing tool and typical steel anchor elements, are shown in Figure 1.

FIGURE 1—PURE110+ EPOXY ADHESIVE ANCHOR SYSTEM INCLUDING TYPICAL STEEL ANCHOR ELEMENTS

The Pure110+ epoxy adhesive is an injectable two component epoxy. The two components are separated by means of a labeled dual-cylinder cartridge. The two components combine and react when dispensed through a static mixing nozzle, supplied by DEWALT, which is attached to the cartridge. The Pure110+ epoxy adhesive is available in 9-ounce (265 mL), 13-ounce (385 mL), 19.5-ounce (585 mL), 20.5-ounce (610 mL), and 50.5-ounce (1500 mL) cartridges. Each cartridge label is marked with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to an unopened cartridge when stored in accordance with the manufacturer's printed installation instructions (MPII), as illustrated in Figure 3 of this report.

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

Standard hole cleaning equipment used after drilling is comprised of steel wire brushes supplied by DEWALT and a compressed air nozzle. Standard hole cleaning equipment is shown in Figure 3.

The DustX+™ extraction system automatically cleans the holes during drilling using hollow drill bits with a carbide head meeting the requirements of ANSI B212.15 and a DEWALT DWV012 / DWV902M vacuum equipped with an automatic filter cleaning system or equivalent approved by DEWALT. After drilling with the DustX+ system, no further hole cleaning is required. See Figure 2 for an illustration of the DustX+™ extraction system.

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

Identification:

1. The Pure110+ epoxy adhesive is identified by packaging labelled with the lot number; expiration date; company name; listing report number (ELC-3298); and the ICC-ES listing mark. Threaded rods, nuts, washers, and deformed reinforcing bars are standard steel anchor elements and must conform to applicable national or international specifications as set forth in Tables 2 and 3 of this report or equivalent.
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

Installation: The installation parameters are illustrated in Table 1. Installation of the Pure110+ epoxy adhesive anchor system must conform to the manufacturer's printed installation instructions (MPII) as reproduced in each unit package as described in Figure 3. The injection tools, mixing nozzles, wire brushes, air blowers, and piston plugs along with the adhesive cartridges must be supplied by the manufacturer, as described in Figure 3.

The adhesive anchor system may be used for upwardly inclined orientation applications (e.g. overhead). Upwardly inclined and horizontal orientation applications are to be installed using piston plugs for the $^{5}/_{8}$-inch through $1^{1}/_{4}$-inch (M16 through M30) diameter threaded steel rods and No. 5 through No. 10 (14 mm through 32 mm) steel reinforcing bars, installed in the specified hole diameter, and attached to the mixing nozzle and extension tube supplied by DEWALT as described in Figure 3 in this report. Upwardly inclined and horizontal orientation installation for the $^{3}/_{8}$-inch and $^{1}/_{2}$-inch (M10 and M12) diameter threaded steel rods, and No. 3 and No. 4 (10 mm and 12 mm) steel reinforcing bars may be injected directly to the end of the hole using extension tubing attached to the mixing nozzle with a hole depth $h_0 \leq 10$" (250 mm).

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

The DEWALT drilling systems in Figure 2 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 in Figure 3).

