ICC-ES Listing Report

ELC-3814

Reissued May 2025

This listing is subject to renewal May 2026.

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A Subsidiary of the International Code Council®

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: Hilti HIT-RE 500 V3 Adhesive Anchor System in Cracked and Uncracked Concrete.

Listee: HILTI, INC.

Compliance with the following standards:

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

Compliance with the following codes:

Hilti HIT-RE 500 V3 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 Hilti HIT-RE 500 V3 Adhesive is an injectable two-component epoxy adhesive. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold. Hilti HIT-RE 500 V3 is available in 11.1-ounce (330 mL), 16.9-ounce (500 mL), and 47.3-ounce (1400 mL) foil packs. The manifold attached to each foil pack is stamped with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to an unopened foil pack stored in a dry, dark environment and in accordance with Figure 2.

Hole Cleaning Equipment:

Standard hole cleaning equipment, comprised of steel wire brushes and air nozzles, is described in Figure 2 of this listing report

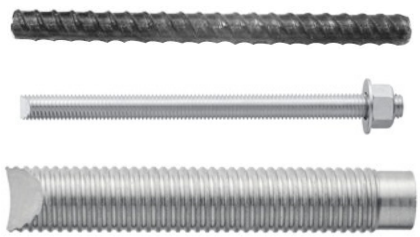
The Hilti Safe-Set™ with Hilti HIT-RE 500 V3 consists of one of the following:

- For the anchor elements, threaded steel rods, steel reinforcing bars for use as anchors and Hilti HIS-N and HIS-RS inserts, the Hilti TE-CD or TE-YD hollow carbide drill bit with a carbide drilling head conforming to ANSI B212.15 must be used. Used in conjunction with a Hilti vacuum with a minimum value for the maximum volumetric flow rate of 129 CFM (61 ℓ/s), the Hilti TE-CD or TE-YD drill bit will remove the drilling dust, automatically cleaning the hole.
- For the anchor elements, threaded steel rods, steel reinforcing bars for use as anchors and Hilti HIS-N and HIS-RS inserts, the Hilti Safe-Set™ with TE-YRT roughening tool with a carbide roughening head is used for hole preparation in conjunction with holes core drilled with a diamond core bit as illustrated in Figure 4.

Hilti HIT-RE 500 V3 must be dispensed with manual or electric dispensers provided by Hilti.

HILTI HIT-RE 500 V3 FOIL PACK AND MIXING NOZZLE

HILTI DISPENSER



ANCHORING ELEMENTS

HILTI TE-CD OR TE-YD HOLLOW CARBIDE DRILL BIT

HILTI TE-YRT ROUGHENING TOOL

FIGURE 1—HILTI HIT-RE 500 V3 ANCHORING SYSTEM

Identification:

1. The Hilti HIT-RE 500 V3 anchors are identified by packaging labeled with the manufacturer's name (Hilti, Inc.) and address, product name, lot number, expiration date, and listing number (ELC-3814), and the ICC-ES listing mark. Threaded rods, nuts, washers, cap screws, and deformed reinforcing bars are standard elements and must conform to applicable national or specifications as set forth in Tables 3-6 of this listing report or equivalent.
2. **The report holder's contact information is the following:**

HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.us.hilti.com
HiltiTechEng@us.hilti.com

Installation:

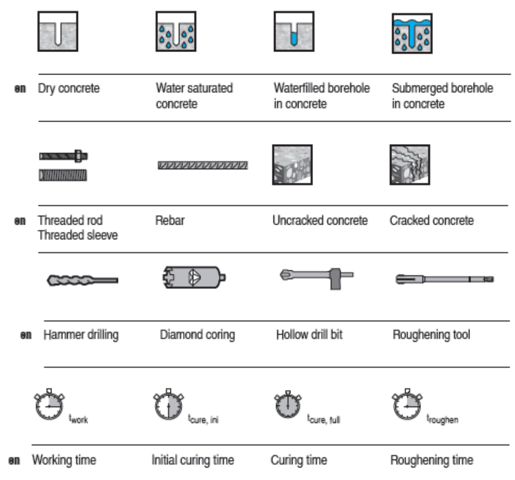
1. The installation parameters are illustrated in Figure 3. Installation must be in accordance with CSA A23.3-14 D.10 and D.10.2, as applicable. Anchor locations must comply with this listing report and the plans and specifications approved by the code official. Installation of the Hilti HIT-RE 500 V3 Adhesive Anchor Systems must conform to the manufacturer's printed installation instructions (MPII) included in each unit package as provided in Figure 2 of this report. The MPII contains additional requirements for combinations of drill hole depth, diameter, drill bit type, and dispensing tools.

   Hilti HIT-RE 500 V3 adhesive anchors may be used to resist tension and shear forces in floor, wall, and overhead installations only if installation is into concrete with a temperature between 23°F and 104°F (-5°C and 40°C) for threaded rods, rebar, and Hilti HIS-(R)N inserts. Overhead installations for hole diameters larger than $^7/_{16}$-inch or 10mm require the use of piston plugs (HIT-SZ, -IP) during injection to the back of the hole. $^7/_{16}$-inch or 10mm diameter holes may be injected directly to the back of the hole with the use of extension tubing on the end of the nozzle. The anchor must be supported until fully cured (i.e., with Hilti HIT-OHW wedges, or other suitable means). Where temporary restraint devices are used, their use shall not result in impairment of the anchor shear resistance. Installations in concrete temperatures below 41°F (5°C) require the adhesive to be conditioned to a minimum temperature of 41°F (5°C).

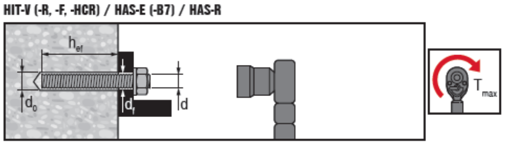
   Installation of anchors in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed by personnel certified by an applicable certification program in accordance with CSA A23.3-14 D.10.2.2 or D.10.2.3, as applicable.

			d_0	h_{ef}		
1			7/16"… 1 3/4" 10…40 mm	2 3/8"…10" 60…250 mm		16 17
2			7/16"… 1 3/4" 10…40 mm	2 3/8"…75" 60…1920 mm		18 19
3						20 21
4			7/16"… 1 3/4" 10…40 mm	2 3/8"…10" 60…250 mm		22 23
5			7/16"… 1 3/4" 10…40 mm	2 3/8"…75" 60…1920 mm		24 25
6			7/16"… 1 3/4" 10…40 mm	2 3/8"…25" 60…640 mm		26 27
7			9/16"…1 1/8" 14…32 mm	2 3/8"…10" 60…250 mm		28 29

			d_0	h_{ef}		
8			9/16"…1 1/8" 14…32 mm	2 3/8"…39 3/8" 60…1000 mm		30 31
9						32 33
10			3/4"… 1 3/8" 18…35 mm	3 1/8"… 10" 80…250 mm		34 35
11			3/4"… 1 3/8" 18…35 mm	3 1/8"… 25" 80…635 mm		36 37
12						38 39
13			7/16"… 1 3/4" 10…40 mm	2 3/8"…10" 60…250 mm		22 23
14			7/16"… 1 3/4" 10…40 mm	2 3/8"…25" 60…640 mm		24 25
15						40 41



HIT-V (-R, -F, -HCR) / HAS-E (-B7) / HAS-R



HAS / HIT-V

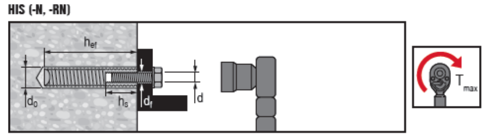
Ø d [inch]	Ø d_0 [inch]	h_{ef} [inch]	Ø d_f [inch]	T_{max} [ft-lb]	T_{max} [Nm]
3/8	7/16	2 3/8 … 7 1/2	7/16	15	20
1/2	9/16	2 3/4 … 10	9/16	30	41
5/8	3/4	3 1/8 … 12 1/2	11/16	60	81
3/4	7/8	3 1/2 … 15	13/16	100	136
7/8	1	3 1/2 … 17 1/2	15/16	125	169
1	1 1/8	4 … 20	1 1/8	150	203
1 1/4	1 3/8	5 … 25	1 3/8	200	271

HIT-V

Ø d [mm]	Ø d_0 [mm]	h_{ef} [mm]	Ø d_f [mm]	T_{max} [Nm]
M8	10	60...160	9	10
M10	12	60...200	12	20
M12	14	70...240	14	40
M16	18	80...320	18	80
M20	22	90...400	22	150
M24	28	100...480	26	200
M27	30	110...540	30	270
M30	35	120...600	33	300

1 inch = 25,4 mm

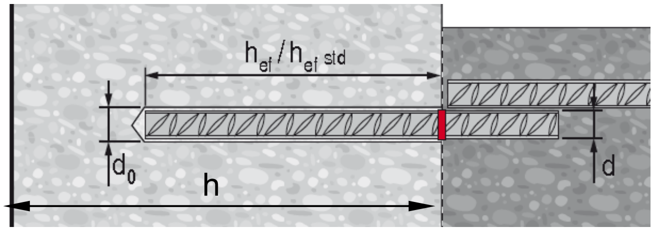
HIS (-N, -RN)



Ø d [inch]	Ø d_0 [inch]	h_{ef} [inch]	Ø d_f [inch]	h_s [inch]	T_{max} [ft-lb]	T_{max} [Nm]
3/8	11/16	4 3/8	7/16	3/8…15/16	15	20
1/2	7/8	5	9/16	1/2…1 3/16	30	41
5/8	1 1/8	6 3/4	11/16	5/8…1 1/2	60	81
3/4	1 1/4	8 1/8	13/16	3/4…1 7/8	100	136

Ø d [mm]	Ø d_0 [mm]	h_{ef} [mm]	Ø d_f [mm]	h_s [mm]	T_{max} [Nm]
M8	14	90	9	8…20	10
M10	18	110	12	10…25	20
M12	22	125	14	12…30	40
M16	28	170	18	16…40	80
M20	32	205	22	20…50	150

FIGURE 2—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)



US REBAR

d	Ø d_0 [inch]	h_{ef} std [inch]	h_{ef} [inch]
#3	½	3⅜	2⅜…7½
#4	⅝	4½	2¾…10
#5	¾	5⅝	3⅛…12½
#6	⅞	6¾	3½…15
#7	1	7⅞	3½…17½
#8	1⅛	9	4…20
#9	1⅜	10⅛	4½…22½
#10	1½	11¼	5…25

EUROPEAN REBAR

Ø d [mm]	Ø d_0 [mm]	h_{ef} std [mm]	h_{ef} [mm]
10	14	90	60…200
12	16	110	70…240
14	18	125	75…280
16	20	125	80…320
20	25	170	90…400
25	32	210	100…500
28	35	270	112…560
32	40	300	128…640

CANADIAN REBAR

d	Ø d_0 [inch]	h_{ef} std [mm]	h_{ef} [mm]
10 M	9/16	115	70…226
15 M	¾	145	80…320
20 M	1	200	90…390
25 M	1¼	230	101…504
30 M	1½	260	120…598

Ø d_0 [inch]	HAS d [inch]	HIS-N d [inch]	Rebar d [inch]	HIT-RB [inch]	HIT-SZ [inch]	HIT-DL [inch]	TE-YRT [inch]
7/16	3/8	–	–	7/16	–	–	
1/2	–	–	#3	1/2	1/2	1/2	
9/16	1/2	–	10M	9/16	9/16	9/16	
5/8	–	–	#4	5/8	5/8	9/16	
11/16	–	3/8	–	11/16	11/16	11/16	
3/4	5/8	–	15M #5	3/4	3/4	3/4	3/4
7/8	3/4	1/2	#6	7/8	7/8	7/8	7/8
1	7/8	–	20M #6 #7	1	1	1	1
1 1/8	1	5/8	#7 #8	1 1/8	1 1/8	1	1 1/8
1 1/4	–	3/4	25M #8	1 1/4	1 1/4	1	
1 3/8	1 1/4	–	#9	1 3/8	1 3/8	1 3/8	1 3/8
1 1/2	–	–	30M #10	1 1/2	1 1/2	1 3/8	
1 3/4	–	–	#11	1 3/4	1 3/4	1 3/8	

HIT-DL: h_{ef} > 10" HIT-RB: h_{ef} > 20 x d

Ø d_0 [mm]	HIT-V d [mm]	HIS-N d [mm]	Rebar d [mm]	HIT-RB [mm]	HIT-SZ [mm]	HIT-DL	TE-YRT [mm]
10	8	–	–	10	–	–	
12	10	–	8	12	12	12	
14	12	8	10	14	14	14	
16	–	–	12	16	16	16	
18	16	10	14	18	18	18	18
20	–	–	16	20	20	20	20
22	20	12	18	22	22	20	22
25	–	–	20	25	25	25	25
28	24	16	22	28	28	25	28
30	27	–	–	30	30	25	30
32	–	20	24/25	32	32	32	32
35	30	–	26/28	35	35	32	35
37	–	–	30	37	37	32	
40	–	–	32	40	40	32	

HIT-DL: h_{ef} > 250 mm HIT-RB: h_{ef} > 20 x d

	HIT-RE-M Art. No.		HIT-OHW Art. No.
Hilti VC	337111	HDM 330 HDM 500 HDE 500-A18	387550

	HIT-RE-M Art. No.		HIT-OHW Art. No.
Hilti VC	337111	HDM 330 / 500 HDE 500-A18	387550

Ø d_0 [inch]	h_{ef} [inch]	Art. No. 381215	
7/16"…1 1/8"	2 3/8"… 52 1/2"	✔	≥ 6 bar/90 psi @ 6 m³/h
1 1/4"…1 1/2"	4"… 75"	–	≥ 140 m³/h / ≥ 82 CFM

