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# Technical data

# No. 17/0001 of 25/04/2017

**General Part**

| | |
|---|---|
| Trade name | **Injection system Hilti HIT-RE 500 V3** |
| Scope of document | **HIT-RE 500 V3 for use in uncracked concrete in underwater applications for design according to „EOTA Technical Report TR 029" or"CEN/TS 1992-4:2009".** |
| Assessment by | Hilti Corporation<br>Business Unit Anchor<br>Feldkircherstrasse 100<br>FL-9494 Schaan<br>Principality of Liechtenstein |
| This assessment contains | 8 pages which form an integral part of this assessment |
| Basis of Technical data assessment | ETA-16/0143 (issue date: 11/2016)<br>ESR-3814 (issue date: 01/2016) |
| Author(s) | ARAzt |

This document is subject to revision.

## Revision log

| Version | Date | Comment |
|---|---|---|
| 1.0 | 25.04.2017 | First release |
| | | |
| | | |
| | | |

# 1 Preliminary note

The given bond strength data is calculated from $\tau_{ucr}$ and $\tau_{cr}$ for hammer drilling given in ETA-16/0143 and using a reduction factor $\alpha_{cat3}$ from the assessment done for ESR-3814. In addition, a reduction factor is applied reflecting the provisions used for sustained loads for adhesive anchors from ACI 318-11. As this factor is not used for design according EOTA TR 29 and CEN/TS 1992-4:2009, it'll be applied already to the resistance values $\tau_{Rk}$ herein.

Following boundary conditions apply:

- Static or quasi-static loading
- Hammer drilling,
  no hollow drill bit, no diamond coring, no diamond coring with roughening

# 2 Installation

**Table 1: Installation parameters for threaded rods**

| **Threaded rod** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter of element | $d^{1)} = d_{nom}^{2)}$ | [mm] | 8 | 10 | 12 | 16 | 20 | 24 | 27 | 30 |
| Diameter of drill bit | $d_0$ | [mm] | 10 | 12 | 14 | 18 | 22 | 28 | 30 | 35 |
| Diameter of brush | HIT-RB | [mm] | 10 | 12 | 14 | 18 | 22 | 28 | 30 | 35 |
| Diameter of piston plug | HIT-SZ | [mm] | 10 | 12 | 14 | 18 | 22 | 28 | 30 | 35 |
| Effective embedment depth and drill hole depth | min $h_{ef}$ | [mm] | 60 | 60 | 70 | 80 | 90 | 96 | 108 | 120 |
| | max $h_{ef}$ | [mm] | 160 | 200 | 240 | 320 | 400 | 480 | 540 | 600 |
| Maximum diameter of clearance hole in the fixture[3)] | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 | 30 | 33 |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | $h_{ef}$ + 30 ≥ 100 mm | | | $h_{ef} + 2\,d_0$ | | | | |
| Maximum torque moment | $T_{max}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 | 270 | 300 |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 75 | 90 | 115 | 120 | 140 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 45 | 50 | 55 | 60 | 75 | 80 |

1) Parameter for design acc. to "EOTA Technical Report TR 029".
2) Parameter for design acc. to "CEN/TS 1992-4:2009".
3) For larger clearance hole see "TR 029 section 1.1".

## Table 2: Installation parameters for internally threaded sleeve

| **Internally threaded sleeve HIS-(R)N** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|
| Outer diameter of sleeve | d[1)] = $d_{nom}$[2)] | [mm] | 12,5 | 16,5 | 20,5 | 25,4 | 27,6 |
| Nominal diameter of drill bit | $d_0$ | [mm] | 14 | 18 | 22 | 28 | 32 |
| Diameter of brush | HIT-RB | [mm] | 14 | 18 | 22 | 28 | 32 |
| Diameter of piston plug | HIT-SZ | [mm] | 14 | 18 | 22 | 28 | 32 |
| Effective embedment depth and drill hole depth | $h_{ef} = h_0$ | [mm] | 90 | 110 | 125 | 170 | 205 |
| Maximum diameter of clearance hole in the fixture [3)] | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 120 | 150 | 170 | 230 | 270 |
| Maximum torque moment | $T_{max}$ | [Nm] | 10 | 20 | 40 | 80 | 150 |
| Thread engagement length min-max | $h_s$ | [mm] | 8-20 | 10-25 | 12-30 | 16-40 | 20-50 |
| Minimum spacing | $s_{min}$ | [mm] | 60 | 75 | 90 | 115 | 130 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 55 | 65 | 90 |

1) Parameter for design acc. to “EOTA Technical Report TR 029”.
2) Parameter for design acc. to “CEN/TS 1992-4:2009”.
3) For larger clearance hole see “TR 029 section 1.1”.