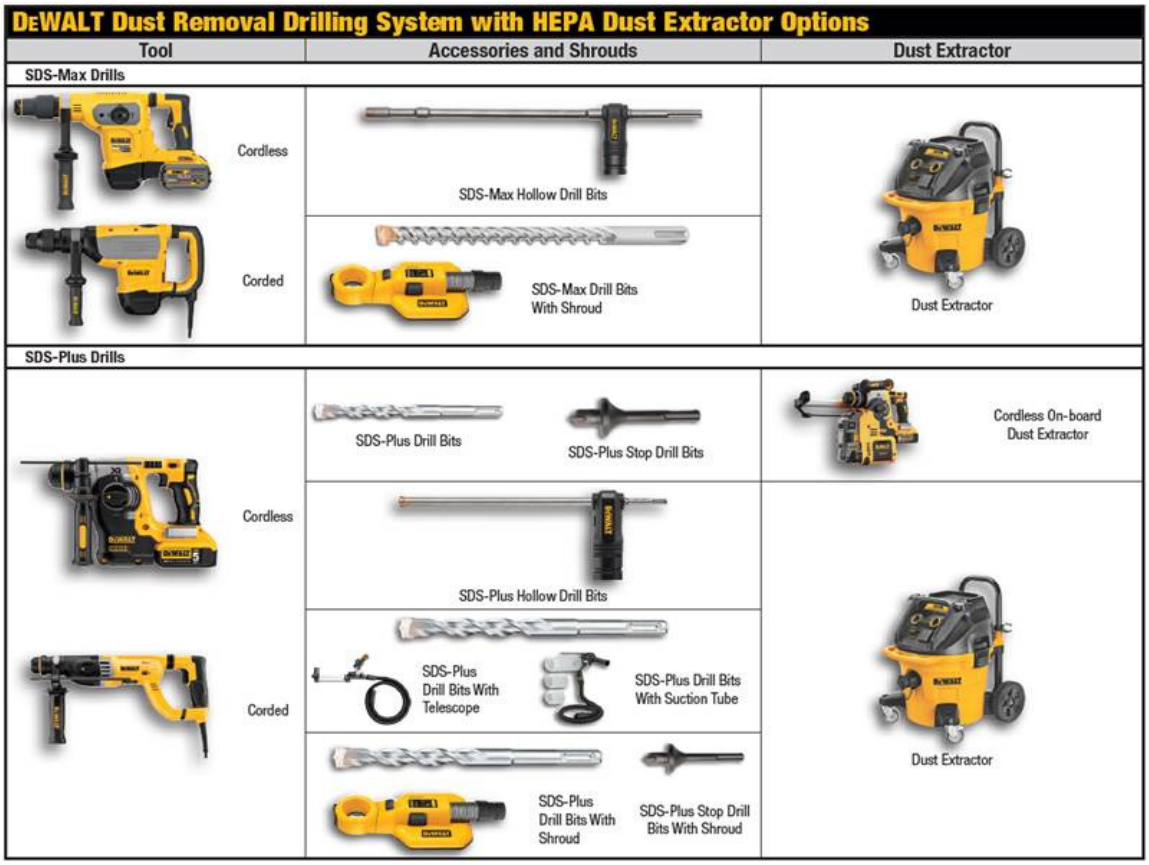

FIGURE 2—EXAMPLES DEWALT DUST REMOVAL DRILLING SYSTEMS WITH HEPA DUST EXTRACTORS FOR ILLSTRATION

Pure110+ Instruction Card

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

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

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

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

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

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Towson, MD 21286 U.S.A.
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P: (800) 524-3244 [H]

[I.] Pure110+ epoxy system selection table

Dispensers			Cartridges			Mixing nozzles
Tool	Size	Cat.#	Type	Size	Cat.#	Cat.#
Manual	Caulking	08437	Quik-shot (coaxial)	9 fl.oz.	08310SD	PFC1640600
Cordless		DCE580D1				
Manual	13 fl.oz.	08298	Dual tube	13 fl.oz.	08313SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	19.5 fl.oz.	08298	Dual tube	19.5 fl.oz.	08320SD	08609
Cordless		DCE593D1				
Pneumatic		08497SD				
Manual	20.5 fl.oz.	08409	Dual tube	20.5 fl.oz.	08321SD	08609
Pneumatic		08413				
Cordless		DCE591D1				
Pneumatic	50.5 fl.oz.	08438	Dual tube	50.5 fl.oz.	08351SD	08609

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

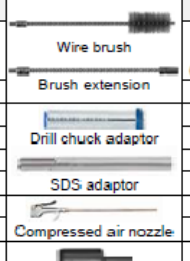
Temperature of base material		Gel (working) time	Full curing time
41°F	5°C	120 minutes	48 hours
50°F	10°C	90 minutes	24 hours
68°F	20°C	25 minutes	8 hours
86°F	30°C	20 minutes	8 hours
95°F	35°C	15 minutes	6 hours
104°F	40°C	12 minutes	4 hours
110°F	43°C	10 minutes	4 hours

Linear interpolation for intermediate base material temperatures is possible.

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

Fractional anchor sizes

Rod dia. (inch)	Rebar size (No.)	Drill bit size (inch)	Brush size (inch)	Brush length (inches)	Wire brush (Cat. #)	Plug size (inch)	Piston plug (Cat. #)
3/8	3	7/16	7/16	$6^3/_4$	08284	N/A	N/A
1/2	-	9/16	9/16	$6^3/_4$	08285	N/A	N/A
-	4	5/8	5/8	$6^3/_4$	08275	N/A	N/A
5/8	5	11/16	11/16	$7^7/_8$	08286	11/16	08258
		3/4	3/4	$7^7/_8$	08278	3/4	08259
3/4	6	7/8	7/8	$7^7/_8$	08287	7/8	08300
7/8	7	1	1	$11^7/_8$	08288	1	08301
1	8	$1^1/_8$	$1^1/_8$	$11^7/_8$	08289	$1^1/_8$	08303
$1^1/_4$	9	$1^3/_8$	$1^3/_8$	$11^7/_8$	08290	$1^3/_8$	08305
-	10	$1^1/_2$	$1^1/_2$	$11^7/_8$	08291	$1^1/_2$	08309



Metric anchor sizes

Rod dia. (mm)	Rebar size (Ø)	Drill bit size (inch)	Brush size (mm)	Brush length (mm)	Wire brush (Cat. #)	Plug size (mm)	Piston plug (Cat. #)
10	-	12	12	170	DFC1670100	N/A	N/A
12	10	14	14	170	DFC1670150	N/A	N/A
-	12	16	16	200	DFC1670200	N/A	N/A
16	14	18	18	200	DFC1670250	18	08259
-	16	20	20	300	DFC1670300	20	08259
20	20	25	25	300	DFC1670400	25	08301
24	-	28	28	300	DFC1670450	28	08303
27	25	32	32	300	DFC1670500	32	08307
30	28	35	35	300	DFC1670550	35	08305
-	32	38	38	300	DFC1670600	38	08309

[1]If the DEWALT DustX+ extraction system is used to automatically clean the holes during drilling, standard hole cleaning (brushing and blowing following drilling) is not required.
[2]Holes are drilled with hammer-drill (i.e. rotary impact drills or rock drills with a carbide drill bit, including the use of hollow drill bits).
[3]For any case, it must be possible for the anchor to be inserted into the cleaned drill hole without resistance.
[4]A brush extension (Cat. #08282) must be used with a steel wire brush for holes drilled deeper than the listed brush length.
[5]Brush adaptors for power tool connections are available for drill chuck (Cat.# 08298) and SDS (Cat.# 08283).
[6]A plastic extension tube (Cat# 08281 or 8297) or flexible extension hose (Cat.# PFC1640600) or equivalent approved by DEWALT must be used if the bottom or back of the anchor hole is not reached with the mixing nozzle only.
[7]All overhead (i.e upwardly inclined) installations require the use of piston plugs where one is tabulated together with the anchor size (see table). N/A = Not applicable.
All horizontal installations require the use of piston plugs where one is tabulated together with the anchor size and where the embedment depth is greater than 8 inches.
A plastic extension tube (Cat# 08281 or 08297) or equivalent approved by DEWALT must be used with piston plugs.
The use of piston plugs is also recommended for underwater installations where one is tabulated together with the anchor size.