Ø d_0 [mm]	h_{ef} [mm]	Art. No. 381215	
10…32	60…1500	✔	≥ 6 bar/90 psi
35…40	100…1920	–	≥ 140 m³/h

[°F]	[°C]	t_{work}	$t_{cure, ini}$	$t_{cure, full}$
23	-5	2 h	48 h	168 h
32	0	2 h	24 h	36 h
40	4	2 h	16 h	24 h
50	10	1.5 h	12 h	16 h
60	16	1 h	8 h	16 h
72	22	25 min	4 h	6.5 h
85	29	15 min	2.5 h	5 h
95	35	12 min	2 h	4.5 h
105	41	10 min	2 h	4 h

≥ +5 °C / 41 °F = 2x t_{cure}

h_{ef} [inch]	h_{ef} [mm]	$t_{roughen}$
0 … 4	0 … 100	10 sec
4.01 …8	101 … 200	20 sec
8.01 …12	201 … 300	30 sec
12.01 … 16	301 … 400	40 sec
16.01 … 20	401 … 500	50 sec

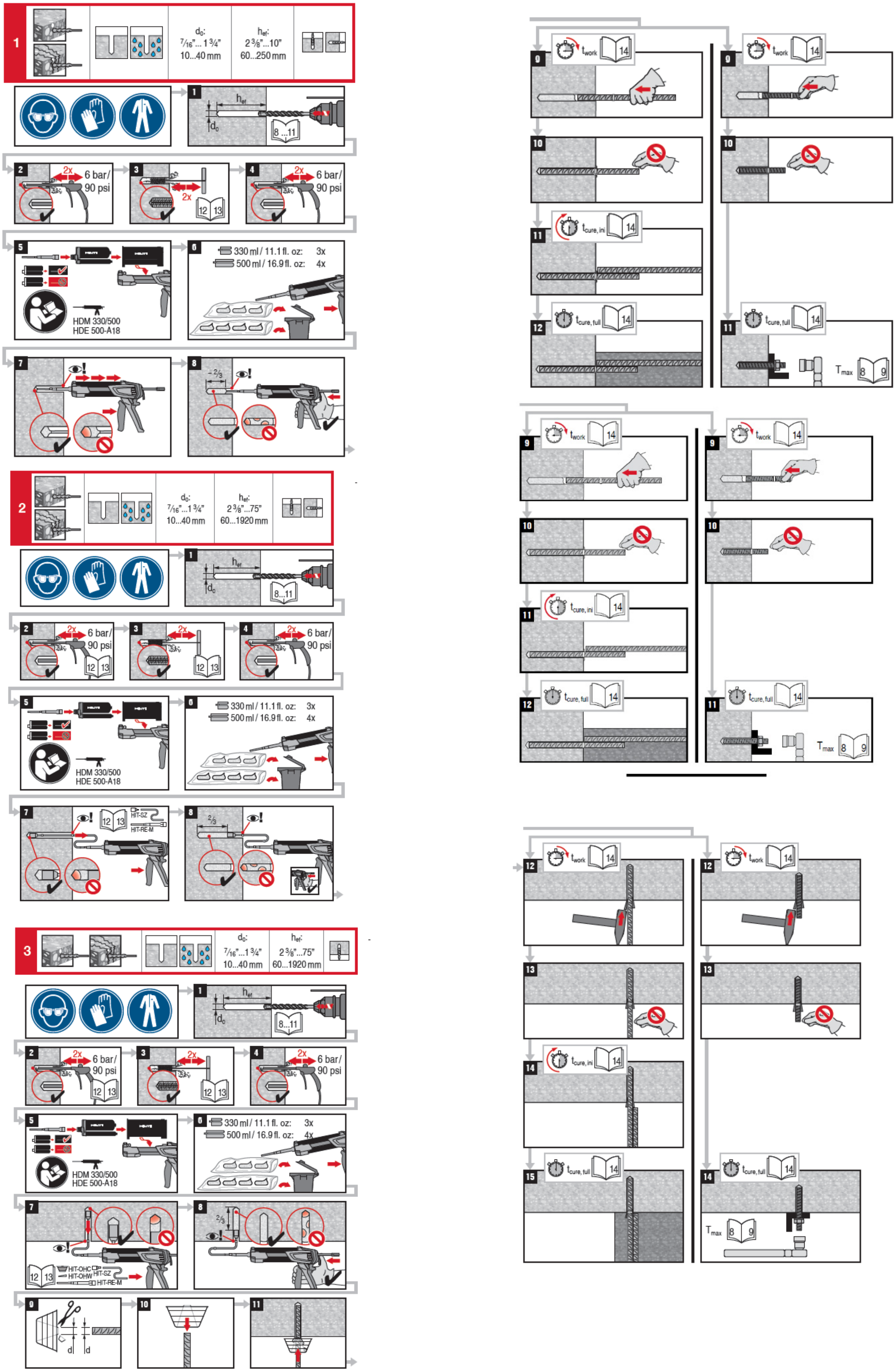
$t_{roughen}$ = h_{ef} [inch] * 2.5 $t_{roughen}$ = h_{ef} [mm] / 10

Rebar - h_{ef} ≥ 20d

		h_{ef}		
HDM, HDE, HIT-P 8000D	≤ US #5	12 ½ … 37 ½ [inch]	23 °F … 104 °F -5 °C … 40 °C	41 °F … 104 °F 5 °C … 40 °C
	≤ EU 16mm	320 … 960 [mm]		
	≤ CAN 15M	320 … 960 [mm]		
HDE, HIT-P 8000D	≤ US #7	17 ½ …52 ½ [inch]	23 °F … 104 °F -5 °C … 40 °C	41 °F … 104 °F 5 °C … 40 °C
	≤ EU 20mm	400 … 1200 [mm]		
	≤ CAN 20M	390 … 1170 [mm]		
HIT-P 8000D	≤ US #10	25 … 75 [inch]	23 °F … 104 °F -5 °C … 40 °C	41 °F … 104 °F 5 °C … 40 °C
	≤ EU 32mm	640 … 1920 [mm]		
	≤ CAN 30M	598 … 1794 [mm]		

		h_{ef}		
HDM, HDE, HIT-P 8000D	≤ US #5	12 ½ … 37 ½ [inch]	23 °F … 104 °F -5 °C … 40 °C	41 °F … 104 °F 5 °C … 40 °C
	≤ EU 16mm	320 … 960 [mm]		
	≤ CAN 15M	320 … 960 [mm]		
HDE, HIT-P 8000D	≤ US #7	17 ½ … 39 3/8 [inch]	23 °F … 104 °F -5 °C … 40 °C	41 °F … 104 °F 5 °C … 40 °C
	≤ EU 20mm	400 … 1000 [mm]		
	≤ CAN 20M	390 … 1000 [mm]		

FIGURE 2—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)



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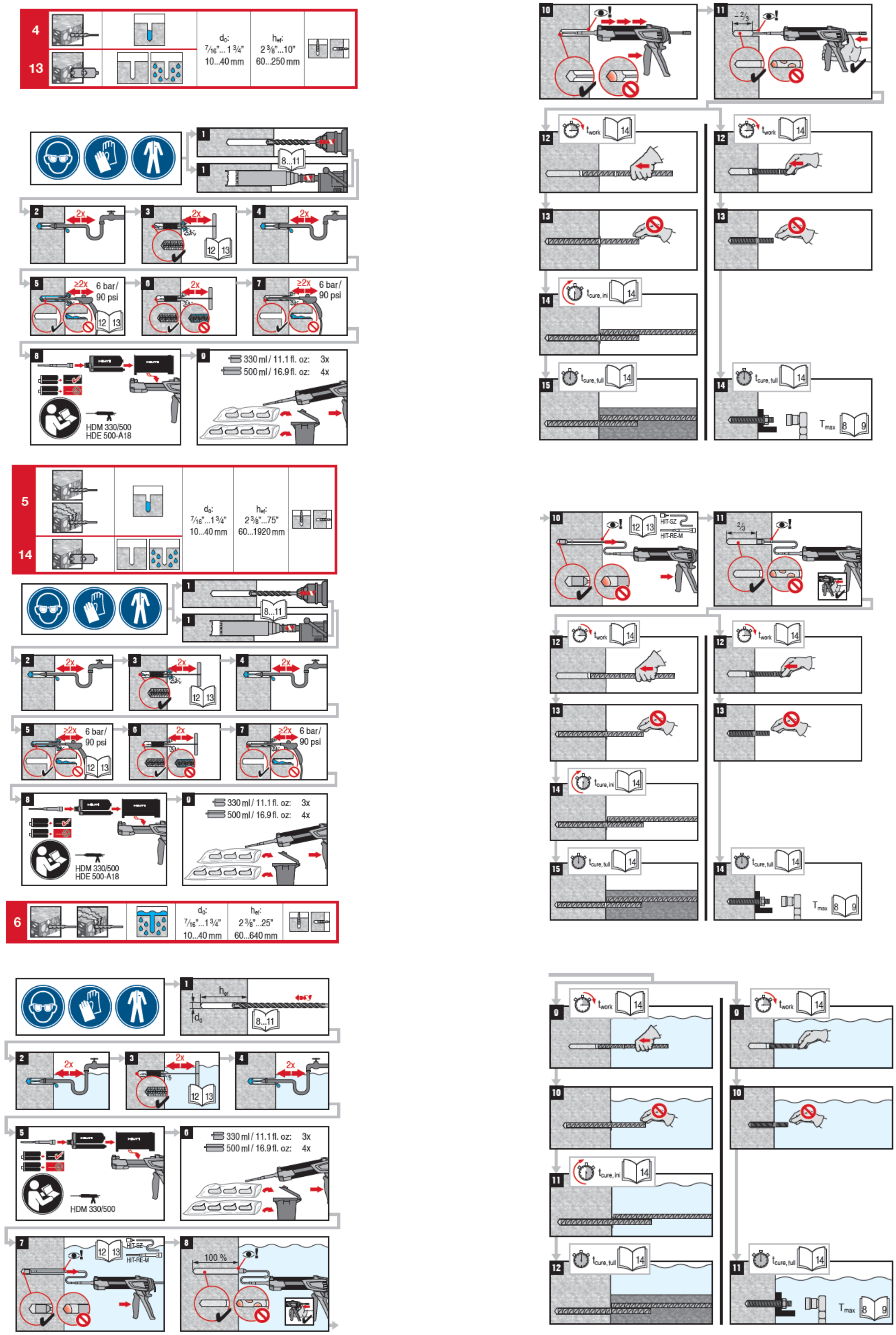

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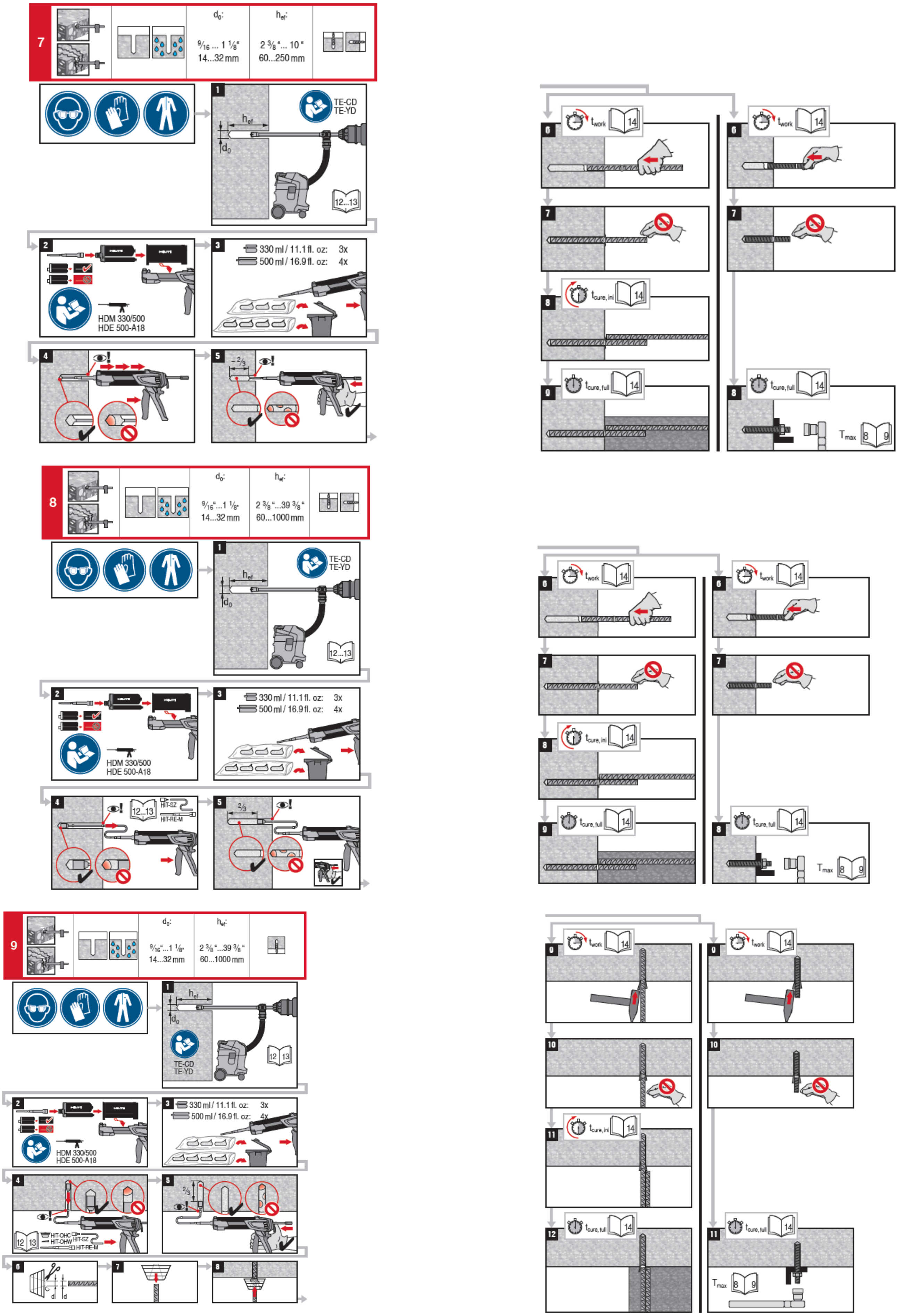

