ICC-ES Listing Report
ELC-4457

Reissued June 2024

This listing is subject to renewal June 2025.

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: WIT-VM 250 Adhesive Anchor System in Cracked and Uncracked Concrete.

Listee: ADOLF WÜRTH GMBH & CO. KG

Compliance with the following standards:

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

Compliance with the following codes:

The WIT-VM 250 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 and 2010
  Applicable Section: Division B, Part 4, Section 4.3.3.

Description of adhesive anchor system:

The WIT-VM 250 Adhesive Anchor System is comprised of WIT-VM 250 two-component adhesive filled in cartridges, static mixing nozzles and manual or powered dispensing tools, hole cleaning equipment and adhesive injection accessories.

WIT-VM 250 adhesive is an injectable two-component vinyl ester adhesive. The two components are kept separate in the same cylinder cartridge or in two cylinders as shown in Figure 3. The two components combine and react when dispensed through a static mixing nozzle, supplied by Adolf Würth GmbH & Co. KG, which is attached to the cartridge. WIT-VM 250 is available in 330 mL (11.2-ounce), 420 mL (14.2-ounce), and 825 mL (27.9-ounce) 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 stored in a dry, dark, and cool environment, in accordance with the MPII, as illustrated in Figure 4 of this report.

Hole cleaning equipment is comprised of steel wire brushes supplied by Adolf Würth GmbH & Co. KG, and air blowers which are shown in Figures 1 and 4 of this report.

WIT-VM 250 adhesive must be dispensed with manual dispensers, pneumatic dispensers, or electric powered dispensers supplied by Adolf Würth GmbH & Co. KG.

WIT-VM 250 adhesive may be used with continuously threaded steel rods or deformed steel reinforcing bars. The primary components of the WIT-VM 250 Adhesive Anchor System, including the WIT-VM 250 adhesive cartridge, static mixing nozzle, the nozzle extension tube and steel anchor elements, are shown in

Figures 2 and 3 of this report. The manufacturer's printed installation instructions (MPII), included with each adhesive unit package, are shown in Figure 4 of this report.

The WIT-VM 250 adhesive anchors are used to resist static, wind or earthquake tension and shear loads in cracked and uncracked normal-weight concrete with 12.7, 15.9, 19.1, 22.2, 25.4 and 31.8 mm ($^1/_2$-, $^5/_8$-, ¾, $^7/_8$-, 1-, and $1^1/_4$-inch) diameter threaded steel rods and No. 4 through No. 10 steel reinforcing bars in hammer-drilled holes.

The WIT-VM 250 adhesive anchors are used to resist static, wind or earthquake tension and shear loads in uncracked normal-weight concrete only with 9.5 mm ($^3/_8$-inch) threaded steel rods and No. 3 steel reinforcing bars in hammer-drilled holes.

Drilling Tools

Rotary Drill Hammer

- H 36-MAS / H24-MLS (SDS-plus) for #3 & #4 rebar size.
- BMH 32-XE (SDS-Plus) for #3 – #6 rebar sizes.
- BMH 40-XES (SDS-Max) for #7 – #10 rebar sizes.
- BMH 45-XE (SDS-Max) for #7 – #10 rebar sizes.

Accessories

Drill Bits

- Longlife Quadro-L (0648 xxx yyy) for #3 – #8 rebar sizes.
- Longlife Quadro-L (0647 0xx yyy) for #7 – #10 rebar sizes.
- Quadro-S (0647 7xx yyy) for #7 – #10 rebar sizes.

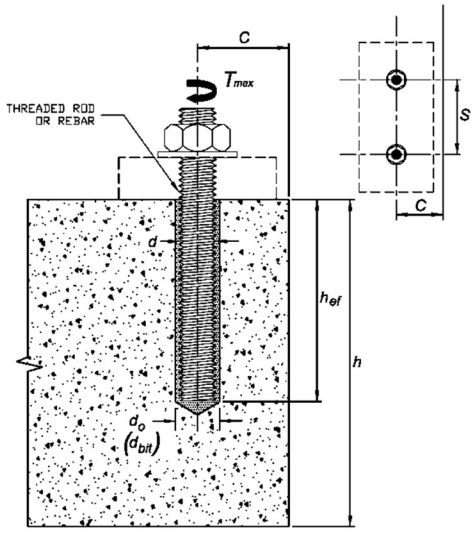
Brush and Brush Extension

Compressed-Air Cleaning

Manual Blow-out Pump

Jet Nozzle, Thread Adapter and Hose

FIGURE 1—ADOLF WÜRTH GMBH & CO. KG DUST REMOVAL DRILLING SYSTEM



THREADED ROD

REINFORCING BAR

FIGURE 2—INSTALLATION PARAMETERS FOR THREADED RODS AND REINFORCING BARS

Various Available Two-Component Cartridge Adhesive with Static Mixing Nozzle

330 ml

420 ml

825 ml

Dispensing Gun / Dispensing Gun Handy Max

Mixer Extension

Injection Adapter (repulsion piston)

FIGURE 3—WIT-VM 250 ADHESIVE ANCHOR SYSTEM

Identification:

1. The WIT-VM 250 adhesive is identified by packaging labelled with the manufacturer's name (Adolf Würth GmbH & Co. KG) and address, anchor name, the lot number, the expiration date, and the evaluation report number (ELC-4457). 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.