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

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

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

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

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

Pure110+ Instruction Card (continued)

SELECT HAMMER DRILLING AS SUITABLE FOR APPLICATION

HAMMER DRILLING

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

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

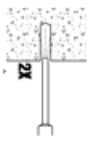
Notes: In case of standing water in the drilled hole (flooded hole condition), all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

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

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

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

HOLE CLEANING DRY OR WET HOLES

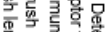


2a. Starting from the bottom or back of the drilled anchor hole, blow the hole clean a minimum of two times (**2x**).

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

2b. Determine wire brush diameter (see Table III) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screwgun. Brush the hole with the selected wire brush a minimum of two times (**2x**).

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



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

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

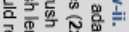
→ Next go to Step 3.

HOLE CLEANING UNDERWATER INSTALLATION

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

2uw-ii. Determine wire brush diameter (see Table III) for the drilled hole and attach the brush with adaptor to a rotary drill tool. Brush the hole with the selected wire brush a minimum of two times (**2x**).

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



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

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

→ Next go to Step 3.

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FOLLOW STEPS #1 THROUGH #10 FOR RECOMMENDED INSTALLATION

PREPARING

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

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

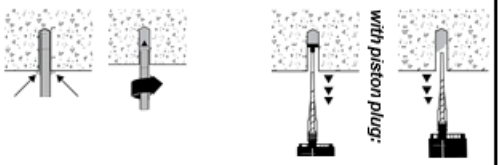
Note: Always use a new mixing nozzle with new cartridges of adhesive and also for all work interruptions exceeding the published gel (working) time of the adhesive.

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

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

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

INSTALLATION



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

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

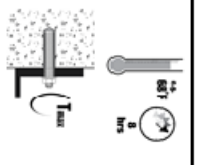
Attention! *Do not install anchors overhead without proper training, and installation hardware provided by DEWALT, contact DEWALT prior to use.*

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

8. Ensure that the anchor element is installed to the specified embedment depth. Adhesive must completely fill the annular gap at the concrete surface. Following installation of the anchor element, remove excess adhesive. Protect the anchor element threads from fouling with adhesive.

For all installations the anchor element must be restrained from movement throughout the specified curing period (where necessary) through the use of temporary wedges, external supports, or other methods. Minor adjustments to the position of the anchor element may be performed during the gel (working) time only.

CURING & FIXTURE



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

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

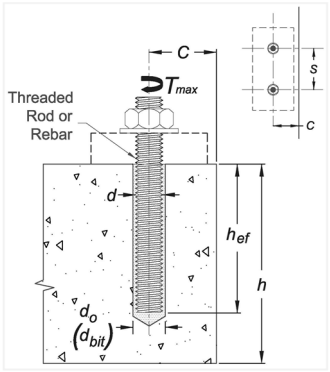
10. After full curing of the adhesive anchor, a fixture can be installed to the anchor and tightened up to the maximum torque (shown in Table III) by using a calibrated torque wrench.

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

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

Anchor setting information:

TABLE 1—ANCHOR SETTING FOR FRACTIONAL THREADED ROD AND REINFORCING BARS



PARAMETER	SYMBOL	UNITS	FRACTIONAL NOMINAL ROD DIAMETER (inch) / REINFORCING BAR SIZE									
			3/8 or #3	1/2	#4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1 1/4	#10
Threaded rod outside diameter	d	mm (inch)	9.5 (0.375)	12.7 (0.500)		15.9 (0.625)	19.1 (0.750)	22.2 (0.875)	25.4 (1.000)	-	31.8 (1.250)	-
Rebar nominal outside diameter	d	mm (inch)	9.5 (0.375)	12.7 (0.500)		15.9 (0.625)	19.1 (0.750)	22.2 (0.875)	25.4 (1.000)	28.7 (1.125)	-	31.8 (1.250)
Carbide drill bit nominal size[6]	d_{bit}	inch	7/16	9/16	5/8	11/16 or 3/4[5]	7/8	1	1 1/8	1 3/8	1 3/8	1 1/2
Minimum embedment	$h_{ef,min}$	mm (inch)	60 (2 3/8)	70 (2 3/4)		79 (3 1/8)	89 (3 1/2)	89 (3 1/2)	102 (4)	114 (4 1/2)	127 (5)	127 (5)
Maximum embedment	$h_{ef,max}$	mm (inch)	191 (7 1/2)	254 (10)		318 (12 1/2)	381 (15)	445 (17 1/2)	508 (20)	572 (22 1/2)	635 (25)	635 (25)
Minimum member thickness	h_{min}	mm (inch)	h_{ef} + 30 (h_{ef} + 1 1/4)			h_{ef} + 2d_o						
Minimum anchor spacing	s_{min}	mm (inch)	48 (1 7/8)	64 (2 1/2)		79 (3 1/8)	95 (3 3/4)	111 (4 3/8)	127 (5)	143 (5 5/8)	159 (6 1/4)	159 (6 1/4)
Minimum edge distance	c_{min}	mm (inch)	48 (1 7/8)	64 (2 1/2)		79 (3 1/8)	95 (3 3/4)	111 (4 3/8)	127 (5)	143 (5 5/8)	159 (6 1/4)	159 (6 1/4)
Max. torque[1]	T_{max}	N-m	20	41		81	142	169	224	271	380	380
Max. torque[1,2] (low strength rods)	T_{max}	N-m	7	27		54	81	136	234	-	380	-
Minimum edge distance, reduced[4]	$c_{min,red}$	mm (inch)	45 (1 3/4)	45 (1 3/4)		45 (1 3/4)	45 (1 3/4)	45 (1 3/4)	45 (1 3/4)	70 (2 3/4)	70 (2 3/4)	70 (2 3/4)
Max. torque, reduced[1]	$T_{max,red}$	N-m	9 [7][3]	19		37	64	76	100	122	171	171