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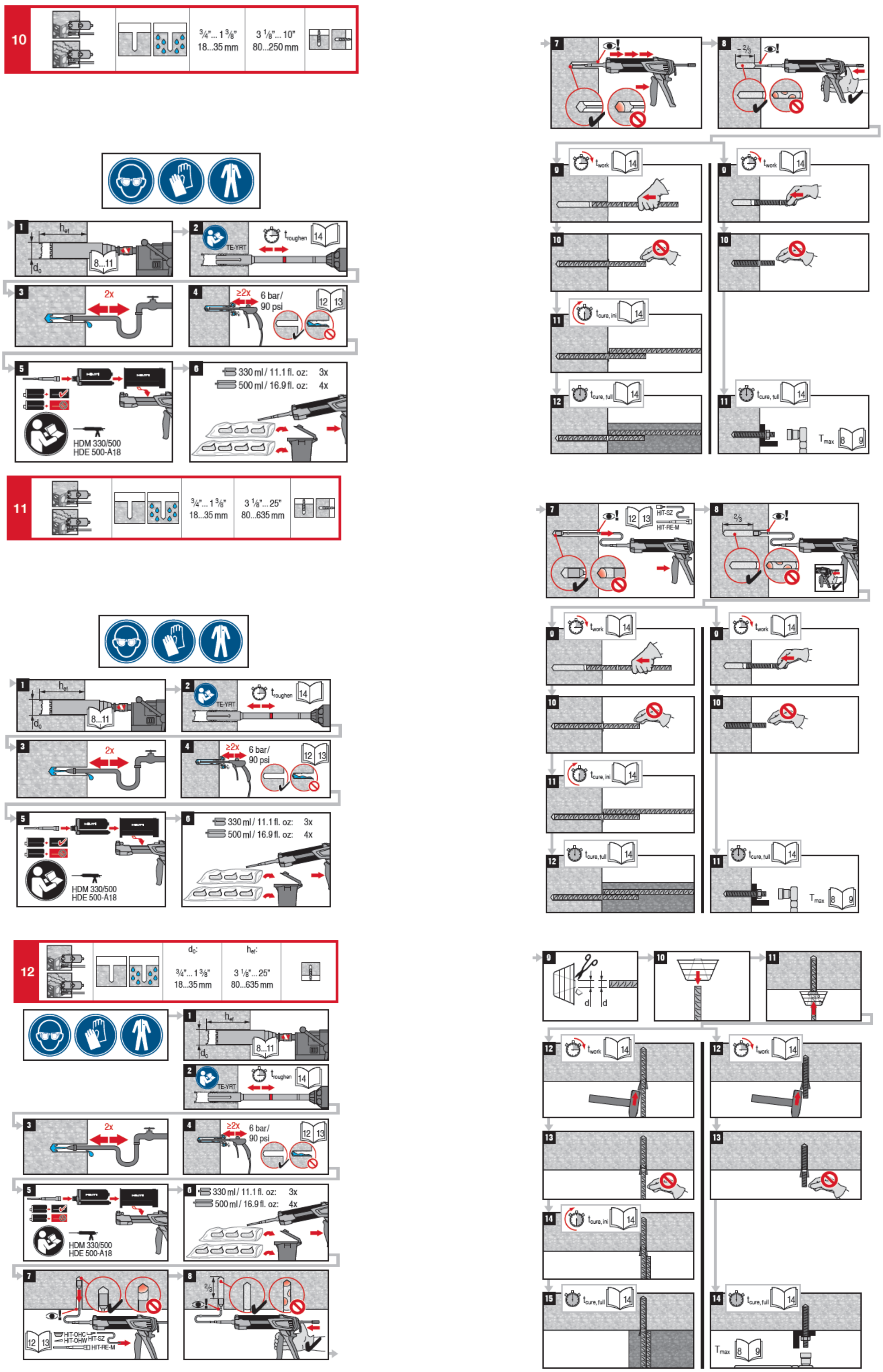

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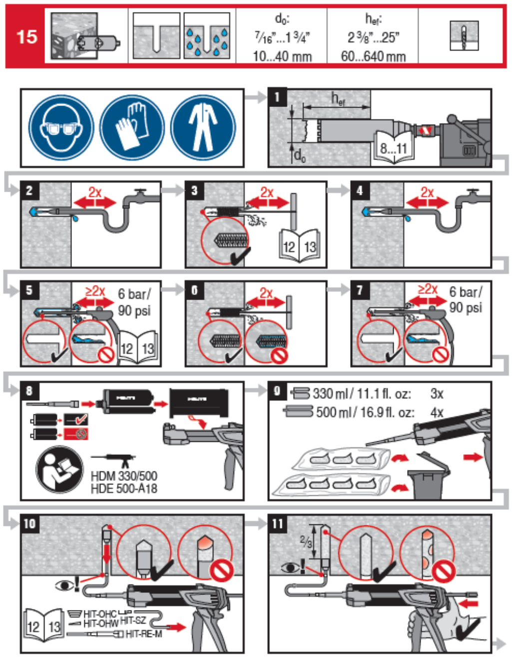

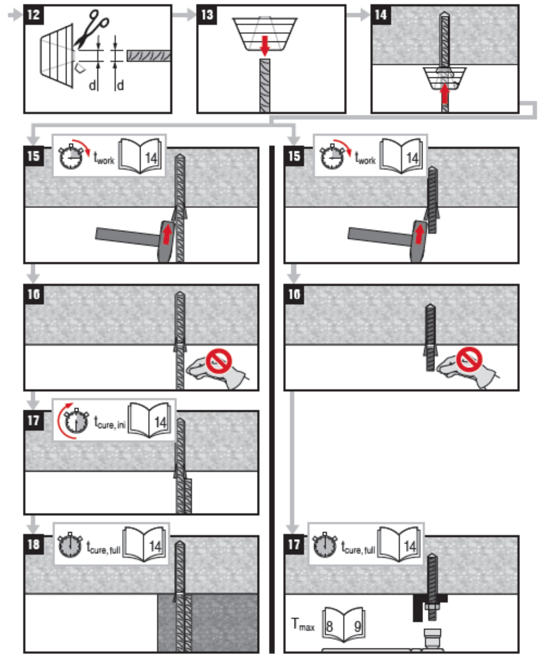

Adhesive anchoring system for rebar and anchor fastenings in concrete

► Prior to use of product, follow the instructions for use and the legally obligated safety precautions.
► See the Safety Data Sheet for this product.

Hilti HIT-RE 500 V3

Contains epoxy constituents. May produce an allergic reaction.(A)
Contains: reaction product: bisphenol-A/F-(epichlorhydrin) epoxy resin MW ≤ 700 (A), butanedioldiglycidyl ether (A), m-Xylenediamine (B), 2-methyl-1,5-pentanediamine (B)

Danger

H314	Causes severe skin burns and eye damage.(A,B)
H317	May cause an allergic skin reaction.(A,B)
H335	May cause respiratory irritation (B)
H411	Toxic to aquatic life with long lasting effects.(A)
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P260	Do not breathe vapours.
P303+P361+P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.

Recommended protective equipment:
Eye protection: Tightly sealed safety glasses e.g.: #02065449 Safety glasses PP EY-CA NCH clear; #02065591 Goggles PP EY-HA R HC/AF clear;
Protective gloves: EN 374 ; Material of gloves: Nitrile rubber, NBR
Avoid direct contact with the chemical/ the product/ the preparation by organizational measures.
Final selection of appropriate protective equipment is in the responsibility of the user

Disposal considerations

Empty packs:
► Leave the Mixer attached and dispose of via the local Green Dot collecting system
– or EAK waste material code 15 01 02 plastic packaging.

Full or partially emptied packs:
► dispose of as special waste in accordance with official regulations.
– EAK waste material code: 20 01 27* paint, inks, adhesives and resins containing dangerous substances.
– or waste material code: EAK 08 04 09* waste adhesives and sealants containing organic solvents or other dangerous substances.

Content:	330 ml / 11.1 fl.oz	500 ml / 16.9 fl.oz
Weight:	465 g / 16.4 oz	705 g / 24.9 oz

Warranty: Refer to standard Hilti terms and conditions of sale for warranty information.

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Failure to observe these installation instructions, use of non-Hilti anchors, poor or questionable concrete conditions, or unique applications may affect the reliability or performance of the fastenings.

Product Information

– Always keep this instruction for use together with the product.
– Ensure that the instruction for use is with the product when it is given to other persons.
– **Safety Data Sheet:** Review the DS before use.
– **Check expiration date:** See expiration date imprint on foilpack manifold (month/year). Do not use expired product.
– **Foil pack temperature during usage:** +5 °C to 40 °C / 41 °F to 104 °F.
– **Conditions for transport and storage:** Keep in a cool, dry and dark place between +5 °C to 25 °C / 41 °F to 77 °F.
– For any application not covered by this document / beyond values specified, please contact Hilti.
– **Partly used foil packs must be used up within 4 weeks.** Leave the mixer attached on the foil pack manifold and store under the recommended storage conditions. If reused, attach a new mixer and discard the initial quantity of anchor adhesive.

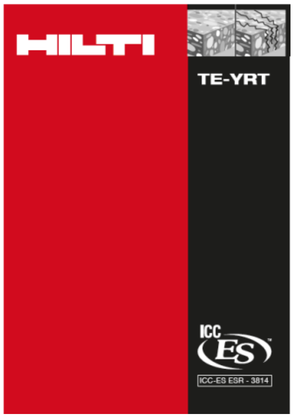
⚠ WARNING

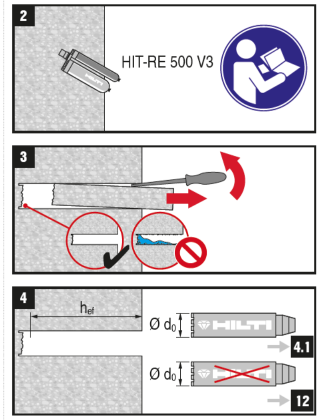
⚠ Improper handling may cause mortar splashes. Eye contact with mortar may cause irreversible eye damage!
– Always wear tightly sealed safety glasses, gloves and protective clothes before handling the mortar!
– Never start dispensing without a mixer properly screwed on.
– When using an extension hose: Discard of initial mortar flow must be done through supplied mixer only (not through the extension hose).
– Attach a new mixer prior to dispensing a new foil pack (snug fit).
– Caution! Never remove the mixer while the foil pack system is under pressure. Press the release button of the dispenser to avoid mortar splashing.
– Use only the type of mixer supplied with the adhesive. Do not modify the mixer in any way.
– Never use damaged foil packs and/or damaged or unclean foil pack holders.

⚠ Poor load values / potential failure of fastening points due to inadequate borehole cleaning. The boreholes must be dry and free of debris, dust, water, ice, oil, grease and other contaminants prior to adhesive injection.
– For blowing out the borehole - blow out with oil free air until return air stream is free of noticeable dust.
– For flushing the borehole - flush with water line pressure until water runs clear.
– Important! Remove all water from the borehole and blow out with oil free compressed air until borehole is completely dried before mortar injection (not applicable to hammer drilled hole in underwater application).

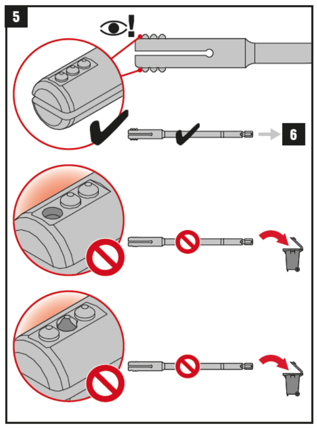
⚠ Ensure that boreholes are filled from the back of the boreholes without forming air voids.
– If necessary, use the accessories / extensions to reach the back of the borehole.
– For overhead applications use the overhead accessories HIT-SZ / IP and take special care when inserting the fastening element. Excess adhesive may be forced out of the borehole. Make sure that no mortar drips onto the installer.
– If a new mixer is installed onto a previously-opened foil pack, the first trigger pulls must be discarded.
– A new mixer must be used for each new foil pack.