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   GERMANY
   +49 794 0150
   www.wuerth.de
   info@wuerth.de

Installation:

1. The installation parameters are illustrated in Figure 2. Installation must be in accordance with CSA A23.3-14 D.10 and D.10.2, as applicable. Anchor locations must comply with this report and the plans and specifications approved by the code official. Installation of the WIT-VM 250 Adhesive Anchor System must conform to the manufacturer's printed installation instructions included in each unit package as described in Figure 4 of this report.

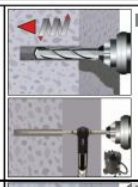
   The adhesive anchor system may be used for upwardly inclined orientation applications (e.g. overhead). Upwardly inclined and horizontal orientation applications are to be installed using piston plugs for the 15.9 mm through 31.8 mm diameter threaded steel rods and No. 5 through No. 10 steel reinforcing bars, installed in the specified hole diameter, and attached to the mixing nozzle and extension tube supplied by Adolf Würth GmbH & Co. KG as described in Figure 4 in this report. Upwardly inclined and horizontal orientation installation for the 9.5 mm and 12.7 mm diameter threaded steel rods, and No. 3 and No. 4 steel reinforcing bars, may be injected directly to the end of the hole using a mixing nozzle with a bore hole depth $d_0 \leq 250$ mm. Installation of anchors in horizontal or upwardly inclined 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.

   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 in accordance with CSA A23.3-14 D.10.2.2 or D.10.2.3, as applicable.

Würth WIT-VM 250 - Instruction Card

1. Setting instructions for solid base material - For any application not covered by this document please contact Adolf Würth GmbH & Co. KG (ESR-4457)

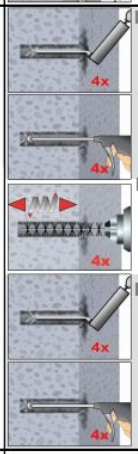
Drilling



1 Drill a hole into the base material with a hammer drill tool to the size and embedment required by the selected steel hardware element (see Table 4.1 or Table 4.2). The tolerances of the carbide drill bit must meet the requirements of 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 Würth to minimize dust emissions)
Note: In case of standing water in the drilled bore hole, all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.

Hole cleaning → In order: *Blow 4x, Brush 4x, Blow 4x*



2a In case of standing water in the drilled bore hole, all the water has to be removed from the hole (e.g. vacuum, compressed air, etc.) prior to cleaning.
Starting from the bottom or back of the anchor hole, blow the hole clean a minimum of *four* times (4x).

- Use a compressed air nozzle (min. 90 psi) ***or*** a hand pump (min. volume 25 fl. oz. supplied by Würth) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump must not be used with these anchor sizes.

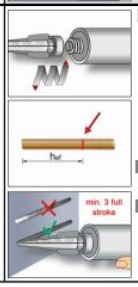
2b Determine brush diameter (see Table 2) for the drilled hole and attach the brush with adaptor to a rotary drill tool or battery screw gun. Brush the hole with the selected wire brush a minimum of *four* times (4x). A brush extension (supplied by Würth) must be used for holes drilled deeper than the listed brush length.
The wire brush diameter must be checked periodically during use ($\varnothing_{brush} > D_{min}$, see Table 2). 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.

2c Finally, blow the hole clean again a minimum of *four* times (4x).

- Use a compressed air nozzle (min. 90 psi) ***or*** a hand pump (min. volume 25 fl. oz. supplied by Würth) for anchor rod 3/8" to 3/4" diameter or reinforcing bar (rebar) sizes #3 to #6.
- Use a compressed air nozzle (min. 90 psi) for anchor rod 7/8" to 1-1/4" diameter and rebar sizes #7 to #10. A hand pump must not be used with these anchor sizes.

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

Preparing

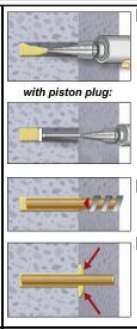


3 Check adhesive expiration date on cartridge label. Do not use expired product. Review Material Safety Data Sheet (MSDS) before use. Cartridge temperature must be between 32°F - 95°F (0°C - 35°C) when in use except as noted in Table 3.. Review working and cure times. Consideration should be given to the reduced gel (working) time of the adhesive in warm temperatures.
For the permitted range of the base material temperature see Table 3.
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 the anchor rod or rebar into the filled bore hole, the position of the embedment depth has to be marked on the anchor. Verify anchor element is straight and free of surface damage.

5 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 gray color.
Review and note the published working and cure times (see Table 3) prior to injection of the mixed adhesive into the cleaned anchor hole.

