HIT-RE 500 V4 injection mortar

Technical data not covered by ETA-20/0541

Injection mortar system

Information covered

HIT-RE 500 V4 and Threaded rods, HIS-(R)N and Reinforcing bar (rebar)	submerged concrete

Hilti Technical data HIT-RE 500 V4

Scope and Specification of intended use

- The technical data in this document are not covered by ETA-20/0541 (issued 04.09.2021).
- Applicability of the technical data provided by this document is limited to an expected service life of maximum 50 years. This information is intended to provide an indication to choose the right product in relation to the expected economically reasonable working life of the works however, this cannot be interpreted as a guarantee (given by Hilti) of a service life of 50 years.
- Durability and serviceability of the Hilti product are ensured only, if the specifications of intended use according to Annex B of ETA-20/0541 (issued 04.09.2021) are considered and the installation instructions, supplied with the Hilti injection mortar, are obeyed unless deviating directives are provided in this document.
- Application is valid for static and quasi-static loading, only.
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work. Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings. The anchorages are designed in accordance with EN 1992-4.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

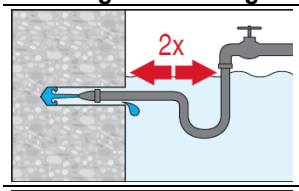
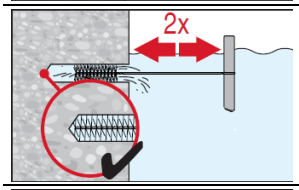
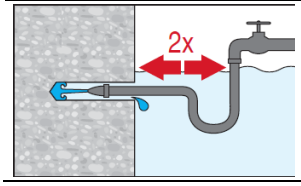
Application Scope

Anchorage subject to static and quasi static loading	
Base material	• Concrete strength C20/25 to C50/60 • Compacted reinforced or unreinforced normal weight concrete without fibers according to EN 206:2013+A1:2016 • Uncracked concrete, only
Concrete condition	submerged concrete
Embedment depth	acc. ETA-20/0541 (issued 04.09.2021)
Installation direction	acc. ETA-20/0541 (issued 04.09.2021)
Temperature in base material at installation	acc. ETA-20/0541 (issued 04.09.2021)
Temperature in base material in-service	acc. ETA-20/0541 (issued 04.09.2021)
Drilling technique	Hammer drilling
Cleaning	acc. Installation Instruction in this document
Setting	acc. ETA-20/0541 (issued 04.09.2021) and Installation Instruction in this document

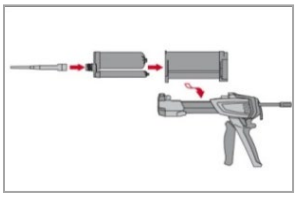
Installation parameters

Installation parameter	acc. ETA-20/0541 (issued 04.09.2021)

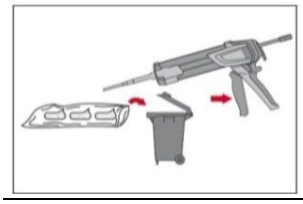
Installation instruction

Drill hole cleaning:	Just before setting an anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.
Cleaning for submerged concrete: For all drill hole diameters d_0 and all drill hole depths h_0.	
	Flush 2 times the hole by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.
	Brush 2 times with the specified brush size (see installation instruction delivered with the product) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the bore hole -- if not the brush is too small and must be replaced with the proper brush diameter.
	Flush again 2 times the hole by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.

Injection preparation



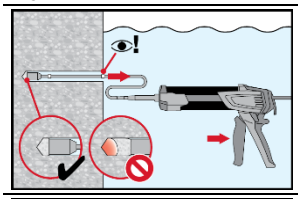
Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into dispenser.



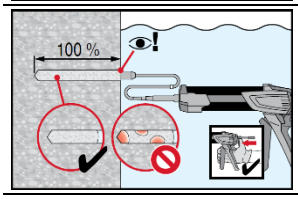
The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.

Discarded quantities are:	3 strokes	for 330 ml foil pack,
	4 strokes	for 500 ml foil pack,
	65 ml	for 1400 ml foil pack.

Inject adhesive from the back of the drill hole without forming air voids.

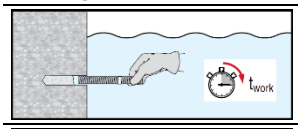


For submerged concrete application the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see installation instruction delivered with the product). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

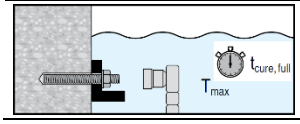


Fill bore hole completely with mortar.
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

Setting the element



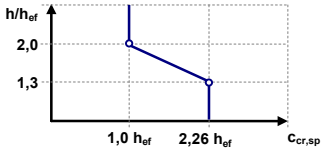
Before use, verify that the element is dry and free of oil and other contaminants. Mark and set element to the required embedment depth before working time t_{work} has elapsed. The working time t_{work} is given in the installation instruction delivered with the product.