FIGURE 2—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)

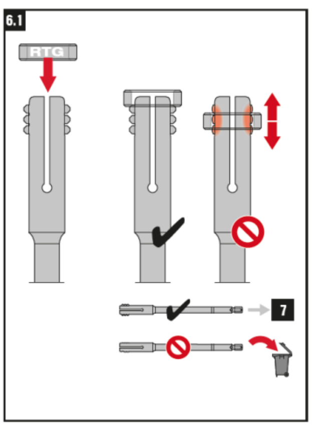


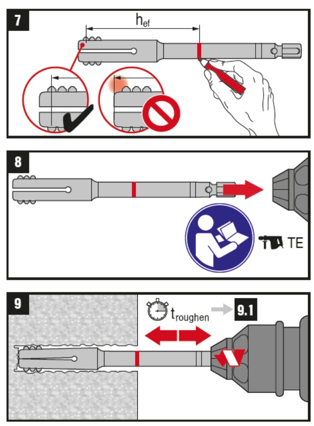


4.1 Ø d_0 [mm]	TE-YRT
18	TE-YRT 18/320
20	TE-YRT 20/320
22	TE-YRT 22/400
25	TE-YRT 25/400
28	TE-YRT 28/480
30	TE-YRT 30/540
32	TE-YRT 32/500
35	TE-YRT 35/600
Ø d_0 [inch]	**TE-YRT**
3/4“	TE-YRT 3/4" / 12 1/2"
7/8“	TE-YRT 7/8" / 15"
1“	TE-YRT 1" / 17 1/2"
1 1/8“	TE-YRT 1 1/8" / 20"
1 3/8“	TE-YRT 1 3/8" / 25"

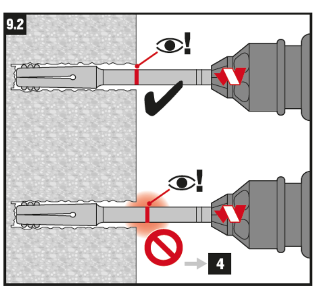


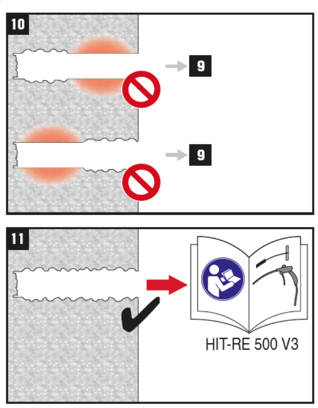
6 TE-YRT	RTG
TE-YRT 18/320	RTG 18
TE-YRT 20/320	RTG 20
TE-YRT 22/400	RTG 22
TE-YRT 25/400	RTG 25
TE-YRT 28/480	RTG 28
TE-YRT 30/540	RTG 30
TE-YRT 32/500	RTG 32
TE-YRT 35/600	RTG 35
TE-YRT	**RTG**
TE-YRT 3/4" / 12 1/2"	RTG 3/4"
TE-YRT 7/8" / 15"	RTG 7/8"
TE-YRT 1" / 17 1/2"	RTG 1"
TE-YRT 1 1/8" / 20"	RTG 1 1/8"
TE-YRT 1 3/8" / 25"	RTG 1 3/8"





9.1 h_{ef} [mm]	$t_{roughen}$ (= h_{ef} / 10)
0 … 100	10 sec
101 … 200	20 sec
201 … 300	30 sec
301 … 400	40 sec
401 … 500	50 sec
501 … 600	60 sec
h_{ef} [inch]	**$t_{roughen}$ (= $h_{ef} \cdot 2.5$)**
0 … 4	10 sec
4.01 … 8	20 sec
8.01 … 12	30 sec
12.01 … 16	40 sec
16.01 … 20	50 sec
20.01 … 25	60 sec



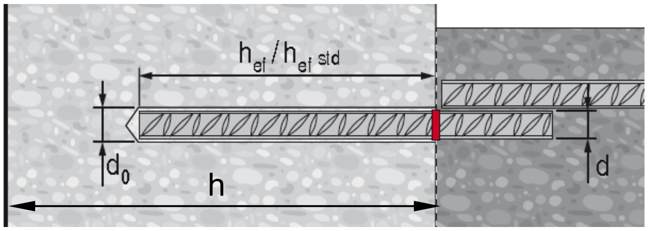


12 Ø d_0 [mm]	TE-YRT
17,9 … 18,2	TE-YRT 18/320
19,9 … 20,2	TE-YRT 20/320
21,9 … 22,2	TE-YRT 22/400
24,9 … 25,2	TE-YRT 25/400
27,9 … 28,2	TE-YRT 28/480
29,9 … 30,2	TE-YRT 30/540
31,9 … 32,2	TE-YRT 32/500
34,9 … 35,2	TE-YRT 35/600
Ø d_0 [inch]	**TE-YRT**
0.764 … 0.776	TE-YRT 3/4" / 12 1/2"
0.862 … 0.874	TE-YRT 7/8" / 15"
1.008 … 1.020	TE-YRT 1" / 17 1/2"
1.146 … 1.157	TE-YRT 1 1/8" / 20"
1.374 … 1.386	TE-YRT 1 3/8" / 25"

FIGURE 2—MANUFACTURER’S PRINTED INSTALLATION INSTRUCTIONS (MPII)

Anchor setting information:

DEFORMED REINFORCMENT



US REBAR

d	Ø d_0 [inch]	$h_{ef\,std}$ [inch]	h_{ef} [inch]
#3	½	3⅜	2⅜…7½
#4	⅝	4½	2¾…10
#5	¾	5⅝	3⅛…12½
#6	⅞	6¾	3½…15
#7	1	7⅞	3½…17½
#8	1⅛	9	4…20
#9	1⅜	10⅛	4½…22½
#10	1½	11¼	5…25

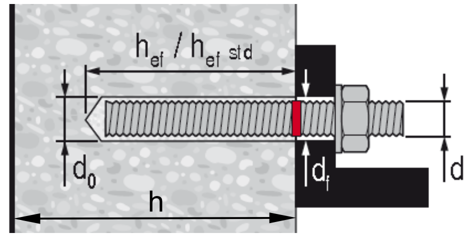
CANADIAN REBAR

d	Ø d_0 [inch]	$h_{ef\,std}$ [mm]	h_{ef} [mm]
10 M	9/16	115	70…226
15 M	¾	145	80…320
20 M	1	200	90…390
25 M	1¼	230	101…504
30 M	1½	260	120…598

EUROPEAN REBAR

Ø d [mm]	Ø d_0 [mm]	$h_{ef\,std}$ [mm]	h_{ef} [mm]
10	14	90	60…200
12	16	110	70…240
14	18	125	75…280
16	20	125	80…320
20	25	170	90…400
25	32	210	100…500
28	35	270	112…560
32	40	300	128…640

THREADED ROD



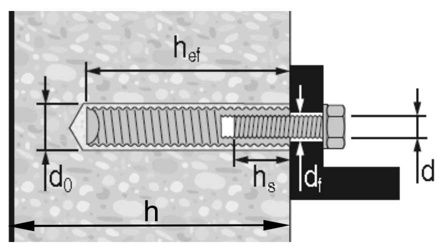
FRACTIONAL THREADED ROD

Ø d [inch]	Ø d_0 [inch]	$h_{ef\,std}$ [inch]	h_{ef} [inch]	T_{max} [ft-lb]	T_{max} [Nm]
⅜	7/16	3⅜	2⅜…7½	15	20
½	9/16	4½	2¾…10	30	41
⅝	¾	5⅝	3⅛…12½	60	81
¾	⅞	6¾	3½…15	100	136
⅞	1	7⅞	3½…17½	125	169
1	1⅛	9	4…20	150	203
1¼	1⅜	11¼	5…25	200	271

METRIC THREADED ROD

Ø d [mm]	Ø d_0 [mm]	$h_{ef\,std}$ [mm]	h_{ef} [mm]	T_{max} [Nm]
M10	12	90	60…200	20
M12	14	110	70…240	40
M16	18	125	80…320	80
M20	22	170	90…400	150
M24	28	210	96…480	200
M27	30	240	108…540	270
M30	35	270	120…600	300

HILTI HIS-N AND HIS-RN THREADED INSERTS



FRACTIONAL HILTI HIS-N AND HIS-RN THREADED INSERTS

Ø d [inch]	Ø d_0 [inch]	h_{ef} [inch]	Ø d_f [inch]	h_s [inch]	T_{max} [ft-lb]	T_{max} [Nm]
⅜	11/16	4⅜	7/16	⅜…15/16	15	20
½	⅞	5	9/16	½…1 3/16	30	41
⅝	1⅛	6¾	11/16	⅝…1½	60	81
¾	1¼	8⅛	13/16	¾…1⅞	100	136

METRIC HILTI HIS-N AND HIS-RN THREADED INSERTS

Ø d [mm]	Ø d_0 [mm]	h_{ef} [mm]	Ø d_f [mm]	h_s [mm]	T_{max} [Nm]
M8	14	90	9	8…20	10
M10	18	110	12	10…25	20
M12	22	125	14	12…30	40
M16	28	170	18	16…40	80
M20	32	205	22	20…50	150

FIGURE 3—INSTALLATION PARAMETERS FOR POST-INSTALLED ADHESIVE ANCHORS

TABLE 1—INSTALLATION TORQUE SUBJECT TO EDGE DISTANCE

For anchors that will be torqued during installation, the maximum torque, T_{max}, must be reduced for edge distances less than the values given in Tables 8, 16, and 28 as applicable. For edge distances c_{ai} and anchor spacing s_{ai}, the maximum torque T_{max} shall comply with the following requirements:

REDUCED MAXIMUM INSTALLATION TORQUE $T_{max,red}$ FOR EDGE DISTANCES c_{ai} < (5 x d_a)		
EDGE DISTANCE, c_{ai}	**MINIMUM ANCHOR SPACING, s_{ai}**	**MAXIMUM TORQUE, $T_{max,red}$**
1.75 in. (45 mm) ≤ c_{ai} < 5 x d_a	5 x d_a ≤ s_{ai} < 16 in.	0.3 x T_{max}
	s_{ai} ≥ 16 in. (406 mm)	0.5 x T_{max}

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 2 and design parameters are provided in Tables 3 through 31 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 7 through 31 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 7A, 7B, 9, 15, 23, and 27 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 8, 16, 24, and 28 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 9 through 14, 17 through 22, 25 through 26B, and 29 through 31.

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 7, 15, 23, and 27 for the corresponding anchor steel. The nominal bond strength $\tau_{k,cr}$ must be adjusted by $\alpha_{N,seis}$ as given in Tables 9, 10, 12, 13, 17, 18, 20, 21, 25, 26A, 29, and 30.

TABLE 2—DESIGN TABLE INDEX

Design Table		**Fractional**		**Metric**	
		Table	**Page**	**Table**	**Page**
Standard Threaded Rod	Steel Strength - N_{sa}, V_{sa}	7A	16	15	23
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	8	18	16	24
	Bond Strength - N_a, N_{ag}	12-14	21-22	20-22	28-29
Hilti HIS-N and HIS-RN Internally Threaded Insert	Steel Strength - N_{sa}, V_{sa}	27	33	27	33
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	28	34	28	34
	Bond Strength - N_a, N_{ag}	29-31	35-36	29-31	35-36

Design Table		**Fractional**		**EU Metric**		**Canadian**	
		Table	**Page**	**Table**	**Page**	**Table**	**Page**
Steel Reinforcing Bars	Steel Strength - N_{sa}, V_{sa}	7B	17	15	23	23	30
	Concrete Breakout - N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	8	18	16	24	24	30
	Bond Strength - N_a, N_{ag}	9-11	19-20	17-19	25-27	25-26B	31-32

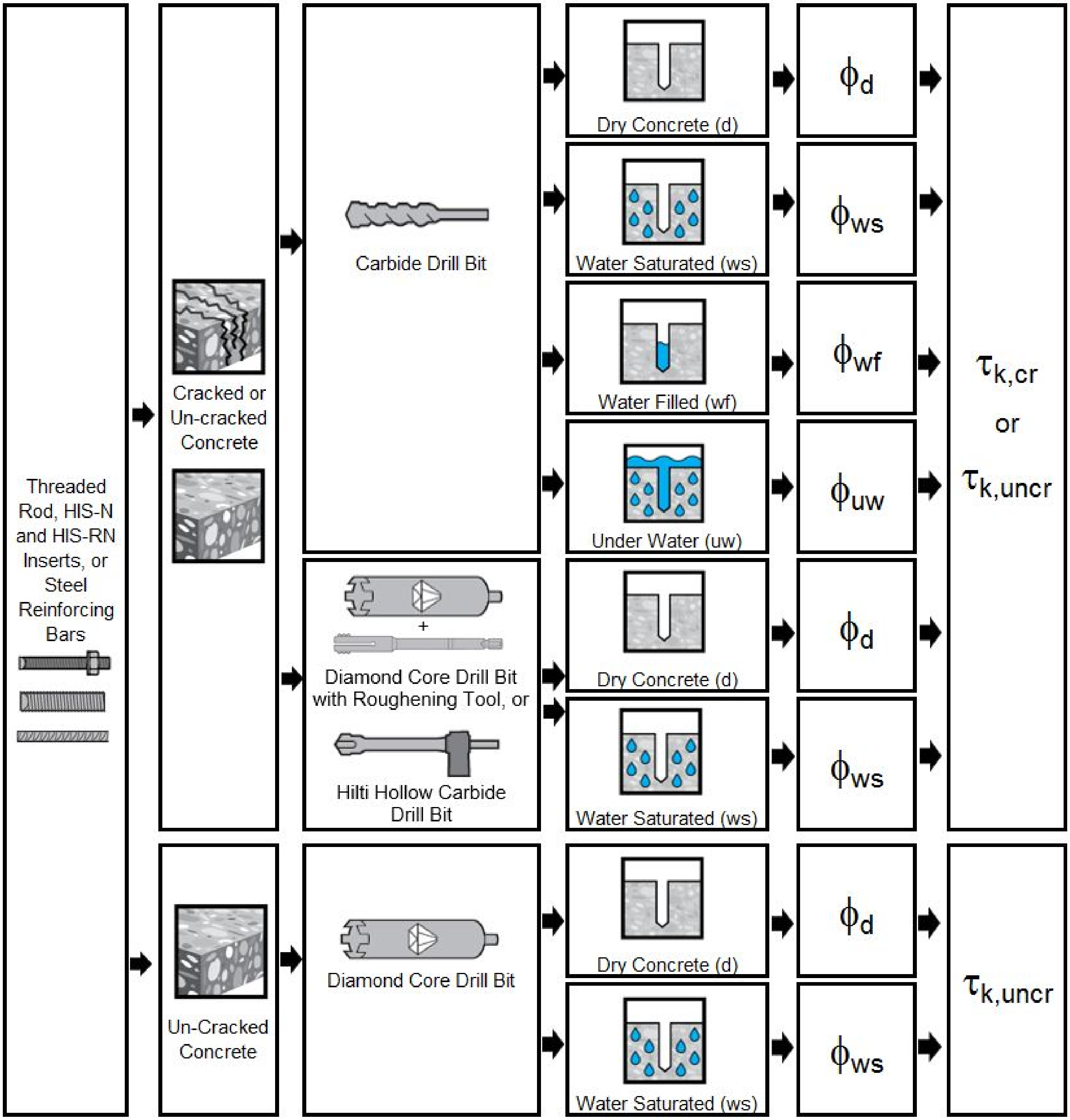


FIGURE 4—FLOWCHART FOR THE ESTABLISHMENT OF DESIGN BOND STRENGTH

TABLE 3—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON CARBON AND STAINLESS STEEL THREADED ROD MATERIALS[1]