Installation

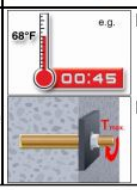


6 Fill the cleaned hole approximately two-thirds full with mixed adhesive starting from the bottom or back of the anchor hole. Slowly withdraw the mixing nozzle as the hole fills to avoid creating air pockets or voids. If the bottom or back of the anchor hole is not reached with the mixing nozzle only an extension nozzle supplied by Würth (3/8" dia., Cat# 0903488123) must be used with the mixing nozzle.
Piston plugs (see Table 6) must be used with and attached to mixing nozzle and extension tube for horizontal and overhead installations with anchor rod 5/8" to 1-1/4" diameter and rebar sizes #5 to #10. Insert piston plug to the back of the drilled hole and inject as described in the method above. During installation the piston plug will be naturally extruded from the drilled hole by the adhesive pressure. **Attention!** Do not install anchors overhead without proper training and installation hardware provided by Würth. Contact Würth for details prior to use.

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

8 Be sure that the anchor is fully seated at the bottom of the hole and that some adhesive has flowed from the hole and all around the top of the anchor. If there is not enough adhesive in the hole, the installation must be repeated. For overhead applications and applications between horizontal and overhead the anchor must be secured from moving/falling during the cure time (e.g. wedges). Minor adjustments to the anchor may be performed during the gel time but the anchor shall not be moved after placement and during cure.

Curing and fixture



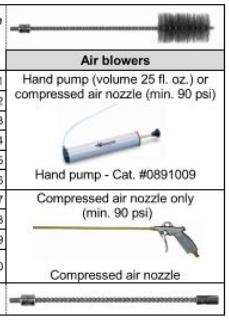
9 Allow the adhesive anchor to cure to the specified full curing time prior to applying any load (see Table 3).
Do not disturb, torque or load the anchor until it is fully cured.

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 4.1) by using a calibrated torque wrench.
Take care not to exceed the maximum torque for the selected anchor.

2. Hole cleaning tools - wire brushes and air blowers

Threaded rod diameter (inch)	Rebar size (no.)	ANSI drill bit diameter[2] (inch)	Min. brush diameter, D_{min} (inches)	Brush length, L[1] (inches)	Steel wire brush (Cat. #)
3/8	#3	7/16	0.475	6-3/4	0903489301
1/2	-	9/16	0.600	6-3/4	0903489302
-	#4	5/8	0.708	6-3/4	0903489303
5/8	#5	11/16	0.735	7-7/8	0903489304
		3/4	0.790	7-7/8	0903489305
3/4	#6	7/8	0.920	7-7/8	0903489306
7/8	#7	1	1.045	11-7/8	0903489307
1	#8	1-1/8	1.175	11-7/8	0903489308
1-1/4	#9	1-3/8	1.425	11-7/8	0903489309
-	#10	1-1/2	1.550	11-7/8	0903489310

[1] A brush extension (Cat. #0905499111) must be used with a steel wire brush for holes drilled deeper than the listed brush length.



Air blowers

Hand pump (volume 25 fl. oz.) or compressed air nozzle (min. 90 psi)

Hand pump - Cat. #0891009

Compressed air nozzle only (min. 90 psi)

Compressed air nozzle

[2] For installations with 5/8-inch threaded rod and #5 rebar size, the preferred ANSI drill bit diameter is 3/4-inch. If an 11/16-inch ANSI drill bit is used the user must check before injecting the adhesive to verify that the steel anchor element can be inserted into the cleaned borehole without resistance.

Würth WIT-VM 250 - Instruction Card

DESCRIPTION:
WIT-VM 250 is an easy dispensing, rapid-curing, high strength anchoring adhesive which is formulated for use by trained professionals. Please refer to installation instructions and MSDS 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 Material Safety Data Sheet (MSDS).
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 32°F (0°C) and 86°F (30°C). Keep away from excessive heat and flame. Keep partially used containers closed when not in use. Protect from damage. Store away from heat and light.
Before use see expiration date on product label.

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 the initial quantity of the anchor adhesive as described in the setting instructions (steps #3 and #5).*

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3. Gel (working) times and curing times

Temperature of base material		Gel (working) time	Full curing time
14°F	-10°C	90 minutes	24 hours
23°F	-5°C	90 minutes	14 hours
32°F	0°C	45 minutes	7 hours
41°F	5°C	25 minutes	2 hours
50°F	10°C	15 minutes	90 minutes
68°F	20°C	6 minutes	45 minutes
86°F	30°C	4 minutes	25 minutes
95°F	35°C	2 minutes	20 minutes
104°F	40°C	1.5 minutes	15 minutes

For installations in base material temperature between 14°F and 23°F the cartridge temperature must be conditioned to between 68°F and 95°F (20°C - 35°C).