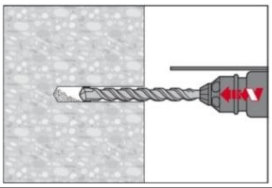
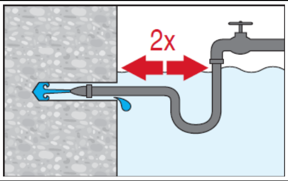
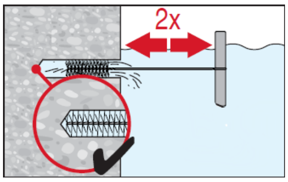
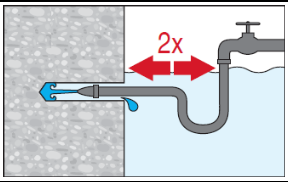
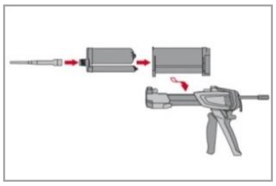
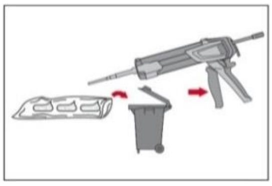
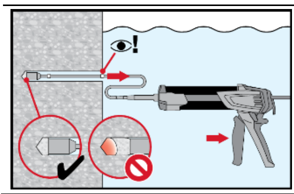
## Table 3: Installation parameters for rebars

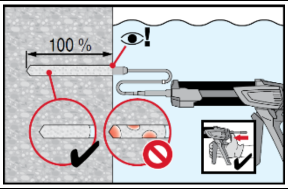
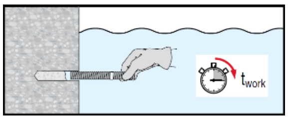
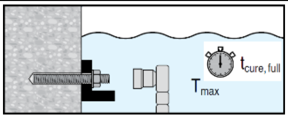
<table>
<tr><th colspan="3">Reinforcing bar (rebar)</th><th>ϕ 8</th><th>ϕ 10</th><th colspan="2">ϕ 12</th><th>ϕ 14</th><th>ϕ 16</th><th>ϕ 20</th><th>ϕ 25</th><th>ϕ 28</th><th>ϕ 30</th><th>ϕ 32</th></tr>
<tr><td>O.D. Element</td><td>d[1)] = $d_{nom}$[2)]</td><td>[mm]</td><td>8</td><td>10</td><td colspan="2">12</td><td>14</td><td>16</td><td>20</td><td>25</td><td>28</td><td>30</td><td>32</td></tr>
<tr><td>Diameter of drill bit</td><td>$d_0$</td><td>[mm]</td><td>10[3)]<br>12[3)]</td><td>12[3)]<br>14[3)]</td><td colspan="2">14</td><td>16</td><td>18</td><td>20</td><td>25</td><td>30[3)]<br>32[3)]</td><td>35</td><td>37</td></tr>
<tr><td>Diameter of brush</td><td>HIT-RB</td><td>[mm]</td><td>10<br>12</td><td>12<br>14</td><td colspan="2">14</td><td>16</td><td>18</td><td>20</td><td>25</td><td>30<br>32</td><td>35</td><td>37</td></tr>
<tr><td>Diameter of piston plug</td><td>HIT-SZ</td><td>[mm]</td><td>10<br>12</td><td>12<br>14</td><td colspan="2">14</td><td>16</td><td>18</td><td>20</td><td>25</td><td>30<br>32</td><td>35</td><td>37</td></tr>
<tr><td>Effective embedment depth and drill hole depth</td><td>$h_{ef} = h_0$</td><td>[mm]</td><td>60<br>to<br>160</td><td>60<br>to<br>200</td><td colspan="2">70<br>to<br>240</td><td>75<br>to<br>280</td><td>80<br>to<br>320</td><td>90<br>to<br>400</td><td>100<br>to<br>500</td><td>112<br>to<br>560</td><td>120<br>to<br>600</td><td>128<br>to<br>640</td></tr>
<tr><td>Nominal diameter of drill bit</td><td>$d_0$</td><td>[mm]</td><td>10[3)]<br>12[3)]</td><td>12[3)]<br>14[3)]</td><td>14[3)]</td><td>16[3)]</td><td>18</td><td>20</td><td>25</td><td>30[3)]<br>32[3)]</td><td>35</td><td>37</td><td>40</td></tr>
<tr><td>Minimum thickness of concrete member</td><td>$h_{min}$</td><td>[mm]</td><td colspan="3">$h_{ef}$ + 30<br>≥ 100 mm</td><td colspan="8">$h_{ef} + 2 \cdot d_0$</td></tr>
<tr><td>Minimum spacing</td><td>$s_{min}$</td><td>[mm]</td><td>40</td><td>50</td><td colspan="2">60</td><td>70</td><td>80</td><td>100</td><td>125</td><td>140</td><td>150</td><td>160</td></tr>
<tr><td>Minimum edge distance</td><td>$c_{min}$</td><td>[mm]</td><td>40</td><td>45</td><td colspan="2">45</td><td>50</td><td>50</td><td>65</td><td>70</td><td>75</td><td>80</td><td>80</td></tr>
</table>