THREADED ROD SPECIFICATION 			Minimum specified ultimate strength, f_{uta}	Minimum specified yield strength 0.2 percent offset, f_{ya}	f_{uta}/f_{ya}	Elongation, min. percent[7]	Reduction of Area, min. percent	Specification for nuts[8]
CARBON STEEL	ASTM A193[2] Grade B7 ≤ 2 1/2 in. (≤ 64 mm)	MPa	862	724	1.19	16	50	ASTM A563 Grade DH
	ASTM F568M[3] Class 5.8 M5 (1/4 in.) to M24 (1 in.) (equivalent to ISO 898-1)	MPa	500	400	1.25	10	35	ASTM A563 Grade DH[9] DIN 934 (8-A2K)
	ASTM F1554, Grade 36[7]	MPa	400	248	1.61	23	40	ASTM A194 or ASTM A563
	ASTM F1554, Grade 55[7]	MPa	517	379	1.36	21	30	ASTM A194 or ASTM A563
	ASTM F1554, Grade 105[7]	MPa	862	724	1.19	15	45	ASTM A194 or ASTM A563
	ISO 898-1[4] Class 5.8	MPa	500	400	1.25	22	-	DIN 934 Grade 6
	ISO 898-1[4] Class 8.8	MPa	800	640	1.25	12	52	DIN 934 Grade 8
STAINLESS STEEL	ASTM F593[5] CW1 (316) 1/4-in. to 5/8-in.	MPa	689	448	1.54	20	-	ASTM F594
	ASTM F593[5] CW2 (316) 3/4-in. to 1 1/2-in.	MPa	586	310	1.89	25	-	ASTM F594
	ASTM A193 Grade 8(M), Class 1[2] - 1 ¼-in.	MPa	517	207	2.50	30	50	ASTM F594
	ISO 3506-1[6] A4-70 M8 – M24	MPa	700	450	1.56	40	-	ISO 4032
	ISO 3506-1[6] A4-50 M27 – M30	MPa	500	210	2.38	40	-	ISO 4032

[1] Hilti HIT-RE 500 V3 adhesive may be used in conjunction with all grades of continuously threaded carbon or stainless steel rod (all-thread) that comply with the code reference standards and that have thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series. Values for threaded rod types and associated nuts supplied by Hilti are provided here.
[2] *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*
[3] *Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners*
[4] *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs*
[5] *Standard Steel Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs*
[6] *Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs*
[7] Based on 2-in. (50 mm) gauge length except for A193, which are based on a gauge length of 4d and ISO 898, which is based on 5d.
[8] Nuts of other grades and styles having specified proof load stresses 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.
[9] Nuts for fractional rods.

TABLE 4—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON STEEL REINFORCING BARS

REINFORCING BAR SPECIFICATION 		Minimum specified ultimate strength, f_{uta}	Minimum specified yield strength, f_{ya}
ASTM A615[1] Gr. 60	MPa	620	414
ASTM A615[1] Gr. 40	MPa	414	276
ASTM A706[2] Gr. 60	MPa	550	414
DIN 488[3] BSt 500	MPa	550	500
CAN/CSA-G30.18[4] Gr. 400	MPa	540	400

[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] *Reinforcing steel; reinforcing steel bars; dimensions and masses*
[4] *Billet-Steel Bars for Concrete Reinforcement*

TABLE 5—SPECIFICATIONS AND PHYSICAL PROPERTIES OF FRACTIONAL AND METRIC HIS-N AND HIS-RN INSERTS

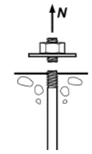
HILTI HIS-N AND HIS-RN INSERTS 		**Minimum specified ultimate strength, f_{uta}**	**Minimum specified yield strength, f_{ya}**
Carbon Steel DIN EN 10277-3 11SMnPb30+c or DIN 1561 9SMnPb28K	MPa	490	390
Stainless Steel EN 10088-3 X5CrNiMo 17-12-2	MPa	700	350

TABLE 6—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON BOLTS, CAP SCREWS AND STUDS FOR USE WITH HIS-N AND HIS-RN INSERTS[1,2]

BOLT, CAP SCREW OR STUD SPECIFICATION 		**Minimum specified ultimate strength f_{uta}**	**Minimum specified yield strength 0.2 percent offset f_{ya}**	**f_{uta}/f_{ya}**	**Elongation, min.**	**Reduction of Area, min.**	**Specification for nuts[6]**
ASTM A193 Grade B7	MPa	862	724	1.119	16	50	ASTM A563 Grade DH
SAE J429[3] Grade 5	MPa	828	634	1.30	14	35	SAE J995
ASTM A325[4] $^{1}/_{2}$ to 1-in.	MPa	828	634	1.30	14	35	A563 C, C3, D, DH, DH3 Heavy Hex
ASTM A193[5] Grade B8M (AISI 316) for use with HIS-RN	MPa	759	655	1.16	15	45	ASTM F594[7] Alloy Group 1, 2 or 3
ASTM A193[5] Grade B8T (AISI 321) for use with HIS-RN	MPa	862	690	1.25	12	35	ASTM F594[7] Alloy Group 1, 2 or 3

[1] Minimum Grade 5 bolts, cap screws or studs must be used with carbon steel HIS inserts.
[2] Only stainless steel bolts, cap screws or studs must be used with HIS-RN inserts.
[3] Mechanical and Material Requirements for Externally Threaded Fasteners
[4] Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
[5] Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
[6] Nuts must have specified minimum proof load stress equal to or greater than the specified minimum full-size tensile strength of the specified stud.
[7] Nuts for stainless steel studs must be of the same alloy group as the specified bolt, cap screw, or stud.

Fractional Threaded Rod



Steel Strength

TABLE 7A—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)[1]						
				3/8	1/2	5/8	3/4	7/8	1	1 1/4
Rod O.D.		d	in. (mm)	0.375 (9.5)	0.5 (12.7)	0.625 (15.9)	0.75 (19.1)	0.875 (22.2)	1 (25.4)	1.25 (31.8)
Rod effective cross-sectional area		A_{se}	in.^{2} (mm^2)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	0.4617 (298)	0.6057 (391)	0.9691 (625)
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength	N_{sa}	kN	25.0	45.8	72.9	107.9	148.9	195.3	312.5
		V_{sa}	kN	15.0	27.5	43.7	64.7	89.3	117.2	187.5
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.0						
	Resistance modification factor for tension[3]	R	-	0.70						
	Resistance modification factor for shear[3]	R	-	0.65						
ASTM A193 B7	Nominal strength as governed by steel strength	N_{sa}	kN	43.1	78.9	125.7	186.0	256.7	336.8	538.8
		V_{sa}	kN	25.9	47.3	75.4	111.6	154.0	202.1	323.3
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.0						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM F1554 Gr. 36	Nominal strength as governed by steel strength	N_{sa}	kN	-	36.6	58.3	86.3	119.1	156.3	250.0
		V_{sa}	kN	-	22.0	35.0	51.8	71.5	93.8	150.0
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	0.60						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM F1554 Gr. 55	Nominal strength as governed by steel strength	N_{sa}	kN	-	47.4	75.4	111.6	154.0	202.1	323.3
		V_{sa}	kN	-	28.4	45.2	67.0	92.4	121.3	194.0
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	1.0						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM F1554 Gr. 105	Nominal strength as governed by steel strength	N_{sa}	kN	-	78.9	125.7	186.0	256.7	336.8	538.8
		V_{sa}	kN	-	47.3	75.4	111.6	154.0	202.1	323.3
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	1.0						
	Resistance modification factor for tension[2]	R	-	0.80						
	Resistance modification factor for shear[2]	R	-	0.75						
ASTM F593, CW Stainless	Nominal strength as governed by steel strength	N_{sa}	kN	34.5	63.1	100.5	126.5	174.6	229.0	-
		V_{sa}	kN	20.7	37.9	60.3	75.9	104.7	137.4	-
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	0.8						-
	Resistance modification factor for tension[3]	R	-	0.70						-
	Resistance modification factor for shear[3]	R	-	0.65						-
ASTM A193, Gr. 8(M), Class 1 Stainless	Nominal strength as governed by steel strength	N_{sa}	kN	-						245.7
		V_{sa}	kN	-						147.4
	Reduction factor, seismic shear	$\alpha_{v,seis}$	-	-						0.8
	Resistance modification factor for tension[2]	R	-	-						0.80
	Resistance modification factor for shear[2]	R	-	-						0.75

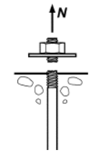
For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf

[1] Values provided for common 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. 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.

Fractional Reinforcing Bars



Steel Strength

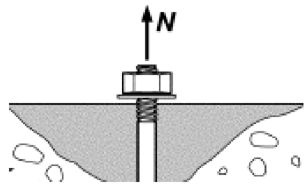
TABLE 7B—STEEL DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS

DESIGN INFORMATION		Symbol	Units	Nominal Reinforcing bar size (Rebar)							
				#3	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**#10**
Nominal bar diameter		d	in. (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19.1)	7/8 (22.2)	1 (25.4)	1 1/8 (28.6)	1 1/4 (31.8)
Bar effective cross-sectional area		A_{se}	in.^{2} (mm^2)	0.11 (71)	0.2 (129)	0.31 (200)	0.44 (284)	0.6 (387)	0.79 (510)	1.0 (645)	1.27 (819)
ASTM A615 Grade 40	Nominal strength as governed by steel strength	N_{sa}	kN	29.4	53.4	82.7	117.4	160.1	210.9	266.9	339.0
		V_{sa}	kN	17.6	32.0	49.6	70.5	96.1	126.5	160.1	203.4
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	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	N_{sa}	kN	44.0	80.1	124.1	176.2	240.2	316.3	400.4	508.5
		V_{sa}	kN	26.4	48.0	74.5	105.7	144.1	189.8	240.2	305.1
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70							
	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	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 for seismic shear	$\alpha_{V,seis}$		0.70							
	Resistance modification factor for tension[2]	R	-	0.80							
	Resistance modification factor for shear[2]	R	-	0.75							

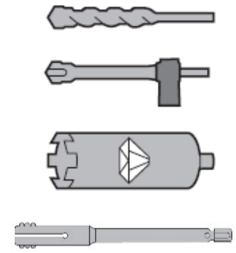
For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.448 N. For **pound-inch** units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf

[1] Values provided for common 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. 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.

Fractional Threaded Rod and Reinforcing Bars



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit Diamond Core Bit + Roughening Tool, or Diamond Core Bit

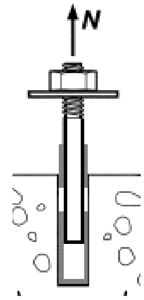
TABLE 8—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD AND REINFORCING BARS ALL DRILLING METHODS[1]

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.) / Reinforcing bar size											
			$^{3}/_{8}$ or #3	$^{1}/_{2}$	#4	$^{5}/_{8}$	#5	$^{3}/_{4}$	#6	$^{7}/_{8}$	#7	1 or #8	#9	$1^{1}/_{4}$ or #10
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	7 (17)											
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	10 (24)											
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 ($2^{3}/_{8}$)	70 ($2^{3}/_{4}$)	60 ($2^{3}/_{8}$)	79 ($3^{1}/_{8}$)	76 (3)	89 ($3^{1}/_{2}$)	76 (3)	89 ($3^{1}/_{2}$)	85 ($3^{3}/_{8}$)	102 (4)	114 ($4^{1}/_{2}$)	127 (5)
Maximum Embedment	$h_{ef,max}$	mm (in.)	191 ($7^{1}/_{2}$)	254 (10)	254 (10)	318 ($12^{1}/_{2}$)	318 ($12^{1}/_{2}$)	381 (15)	381 (15)	445 ($17^{1}/_{2}$)	445 ($17^{1}/_{2}$)	508 (20)	572 ($22^{1}/_{2}$)	635 (25)
Min. anchor spacing[3]	s_{min}	mm (in.)	48 ($1^{7}/_{8}$)	64 ($2^{1}/_{2}$)	64 ($2^{1}/_{2}$)	79 ($3^{1}/_{8}$)	79 ($3^{1}/_{8}$)	95 ($3^{3}/_{4}$)	95 ($3^{3}/_{4}$)	111 ($4^{3}/_{8}$)	111 ($4^{3}/_{8}$)	127 (5)	143 ($5^{5}/_{8}$)	159 ($6^{1}/_{4}$)
Min. edge distance[3]	c_{min}	-	5d; or see Table 1 of this report for design with reduced minimum edge distances											
Minimum concrete 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)	c_{ac}	-	$2h_{ef}$											
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											

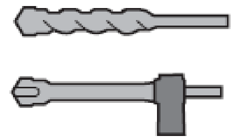
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 2, Manufacturers Printed 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.