4. Setting parameters

Table 4.1 Specifications for installation of threaded rods

Anchor property / Setting information	Nominal threaded rod size						
	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
d = Nominal anchor rod diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	1.250
A_{se} = Nominal area of threaded rod (in.²)	0.078	0.142	0.226	0.335	0.462	0.606	0.969
d_o (d_{bit}) = Nominal ANSI drill bit size (in.)	7/16	9/16	11/16 or 3/4	7/8	1	1-1/8	1-3/8
T_{max} = Maximum torque (ft.-lb.) for A193 B7 carbon steel rod or F593 SS rod	16	33	60	105	125	165	280
T_{max} = Maximum torque (ft.-lb.) for A36/A307 carbon steel rod **only**	10	25	50	90			
$h_{ef,min}$ = Minimum embedment (inches)	2-3/8	2-3/4	3-1/8	3-1/2	3-1/2	4	5
$h_{ef,max}$ = Maximum embedment (inches)	4-1/2	6	7-1/2	9	10-1/2	12	15
s_{min} = Minimum spacing (inches)	1-7/8	2-1/2	3-1/8	3-3/4	4-3/8	5	6-1/4
c_{min} = Minimum edge distance (inches)	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	2-3/4
h_{min} = Minimum member thickness (inches)	h_{ef} + 1-1/4		h_{ef} + 2d_o				

For installations between the minimum edge distance and 5 anchor diameters, the tabulated maximum torque must be reduced (multiplied) by a factor of 0.45.

Table 4.2 Specifications for installation of deformed steel reinforcing bars

Anchor property / Setting information	Reinforcing bar size							
	#3	#4	#5	#6	#7	#8	#9	#10
d = Nominal bar diameter (in.)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
d_o (d_{bit}) = Nominal ANSI drill bit size (in.)	7/16	5/8	11/16 or 3/4	7/8	1	1-1/8	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
$h_{ef,max}$ = Maximum embedment (inches)	4-1/2	6	7-1/2	9	10-1/2	12	13-1/2	15
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
c_{min} = Minimum edge distance (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
h_{min} = Minimum member thickness (inches)	h_{ef} + 1-1/4		h_{ef} + 2d_o					

6. Adhesive Piston Plugs

Threaded rod diameter (inch)	Rebar size (no.)	ANSI drill bit diameter (inch)	Plug No.	Plastic Plug (Cat. #)	Horizontal and overhead installations
5/8	#5	11/16	11/16	0903488063	
		3/4	3/4	0903488064	
3/4	#6	7/8	7/8	0903488062	
7/8	#7	1	1	0903488059	
1	#8	1-1/8	1-1/8	0903488052	
1-1/4	#9	1-3/8	1-3/8	0903488060	
-	#10	1-1/2	1-1/2	0903488065	

A plastic extension tube (3/8" dia., Cat# 0903488123) must be used with piston plugs.

5. WIT-VM 250 adhesive anchor system selection table

Injection tools		Plastic cartridge system	Extra mixing nozzles
WIT-VM 250 11 fl. Oz. Manual dispenser and powered dispenser	Cat. #0891007201 - standard Cat. #0891003 - High performance Cat. #0891003330 – Battery tool	WIT-VM 250 11 fl. Oz. coaxial w/nozzle Cat. #0903450202	Mixing nozzle Fill & Clean Cat. #0903 420 001
WIT-VM 250 14 fl. Oz. Manual dispenser and powered dispenser	Cat. #0891007202 - standard Cat. #08910380 - High performance Cat. #0891003420 – Battery tool	WIT-VM 250 14 fl. Oz. coaxial w/nozzle Cat. #0903450205	Mixing nozzle Fill & Clean Cat. #0903 420 001
WIT-VM 250 12 fl. Oz. Manual dispenser and powered dispenser	Cat. #0891007204 - Standard	WIT-VM 250 12 fl. Oz. dual cart. w/nozzle Cat. #0903450207	Mixing nozzle Fill & Clean Cat. #0903 420 001
WIT-VM 250 28 fl. Oz. powered dispenser	Cat. #0891 004 826 - Pneumatic tool Cat. #0891 003 825 – Battery tool	WIT-VM 250 28 fl. Oz. dual cart. w/nozzle Cat. #0903450206	Mixing nozzle WIT-M 18W Cat. #0903488101

A plastic extension tube (3/8" dia., Cat# 0903488123) must be used for embedment depths greater than 7-1/2 inches.

FIGURE 4—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)

Anchor setting information:

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:

INSTALLATION TORQUE SUBJECT TO EDGE DISTANCE			
NOMINAL ANCHOR SIZE, *D*	**MINIMUM EDGE DISTANCE, c_{min}**	**MINIMUM ANCHOR SPACING, s_{min}**	**MAXIMUM TORQUE, T_{max}**
all sizes	5*d*	5*d*	$1.0 \cdot T_{max}$
9.5 mm to 25.4 mm ($^3/_8$ in. to 1 in.)	44.5 mm (1.75 in.)	5*d*	$0.45 \cdot T_{max}$
31.8 mm ($1^1/_4$ in.)	70 mm (2.75 in.)		

