



## HILTI TECHNICAL BULLETIN

Date: August 28, 2019

Subject: Technical Data for Large Diameter Elements with Hilti HIT-RE 500 V3 Adhesive Anchor System

Hilti HIT-RE 500 V3 adhesive anchoring system can be used for post-installed rebar and threaded rod installations for anchor design in accordance with ACI 318-14 Chapter 17 and CSA A23.3-14 Annex D. Current published information is based on testing in accordance with ACI 355.4 and ICC-ES AC308 and can be found in ESR-3814 and in section 3.2.4 of the Hilti North American Product Technical Guide Volume 2: Anchor Fastening Technical Guide, Edition 17 (PTG Ed. 17). The largest element diameter published in ESR-3814 and the PTG Ed. 17 is 1-1/4-inch for threaded rod, #10 US reinforcing bar (US rebar), and 30M Canadian reinforcing bar (CA rebar).

Hilti has performed additional testing with threaded rod up to 80mm in diameter at 20 times the embedment depth for the tested rod diameter (i.e. 1600mm / 63-in. for the 80mm diameter threaded rod). The data in the tables below are evaluated per ACI 355.4 and AC 308, however, the design of these anchors is outside of the scope of ESR-3814.

See ESR-3814 and PTG Ed. 17 section 3.2.4 or contact Hilti Technical Services for additional information that may be needed to complete design calculation. The following data will not be included in ESR-3814.

**Table 1 - Hilti HIT-RE 500 V3 adhesive design information with U.S. Rebar per ACI 318-14 Chapter 17<sup>1</sup>**

Design parameter		Symbol	Units	Nominal reinforcing bar size		
				#11	#14	#18
Nominal drill bit diameter <sup>2</sup>		$d_o$	in	1-3/4	2	2-3/4
Min. edge distance <sup>3</sup>		$c_{min}$	in	7	8-1/2	11-7/8
Min. anchor spacing <sup>3</sup>		$s_{min}$	in	7	8-1/2	11-7/8
Dry and Water Saturated Concrete – Hammer Drilled Holes						
Temp. Range A <sup>4</sup>	Characteristic bond strength in uncracked concrete <sup>5</sup>	$\tau_{k, uncr}$	psi	1,410	1,170	1,102
Dry and Water Saturated Concrete – Core Drilled Holes						
Temp. Range A <sup>4</sup>	Characteristic bond strength in uncracked concrete <sup>5</sup>	$\tau_{k, uncr}$	psi	1,276	1,170	1,102
Anchor Category		-	-	3		
Strength reduction factor for bond failure modes for dry or water-saturated concrete		$\phi_d, \phi_{ws}$	-	0.45		

<sup>1</sup> The values shown are interpolated linearly based on data for testing up to 80mm diameter threaded rod.

<sup>2</sup> See figure 2 of the PTG Ed. 17 Section 3.2.4.3.4

<sup>3</sup> Minimum edge distance may be reduced to  $2 d_o$  provided rebar remains untorqued.

<sup>4</sup> Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).

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.

<sup>5</sup> Bond strength values corresponding to concrete compressive strength  $f'_c = 2,500$  psi (17.2 MPa). For concrete compressive strength,  $f'_c$ , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of  $(f'_c/2,500)^{0.25}$  [for SI:  $(f'_c/17.2)^{0.25}$ ].

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**Table 2 - Hilti HIT-RE 500 V3 adhesive design information with fractional threaded rod per ACI 318-14 Ch. 17<sup>1</sup>**

Design parameter	Symbol	Units	Nominal Rod Diameter (in.)					
			1-3/8	1-1/2	2	2-1/4	2-1/2	
Nominal drill bit diameter <sup>2</sup>	$d_o$	in	1-1/2	1-3/4	2-1/4	2-1/2	2-3/4	
Maximum installation torque <sup>2</sup>	$T_{max}$	ft-lbs	255	280	375	420	470	
Min. edge distance <sup>3</sup>	$c_{min}$	in	8-1/4	9	10	11-1/4	12-1/2	
Min. anchor spacing	$s_{min}$	in	8-1/4	9	10	11-1/4	12-1/2	
Dry and Water Saturated Concrete – Hammer Drilled Holes								
Temp. Range A <sup>4</sup>	Characteristic bond strength in uncracked concrete <sup>5</sup>	$\tau_{k,uncr}$	psi	1,440	1,340	1,174	1,073	957
Dry and Water Saturated Concrete – Core Drilled Holes								
Temp. Range A <sup>4</sup>	Characteristic bond strength in uncracked concrete <sup>5</sup>	$\tau_{k,uncr}$	psi	1,247	1,130	1,174	1,073	957
Anchor Category	-	-	3					
Strength reduction factor for bond failure modes for dry or water-saturated concrete	$\phi_d, \phi_{ws}$	-	0.45					

<sup>1</sup> The values shown are interpolated linearly based on data for testing up to 80mm diameter threaded rod.