Loading the anchor: After required curing time t_{cure} (see installation instruction delivered with the product) the anchor can be loaded. The applied installation torque shall not exceed the values T_{max} given in the installation instruction delivered with the product.

Essential characteristics

TENSION LOAD										
Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure				acc. EN 1992-4							
Installation factor											
Hammer drilling (submerged concrete)		γ_{inst}	[-]	1,4							
Concrete cone failure				acc. EN 1992-4							
Splitting failure											
Edge distance $c_{cr,sp}$ [mm] for		$h / h_{ef} \geq 2,0$		$1,0 \cdot h_{ef}$							
		$2,0 > h / h_{ef} > 1,3$		$4,6 \cdot h_{ef} - 1,8 \cdot h$							
		$h / h_{ef} \leq 1,3$		$2,26 \cdot h_{ef}$							
Spacing		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$							
Combined pullout and concrete cone failure for a working life of 50 years											
Characteristic resistance in uncracked concrete C20/25 in hammer drilled holes											
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	6,0	6,0	6,0	5,5	5,5	5,0	5,0	4,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	5,0	5,0	5,0	4,5	4,5	4,0	4,0	4,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	2,0	2,0	2,0	2,0	1,5	1,5	1,5	1,5
Influence factors ψ on bond resistance τ_{Rk} in uncracked concrete											
Influence of concrete strength											
Temperature range I to III:		ψ_c	[-]	$(f_{ck}/20)^{0,1}$							
Influence of sustained load											
Temperature range I:	40°C / 24°C	ψ^0_{sus}	[-]	0,88							
Temperature range II:	55°C / 43°C	ψ^0_{sus}	[-]	0,72							
Temperature range III:	75°C / 55°C	ψ^0_{sus}	[-]	0,69							

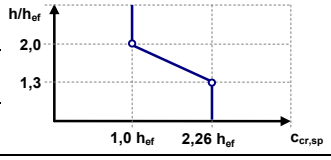


SHEAR LOAD										
Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure without lever arm											
Characteristic resistance		$V^0_{Rk,s}$	[kN]	$k_6 \cdot A_s \cdot f_{uk}$ with k_6 acc. EN 1992-4							
Partial factor		$\gamma_{Ms,V}$	[kN]	acc. EN 1992-4							
Ductility factor		k_7	[-]	1,0							
Steel failure with lever arm											
Characteristic resistance		$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$							
Ductility factor		k_7	[-]	1,0							
Concrete pry-out failure and concrete edge failure				acc. EN 1992-4 with k_8 = 2,0							

DISPLACEMENTS										
Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
TENSION LOAD											
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,04	0,05	0,05	0,06	0,06	0,07	0,08	0,08
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,13	0,15	0,17	0,18	0,19
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,05	0,06	0,07	0,07	0,08	0,09	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,18	0,20	0,21	0,23
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08	0,09	0,09	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,19	0,21	0,23	0,24
SHEAR LOAD											
Temperature range I to III:		δ_{V0}	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
		$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

TENSION LOAD

HIS-(R)N				M8	M10	M12	M16	M20
Steel failure								
Characteristic resistance HIS-N with screw grade 8.8		$N_{Rk,s}$	[kN]	25	46	67	125	116
Partial factor		$\gamma_{Ms,N}$	[-]	1,5				
Characteristic resistance HIS-RN with screw grade 70		$N_{Rk,s}$	[kN]	26	41	59	110	166
Partial factor		$\gamma_{Ms,N}$	[-]	1,87				2,4
Installation factor								
Hammer drilling (submerged concrete)		γ_{inst}	[-]	1,4				
Concrete cone failure								
Splitting failure								
Edge distance $c_{cr,sp}$ [mm] for	$h / h_{ef} \geq 2,0$			$1,0 \cdot h_{ef}$				
	$2,0 > h / h_{ef} > 1,3$			$4,6 \cdot h_{ef} - 1,8 \cdot h$				
	$h / h_{ef} \leq 1,3$			$2,26 \cdot h_{ef}$				
Spacing		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$				
Combined pullout and concrete cone failure for a working life of 50 years								
Characteristic resistance in uncracked concrete C20/25								
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	4,5	4,5	4,5	4,5	4,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	4,0	4,0	4,0	4,0	4,0
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	1,5	1,5	1,5	1,5	1,5
Influence factors ψ on bond resistance τ_{Rk} in uncracked concrete								
Influence of concrete strength								
Temperature range I to III:		ψ_c	[-]	$(f_{ck}/20)^{0,1}$				
Influence of sustained load								
Temperature range I:	40°C / 24°C	ψ^0_{sus}	[-]	0,88				
Temperature range II:	55°C / 43°C	ψ^0_{sus}	[-]	0,72				
Temperature range III:	75°C / 55°C	ψ^0_{sus}	[-]	0,69				