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 table index is provided in Table 1 and design parameters are provided in Tables 2 through 9 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 $\phi_c = 0.65$ and $\phi_s = 0.85$ 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 through 9 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 and 7 of this listing report must be multiplied by ϕ_s and *R* to determine the factored resistance, N_{sar} or V_{sar}. The nominal strength, N_{cbr}, N_{cbgr}, V_{cbr}, and V_{cbgr}, in Tables 5 and 8 of this listing report must be multiplied by ϕ_c and *R* to determine the factored resistance, N_{cbr}, N_{cbgr}, V_{cbr}, and V_{cbgr},.

The factored bond resistance, N_{bar}, must be multiplied by ϕ_c and the permissible installation condition factors for dry concrete, R_d, water-saturated concrete, R_{ws}, water-filled holes, R_{wf}, and submerged concrete, R_{uw}, for the corresponding installation conditions as given in Tables 6 and 9.

For anchors to be installed in seismic regions described in NBCC 2015: The factored resistance shear strength, V_{sar}, must be adjusted by $\alpha_{V,seis}$ as given in Tables 5 and 8 for the corresponding anchor steel. The nominal bond strength $\tau_{k,cr}$ must be adjusted by $\alpha_{N,seis}$ as given in Tables 6 and 9.

TABLE 1—DESIGN TABLE INDEX

DESIGN STRENGTH		THREADED ROD	DEFORMED REINFORCING BAR
Steel	N_{sa}, V_{sa}	Table 4	Table 7
Concrete	N_{pn}, N_{sb}, N_{sbg}, N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	Table 5	Table 8
Bond	N_a, N_{ag}	Table 6	Table 9

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

THREADED ROD SPECIFICATIONS			MINIMUM SPECIFIED ULTIMATE STRENGTH, f_{uta}	MINIMUM SPECIFIED YIELD STRENGTH 0.2 PERCENT OFFSET, f_{ya}	f_{uta}/f_{ya}	ELONGATION, MIN. PERCENT[5]	REDUCTION OF AREA, MIN. PERCENT	SPECIFICATION FOR NUTS[6]	SPECIFICATION FOR WASHERS[6]
CARBON STEEL	ASTM A193[2] Grade B7 all sizes	(psi) MPa	(125,000) 862	(105,000) 724	1.19	16	50	ASTM A563 Grade D	ASTM F436
	ASTM A36[3] / F1554, Grade 36 all sizes	(psi) MPa	(58,000) 400	(36,000) 250	1.61	23	50	ASTM A563 Grade A	ASTM B18.22.1 Type A Plain
STAINLESS STEEL (304/316)	ASTM F593[4] CW1, 9.5 mm to 1.9 mm ($^3/_8$ to $^5/_8$ in.)	(psi) MPa	(100,000) 690	(65,000) 450	1.54	40	- [7]	ASTM F594 Alloy Group 1, 2 or 3	ASTM B18.22.1 Type A Plain
	ASTM F593[4] CW2, 19.1 mm to 31.8 mm ($^3/_4$ to $1^1/_4$ in.)	(psi) MPa	(85,000) 590	(45,000) 310	1.89	40	- [7]		

[1]Adhesive must be used with continuously threaded carbon or stainless steel rod (all-thread) having thread characteristics complying with ANSI B1.1 UNC Coarse Thread Series.
[2]Standard Specification for Alloy-Steel and Stainless steel Bolting Materials for High temperature of High Pressure service and Other Special Purpose Applications.
[3]Standard Specification for Carbon Structural steel
[4]Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
[5]Based on 50 mm (2-in.) gauge length except for ASTM A193, which is based on a gauge length of 4d.
[6]Nuts and washers 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.
[7]Minimum percent reduction of area not reported in the referenced ASTM standard.

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

REINFORCING SPECIFICATION	UNITS	MINIMUM SPECIFIED ULTIMATE STRENGTH, f_{uta}	MINIMUM SPECIFIED YIELD STRENGTH, f_{ya}
ASTM A615[1], A767[3], A996[4] Grade 60	(psi) (MPa	(90,000) 620	(60,000) 414
ASTM A615[1], Grade 40	(psi) MPa	(60,000) 415	(40,000) 275

[1]Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
[2]Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
[3]Standard specification for Zinc-Coated (Galvanized) steel Bars for Concrete Reinforcement.
[4]Standard specification for Rail-Steel and Axle-steel Deformed bars for Concrete Reinforcement.