<sup>2</sup> See figure 2 of the PTG Ed. 17 Section 3.2.4.3.4

<sup>3</sup> Minimum edge distance may be reduced to  $2d_o < c_{ai} < 5d_o$  provided  $T_{inst}$  is reduced per Table 5

<sup>4</sup> Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).

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.

<sup>5</sup> Bond strength values corresponding to concrete compressive strength  $f'_c = 2,500$  psi (17.2 MPa). For concrete compressive strength,  $f'_c$ , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of  $(f'_c/2,500)^{0.25}$  [for SI:  $(f'_c/17.2)^{0.25}$ ].

**Table 3 - Hilti HIT-RE 500 V3 adhesive design information with CA rebar per CSA A23.3-14 Annex D <sup>1</sup>**

Design parameter	Symbol	Units	Nominal reinforcing bar size			
			35M	45M	55M	
Nominal drill bit diameter <sup>2</sup>	$d_o$	in	1-3/4	2	2-3/4	
Minimum edge distance <sup>3</sup>	$c_{min}$	mm	180	220	300	
Minimum anchor spacing	$s_{min}$	mm	180	220	300	
Dry and Water Saturated Concrete – Hammer Drilled Holes						
Temp. range A <sup>4</sup>	Characteristic bond stress in uncracked concrete <sup>5</sup>	$\tau_{uncr}$	MPa	9.7	8.0	7.7
Dry and Water Saturated Concrete – Core Drilled Holes						
Temp. range A <sup>4</sup>	Characteristic bond stress in uncracked concrete <sup>5</sup>	$\tau_{uncr}$	MPa	8.8	8.0	7.7
Anchor category	-	-	3			
Resistance modification factor for bond failure modes for dry or water-saturated concrete	$R_{dry}, R_{ws}$	-	0.75			

<sup>1</sup> The values shown are interpolated linearly based on data for testing up to 80mm diameter threaded rod.

<sup>2</sup> See figure 2 of the PTG Ed. 17 Section 3.2.4.3.4

<sup>3</sup> Minimum edge distance may be reduced to  $2d_o$  provided rebar remains untorqued.

<sup>4</sup> Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).

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.

<sup>5</sup> Bond strength values corresponding to concrete compressive strength  $f'_c = 2,500$  psi (17.2 MPa). For concrete compressive strength,  $f'_c$ , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of  $(f'_c/2,500)^{0.25}$  [for SI:  $(f'_c/17.2)^{0.25}$ ].

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**Table 4 - Hilti HIT-RE 500-V3 design information with threaded rods per CSA A23.3-14 Annex D <sup>1</sup>**

Design parameter	Symbol	Units	Nominal rod diameter (in.)					
			1-3/8	1-1/2	2	2-1/4	2-1/2	
Nominal drill bit diameter <sup>2</sup>	$d_o$	in	1-1/2	1-3/4	2-1/4	2-1/2	2-3/4	
Maximum installation torque	$T_{max}$	Nm	350	380	510	570	635	
Minimum edge distance <sup>3</sup>	$c_{min}$	mm	175	191	254	286	318	
Minimum anchor spacing	$s_{min}$	mm	175	191	254	286	318	
Dry and Water Saturated Concrete – Hammer Drilled Holes								
Temp. range A <sup>4</sup>	Characteristic bond stress in uncracked concrete <sup>5</sup>	$\tau_{uncr}$	MPa	9.9	9.2	8.1	7.4	6.6
Dry and Water Saturated Concrete – Core Drilled Holes								
Temp. range A <sup>4</sup>	Characteristic bond stress in uncracked concrete <sup>5</sup>	$\tau_{uncr}$	MPa	8.6	8.5	8.1	7.4	6.6
Anchor category		-	-	3				
Resistance modification factor for bond failure modes for dry or water-saturated concrete	$R_{dry}, R_{ws}$	-	-	0.75				

<sup>1</sup> The values shown are interpolated linearly based on data for testing up to 80mm diameter threaded rod.

<sup>2</sup> See figure 2 of the PTG Ed. 17 Section 3.2.4.3.4

<sup>3</sup> Minimum edge distance may be reduced to  $2d_o < c_{ai} < 5d_o$  provided  $T_{inst}$  is reduced per Table 5

<sup>4</sup> Temperature range A: Max. short term temperature = 130°F (55°C), max. long term temperature = 110°F (43°C).

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.