Fractional Reinforcing Bars



Bond Strength



Carbide Bit or Hilti Hollow Carbide Bit

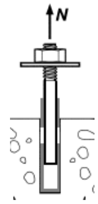
TABLE 9—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar size							
					#3	#4	#5	#6	#7	#8	#9	#10
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 ($2^{3}/_{8}$)	60 ($2^{3}/_{8}$)	76 (3)	76 (3)	85 ($3^{3}/_{8}$)	102 (4)	114 ($4^{1}/_{2}$)	127 (5)
Maximum Embedment			$h_{ef,max}$	mm (in.)	191 ($7^{1}/_{2}$)	254 (10)	318 ($12^{1}/_{2}$)	381 (15)	445 ($17^{1}/_{2}$)	508 (20)	572 ($22^{1}/_{2}$)	635 (25)
Dry concrete and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	9.3	9.4	9.6	9.7	9.7	9.8	9.6	9.3
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.2	12.0	11.9	11.7	11.5	11.3	11.2	11.0
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.4	6.5	6.6	6.7	6.7	6.8	6.6	6.4
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.4	8.3	8.2	8.1	7.9	7.8	7.7	7.6
	Anchor Category		-	-	1	1	1	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.9	6.9	7.2	7.3	7.4	7.5	7.4	7.2
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	9.0	8.9	8.9	8.8	8.7	8.7	8.6	8.6
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.7	4.8	5.0	5.0	5.1	5.2	5.1	5.0
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	6.2	6.1	6.1	6.1	6.0	6.0	5.9	5.9
	Anchor Category		-	-	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	5.9	6.1	6.3	6.5	6.6	6.9	6.7	6.8
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.9	7.8	7.9	7.9	7.9	7.9	7.8	8.0
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.1	4.2	4.4	4.5	4.6	4.7	4.6	4.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.4	5.4	5.4	5.4	5.4	5.5	5.4	5.5
	Anchor Category		-	-	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

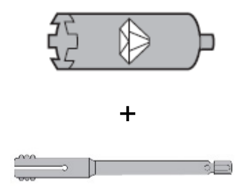
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Fractional Reinforcing Bars



Bond Strength



Diamond Core Bit + Roughening Tool

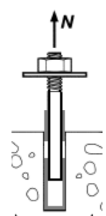
TABLE 10—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units			Nominal reinforcing bar size		
					#5	#6	#7	#8	#9
Minimum Embedment			$h_{ef,min}$	mm (in.)	76 (3)	76 (3)	85 ($3^{3}/_{8}$)	102 (4)	115 (4½)
Maximum Embedment			$h_{ef,max}$	mm (in.)	318 (12½)	286 (11 ¼)	445 (17½)	508 (20)	573 (22½)
Dry and water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.7	6.8	6.8	6.9	6.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	11.9	11.7	11.5	11.3	11.2
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.6	4.7	4.7	4.8	4.6
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.2	8.1	7.9	7.8	7.7
	Anchor Category		-	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9	0.9	0.9	0.9

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
[3] Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Fractional Reinforcing Bars



Bond Strength

Diamond Core Bit

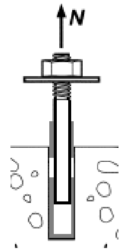
TABLE 11—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar size							
					#3	#4	#5	#6	#7	#8	#9	#10
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 ($2^{3}/_{8}$)	60 ($2^{3}/_{8}$)	76 (3)	76 (3)	85 ($3^{3}/_{8}$)	102 (4)	114 ($4^{1}/_{2}$)	127 (5)
Maximum Embedment			$h_{ef,max}$	mm (in.)	191 ($7^{1}/_{2}$)	254 (10)	318 ($12^{1}/_{2}$)	381 (15)	445 ($17^{1}/_{2}$)	508 (20)	572 ($22^{1}/_{2}$)	635 (25)
Dry and water saturated concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
	Anchor Category		-	-	2	2	3	3	3	3	3	3
	Resistance modification factor		R_d, R_{ws}	-	0.85	0.85	0.75	0.75	0.75	0.75	0.75	0.75

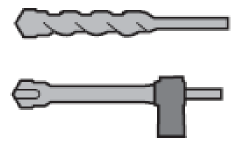
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$].
[4] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F)
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.

Fractional Threaded Rod



Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit

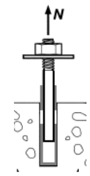
TABLE 12—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED ROD IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (in.)						
					3/8	1/2	5/8	3/4	7/8	1	1 1/4
Minimum Embedment			$h_{ef,min}$	mm	60	70	79	89	89	102	127
				(in.)	(2 3/8)	(2 3/4)	(3 1/8)	(3 1/2)	(3 1/2)	(4)	(5)
Maximum Embedment			$h_{ef,max}$	mm	191	254	318	381	445	508	635
				(in.)	(7 1/2)	(10)	(12 1/2)	(15)	(17 1/2)	(20)	(25)
Dry concrete and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	8.8	8.7	8.7	8.6	8.6	8.5	8.1
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	16.4	15.8	15.3	14.7	14.1	13.5	12.4
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	6.1	6.0	6.0	5.9	5.9	5.9	5.6
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	11.3	10.9	10.5	10.1	9.7	9.3	8.5
	Anchor Category		-	-	1	1	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	6.5	6.5	6.5	6.5	6.5	6.5	6.4
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	12.1	11.7	11.4	11.0	10.7	10.4	9.7
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	4.5	4.5	4.5	4.5	4.5	4.5	4.4
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	8.4	8.1	7.9	7.6	7.4	7.1	6.7
	Anchor Category		-	-	3	3	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	5.7	5.7	5.8	5.8	5.9	5.9	5.9
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	10.6	10.3	10.1	9.9	9.6	9.4	9.0
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{\kappa;cr}$	MPa	3.9	3.9	4.0	4.0	4.0	4.1	4.1
		Characteristic bond strength in uncracked concrete	$\tau_{\kappa;uncr}$	MPa	7.3	7.1	7.0	6.8	6.6	6.5	6.2
	Anchor Category		-	-	3	3	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.92	0.93	0.95	1	1	1	1

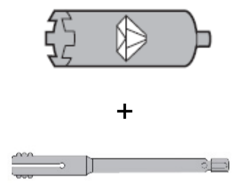
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Fractional Threaded Rod



Bond Strength



Diamond Core Bit + Roughening Tool

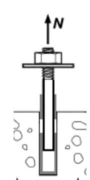
TABLE 13—BOND STRENGTH DESIGN INFORMATION FOR U.S. CUSTOMARY UNIT THREADED RODS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (in.)				
					5/8	¾	7/8	1	1¼
Minimum Embedment			$h_{ef,min}$	mm (in.)	79 (3 1/8)	89 (3 1/2)	89 (3½)	102 (4)	127 (5)
Maximum Embedment			$h_{ef,max}$	mm (in.)	318 (12½)	286 (11¼)	445 (17½)	508 (20)	635 (25)
Dry and water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.1	6.0	6.0	6.0	5.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	15.3	14.7	14.1	13.5	12.4
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.2	4.2	4.2	4.1	3.9
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	(MPa)	(10.5)	(10.1)	(9.7)	(9.3)	(8.5)
	Anchor Category		-	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.95	1	1	1	1

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Fractional Threaded Rod



Bond Strength

Diamond Core Bit

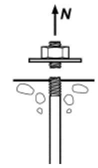
TABLE 14—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED RODS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (in.)						
					3/8	½	5/8	¾	7/8	1	1 ¼
Minimum Embedment			$h_{ef,min}$	mm (in.)	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 (in.)	191 (7 1/2)	254 (10)	318 (12 1/2)	381 (15)	445 (17 1/2)	508 (20)	635 (25)
Dry concrete and Water saturated concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	10.7	10.7	10.7	10.7	10.7	10.7	10.7
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.4	7.4	7.4	7.4	7.4	7.4	7.4
	Anchor Category		-	-	2	2	3	3	3	3	3
	Resistance modification factor		R_d, R_{ws}	-	0.85	0.85	0.75	0.75	0.75	0.75	0.75

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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$].
[5] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Metric Threaded Rod and EU Metric Reinforcing Bars



Steel Strength

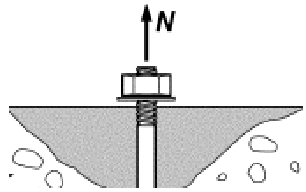
TABLE 15—STEEL DESIGN INFORMATION FOR METRIC THREADED ROD AND EU METRIC REINFORCING BARS

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)[1]							
				8	10	12	16	20	24	27	30
Rod Outside Diameter		d	mm (in.)	8 (0.31)	10 (0.39)	12 (0.47)	16 (0.63)	20 (0.79)	24 (0.94)	27 (1.06)	30 (1.18)
Rod effective cross-sectional area		A_{se}	mm² (in.²)	36.6 (0.057)	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	N_{sa}	kN	18.3	29.0	42.0	78.5	122.5	176.5	229.5	280.5
		V_{sa}	kN	11.0	14.5	25.5	47.0	73.5	106.0	137.5	168.5
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.00							
	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	N_{sa}	kN	29.3	46.5	67.5	125.5	196.0	282.5	367.0	449.0
		V_{sa}	kN	17.6	23.0	40.5	75.5	117.5	169.5	220.5	269.5
	Reduction for seismic shear	$\alpha_{V,seis}$	-	1.00							
	Resistance modification factor for tension[3]	R	-	0.70							
	Resistance modification factor for shear[3]	R	-	0.65							
ISO 3506-1 Class A4 Stainless[3]	Nominal strength as governed by steel strength	N_{sa}	kN	25.6	40.6	59.0	109.9	171.5	247.1	229.5	280.5
		V_{sa}	kN	15.4	20.3	35.4	65.9	102.9	148.3	137.7	168.3
	Reduction 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							

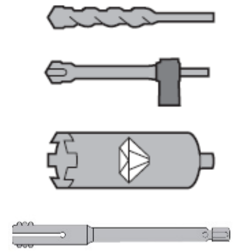
DESIGN INFORMATION		Symbol	Units	Nominal reinforcing bar diameter (mm)								
				10	12	14	16	20	25	28	30	32
Nominal bar diameter		d	mm (in.)	10.0 (0.394)	12.0 (0.472)	14.0 (0.551)	16.0 (0.630)	20.0 (0.787)	25.0 (0.984)	28.0 (1.102)	30.0 (1.224)	32.0 (1.260)
Bar effective cross-sectional area		A_{se}	mm² (in.²)	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)	706.9 (1.096)	804.2 (1.247)
DIN 488 BSt 550/500	Nominal strength as governed by steel strength	N_{sa}	kN	43.0	62.0	84.5	110.5	173.0	270.0	338.5	388.8	442.5
		V_{sa}	kN	26.0	37.5	51.0	66.5	103.0	162.0	203.0	233.3	265.5
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70								
	Resistance modification factor for tension[3]	R	-	0.70								
	Resistance modification factor for shear[3]	R	-	0.65								

[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 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.
[3] A4-70 Stainless (M8- M24); A4-502 Stainless (M27- M30)

Metric Threaded Rod and EU Metric Reinforcing Bars



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit Diamond Core Bit + Roughening Tool, or Diamond Core Bit

TABLE 16—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD AND EU METRIC REINFORCING BARS ALL DRILLING METHODS[1]

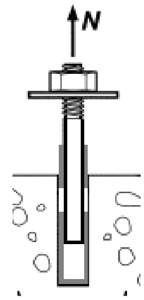
DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (mm)							
			8	10	12	16	20	24	27	30
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 (2.4)	60 (2.4)	70 (2.8)	80 (3.1)	90 (3.5)	100 (3.9)	110 (4.3)	120 (4.7)
Maximum Embedment	$h_{ef,max}$	mm (in.)	160 (6.3)	200 (7.9)	240 (9.4)	320 (12.6)	400 (15.7)	480 (18.9)	540 (21.4)	600 (23.7)
Min. anchor spacing[3]	s_{min}	mm (in.)	40 (1.6)	50 (2.0)	60 (2.4)	80 (3.2)	100 (3.9)	120 (4.7)	135 (5.3)	150 (5.9)
Min. edge distance[3]	c_{min}	-	5d; or see Table 1 of this report for design with reduced minimum edge distances							
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + 1$^1/_4$)		$h_{ef} + 2d_o^{(4)}$					

DESIGN INFORMATION	Symbol	Units	Nominal reinforcing bar diameter (mm)								
			10	12	14	16	20	25	28	30	32
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 (2.4)	70 (2.8)	80 (3.1)	80 (3.1)	90 (3.5)	100 (3.9)	112 (4.4)	120 (4.7)	128 (5.0)
Maximum Embedment	$h_{ef,max}$	mm (in.)	200 (7.9)	240 (9.4)	280 (11.0)	320 (12.6)	400 (15.7)	500 (19.7)	560 (22.0)	600 (23.7)	640 (25.2)
Min. anchor spacing[3]	s_{min}	mm (in.)	50 (2.0)	60 (2.4)	70 (2.8)	80 (3.2)	100 (3.9)	125 (4.9)	140 (5.5)	150 (5.9)	160 (6.3)
Min. edge distance[3]	c_{min}	-	5d; or see Table 1 of this report for design with reduced minimum edge distances								
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + 1$^1/_4$)	$h_{ef} + 2d_o^{(4)}$							
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	2h_{ef}								
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	7.1 (17)								
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	10 (24)								
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								

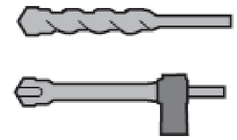
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 2, Manufacturers Printed 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.