TABLE 4—STEEL DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD[1]

DESIGN INFORMATION		Symbol	Units	Nominal Rod Diameter, mm (inch)						
				9.5 (3/8)	**12.7 (1/2)**	**15.9 (5/8)**	**19.1 (3/4)**	**22.2 (7/8)**	**25.4 (1)**	**31.8 (1 1/4)**
Threaded rod O.D.		*d*	(in.) mm	(0.375) 9.5	(0.500) 12.7	(0.625) 15.9	(0.750) 19.1	(0.875) 22.2	(1.000) 25.4	(1.250) 31.8
Threaded rod effective cross-sectional area		A_{se}	(in.²) mm²	(0.0775) 50	(0.1419) 92	(0.2260) 146	(0.3345) 216	(0.4617) 298	(0.6057) 391	(0.9691) 625
ASTM A36/F1554, Grade 36	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	(lb) kN	(4,495) 20.0	(8,230) 36.6	(13,110) 58.3	(19,400) 86.3	(26,780) 119.1	(35,130) 156.3	(56,210) 250.0
		V_{sa}	(lb) kN	(2,695) 12.0	(4,940) 22.0	(7,860) 35.0	(11,640) 51.8	(16,070) 71.4	(21,080) 93.8	(33,725) 150.0
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	Not applicable	0.85	0.85	0.85	0.85	0.80	0.80
	Resistance modification factor for tension[2]	*R*	-	0.80						
	Resistance modification factor for shear[2]	*R*	-	0.75						
ASTM A193 Grade B7	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	(lb) kN	(9,685) 43.1	(17,735) 78.9	(28,250) 125.7	(41,810) 186.0	(57,710) 256.7	(75,710) 336.8	(121,135) 538.8
		V_{sa}	(lb) kN	(4,845) 21.5	(10,640) 7.3	(16,950) 75.4	(25,085) 111.6	(34,625) 154.0	(45,425) 202.1	(72,680) 323.3
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	Not applicable	0.85	0.85	0.85	0.85	0.80	0.80
	Resistance modification factor for tension[2]	*R*	-	0.80						
	Resistance modification factor for shear[2]	*R*	-	0.70						
ASTM F593 CW Stainless	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	(lb) kN	(7,750) 34.5	(14,190) 63.1	(22,600) 100.5	(28,430) 126.5	(39,245) 174.6	(51,485) 229.0	(82,370) 366.4
		V_{sa}	(lb) kN	(4,650) 20.7	(8,515) 37.9	(13,560) 60.3	(17,060) 75.9	(23,545) 104.7	(30,890) 137.4	(49,425) 219.8
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	Not applicable	0.85	0.85	0.85	0.85	0.80	0.80
	Resistance modification factor for tension[2]	*R*	-	0.70						
	Resistance modification factor for shear[2]	*R*	-	0.65						

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 006894 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.

[1]Values provided for common rod material types based on specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3. Nuts and washers must comply with requirements for the rod.
[2]The tabulated value of the 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.

TABLE 5—CONCRETE BREAKOUT DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT[1]

DESIGN INFORMATION	Symbol	Units	Nominal Rod Diameter, mm (inch)						
			9.5 (3/8)	12.7 (1/2)	15.9 (5/8)	19.1 (3/4)	22.2 (7/8)	25.4 (1)	31.8 (1 1/4)
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	n.a.	7 (17)					
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	(10) 24						
Min. anchor spacing	s_{min}	mm (in.)	48 (1 7/8)	64 (2 1/2)	79 (3 1/8)	95 (3 3/4)	111 (4 3/8)	127 (5)	159 (6 1/4)
Min. edge distance	c_{min}	mm (in.)	5d; or see anchor setting information section of this report.						
Min. member thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + 1 1/4)		$h_{ef} + 2d_0$ [3]				
Critical edge distance - splitting (for uncracked concrete)[2]	c_{ac}	-	$2h_{ef}$						
Critical anchor spacing – splitting	s_{ac}	-	$2 \cdot c_{ac}$						
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, 1 psi = 006894 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.
[1]Additional setting information is described in Figure 4, installation instructions (MPII).
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pullout or pryout governs, as set forth in CSA A23.3-14 D.5. The tabulated value of the 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] d_0 = hole diameter.

TABLE 6—BOND STRENGTH DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal Rod Diameter, mm (inch)						
					9.5 (3/8)	12.7 (1/2)	15.9 (5/8)	19.1 (3/4)	22.2 (7/8)	25.4 (1)	31.8 (1 1/4)
Minimum embedment			$h_{ef,min}$	(in.) mm	(2 3/8) 60.3	(2 3/4) 69.9	(3 1/8) 79.4	(3 1/2) 88.9	(3 1/2) 88.9	(4) 101.6	(5) 127.0
Maximum embedment			$h_{ef,max}$	(in.) mm	(4 1/2) 114	(6) 152	(7 1/2) 191	(9) 229	(10 1/2) 267	(12) 305	(15) 381
Dry concrete	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(743) 5.1	(588) 4.1
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(498) 3.4	(519) 3.6	(519) 3.6	(519) 3.6	(519) 3.6	(525) 3.6
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(366) 2.5	Not applicable
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(245) 1.7	(255) 1.8	(255) 1.8	(255) 1.8	(255) 1.8	(255) 1.8
	Resistance modification factor		R_d	-	1	1	1	1	1	1	1
Water-saturated concrete	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(743) 5.1	(588) 4.1
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(498) 3.4	(519) 3.6	(519) 3.6	(519) 3.6	(519) 3.6	(525) 3.6
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(366) 2.5	Not applicable
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(245) 1.7	(255) 1.8	(255) 1.8	(255) 1.8	(255) 1.8	(255) 1.8
	Resistance modification factor		R_{ws}	-	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Water-filled hole (flooded)	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(642) 4.4	(642) 4.4	(642) 4.4	(642) 4.4	(576) 4.0	Not applicable	
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(388) 2.7	(405) 2.8	(405) 2.8	(363) 2.5	(358) 2.5	(352) 2.4
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(316) 2.2	(316) 2.2	(316) 2.2	(316) 2.2	Not applicable		
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(191) 1.3	(199) 1.4	(199) 1.4	(179) 1.3	(176) 1.2	(171) 1.2
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction factor for seismic tension			$\alpha_{N,seis}$	-	0.95						