<sup>5</sup> Bond strength values corresponding to concrete compressive strength  $f'_c = 2,500$  psi (17.2 MPa). For concrete compressive strength,  $f'_c$ , between 2,500 psi (17.2 MPa) and 8,000 psi (55.2 MPa), the tabulated characteristic bond strength may be increased by a factor of  $(f'_c/2,500)^{0.25}$  [for SI:  $(f'_c/17.2)^{0.25}$ ].

**Table 5 – Reduced maximum installation torque for edge distances less than 5d<sub>o</sub>.**

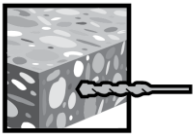
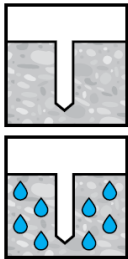
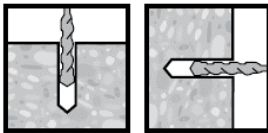
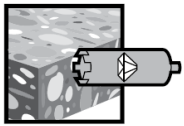
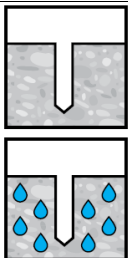
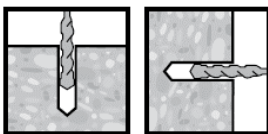
Edge distance, $c_{ai}$	Minimum anchor spacing, $s_{ai}$	Maximum torque, $T_{max,red}$
$2d_o \leq c_{ai} < 5d_o$	$5d_o \leq s_{ai} < 16$ in (406 mm)	$0.3 * T_{max}$
	$s_{ai} \geq 16$ in (406 mm)	$0.5 * T_{max}$

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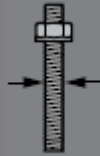
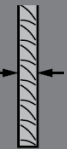

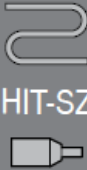

### Supplemental instructions for use:

In general, the existing Instructions For Use (IFU) for HIT-RE 500 V3 can be followed for installing the system vertically downward and horizontal. Overhead installations have not been evaluated and is outside of the scope of this document.

The following table is intended to supplement the instructions on page 4-5 of the attached IFU for large diameters elements. Refer to the instructions on the indicated page of the attached IFU for the condition indicated below. Extra care should be used to ensure that the borehole is completely dry using compressed air prior to installation of the adhesive.

Drilling method/concrete condition	Hole condition	Hole diameter	Installation direction	IFU page
		7/16" – 2-3/4"		18-19
		7/16" – 2-3/4"		24-25

The following installation equipment is supplemental to the equipment shown in the table on page 12 of the IFU for the larger threaded rods and rebar diameters. HIT-RB brushes and HIT-SZ piston plugs for diameters over 1-3/4" are special order items. Contact Hilti for more details.

		HAS 	Rebar 	HIT-RB 	HIT-SZ 	HIT-DL 
do [inch]	do [inch]	d [inch]	d [inch]	[inch]	[inch]	[inch]
1-1/2	1-1/2	1-3/8		1-1/2	1-1/2	1-3/8
1-3/4	1-3/4	1-1/2	#11, 35M	1-3/4	1-3/4	1-3/8
2-1/4	-	2	#14, 45M	2-1/4	2-1/4	1-3/8
2-1/2	-	2-1/4		2-1/2	2-1/2	1-3/8
2-3/4	-	2-1/2	#18, 55M	2-3/4	2-3/4	1-3/8

## HIT-RE 500 V3 Technical Data for large diameter elements

### Ordering information:

#### Round Steel Brushes

Item Number	Product Name	Description	Package Quantity
273217	HIT-RB 1-1/2"	1-1/2" Round Steel Brush	1
273219	HIT-RB 1-3/4"	1-3/4" Round Steel Brush	1
2085433	HIT-RB 2-1/4"	2-1/4" Round Steel Brush	2
2085434	HIT-RB 2-1/2"	2-1/2" Round Steel Brush	2
2085435	HIT-RB 2-3/4"	2-3/4" Round Steel Brush	2

#### Piston Plugs

Item Number	Product Name	Description	Package Quantity
2039306	HIT-SZ 1-1/2"	1-1/2" Piston Plug	10
2039307	HIT-SZ 1-3/4"	1-3/4" Piston Plug	10
2074310	HIT-SZ 2-1/4"	2-1/4" Piston Plug	10
2082155	HIT-SZ 2-1/2"	2-1/2" Piston Plug	10
2082156	HIT-SZ 2-3/4"	2-3/4" Piston Plug	10

#### Air Nozzle

Item Number	Product Name	Description	Package Quantity
38243	HIT-DL 1-3/8"	1-3/8" Air Nozzle	1

Please feel free to contact our Engineering Technical Services department for more information or any questions.

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