



TEST-REPORT

Testing of water tightness of anchor fastenings in composite specimens
on the basis of
RVS 15.04.12 (issue 01.09.2006)
Bridges – Equipment of bridges – Edge beams – Anchoring in concrete
with
water pressure of 0,5 bar for a test duration of 8,3 days

Adhesive anchoring system Hilti HIT-RE 500 V4
and stainless steel A4 anchor rods M12x160 mm

description of order

Ordering party	Hilti AG
Address of ordering party	Feldkircherstr. 100 FL-9494 Schaan Principality of Liechtenstein
Date of order Order No.	21.12.2020
Test material	<ul style="list-style-type: none">• six composite specimens^{*)}• Hilti HIT-RE 500 V4• Stainless steel A4 anchor rods M12x160 mm
Receipt of test material	21.12.2020 ^{*)} , 15.01.2021

Test Report No.	301/20a
Date of issue	31.03.2021
This report consists of:	Text 9 pages

The reported test results relate only to the tested items. If this test report is transcribed or copied, the wording and layout may not be changed, nothing may be omitted and no additions may be made. Extracts may only be copied or published with the written permission of the testing laboratory. The Bautechnische Versuchsanstalt (Testing laboratory at the HTL Rankweil) is attached to the HTBL u VA Rankweil and is accredited by BMDW GZ: 2020-0.289.417, dated May 19th, 2020 as testing laboratory according to EN ISO/IEC 17025:2017.

1. MISCELLANEOUS

The *Hilti AG* contracted the Testing Laboratory at the HTL Rankweil (Bautechnische Versuchsanstalt an der HTL Rankweil) to conduct tests to verify the water tightness of an adhesive anchor fastening system in composite specimens on the basis of RVS 15.04.12 (issue 01.09.2006).

The Testing Laboratory at the HTL Rankweil is part of an educational institution and owned by the Republic of Austria. The Testing Laboratory is accredited according to EN ISO/IEC 17025:2017 by the Federal Ministry for Digital and Economic Affairs.

All used testing devices are calibrated with traceability to national or international reference standards.

2. TEST SAMPLES

The testing program comprised tests on six composite specimens with dimensions of approx. 300x300x235 mm. The composite specimens consist of 6 layers, i.e. – beginning from the top surface – (1) ceramic tiles with thickness of approx. 7 mm, (2) tile cement with thickness of approx. 3 mm, (3) sealing with thickness of approx. 2 mm, (4) screed with thickness of 65 mm, (5) sealing with thickness of 3-4 mm, and (6) concrete with height of 150 mm. The different layers are shown in Figure 1.

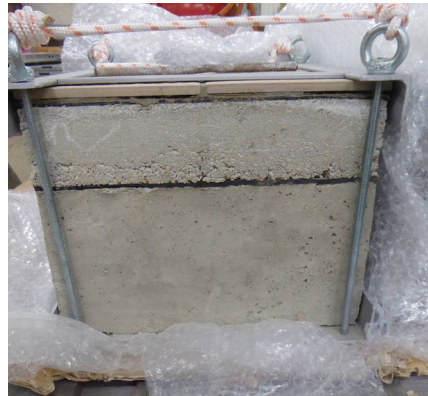


Figure 1. Lateral surface of a composite specimen with six layers.

The composite specimens were delivered by the ordering party to the Testing Laboratory at the HTL Rankweil on 21.12.2020.

The stainless steel A4 anchor rods M12x160 mm and the injection mortar Hilti HIT-RE 500 V4 are shown in Figure 2. These components were delivered by the ordering party to the Testing Laboratory at the HTL Rankweil on 15.01.2021.



Figure 2. Injection mortar Hilti HIT-RE 500 V4 (left) and anchor rods M12x160 mm (right).

The article number of the injection mortar was #2287557 and the batch numbers of component A and component B were 9014250 and 9115373, respectively.

3. PREPARATION OF THE TEST SAMPLES

3.1 Composite specimens

On 15.01.2021 (specimen no. 20.301 01) and on 18.01.2021 (specimens no. 20.301 02-06) the composite specimens were cut wet to the dimensions of 200x200x235 mm, in order to be able to testing the specimens in the water pressure test stand. The cutting surfaces were defined in such a way, that the crossing joint of the four ceramic tiles on the top surface of the composite specimens still remained in the centre of the surface-area. In Figure 3, the composite specimens are depicted after wet cutting.