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

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

[1]Torque may not be applied to the anchors until the full cure time of the adhesive has been achieved.
[2]These torque values apply to ASTM A36 / F1554 Grade 36 carbon steel threaded rods; ASTM F1554 Grade 55 carbon steel threaded rods; and ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rods.
[3]These torque values apply to ASTM A193 Grade B8/B8M (Class 1) stainless steel threaded rod only.
[4]See maximum torque subject to edge distance table below for requirements of anchors installed at reduced edge distances.
[5]Either drill bit size listed is acceptable for threaded rod 5/8-inch diameter and rebar size No. 5.
[6]For any case, it must be possible for the steel anchor element to be inserted into the cleaned drill hole without resistance.

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

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

For values of T_{max}, see Table 1 and Figure 3 of this report.

Ultimate Limit States Design:

Design resistance of anchors for compliance with the 2015 NBCC must be determined in accordance with CSA A23.3-14 Annex D, and this listing report.

Design parameters are provided in Table 2 through 11 of this listing report are based on the 2015 NBCC (CSA A23.3-14). The limit states design of anchors must comply with CSA A23.3-14 D.5.1, except as required in CSA A23.3-14 D.4.3.1.

Material resistance factors must be ϕ_c = 0.65 *and* ϕ_s = 0.85 in accordance with CSA A23.3-14 Sections 8.4.2 and 8.4.3, and resistance modification factor, *R*, as given in CSA A23.3-14 Section D.5.3, and noted in Tables 4, 5, 6, 8, 9 and 10 of this listing report, must be used for load combinations calculated in accordance with Division B, Part 4, Section 4.1.3 of the 2015 NBCC, or Annex C of CSA A23.3-14. The nominal strength, N_{sa} or V_{sa}, in Tables 4, 5, 8 and 9 of this listing report must be multiplied ϕ_s, and *R* to determine the factored resistance, N_{sar} or V_{sar}.

The bond strength must be adjusted by the permissible installation condition factors for dry concrete, R_d, water-saturated concrete, R_{ws}, water-filled hole (flooded), R_{wf}, and underwater (submerged), R_{uw}, for the corresponding installation conditions as given in Tables 7 and 11.

For anchors to be installed in seismic regions described in NBCC 2015. The factored resistance in shear, V_{sar}, must be adjusted by $\alpha_{V,seis}$ as given in tables 4, 5, 8 and 9 for the corresponding anchor steel. The nominal bond strength $\tau_{k,cr}$ must be adjusted by $\alpha_{N,seis}$ a as given in Tables 7 and 11 for threaded rods.

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

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

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

[1]Pure110+ epoxy adhesive may be used in conjunction with all grades of continuously threaded carbon or stainless steels (all-thread) that comply with this table and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series. Tabulated values correspond to anchor diameters included in this report. See CSA A23.3-14 D.2 of this report for ductility of steel anchor elements.
[2]*Standard Specification for Carbon Structural Steel.*
[3]*Standard Specification for Anchor Bolts, Steel, 248, 379, 734-MPa Yield Strength.*
[4]*Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.*
[5]*Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 837/724/621 MPa Minimum Tensile Strength, General Use.*
[6]*Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.*
[7]*Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs*
[8]*Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.*
[9]*Standard Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.*
[10] *Mechanical properties of fasteners made of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs*
[11]Based on 50 mm (2-inch) gauge length except ASTM A193, which are based on a gauge length of 4d and ISO 898, which is based on 5d.
[12]Nuts of other grades and style having specified proof load stress greater than the specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than the minimum tensile strength of the specified threaded rod. Material types of the nuts and washers must be matched to the threaded rods.
[13]Nuts for metric rods.
[14]Minimum percent reduction of area not reported in the referenced standard.