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 006894 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.
[1]Bond strength values correspond to concrete compressive strength f'_c = 17.2 MPa (2,500 psi). For concrete compressive strength, f'_c between 17.2 MPa (2,500 psi) and 55.2 MPa (8,000 psi), the tabulated characteristic bond strength may be increased by a factor of $(f'_c / 17.2)^{0.13}$ [$(f'_c / 2500)^{0.13}$].
[2]Temperature range A: Maximum short-term temperature = 80°C (176°F), maximum long-term temperature = 50°C (122°F). Temperature range B: Maximum short-term temperature = 120°C (248°F), maximum long-term temperature = 72°C (161°F).
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
[3]Characteristic bond strengths are for sustained loads including dead and live loads. For load combinations consisting of short-term loads only such as wind, bond strengths may be increased by 43 percent for temperature range A and 122 percent for temperature range B.

TABLE 7—STEEL DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING BARS [1]

DESIGN INFORMATION		Symbol	Units	Nominal Bar Size							
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Reinforcing bar O.D.		d	(in.) mm	(0.375) 9.5	(0.500) 12.7	(0.625) 15.9	(0.750) 19.1	(0.875) 22.2	(1.000) 25.4	(1.125) 28.6	(1.250) 31.8
Reinforcing bar effective cross-sectional area		A_{se}	(in.²) mm²	(0.110) 71	(0.200) 129	(0.310) 200	(0.440) 284	(0.600) 387	(0.790) 510	(1.000) 645	(1.270) 819
ASTM A615, A706, A767, A996 Grade 60	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	(lb) kN	(9,900) 44.0	(18,000) 80.1	(27,900) 124.1	(39,600) 176.1	(54,00) 240.2	(71,100) 316.3	(90,000) 400.3	(114,300) 508.4
		V_{sa}	(lb) kN	(5,940) 26.4	(10,800) 48.0	(16,740) 74.5	(23,760) 105.7	(32,400) 144.1	(42,660) 189.8	(54,000) 240.2	(68,580) 305.0
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	Not applicable	0.70	0.70	0.70	0.70	0.70	0.70	0.70
	Resistance modification factor for tension[2]	R	-	0.70							
	Resistance modification factor for shear[2]	R	-	0.65							
ASTM A615 Grade 40[3]	Nominal strength as governed by steel strength (for a single anchor)	N_{sa}	(lb) kN	(6,600) 29.4	(12,000) 53.4	(18,600) 82.7	(26,400) 117.4	In accordance with ASTM A615, Grade 40 bars are furnished only in sizes No. 3 through No. 6			
		V_{sa}	(lb) kN	(3,960) 17.6	(7,200) 32.0	(11,160) 49.6	(15,840) 70.5				
	Reduction factor for seismic shear	$\alpha_{V,seis}$	-	Not applicable	0.70	0.70	0.70				
	Resistance modification factor for tension [2]	R	-	0.70							
	Resistance modification factor for shear[2]	R	-	0.65							

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 006894 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.
[1]Values provided for common bar material types based on specified strengths and calculated in accordance with CSA A23.3-14 Eq. D.2 and Eq. D.3.
[2]The tabulated value of the 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]In accordance with ASTM A615, Grade 40 bars are furnished only in sizes No. 3 through No. 6.

TABLE 8—CONCRETE BREAKOUT DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT[1]

DESIGN INFORMATION	Symbol	Units	Nominal Bar Size							
			No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No.10
Effectiveness factor for cracked concrete	$k_{c,cr}$	(in-lb) SI	n.a.	(17) 7						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	(in.-lb.) SI	(24) 10							
Min. anchor spacing	s_{min}	(in.) mm	($1^7/_8$) 48	($2^1/_2$) 64	($3^1/_8$) 79	($3^3/_4$) 95	($4^3/_8$) 111	(5) 127	($5^5/_8$) 143	($6^1/_4$) 159
Min. edge spacing	c_{min}	in. (mm)	5d; or see anchor setting information section of this report.							
Min. member thickness	h_{min}	in. (mm)	$h_{ef} + 1^1/_4$ (h_{ef} + 30)		$h_{ef} + 2d_0$[3]					
Critical edge spacing – splitting (for uncracked concrete)[2]	c_{ac}	-	$2h_{ef}$							
Critical anchor spacing – splitting	s_{ac}	-	$2 \cdot c_{ac}$							
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, 1 psi = 0.006897 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.
[1]Additional setting information is described in Figure 4, installation instructions.
[2]Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pullout or pryout governs, as set forth in CSA A23.3-14 D.5. The tabulated value of the 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]d_0 = hole diameter.