EU Metric Reinforcing Bars



Bond Strength



Carbide Bit or Hilti Hollow Carbide Bit

TABLE 17—BOND STRENGTH DESIGN INFORMATION FOR EU METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

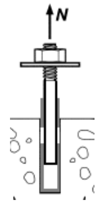
DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar diameter (mm)								
					10	12	14	16	20	25	28	30	32
Minimum Embedment			$h_{ef,min}$	mm	60	70	80	80	90	100	112	120	128
				(in.)	(2.4)	(2.8)	(3.1)	(3.1)	(3.5)	(3.9)	(4.4)	(4.7)	(5.0)
Maximum Embedment			$h_{ef,max}$	mm	200	240	280	320	400	500	560	600	640
				(in.)	(7.9)	(9.4)	(11.0)	(12.6)	(15.7)	(19.7)	(22.0)	(23.7)	(25.2)
Dry concrete and Water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	9.3	9.4	9.5	9.6	9.7	9.8	9.7	9.5	9.3
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.2	12.1	12.0	11.8	11.6	11.4	11.2	11.1	11.0
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.4	6.5	6.5	6.6	6.7	6.8	6.7	6.5	6.4
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.4	8.3	8.3	8.2	8.0	7.8	7.7	7.7	7.6
	Anchor Category		-	-	1	1	1	1	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.9	6.9	7.0	7.2	7.4	7.4	7.4	7.4	7.2
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	9.0	8.9	8.9	8.9	8.8	8.7	8.6	8.6	8.6
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.7	4.8	4.8	5.0	5.1	5.1	5.1	5.1	5.0
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	6.2	6.2	6.1	6.1	6.1	6.0	5.9	5.9	5.9
	Anchor Category		-	-	3	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.0	6.1	6.2	6.3	6.6	6.8	6.8	6.8	6.8
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.9	7.8	7.8	7.8	7.9	7.8	7.9	8.0	8.0
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.2	4.2	4.3	4.4	4.6	4.7	4.7	4.7	4.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.5
	Anchor Category		-	-	3	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

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

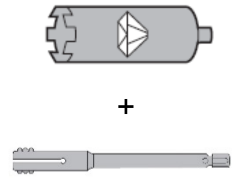
[1] Bond strength values correspond to concrete compressive strength f'_c = 17.2 MPa (2,500 psi). For concrete compressive strength, f'_c, between 17.2 MPa (2,500 psi) and 55.2 MPa (8,000 psi), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].

[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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

EU Metric Reinforcing Bars



Bond Strength



Diamond Core Bit + Roughening Tool

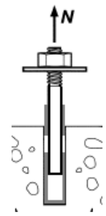
TABLE 18—BOND STRENGTH DESIGN INFORMATION FOR EU METRIC REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar diameter (mm)				
					14	**16**	**20**	**25**	**28**
Minimum Embedment			$h_{ef,min}$	mm	80	80	90	100	112
				(in.)	(3.1)	(3.1)	(3.5)	(3.9)	(4.4)
Maximum Embedment			$h_{ef,max}$	mm	280	320	400	500	560
				(in.)	(11.0)	(12.6)	(15.7)	(19.7)	(22.0)
Dry and water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.7	6.7	6.8	6.9	6.8
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.0	11.8	11.6	11.4	11.2
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.6	4.6	4.7	4.8	4.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.3	8.2	8.0	7.8	7.7
	Anchor Category		-	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9	0.9	0.9	0.9

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

EU Metric Reinforcing Bars



Bond Strength

Diamond Core Bit

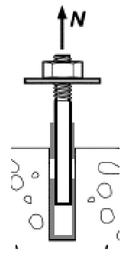
TABLE 19—BOND STRENGTH DESIGN INFORMATION FOR EU METRIC REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar diameter (mm)								
					10	12	14	16	20	25	28	30	32
Minimum Embedment			$h_{ef,min}$	mm	60	70	80	80	90	100	112	120	128
				(in.)	(2.4)	(2.8)	(3.1)	(3.1)	(3.5)	(3.9)	(4.4)	(4.7)	(5.0)
Maximum Embedment			$h_{ef,max}$	mm	200	240	280	320	400	500	560	600	640
				(in.)	(7.9)	(9.4)	(11.0)	(12.6)	(15.7)	(19.7)	(22.0)	(23.7)	(25.2)
Dry and Water Saturated concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
	Anchor Category		-		2	2	2	3	3	3	3	3	3
	Resistance modification factor		R_d, R_{ws}		0.85	0.85	0.85	0.75	0.75	0.75	0.75	0.75	0.75

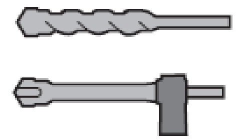
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Metric Threaded Rod



Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit

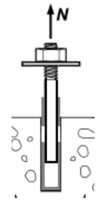
TABLE 20—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED RODS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (mm)							
					8	10	12	16	20	24	27	30
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 (2.4)	60 (2.4)	70 (2.8)	80 (3.1)	90 (3.5)	100 (3.9)	110 (4.3)	120 (4.7)
Maximum Embedment			$h_{ef,max}$	mm (in.)	160 (6.3)	200 (7.9)	240 (9.4)	320 (12.6)	400 (15.7)	480 (18.9)	540 (21.4)	600 (23.7)
Dry and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	8.8	8.8	8.8	8.7	8.6	8.5	8.5	8.4
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	16.7	16.3	16.0	15.2	14.5	13.8	13.2	12.7
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.1	6.1	6.0	6.0	5.9	5.9	5.9	5.8
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	11.5	11.3	11.0	10.5	10.0	9.5	9.1	8.7
	Anchor Category		-	-	1	1	1	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.3	12.1	11.8	11.4	11.0	10.5	10.2	9.8
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.5	8.3	8.2	7.9	7.6	7.2	7.0	6.8
	Anchor Category		-	-	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	5.7	5.7	5.7	5.7	5.8	5.9	6.0	6.0
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	10.7	10.5	10.4	10.1	9.8	9.5	9.3	9.1
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.2
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.4	7.3	7.2	7.0	6.8	6.6	6.4	6.3
	Anchor Category		-	-	3	3	3	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	1	0.92	0.93	0.95	1	1	1	1

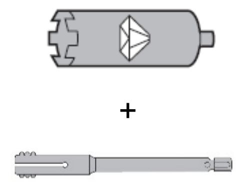
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Metric Threaded Rod



Bond Strength



Diamond Core Bit + Roughening Tool

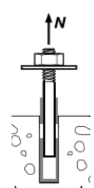
TABLE 21—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED RODS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (mm)				
					16	20	24	27	30
Minimum Embedment			$h_{ef,min}$	mm (in.)	80 (3.1)	90 (3.5)	100 (3.9)	110 (4.3)	120 (4.7)
Maximum Embedment			$h_{ef,max}$	mm (in.)	320 (12.6)	400 (15.7)	480 (18.9)	540 (21.4)	600 (23.7)
Dry and water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.1	6.0	6.0	6.0	5.9
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	15.2	14.5	13.8	13.2	12.7
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.2	4.2	4.2	4.2	4.1
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	10.5	10.0	9.5	9.1	8.7
	Anchor Category		-	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.95	1	1	1	1

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Metric Threaded Rod



Bond Strength

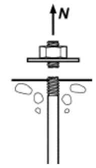
Diamond Core Bit

TABLE 22—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED RODS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal rod diameter (mm)							
					8	10	12	16	20	24	27	30
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 (2.4)	60 (2.4)	70 (2.8)	80 (3.1)	90 (3.5)	100 (3.9)	110 (4.3)	120 (4.7)
Maximum Embedment			$h_{ef,max}$	mm (in.)	160 (6.3)	200 (7.9)	240 (9.4)	320 (12.6)	400 (15.7)	480 (18.9)	540 (21.4)	600 (23.7)
Dry concrete and Water saturated concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
	Anchor Category		-	-	2	2	2	3	3	3	3	3
	Resistance modification factor		R_d, R_{ws}	-	0.85	0.85	0.85	0.75	0.75	0.75	0.75	0.75

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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.



Canadian Reinforcing Bars **Steel Strength**

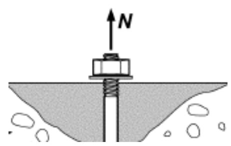
TABLE 23—STEEL DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS[1]

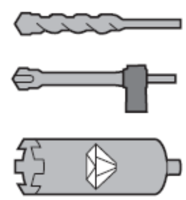
DESIGN INFORMATION		Symbol	Units	Nominal reinforcing bar size				
				10 M	**15 M**	**20 M**	**25 M**	**30 M**
Nominal bar diameter		d	mm (in.)	11.3 (0.445)	16.0 (0.630)	19.5 (0.768)	25.2 (0.992)	29.9 (1.177)
Bar effective cross-sectional area		A_{se}	mm^2 ($in.^2$)	100.3 (0.155)	201.1 (0.312)	298.6 (0.463)	498.8 (0.773)	702.2 (1.088)
CSA G30	Nominal strength as governed by steel strength	N_{sa}	kN	54.0	108.5	161.5	270.0	380.0
		V_{sa}	kN	32.5	65.0	97.0	161.5	227.5
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.70				
	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, 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] 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 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.





Canadian Reinforcing Bars **Concrete Breakout Strength** **Carbide Bit or Hilti Hollow Carbide Bit or Diamond Core Bit**

TABLE 24—CONCRETE BREAKOUT DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT), OR DIAMOND CORE BIT[1]

DESIGN INFORMATION	Symbol	Units	Nonminal reinforcing bar size				
			10 M	**15 M**	**20 M**	**25 M**	**30 M**
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI (in-lb)	7.1 (17)				
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI (in-lb)	10 (24)				
Minimum Embedment	$h_{ef,min}$	mm (in.)	60 (2.4)	80 (3.1)	90 (3.5)	101 (4.0)	120 (4.7)
Maximum Embedment	$h_{ef,max}$	mm (in.)	226 (8.9)	320 (12.6)	390 (15.4)	504 (19.8)	598 (23.5)
Min. bar spacing[3]	s_{min}	mm (in.)	57 (2.2)	80 (3.1)	98 (3.8)	126 (5.0)	150 (5.9)
Min. edge distance[3]	c_{min}	mm (in.)	5d; or see Table 1 of this report for design with reduced minimum edge distances				
Minimum concrete thickness	h_{min}	mm (in.)	h_{ef} + 30 (h_{ef} + 1$^1/_4$)	$h_{ef} + 2d_o$(3)			
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	$2h_{ef}$				
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				

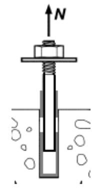
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.

[1] Additional setting information is described in Figure 2, Manufacturers Printed Installation Instructions (MPII).

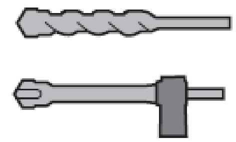
[2] Condition A requires supplemental reinforcement, while Condition B applies where supplemental reinforcement is not provided or where pullout or pryout governs, as set forth in CSA A23.3-14 D.5. The tabulated value of the material resistance factors ϕ_c and ϕ_s, and resistance modification factor, 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.

Canadian Reinforcing Bars



Bond Strength



Carbide Bit or
Hilti Hollow Carbide Bit

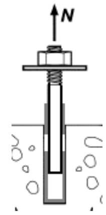
TABLE 25—BOND STRENGTH DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar size				
					10M	15M	20M	25M	30M
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 (2.4)	80 (3.1)	90 (3.5)	101 (4.0)	120 (4.7)
Maximum Embedment			$h_{ef,max}$	mm (in.)	226 (8.9)	320 (12.6)	390 (15.4)	504 (19.8)	598 (23.5)
Dry concrete and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	9.4	9.6	9.7	9.8	9.5
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.1	11.8	11.7	11.3	11.1
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.5	6.6	6.7	6.8	6.5
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.4	8.2	8.0	7.8	7.7
	Anchor Category		-	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.9	7.2	7.3	7.4	7.3
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.9	8.9	8.8	8.6	8.5
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.8	5.0	5.0	5.1	5.0
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	6.2	6.1	6.1	6.0	5.9
	Anchor Category		-	-	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.1	6.3	6.5	6.8	6.6
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	7.8	7.8	7.8	7.8	7.8
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.2	4.4	4.5	4.7	4.6
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.4	5.4	5.4	5.4	5.4
	Anchor Category		-	-	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9	0.9	0.9	0.9

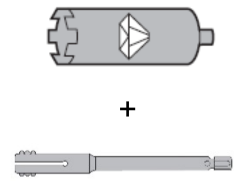
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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

Canadian Reinforcing Bars



Bond Strength



Diamond Core Bit + Roughening Tool

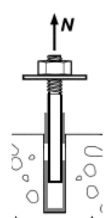
TABLE 26A—BOND STRENGTH DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar size	
					15M	**20M**
Minimum Embedment			$h_{ef,min}$	mm (in.)	80 (3.1)	90 (3.5)
Maximum Embedment			$h_{ef,max}$	mm (in.)	320 (12.6)	390 (15.4)
Dry and Water Saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	6.7	6.8
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	11.8	11.7
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.6	4.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.2	8.0
	Anchor Category		-	-	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	0.9	0.9

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Canadian Reinforcing Bars



Bond Strength

Diamond Core Bit

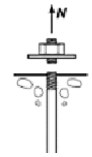
TABLE 26B—BOND STRENGTH DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BARS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal reinforcing bar size				
					10M	**15M**	**20M**	**25M**	**30M**
Minimum Embedment			$h_{ef,min}$	mm (in.)	60 (2.4)	80 (3.1)	90 (3.5)	101 (4.0)	120 (4.7)
Maximum Embedment			$h_{ef,max}$	mm (in.)	226 (8.9)	320 (12.6)	390 (15.4)	504 (19.8)	598 (23.5)
Dry and Water Saturated concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.0	8.0	8.0	8.0	8.0
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.5	5.5	5.5	5.5	5.5
	Anchor Category		-	-	2	3	3	3	3
	Resistance modification factor		R_d, R_{ws}	-	0.85	0.75	0.75	0.75	0.75

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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert



Steel Strength

TABLE 27—STEEL DESIGN INFORMATION FOR FRACTIONAL AND METRIC HIS-N AND HIS-RN THREADED INSERTS[1]