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

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

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

[1]Adhesive must be used with specified deformed reinforcing bars. Tabulated values correspond to bar sizes included in this report.
[2]*Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.* Grade 40 and Grade 60 bars furnished to specification are considered ductile elements. In accordance with CSA A23.3-14 D.4.3.5.3(a)(ii)(4), deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of CSA A23.3-14 Section 21. Grade 75 bars furnished to specification are considered brittle elements.
[3]*Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.* Bars furnished to specification are considered ductile elements.
[4]*Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.* Bars furnished to specification are considered brittle elements.
[5]*Reinforcing steel; reinforcing steel bars; dimensions and masses*. Bars furnished to this specification are considered brittle elements.
[6]*Billet bars for Concrete Reinforcement.*

TABLE 4—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER[1] (inch)						
				3/8	1/2	5/8	3/4	7/8	1	1 1/4
Threaded rod nominal outside diameter		d	mm (inch)	9.5 (0.375)	12.7 (0.500)	15.9 (0.625)	19.1 (0.750)	22.2 (0.875)	25.4 (1.000)	31.8 (1.250)
Threaded rod effective cross-sectional area		A_{se}	mm² (inch²)	50 (0.0775)	92 (0.1419)	146 (0.2260)	216 (0.3345)	298 (0.4617)	391 (0.6057)	625 (0.9691)
ASTM A36 and ASTM F1554 Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	20.0	36.6	58.3	86.3	119.1	156.3	250.0
		V_{sa}	kN	12.0	22.0	35.0	51.8	71.4	93.8	150.0
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM F1554 Grade 55	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	25.9	47.3	75.4	111.6	154.0	202.0	323.3
		V_{sa}	kN	15.5	28.4	45.2	67.0	92.4	121.2	194.0
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM A193 Grade B7 and ASTM F1554 Grade 105	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	43.1	78.9	125.7	186.0	256.7	336.8	538.8
		V_{sa}	kN	25.9	7.3	75.4	111.6	154.0	202.1	323.3
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM A449	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	41.4	75.7	120.6	178.5	248.7	323.3	452.6
		V_{sa}	kN	24.8	45.4	72.4	107.1	149.2	194.0	271.6
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	25.0	45.8	72.9	107.9	148.9	195.4	-[5]
		V_{sa}	kN	15.0	27.5	43.7	64.7	89.3	117.2	-[5]
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						-[5]
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ASTM F593 CW Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	34.5	63.1	100.5	126.5	174.6	229.0	366.4
		V_{sa}	kN	20.7	37.9	60.3	75.9	104.7	137.4	219.8
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ASTM A193 Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	kN	19.7	36.0	57.3	84.8	117.1	153.6	245.7
		V_{sa}	kN	11.8	21.6	34.4	50.9	70.2	92.1	147.4
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM A193 Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	32.8	60.0	95.5	141.3	195.1	256.0	409.5
		V_{sa}	kN	19.7	36.0	57.3	84.8	117.1	153.6	245.7
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80				
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						

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

[1]Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3. Nuts and washers must be appropriate for the rod. See Table 1 for nut specifications.

[2]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to ductile steel elements.

[3]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to brittle steel elements.

[4]In accordance with CSA A23.3-14 D.6.1.2 and D.7.1.2 the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to $1.9f_y$ or 393 MPa.

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

TABLE 5—STEEL DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL REINFORCING BAR SIZE (REBAR)[1]							
				#3	# 4	#5	#6	#7	#8	#9	#10
Rebar nominal outside diameter		d	mm (inch)	9.5 (0.375)	12.7 (0.500)	15.9 (0.625)	19.1 (0.750)	22.2 (0.875)	25.4 (1.000)	28.7 (1.125)	32.3 (1.250)
Rebar effective cross-sectional area		A_{se}	mm^2 (inch^2)	71 (0.110)	129 (0.200)	200 (0.310)	284 (0.440)	387 (0.600)	510 (0.790)	645 (1.000)	819 (1.270)
ASTM A615, Grade 75	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	48.9	89.0	137.9	195.7	266.9	351.4	444.8	564.9
		V_{sa}	kN	29.4	53.4	82.7	117.4	160.1	210.8	266.9	338.9
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Resistance modification factor for tension[3]	R	-	0.70							
	Resistance modification factor for shear[3]	R	-	0.65							
ASTM A615, Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	44.0	80.1	124.1	176.1	240.2	316.3	400.3	508.4
		V_{sa}	kN	26.4	48.0	74.5	105.7	144.1	189.8	240.2	305.0
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Resistance modification factor for tension[3]	R	-	0.70							
	Resistance modification factor for shear[3]	R	-	0.65							
ASTM A706, Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	39.1	71.2	110.3	156.6	213.5	281.1	355.9	452.0
		V_{sa}	kN	23.5	42.7	66.2	94.0	128.1	168.7	213.5	271.2
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Resistance modification factor for tension[2]	R	-	0.80							
	Resistance modification factor for shear[2]	R	-	0.75							
ASTM A615, Grade 40	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	29.4	53.4	82.7	117.4	In accordance with ASTM A615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	kN	17.6	32.0	49.6	70.5				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Resistance modification factor for tension[3]	R	-	0.70							
	Resistance modification factor for shear[3]	R	-	0.65							

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

[1]Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3.
[2]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to ductile steel elements. In accordance with CSA A23.3-14 D.4.3.5.3(a)(ii)(4), deformed reinforcing bars meeting this specification used as ductile steel elements to resist earthquake effects shall be limited to reinforcing bars satisfying the requirements of CSA A23.3-14 Section 21.
[3]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to brittle steel elements.