TABLE 9—BOND STRENGTH DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT[1]

DESIGN INFORMATION					Nominal Bar Size							
			Symbol	Units	No.3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No.10
Minimum embedment			$h_{ef,min}$	(in.) mm	($2^3/_8$) 60.3	($2^3/_4$) 69.9	($3^1/_8$) 79.4	($3^1/_2$) 88.9	($3^1/_2$) 88.9	(4) 101.6	($4^1/_2$) 114	(5) 127.0
Maximum embedment			$h_{ef,max}$	(in.) mm	($4^1/_2$) 114	(6) 152	($7^1/_2$) 191	(9) 229	($10^1/_2$) 267	(12) 305	($13^1/_2$) 343	(15) 381
Dry concrete	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(743) 5.1	(668) 4.6	(588) 4.1
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(331) 2.3	(345) 2.4	(345) 2.4	(345) 2.4	(345) 2.4	(349) 2.4	(349) 2.4
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(366) 2.5	(329) 2.3	Not applicable
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(163) 1.1	(170) 1.2	(170) 1.2	(170) 1.2	(170) 1.2	(172) 1.2	(172) 1.2
	Resistance modification factor		R_d	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water-saturated concrete	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(823) 5.7	(743) 5.1	(668) 4.6	(588) 4.1
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(331) 2.3	(345) 2.4	(345) 2.4	(345) 2.4	(345) 2.4	(349) 2.4	(349) 2.4
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(405) 2.8	(366) 2.5	(329) 2.3	Not applicable
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(163) 1.1	(170) 1.2	(170) 1.2	(170) 1.2	(170) 1.2	(172) 1.2	(172) 1.2
	Resistance modification factor		R_{ws}	-	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Water-filled hole (flooded)	**Temperature range A[2,3]:**	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(642) 4.4	(642) 4.4	(642) 4.4	(642) 4.4	(576) 4.0	Not applicable		
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(258) 1.8	(269) 1.9	(269) 1.9	(242) 1.7	(238) 1.7	(237) 1.6	(234) 1.6
	Temperature range B[2,3]:	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(psi) N/mm²	(316) 2.2	(316) 2.2	(316) 2.2	(316) 2.2	Not applicable			
		Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	(psi) N/mm²	Not applicable	(127) 0.9	(133) 0.9	(133) 0.9	(119) 0.8	(117) 0.8	(117) 0.8	(115) 0.8
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction factor for seismic tension			$\alpha_{N,seis}$	-	1.00							

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi.
[1]Bond strength values correspond to concrete compressive strength f'_c = 17.2 MPa (2,500 psi). For concrete compressive strength f'_c between 17.2 MPa (2,500 psi) and 55.2 MPa (8,000 psi), tabulated characteristic bond strength may be increased by a factor of $(f'_c / 17.2)^{0.13}$ $[(f'_c / 2{,}500)^{0.13}]$.
[2]Temperature range A: Maximum short-term temperature = 80°C (176°F), maximum long-term temperature = 50°C (122°F) Temperature range B: Maximum short-term temperature = 120°C (248°F), maximum long-term temperature = 72°C (161°F).
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
[3]Characteristic bond strengths are for sustained loads including dead and live loads. For load combinations consisting of short term loads only, such as wind and seismic, bond strengths may be increased by 42 percent for temperature range A and 122 percent for temperature range B.

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 with 12.7, 15.9, 19.1, 22.2, 25.4 and 31.8 mm ($^1/_2$-, $^5/_8$-, $^3/_4$, $^7/_8$-, 1-, and $1^1/_4$-inch) diameter threaded steel rods and No. 4 through No. 10 steel reinforcing bars in hammer-drilled holes must be limited to use 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. Anchors with 9.5 mm ($^3/_8$-inch) threaded steel rods and No. 3 steel reinforcing bars in hammer-drilled holes must be limited to use in 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 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, WIT-VM 250 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-plated carbon steel threaded rods or steel reinforcing bars is limited to dry, interior locations.

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

13. Steel anchoring materials in contact with preservative-treated wood and fire-retardant-treated wood must be of zinc-coated 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, conform with the approved contract documents and the MPII in accordance with CSA A23.3-14 D.10.2.4.

15. Anchors shall not be used for applications where the concrete temperature can rise from 40°F (5°C) or less to 80°F (27°C) or higher within a 12-hour period. Such applications may include but are not limited to anchorage of building facade systems and other applications subject to direct sun exposure.