DESIGN INFORMATION		Symbol	Units	Nominal Bolt/Cap Screw Diameter (in.) Fractional				Units	Nominal Bolt/Cap Screw Diameter (mm) Metric				
				3/8	1/2	5/8	3/4		8	10	12	16	20
HIS Insert O.D.		D	in. (mm)	0.65 (16.5)	0.81 (20.5)	1.00 (25.4)	1.09 (27.6)	mm (in.)	12.5 (0.49)	16.5 (0.65)	20.5 (0.81)	25.4 (1.00)	27.6 (1.09)
HIS insert length		l	in. (mm)	4.33 (110)	4.92 (125)	6.69 (170)	8.07 (205)	mm (in.)	90 (3.54)	110 (4.33)	125 (4.92)	170 (6.69)	205 (8.07)
Bolt effective cross-sectional area		A_{se}	in.^{2} (mm^2)	0.0775 (50)	0.1419 (92)	0.2260 (146)	0.3345 (216)	mm^2 (in.^{2})	36.6 (0.057)	58 (0.090)	84.3 (0.131)	157 (0.243)	245 (0.380)
HIS insert effective cross-sectional area		A_{insert}	in.^{2} (mm^2)	0.178 (115)	0.243 (157)	0.404 (260)	0.410 (265)	mm^2 (in.^{2})	51.5 (0.080)	108 (0.167)	169.1 (0.262)	256.1 (0.397)	237.6 (0.368)
ASTM A193 B7	Nominal steel strength – ASTM A193 B73 bolt/cap screw	N_{sa}	kN	43.1	78.9	125.7	186.0	kN	-	-	-	-	-
		V_{sa}	kN	25.9	47.3	75.4	111.6	kN	-	-	-	-	-
	Nominal steel strength – HIS-N insert	N_{sa}	kN	56.3	76.7	127.6	129.7	kN	-	-	-	-	-
ASTM A193 Grade B8M SS	Nominal steel strength – ASTM A193 Grade B8M SS bolt/cap screw	N_{sa}	kN	37.9	69.4	110.6	163.7	kN	-	-	-	-	-
		V_{sa}	kN	22.8	41.7	66.3	98.2	kN	-	-	-	-	-
	Nominal steel strength – HIS-RN insert	N_{sa}	kN	80.4	109.6	182.2	185.2	kN	-	-	-	-	-
ISO 898-1 Class 8.8	Nominal steel strength – ISO 898-1 Class 8.8 bolt/cap screw	N_{sa}	(kN)	-	-	-	-	kN	29.5	46.5	67.5	125.5	196.0
		V_{sa}	(kN)	-	-	-	-	kN	17.5	28.0	40.5	75.5	117.5
	Nominal steel strength – HIS-N insert	N_{sa}	(kN)	-	-	-	-	kN	25.0	53.0	83.0	125.5	116.5
ISO 3506-1 Class A4-70 Stainless	Nominal steel strength – ISO 3506-1 Class A4-70 Stainless bolt/cap screw	N_{sa}	(kN)	-	-	-	-	kN	25.5	40.5	59.0	110.0	171.5
		V_{sa}	(kN)	-	-	-	-	kN	15.5	24.5	35.5	66.0	103.0
	Nominal steel strength – HIS-RN insert	N_{sa}	(kN)	-	-	-	-	kN	36.0	75.5	118.5	179.5	166.5
Reduction for seismic shear		$\alpha_{V,seis}$	-	0.94				-	0.94				
Resistance modification factor for tension[2]		R	-	0.70				-	0.70				
Resistance modification factor for shear[2]		R	-	0.65				-	0.65				

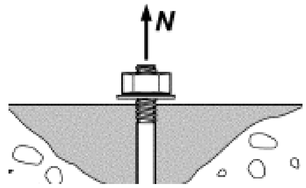
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

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.

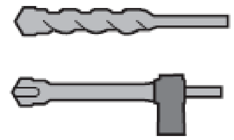
2 The tabulated value of material resistance factors ϕ_c and ϕ_s, and resistance modification factor, *R*, applies when the load combinations of Division B, Part 4, Section 4.1.3 of the 2015 NBCC or Annex C of CSA A23.3-14 are used. Values correspond to brittle steel elements.

3 For the calculation of the design steel strength in tension and shear for the bolt or screw, the *R* factor for ductile steel failure according to CSA A23.3-14 Section D.5.3, as applicable, can be used.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert



Concrete Breakout Strength



Carbide Bit or Hilti Hollow Carbide Bit

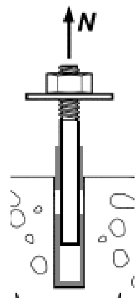
TABLE 28—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION	Symbol	Units	Nominal Bolt/Cap Screw Diameter (in.) Fractional				Units	Nominal Bolt/Cap Screw Diameter (mm) Metric				
			$^{3}/_{8}$	$^{1}/_{2}$	$^{5}/_{8}$	$^{3}/_{4}$		8	10	12	16	20
Effectiveness factor for cracked concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)				SI (in-lb)	7.1 (17)				
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in-lb (SI)	24 (10)				SI (in-lb)	10 (24)				
Effective embedment depth	h_{ef}	in. (mm)	$4^{3}/_{8}$ (110)	5 (125)	$6^{3}/_{4}$ (170)	$8^{1}/_{8}$ (205)	mm (in.)	90 (3.5)	110 (4.3)	125 (4.9)	170 (6.7)	205 (8.1)
Min. anchor spacing[3]	s_{min}	in. (mm)	$3^{1}/_{4}$ (83)	4 (102)	5 (127)	$5^{1}/_{2}$ (140)	mm (in.)	63 (2.5)	83 (3.25)	102 (4.0)	127 (5.0)	140 (5.5)
Min. edge distance[3]	c_{min}	in. (mm)	$3^{1}/_{4}$ (83)	4 (102)	5 (127)	$5^{1}/_{2}$ (140)	mm (in.)	63 (2.5)	83 (3.25)	102 (4.0)	127 (5.0)	140 (5.5)
Minimum concrete thickness	h_{min}	in. (mm)	5.9 (150)	6.7 (170)	9.1 (230)	10.6 (270)	mm (in.)	120 (4.7)	150 (5.9)	170 (6.7)	230 (9.1)	270 (10.6)
Critical edge distance – splitting (for uncracked concrete)	c_{ac}	-	$2h_{ef}$				-	$2h_{ef}$				
Resistance modification factor for tension, concrete failure modes, Condition B[2]	R	-	1.00				-	1.00				
Resistance modification factor for shear, concrete failure modes, Condition B[2]	R	-	1.00				-	1.00				

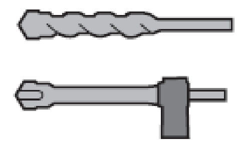
For **SI**: 1 inch ≡ 25.4 mm, 1 lbf = 4.448 N, 1 psi = 0.006897MPa.
For pound-inch units: 1 mm = 0.03937 inches, 1 N = 0.2248 lbf, 1 MPa = 145.0 psi

[1] Additional setting information is described in Figure 2, Manufacturers Printed 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.

Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert



Bond Strength



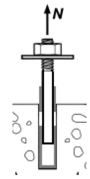
Carbide Bit or Hilti Hollow Carbide Bit

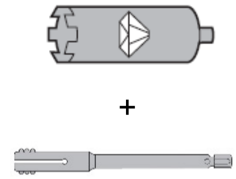
TABLE 29—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES DRILLED WITH A HAMMER DRILL AND CARBIDE BIT (OR HILTI HOLLOW CARBIDE DRILL BIT)[1]

DESIGN INFORMATION			Symbol	Units	Nominal bolt/cap screw diameter (in.)				Units	Nominal bolt/cap screw diameter (mm)				
					$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$		8	10	12	16	20
Embedment			h_{ef}	in. (mm)	$4^3/_8$ (110)	5 (125)	$6^3/_4$ (170)	$8^1/_8$ (205)	mm (in.)	90 (3.5)	110 (4.3)	125 (4.9)	170 (6.7)	205 (8.1)
Dry concrete and Water saturated concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	7.4	7.4	7.4	7.4	MPa	7.4	7.4	7.4	7.4	7.4
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.3	12.3	12.3	12.3	MPa	12.3	12.3	12.3	12.3	12.3
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	5.1	5.1	5.1	5.1	MPa	5.1	5.1	5.1	5.1	5.1
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.5	8.5	8.5	8.5	MPa	8.5	8.5	8.5	8.5	8.5
	Anchor Category		-	-	1	1	1	1	-	1	1	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	1.00	-	1.00	1.00	1.00	1.00	1.00
Water-filled hole	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	5.5	5.5	5.6	5.7	MPa	5.5	5.5	5.6	5.7	5.7
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	9.1	9.2	9.3	9.5	MPa	9.1	9.2	9.3	9.5	9.5
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	3.8	3.8	3.8	3.9	MPa	3.8	3.8	3.8	3.9	3.9
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	6.3	6.4	6.4	6.5	MPa	6.3	6.4	6.4	6.5	6.6
	Anchor Category		-	-	3	3	3	3	-	3	3	3	3	3
	Resistance modification factor		R_{wf}	-	0.75	0.75	0.75	0.75	-	0.75	0.75	0.75	0.75	0.75
Submerged concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	4.9	5.0	5.1	5.2	MPa	4.8	4.9	5.0	5.1	5.2
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.2	8.4	8.6	8.7	MPa	8.0	8.2	8.4	8.6	8.7
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	3.4	3.4	3.5	3.6	MPa	3.3	3.4	3.4	3.5	3.6
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.6	5.8	5.9	6.0	MPa	5.5	5.6	5.8	5.9	6.0
	Anchor Category		-	-	3	3	3	3	-	3	3	3	3	3
	Resistance modification factor		R_{uw}	-	0.75	0.75	0.75	0.75	-	0.75	0.75	0.75	0.75	0.75
Reduction for seismic tension			$\alpha_{N,seis}$	-	1	1	1	1	-	1	1	1	1	1

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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2{,}500)^{0.25}$] and $(f'_c / 17.2)^{0.15}$ for cracked concrete [For pound-inch: $(f'_c / 2{,}500)^{0.15}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.





Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert

Bond Strength

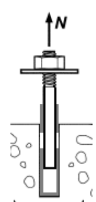
Diamond Core Bit + Roughening Tool

TABLE 30—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT AND ROUGHENED WITH A HILTI ROUGHENING TOOL[1]

DESIGN INFORMATION			Symbol	Units	Nominal bolt/cap screw diameter (in.)			Units	Nominal bolt/cap screw diameter (mm)		
					1/2	5/8	3/4		12	16	20
Embedment			h_{ef}	in. (mm)	5 (125)	6¾ (170)	8 1/8 (205)	mm (in.)	125 (4.9)	170 (6.7)	205 (8.1)
Dry concrete and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	5.2	5.2	5.2	MPa	5.2	5.2	5.2
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	12.3	12.3	12.3	MPa	12.3	12.3	12.3
	Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	MPa	3.6	3.6	3.6	MPa	3.6	3.6	3.6
		Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.5	8.5	8.5	MPa	8.5	8.5	8.5
	Anchor Category		-	-	1	1	1	-	1	1	1
	Resistance modification factor		R_d, R_{ws}	-	1.00	1.00	1.00	-	1.00	1.00	1.00
Reduction for seismic tension			$\alpha_{N,seis}$	-	1	1	1	-	1	1	1

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).
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.



Fractional and Metric HIS-N and HIS-RN Internal Threaded Insert

Bond Strength

Diamond Core Bit

TABLE 31—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL AND METRIC HILTI HIS-N AND HIS-RN INSERTS IN HOLES CORE DRILLED WITH A DIAMOND CORE BIT[1]

DESIGN INFORMATION			Symbol	Units	Nominal bolt/cap screw diameter (in.)				Units	Nominal bolt/cap screw diameter (mm)				
					3/8	1/2	5/8	3/4		8	10	12	16	20
Embedment			h_{ef}	in. (mm)	4 3/8 (110)	5 (125)	6 3/4 (170)	8 1/8 (205)	mm (in.)	90 (3.5)	110 (4.3)	125 (4.9)	170 (6.7)	205 (8.1)
Dry concrete and Water Saturated Concrete	Temperature range A[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	8.3	8.3	8.3	8.3	MPa	8.3	8.3	8.3	8.3	8.3
	Temperature range B[2]	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	MPa	5.7	5.7	5.7	5.7	MPa	5.7	5.7	5.7	5.7	5.7
	Anchor Category		-	-	3	3	3	3	-	2	3	3	3	3
	Resistance modification factor		R_d, R_{ws}	-	0.75	0.75	0.75	0.75	-	0.85	0.75	0.75	0.75	0.75

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), the tabulated characteristic bond strength may be increased by a factor of:: $(f'_c / 17.2)^{0.25}$ for uncracked concrete [For pound-inch $(f'_c / 2,500)^{0.25}$].
[2] Temperature range A: Maximum short term temperature = 55°C (130°F), Maximum long term temperature = 43°C (110°F).
Temperature range B: Maximum short term temperature = 80°C (176°F), Maximum long term temperature = 43°C (110°F).
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.

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, f'_c, of 17.2 MPa (2,500 psi) to 58.6 MPa (8,500 psi).
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, Hilti HIT-RE 500 V3 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 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.
16. Anchors may be used to resist tension and shear forces in floor, wall, and overhead installations only if installation is into concrete with a temperature between -5°C and 40°C (23°F and 104°F) for threaded rods, rebar, and Hilti HIS-(R)N inserts. Overhead installations for hole diameters larger than $^7/_{16}$-inch or 10mm require the use of piston plugs (HIT-SZ, -IP) during injection to the back of the hole. $^7/_{16}$-inch diameter holes may be injected directly to the back of the hole with the use of extension tubing on the end of the nozzle. The anchor or post-installed reinforcing bars must be supported until fully cured (i.e., with Hilti HIT-OHW wedges, or other suitable means). Where temporary restraint devices are used, their use shall not result in impairment of the anchor shear resistance. Installation in concrete temperature below 5°C (41°F) requires the adhesive to be conditioned to a minimum temperature of 5°C (32°F).