TABLE 6—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD AND REINFORCING BARS[1,3]

DESIGN INFORMATION	SYMBOL	UNITS	NOMINAL ROD DIAMETER (inch) / REINFORCING BAR SIZE							
			3/8 or #3	1/2 or #4	5/8 or #5	3/4 or #6	7/8 or #7	1 or #8	#9	1 1/4 or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$[4]	SI (-)	7.1 (17)							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$[4]	SI (-)	10.0 (24)							
Minimum embedment	$h_{ef,min}$	mm (inch)	60 (2 3/8)	70 (2 3/4)	79 (3 1/8)	89 (3 1/2)	89 (3 1/2)	102 (4)	114 (4 1/2)	127 (5)
Maximum embedment	$h_{ef,max}$	mm (inch)	191 (7 1/2)	254 (10)	318 (12 1/2)	381 (15)	445 (17 1/2)	508 (20)	572 (22 1/2)	635 (25)
Minimum anchor spacing	s_{min}	mm (inch)	48 (1 7/8)	64 (2 1/2)	79 (3 1/8)	95 (3 3/4)	111 (4 3/8)	127 (5)	143 (5 5/8)	159 (6 1/4)
Minimum edge distance	c_{min}	mm (inch)	5*d* where *d* is nominal outside diameter of the anchor; see Table 1 of this report for design with reduced minimum edge distances (with reduced torque) down to the following values:							
			45 (1 3/4)						70 (2 3/4)	
Minimum member thickness	h_{min}[5]	mm (inch)	h_{ef} + 30 (h_{ef} + 1 1/4)		h_{ef} + 2d_o where d_o is hole diameter; for installation parameters see Figure 3 of this listing report					
Critical edge distance—splitting (for uncracked concrete only)	c_{ac}[6]	mm (inch)	2h_{ef} (CSA A23.3-14 Equation D-29)							
Resistance modification factor for tension, concrete failure modes, Condition B[2]	*R*	-	1.00							
Resistance modification factor for shear, concrete failure modes, Condition B[2]	*R*	-	1.00							

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

[1]Additional setting information is described in the installation instructions, Figure 2 of this report.
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in CSA A23.3-14 D.5.3. The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor *R*, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used.
[3]Refer to CSA A23.3-14 D.6.2.1 for concrete breakout resistance of anchor in tension, and CSA A23.3-14 D.7.2.1 for concrete breakout resistance of anchor in shear.
[4]Refer to CSA A23.3-14 D.6.2.2 using the selected values of $k_{c,cr}$ and $k_{c,uncr}$ as provided in the table. Where analysis indicates no cracking in accordance with CSA A23.3-14 D.6.2.6 $\Psi_{c,N}$ shall be taken as 1.0.
[5]The minimum member thicknesses must be observed for anchor design and installation.
[6]Refer to CSA A23.3-14 D.9.7.

TABLE 7—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED RODS AND REINFORCING BARS[1,8]

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

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

Permissible installation conditions[7]	Dry concrete	Anchor Category	-	1	
		R_d	-	1.00	
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category	-	2	
		R_{ws}, R_{wf}	-	0.85	
	Underwater (submerged)	Anchor Category	-	2	3
		R_{uw}	-	0.85	0.75
Reduction factor for seismic tension[9]		$\alpha_{N,seis}$	-	1.0	

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

[1]Bond strength values correspond to a normal-weight concrete compressive strength f'_c = 17.2 MPa. For concrete compressive strength, f'_c between 17.2 MPa and 55.2 MPa, the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 17.2)^{0.23}$.

[2]The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in CSA A23.3 D.4.6., where applicable.

[3]The maximum short-term service temperature may be increased to 72°C provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1 in accordance with D.4.3.4 CSA A23.3-14, Temperature Category B.

[4]Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1 in accordance with D.4.3.4 CSA A23.3-14, Temperature Category A.

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

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

[7]Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation. For installation instructions see Figure 3 of this report.

[8]Bond strength values for uncracked concrete are applicable for structures assigned in non-seismic regions.

[9]For structures to be installed in seismic regions described in NBCC 2015 as referenced in CSA A23.3-14, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.

TABLE 8—STEEL DESIGN INFORMATION FOR METRIC THREADED RODS

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER[1] (mm)						
				10	12	16	20	24	27	30
Threaded rod nominal outside diameter		d	mm (inch)	10 (0.39)	12 (0.47)	16 (0.63)	20 (0.79)	24 (0.94)	27 (1.06)	30 (1.18)
Threaded rod effective cross-sectional area		A_{se}	mm² (inch²)	58.0 (0.090)	84.3 (0.131)	157 (0.243)	245 (0.380)	353 (0.547)	459 (0.711)	561 (0.870)
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	29.0	42.0	78.5	122.5	176.5	229.5	280.5
		V_{sa}	kN	17.4	25.5	47.0	73.5	106.0	137.5	168.5
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ISO 898-1 Class 8.8	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	46.5	67.5	125.5	196.0	282.5	367.0	449.0
		V_{sa}	kN	27.9	40.5	75.5	117.5	169.5	220.5	269.5
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ISO 3506-1 Stainless Grades A4 and HCR	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	40.6	59.0	109.9	171.5	247.1	229.5	280.5
		V_{sa}	kN	24.4	35.4	65.9	102.9	148.3	137.7	168.3
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ASTM A193M Grade B8/B8M, Class 1 Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)[4]	N_{sa}	kN	22.8	33.1	61.7	96.3	138.7	180.4	220.5
		V_{sa}	kN	13.7	19.9	37.0	57.8	83.2	108.2	132.3
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM A193M Grade B8/B8M2, Class 2B Stainless (Types 304 and 316)	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	38.0	55.2	102.8	160.5	231.2	300.6	367.5
		V_{sa}	kN	22.8	33.1	61.7	96.3	138.7	180.4	220.5
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.80						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						

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

[1]Values provided for steel element material types are based on minimum specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3.