1) Parameter for design acc. to “EOTA Technical Report TR 029”.
2) Parameter for design acc. to “CEN/TS 1992-4:2009”.
3) alternative drill bit sizes

## Installation instruction

The MPII (Manufacturers Printed Installation Instruction) delivered with each foil pack applies accordingly. For installation in submerged concrete the following procedure is covered by this data:

| | |
|---|---|
| **Hole Drilling** | |
| **Hammer drilling:** | For dry or wet concrete and installation in flooded holes and submerged concrete (no sea water). |
|  | Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit. |
| **Drill hole cleaning:** | Just before setting an anchor, the drill hole must be free of dust and debris.<br>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 (brush Ø ≥ bore hole Ø, see Table 1 to Table 3) 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.<br><br>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.<br>Observe the instruction for use of the dispenser.<br>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.<br>Discarded quantities are: 3 strokes for 330 ml foil pack,<br>4 strokes for 500 ml foil pack,<br>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 Table 1 to Table 3). 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.<br>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.<br>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 MPII. |
|   | Loading the anchor: After required curing time $t_{cure}$ (see MPII) the anchor can be loaded.<br>The applied installation torque shall not exceed the values $T_{max}$ given in Table 1 to Table 3. |

## 3 Performance

**Table 4: Characteristic resistance for threaded rods under tension load in concrete**

| **Threaded rod, HIT-V-…, AM…8.8** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Installation safety factor** | | | | | | | | | | |
| Hammer drilling in flooded holes and submerged concrete | $\gamma_2$ 1) = $\gamma_{inst}$ 2) | [-] | 1,4 | | | | | | | |
| **Steel failure → see ETA-16/0143** | | | | | | | | | | |
| **Combined pullout and concrete cone failure** | | | | | | | | | | |
| Characteristic bond resistance in **non-cracked concrete** C20/25 in hammer drilled holes and installation in **submerged concrete** | | | | | | | | | | |
| Temperature range I: 40°C / 24°C | $\tau_{Rk,ucr}$ | [N/mm²] | 6 | 6 | 6 | 5,5 | 5 | 5 | 5 | 4,5 |
| Temperature range II: 70°C / 43°C | $\tau_{Rk,ucr}$ | [N/mm²] | 5 | 4,5 | 4,5 | 4 | 4 | 3,5 | 3,5 | 3,5 |
| Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5 | $k_8$ 2) | [-] | 10,1 | | | | | | | |
| Increasing factors for $\tau_{Rk}$ in concrete | $\psi_c$ | C30/37 | 1,04 | | | | | | | |
| | | C40/50 | 1,07 | | | | | | | |
| | | C50/60 | 1,09 | | | | | | | |
| **Concrete cone failure → see ETA-16/0143** | | | | | | | | | | |
| **Splitting failure → see ETA-16/0143** | | | | | | | | | | |

1) Parameter for design acc. to EOTA Technical Report TR 029. 2) Parameter for design acc. to CEN/TS 1992-4:2009.

