

Hilti HIT-RE 500

Use of Hilti HIT-RE 500 Injection Adhesive for Large Anchors up to Diameter M80

In general:

Due to the

- excellent bonding performance
- the low shrinkage
- the good performance in diamond cored holes
- the convenient working time and
- the outstanding handling behaviour regarding dispensing force / dispensing speed

HIT-RE 500 injection adhesive can be used for fastening of large elements like threaded rods up to size M80 or equivalent large diameter rebars.

During HIT-RE 500 development the BU Anchors have tested anchor rods in the range of M8 up to M64 and rebars in the range of Ø8 till Ø40 mm.

Based on the bond strength results of these tests we can give the following design recommendations, which is **valid for anchor sizes of larger than M39 / rebar 40 up to M80** or equivalent rebar size. For sizes M8 till M39 and rebar Ø8 till Ø40 mm the Hilti technical data published in Hilti **Fastening Technology Manual (FTM)**, issue 2004 or in the HIDU design program are decisive.

Design recommendation:

Based on the state of the art anchor design 3 checks have to be made for tensile resistance as well as 2 checks for shear resistance:

$$N_{Rd} = \min\{ N_{Rd,p}; N_{Rd,c}; N_{Rd,s} \} \geq N_{Sd}$$
$$V_{Rd} = \min\{ V_{Rd,c}; V_{Rd,s} \} \geq V_{Sd}$$

As **nominal anchorage depth** we recommend $h_{nom} = 9 \times \varnothing = 9 \times$ nominal diameter of fastening element. For anchors mainly designed as shear connectors the min. allowable anchorage depth is $h_{min} = 6 \times \varnothing$, to avoid pry-out failures.

1. Anchor pull-out design resistance $N_{Rd,p}$

The anchor pull-out design resistance can be calculated by

$$N_{Rd,p} = \varnothing \times \pi \times h_{eff} \times \tau_d \times f_{Temp} \times f_{W.sat}$$

\varnothing = nominal diameter of fastening element (HAS M64: $\varnothing = 64$ mm)
(Rebar 50: $\varnothing = 50$ mm)

$\pi = 3,14$

h_{eff} = effective anchorage depth

τ_d = **recommended design bond strength = 3,5 N/mm²**

for anchor sizes larger than M39 up to M80

for concrete strength of C20/25 till C50/60 / 3.000 till 6.000 psi

f_{Temp} ; $f_{W.sat}$ = adjustment factors

The recommended design bond strength is valid for the above mentioned range of concrete strength. The adjustment factors for water saturated concrete $f_{W.sat}$ and base material temperature f_{Temp} must be used from the **FTM**, issue 2004

2. Concrete failure design resistance $N_{Rd,c}$, $V_{Rd,c}$

The concrete failure design resistance for tensile and shear should be calculated using the CC-Method (Concrete Capacity Method).

This method covers the influence of concrete strength, anchorage depth, anchor spacing and edge distance.

As orientation for minimum and critical anchor spacing and edge influence use the rules published in the FTM, issue 2004:

$$\begin{array}{l} \text{spacing:} \quad s_{\min} = 0,5 \times h_{\text{nom}} \leq s \leq s_{\text{cr,N}} = 2,0 \times h_{\text{nom}} \\ \text{edge distance:} \quad c_{\min} = 0,5 \times h_{\text{nom}} \leq c \leq c_{\text{cr,N}} = 1,0 \times h_{\text{nom}} \end{array}$$

Please contact the DS group of the BU Anchors for design assistance.

3. Steel design resistance $N_{Rd,s}$, $V_{Rd,s}$

We recommend to use the design methods and safety factors published in the FTM, issue 2004.

Setting conditions:

Regarding **annular space between fastening element and base material** we recommend the rule:

$$D + 4\text{mm} \leq d_o \leq D + 10\text{mm}$$

d_o = bore hole diameter

HAS: D = \varnothing = nominal diameter of fastening element

Rebar: D = effective maximum diameter over ribs of the rebar

This means the bore hole diameter should be in a range of 4 to 10 mm bigger than the nominal diameter of the threaded rod or the effective maximum diameter over ribs of the rebar

With this rule a standard Hilti diamond core bit should always match.

We hope these design rules for large fastening elements set with Hilti HIT-RE 500 injection mortar enables you for proper anchor design and qualified support of your customers.

Regards

Hilti Development Anchors
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