[2]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to ductile steel elements.

[3]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to brittle steel elements.

[4]In accordance with CSA A23.3-14 D.6.1.2 and D.7.1.2 the calculated values for nominal tension and shear strength for ASTM A193 Grade B8/B8M Class 1 stainless steel threaded rods are based on limiting the specified tensile strength of the anchor steel to $1.9f_y$ or 393 MPa.

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

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL REINFORCING BAR SIZE (Ø)							
				Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Rebar nominal outside diameter		d	mm (inch)	10.0 (0.394)	12.0 (0.472)	14.0 (0.551)	16.0 (0.630)	20.0 (0.787)	25.0 (0.984)	28.0 (1.102)	32.0 (1.260)
Rebar effective cross-sectional area		A_{se}	mm² (inch²)	78.5 (0.122)	113.1 (0.175)	153.9 (0.239)	201.1 (0.312)	314.2 (0.487)	490.9 (0.761)	615.8 (0.954)	804.2 (1.247)
DIN 488 BSt 500	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	kN	43.0	62.0	84.5	110.5	173.0	270.0	338.5	442.5
		V_{sa}	kN	26.0	37.5	51.0	66.5	103.0	162.0	203.0	265.5
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	0.70		0.80					
	Resistance modification factor for tension[2]	R	-	0.70							
	Resistance modification factor for shear[2]	R	-	0.65							

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

[1]Values provided for reinforcing bar material types based on minimum specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3.
[2]The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to brittle steel elements.

TABLE 10—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD AND REINFORCING BARS[1,3]

DESIGN INFORMATION	SYMBOL	UNITS	NOMINAL ROD DIAMETER / REINFORCING BAR SIZE											
			M10 or Ø10	M12	Ø12	Ø14	M16 or Ø16	M20 or Ø20	M24	Ø25	M27	Ø28	M30	Ø32
Effectiveness factor for cracked concrete	$k_{c,cr}$[4]	SI (-)	17 (7.1)											
Effectiveness factor for uncracked concrete	$k_{c,uncr}$[4]	SI (-)	24 (10.0)											
Minimum embedment	$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	70 (2.8)	70 (2.8)	80 (3.2)	90 (3.6)	96 (3.8)	100 (3.9)	108 (4.3)	112 (4.4)	120 (4.7)	128 (5.0)
Maximum embedment	$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	240 (14.8)	280 (11.0)	320 (12.6)	400 (15.8)	480 (18.8)	500 (19.6)	540 (21.4)	560 (22.0)	600 (23.6)	640 (25.2)
Minimum anchor spacing	s_{min}	mm (inch)	50 (2.0)	60 (2.4)	60 (2.4)	70 (3.7)	80 (3.2)	100 (4.0)	120 (4.8)	125 (4.9)	135 (5.3)	140 (5.5)	150 (5.9)	160 (6.3)
Minimum edge distance	c_{min}	mm (inch)	$5d$ where d is nominal outside diameter of the anchor; see Table 1 of this report for design with reduced minimum edge distances (with reduced torque) down to the following values:											
			45 (1.75)								70 (2.75)			
Minimum member thickness	h_{min}[5]	mm (inch)	h_{ef} + 30 (h_{ef} + 1 1/4)		h_{ef} + 2d_o where d_o is hole diameter; for installation parameters see Table 1 of this listing report									
Critical edge distance—splitting (for uncracked concrete only)	c_{ac}[6]	mm (inch)	$2h_{ef}$ (CSA A23.3-14 Equation D-29)											
Resistance modification factor for tension, concrete failure modes, Condition B[2]	R	-	1.00											
Resistance modification factor for shear, concrete failure modes, Condition B[2]	R	-	1.00											

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

[1]Additional setting information is described in the installation instructions, Figure 3 of this report.
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pryout governs, as set forth in CSA A23.3-14 D.5.3. The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor R, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used.
[3]Refer to CSA 23.3-14 D.6.2.1 for concrete breakout resistance of anchor in tension, and CSA 23.3-14 D.7.2.1 for concrete breakout resistance of anchor in shear.
[4]Refer to CSA 23.3-14 D.6.2.2 using the selected values of $k_{c,cr}$ and $k_{c,uncr}$ as provided in the table. Where analysis indicates no cracking in accordance with CSA 23.3-14 D.6.2.6 $\Psi_{c,N}$ shall be taken as 1.0.
[5]The minimum member thicknesses must be observed for anchor design and installation.
[6]Refer to CSA 23.3-14 D.9.7.