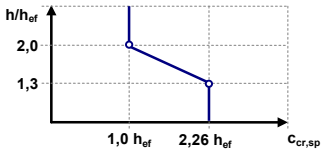


SHEAR LOAD

HIS-(R)N			M8	M10	M12	M16	M20
Steel failure without lever arm							
Characteristic resistance	$V^0_{Rk,s}$	[kN]	13	23	34	63	58
Partial factor	$\gamma_{Ms,V}$ [1)]	[-]	1,25				
Characteristic resistance HIS-RN with screw grade 70	$V_{Rk,s}$	[kN]	13	20	30	55	83
Partial factor	$\gamma_{Ms,V}$ [1)]	[-]	1,56				2,0
Ductility factor	k_7	[-]	1,0				
Steel failure with lever arm							
Characteristic resistance HIS-N	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519
Characteristic resistance HIS-RN	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454
Ductility factor	k_7	[-]	1,0				
Concrete pry-out failure							
Pry-out factor	k_8	[-]	2,0				
Concrete edge failure							
Effective length of fastener	l_f	[mm]	90	110	125	170	205
Outside diameter of fastener	d_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6

DISPLACEMENTS								
HIS-(R)N			**M8**	**M10**	**M12**	**M16**	**M20**	
TENSION LOAD								
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,18
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,07	0,08	0,09
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,16	0,18	0,20	0,21
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,07	0,09	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,16	0,19	0,21	0,22
SHEAR LOAD								
Temperature range I to III:		δ_{V0}	[mm/kN]	0,06	0,06	0,05	0,04	0,04
		$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,08	0,06	0,06

TENSION LOAD												
Reinforcing bar (rebar)				**ϕ 8**	**ϕ10**	**ϕ12**	**ϕ14**	**ϕ16**	**ϕ20**	**ϕ25**	**ϕ28**	**ϕ30**	**ϕ32**
Steel failure				acc. EN 1992-4									
Installation factor													
Hammer drilling (submerged concrete)		γ_{inst}	[-]	1,4									
Concrete cone failure				acc. EN 1992-4									
Splitting failure													
Edge distance $c_{cr,sp}$ [mm] for			$h / h_{ef} \geq 2,0$	$1,0 \cdot h_{ef}$									
			$2,0 > h / h_{ef} > 1,3$	$4,6 \cdot h_{ef} - 1,8 \cdot h$									
			$h / h_{ef} \leq 1,3$	$2,26 \cdot h_{ef}$									
Spacing		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$									
Combined pullout and concrete cone failure for a working life of 50 years													
Characteristic resistance in uncracked concrete C20/25													
Temperature range I:	40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm²]	3,0	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Temperature range II:	55°C / 43°C	$\tau_{Rk,ucr}$	[N/mm²]	2,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5
Temperature range III:	75°C / 55°C	$\tau_{Rk,ucr}$	[N/mm²]	1,0	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
Influence factors ψ on bond resistance τ_{Rk} in uncracked concrete													
Influence of concrete strength													
Temperature range I to III:		ψ_c	[-]	$(f_{ck}/20)^{0,1}$									
Influence of sustained load													
Temperature range I:	40°C / 24°C	ψ^0_{sus}	[-]	0,88									
Temperature range II:	55°C / 43°C	ψ^0_{sus}	[-]	0,72									
Temperature range III:	75°C / 55°C	ψ^0_{sus}	[-]	0,69									



SHEAR LOAD												
Reinforcing bar (rebar)				**ϕ 8**	**ϕ10**	**ϕ12**	**ϕ14**	**ϕ16**	**ϕ20**	**ϕ25**	**ϕ28**	**ϕ30**	**ϕ32**
Steel failure without lever arm													
Characteristic resistance		$V^0_{Rk,s}$	[kN]	$k_6 \cdot A_s \cdot f_{uk}$ with k_6 acc. EN 1992-4									
Partial factor		$\gamma_{Ms,V}$	[kN]	acc. EN 1992-4									
Ductility factor		k_7	[-]	1,0									
Steel failure with lever arm													
Characteristic resistance		$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$									
Ductility factor		k_7	[-]	1,0									
Concrete pry-out failure and concrete edge failure				acc. EN 1992-4 with k_8 = 2,0									

DISPLACEMENTS													
Reinforcing bar (rebar)				**ϕ 8**	**ϕ10**	**ϕ12**	**ϕ14**	**ϕ16**	**ϕ20**	**ϕ25**	**ϕ28**	**ϕ30**	**ϕ32**
TENSION LOAD													
Temperature range I:	40°C / 24°C	δ_{N0}	[mm/(N/mm²)]	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,08	0,08	0,08
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,13	0,15	0,17	0,18	0,19	0,19	0,20
Temperature range II:	55°C / 43°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,05	0,06	0,07	0,07	0,09	0,09	0,09	0,10	0,10
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,18	0,20	0,21	0,22	0,23	0,24
Temperature range III:	75°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,07	0,07	0,08	0,09	0,09	0,10	0,10	0,11
		$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,19	0,22	0,22	0,23	0,24	0,25
SHEAR LOAD													
Temperature range I to III:		δ_{V0}	[mm/kN]	0,05	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
		$\delta_{V\infty}$	[mm/kN]	0,08	0,08	0,07	0,06	0,06	0,05	0,05	0,05	0,04	0,04