**Characteristic resistance for threaded rods under shear load in concrete applies the same way than given in ETA-16/0143**

**Displacements in tension and shear for threaded rods apply the same way than given in ETA-16/0143**

**Table 5: Characteristic resistance for internally threaded sleeve HIS-(R)N under tension load in concrete**

| | | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|
| Outer diameter of sleeve | $d^{1)} = d_{nom}^{2)}$ | [mm] | 12,5 | 16,5 | 20,5 | 25,4 | 27,6 |
| **Installation safety factor** | | | | | | | |
| Hammer drilling in flooded holes | $\gamma_2^{1)} = \gamma_{inst}^{2)}$ | [-] | 1,4 | | | | |
| **Steel failure** | | | | | | | |
| **Combined pullout and concrete cone failure**[3)] | | | | | | | |
| Characteristic bond resistance in **non-cracked concrete** C20/25 in hammer drilled holes and installation in **submerged concrete** | | | | | | | |
| 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: 70°C / 43°C | $\tau_{Rk,ucr}$ | [N/mm²] | 3,5 | 3,5 | 3,5 | 3,5 | 3,5 |
| Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5 | $k_8^{3)}$ | [-] | 10,1 | | | | |
| Increasing factors for $\tau_{Rk}$ in concrete | $\psi_c$ | C30/37 | 1,04 | | | | |
| | | C40/50 | 1,07 | | | | |
| | | C50/60 | 1,09 | | | | |
| **Concrete cone failure → see ETA-16/0143** | | | | | | | |
| **Splitting failure → see ETA-16/0143** | | | | | | | |

1) Parameter for design acc. to EOTA Technical Report TR 029. 2) Parameter for design acc. to CEN/TS 1992-4:2009.
3) For design according to CEN/TS 1992-1:2009, the characteristic tension load values bond resistance may be calculated from the characteristic bond resistance for combined pull-out and concrete cone failure according to: $N_{Rk} = \tau_{Rk} \cdot (h_{ef} \cdot d_1 \cdot \pi)$.

**Characteristic resistance for internally threaded sleeve HIS-(R)N under shear load in concrete applies the same way than given in ETA-16/0143**

**Displacements in tension and shear for internally threaded sleeve HIS-(R)N apply the same way than given in ETA-16/0143**

**Table 6: Characteristic resistance for rebars under tension load in concrete**

| **Reinforcing bar (rebar)** | | | | **ϕ 8** | **ϕ 10** | **ϕ 12** | **ϕ 14** | **ϕ 16** | **ϕ 20** | **ϕ 25** | **ϕ 28** | **ϕ 30** | **ϕ 32** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Installation safety factor** | | | | | | | | | | | | | |
| Hammer drilling in flooded holes | | $\gamma_2$[1] = $\gamma_{inst}$[2] | [-] | 1,4 | | | | | | | | | |
| **Steel failure rebars** | | | | | | | | | | | | | |
| **Combined pullout and concrete cone failure** | | | | | | | | | | | | | |
| Characteristic bond resistance in **non-cracked concrete** C20/25 in hammer drilled holes and installation in **submerged concrete** | | | | | | | | | | | | | |
| Temperature range I: | 40°C / 24°C | $\tau_{Rk,ucr}$ | [N/mm²] | 3 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 |
| Temperature range II: | 70°C / 43°C | $\tau_{Rk,ucr}$ | [N/mm²] | 2,5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5 | | $k_8$ | [-] | 10,1 | | | | | | | | | |
| Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5 | | $k_8$ | [-] | 7,2 | | | | | | | | | |
| Increasing factors for $\tau_{Rk}$ in concrete | | $\psi_c$ | C30/37 | 1,04 | | | | | | | | | |
| | | | C40/50 | 1,07 | | | | | | | | | |
| | | | C50/60 | 1,09 | | | | | | | | | |
| **Concrete cone failure → see ETA-16/0143** | | | | | | | | | | | | | |
| **Splitting failure → see ETA-16/0143** | | | | | | | | | | | | | |

[1] Parameter for design acc. to EOTA Technical Report TR 029. [2] Parameter for design acc. to CEN/TS 1992-4:2009.

**Characteristic resistance for rebars under shear load in concrete applies the same way than given in ETA-16/0143**

**Displacements in tension and shear for rebars apply the same way than given in ETA-16/0143**