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

DESIGN INFORMATION		SYMBOL	UNITS	NOMINAL ROD DIAMETER						
				M10	M12	M16	M20	M24	M27	M30
Minimum embedment		$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	80 (3.2)	90 (3.6)	96 (3.8)	108 (4.3)	120 (4.7)
Maximum embedment		$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	320 (12.6)	400 (15.8)	480 (18.8)	540 (21.4)	600 (23.6)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm²	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm²	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm²	12.5	12.1	11.5	11.1	10.7	10.5	10.3
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm²	12.5	12.1	11.5	11.1	10.7	10.5	10.3
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Threaded Rods	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm²	6.1	6.1	6.1	6.1	6.1	6.1	6.1
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm²	6.1	6.1	6.1	6.1	6.1	6.1	6.1
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm²	9.1	8.8	8.4	8.1	7.8	7.7	7.5
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm²	9.1	8.8	8.4	8.1	7.8	7.7	7.5
DESIGN INFORMATION		**SYMBOL**	**UNITS**	**REINFORCING BAR SIZE**						
				Ø10	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Minimum embedment		$h_{ef,min}$	mm (inch)	60 (2.4)	70 (2.8)	70 (2.8)	80 (3.2)	90 (3.6)	100 (3.9)	112 (4.4)	128 (5.0)
Maximum embedment		$h_{ef,max}$	mm (inch)	200 (7.8)	240 (14.8)	280 (11.0)	320 (12.6)	400 (15.8)	500 (19.6)	560 (22.0)	640 (25.2)
110°F (43°C) Maximum long-term service temperature; 140°F (60°C) maximum short-term service temperature[3,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm²	8.3	8.1	7.7	7.7	7.7	7.7	7.7	7.7
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm²	8.3	8.1	7.7	7.7	7.7	7.7	7.7	7.7
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm²	12.5	12.1	11.8	11.5	11.1	10.6	10.4	10.2
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm²	12.5	12.1	11.8	11.5	11.1	10.6	10.4	10.2
110°F (43°C) Maximum long-term service temperature; 176°F (80°C) maximum short-term service temperature[4,5] with Rebars	Characteristic bond strength in cracked concrete[6,9]	$\tau_{k,cr}$	N/mm²	6.1	5.9	5.6	5.6	5.6	5.6	5.6	5.6
	Characteristic bond strength in cracked concrete, short-term loading only[9]		N/mm²	6.1	5.9	5.6	5.6	5.6	5.6	5.6	5.6
	Characteristic bond strength in uncracked concrete[6,8]	$\tau_{k,uncr}$	N/mm²	9.1	8.8	8.6	8.4	8.1	7.8	7.6	7.4
	Characteristic bond strength in uncracked concrete, short-term loading only[8]		N/mm²	9.1	8.8	8.6	8.4	8.1	7.8	7.6	7.4
Permissible installation conditions[7]	Dry concrete	Anchor Category		1						
		R_d		1.00						
	Water-saturated concrete, Water-filled hole (flooded)	Anchor Category		2						
		R_{ws}, R_{wf},		0.85						
	Underwater (submerged)	Anchor Category		2				3		
		R_{uw}		0.85				0.75		
Reduction factor for seismic tension		$\alpha_{N,seis}$		1.0						

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

[1]Bond strength values correspond to normal-weight concrete compressive strength 17.2 MPa. For concrete compressive strength, f'_c between 17.2 MPa and 55.2 MPa, the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 17.2)^{0.23}$.
[2]The modification factor for bond strength of adhesive anchors in lightweight concrete shall be taken as given in CSA A23.3-14 D.4.6.
[3]The maximum short-term service temperature may be increased to 72°C provided characteristic bond strengths are reduced by 3 percent. Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1 in accordance with D.4.3.4 CSA A23.3-14, Temperature Category B.
[4]Long-term and short-term temperatures meet the requirements of Section 8.5 of ACI 355.4 and Table 8.1 in accordance with D.4.3.4 CSA A23.3-14, Temperature Category A.
[5]Short-term elevated concrete temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.
[6]Characteristic bond strengths are for sustained loads including dead and live loads.
[7]Permissible installation conditions include dry concrete, water-saturated concrete, water-filled holes and underwater. Water-filled holes include applications in dry or water-saturated concrete where the drilled holes contain standing water at the time of anchor installation. For installation instructions see Figure 3 of this report.
[8]Bond strength values for uncracked concrete are applicable for structures assigned in non-seismic regions..
[9]For structures to be installed in seismic regions described in NBCC 2015 as referenced in CSA A23.3-14, the tabulated bond strength values for cracked concrete do not require an additional reduction factor applied for seismic tension ($\alpha_{N,seis}$ = 1.0), where seismic design is applicable.

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 cracked and uncracked normal-weight concrete and lightweight concrete having a specified compressive strength, 17.2 MPa to 58.6 MPa.
6. The values of f'_c, used for calculation purposes must not exceed 55 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 2015.
10. Where not otherwise prohibited in the code as referenced in CSA A23.3-14, Pure110+ epoxy adhesive anchor system are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:
    a. 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 zinc-coated carbon steel anchors is limited to dry, interior locations.
12. Use of anchors made of stainless steel as specified in this report are permitted for exterior exposure and damp environments.
13. Steel anchoring materials in contact with preservative-treated wood and fire-retardant-treated wood must be of zinc-coated carbon steel or stainless steel. The minimum coating weights for zinc-coated steel must comply with ASTM A153.
14. Installation of anchors in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed by personnel certified by an applicable certification program, and the certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program, or equivalent in accordance with CSA A23.3-14 D.10.2.3. The installation shall be continuously inspected during installation by an inspector specially approved for that purpose. The special inspector shall furnish a report to the licensed design professional and building official that the work covered by the report has been performed and that the materials used and the installation procedures used to conform with the approved contract documents and the MPII in accordance with CSA A23.3-14 D.10.2.4.