Figure 3. Composite specimens after wet cutting with dimensions of 200x200x235 mm.

3.2 Setting the anchor rods

The boreholes / the anchor rods were positioned in the centre of the composite specimens, i.e. in / near the crossing joint of the ceramic tiles. The Hilti HEX 14/40 SPX diamond drill bit with a diameter of 14 mm was used for producing the boreholes in the ceramic tiles (diamond drilling procedure), whereas the Hilti TE-CX 14 drill bit with a medium cutting diameter of 14,33 mm was used for hammer drilling in the screed, sealing, and concrete. The borehole depth h_{nom} amounted to approx. 65 mm, hence, an embedment of the anchor rod in the concrete of 60 mm was achieved (schematically shown in Figure 4).



Figure 4. Definition of the borehole depth.

After drilling the boreholes were cleaned according to the borehole cleaning procedure described in ETA-20/0540 (issued on 27.11.2020), i.e. blowing 2 times from the back of the hole over the whole length with compressed air (6 bar), brushing 2 times with a steel brush in a twist motion, blowing again with compressed air 2 times.

Before the installation of the anchor rods, in agreement with the ordering party, the anchor rods were cleaned with a break cleaner (Liqui Moly GmbH), in order to degrease and remove any impurities (oil, dust, chips etc.).

The static mixer Hilti HIT-RE-M was tightly attached to the foil pack manifold. The 500 ml foil pack was inserted in the foil pack holder, which in turn was put into the mechanical dispenser Hilti HDM 500. The first 4 strokes were discarded.

Then, the boreholes were filled with the injection mortar starting at the back of the borehole. With each trigger pull the mixer was slowly withdrawn. The boreholes were filled up to approximately 2/3 of the height, and then, the anchor rods were set to the required embedment depth.

The ambient air temperature was 19°C. The anchors were installed on 28.01.2021.

After curing, the excess mortar was removed very carefully.

No fixture was attached and no tightening torque was applied.

4. WATER TIGHTNESS TESTS – 0,5 BAR FOR 8,3 DAYS

The water tightness tests were conducted on the basis of RVS 15.04.12 (issue 01.09.2006).

The specimens were placed in a testing apparatus that is usually used for testing the water penetration depth according to ONR 23303:2010 resp. EN 12390-8:2019.

A pre-test was conducted on 03.02.2021 on specimen no. 20.301 01. The top surface with ceramic tiles and installed anchor, or more precisely, a circle with 100 mm in diameter with the anchor in its centre, should be exposed to a water pressure of 0,5 bar. However, during filling the testing apparatus with water an escape of water in the area of the tile joints between sealing of the screed an adhesive of the ceramics was observed (shown in Figure 5).



Figure 5. Escape of water during filling the testing apparatus with water.

In agreement with the ordering party, the ceramic tiles and the tile cement layers were removed very carefully by tapping with a hammer. The tested surfaces of the modified composite specimens with the internal numbers 20.301 01, 20.301 05, and 20.301 06 are shown in Figure 6.



Figure 6. Surfaces of specimens no. 20.301 01 (left), 20.301 05 (middle), and 20.301 06 (right) after removing the ceramic tiles and the tile cement layers.

The specimens, shown in Figure 6, were installed in the testing apparatus without any air inclusion, as shown for example for specimen no 20.301 01 in Figure 7.



Figure 7. Specimen no. 20.301 01 after installing in the testing apparatus.

Specimen no. 20.301 01 as well as the specimens with the internal numbers 20.301 05 and 20.301 06 were exposed to a water pressure of 0,5 bar. More precisely, a circle with 100 mm in diameter with the anchor in its centre was exposed to the respective water pressure.

After a period of 8,3 days, the specimens were splitted along the axis of the anchor rods and the fracture surface was investigated visually for water penetration in the screed and in the concrete. The visual inspection was done by two members of the Testing Laboratory at the HTL Rankweil.


5. RESULTS OF THE WATER TIGHTNESS TESTS

The results of the water penetration tests performed with 0,5 bar and the evaluation of the tests are given in the following table.


Table 1. Results of the water penetration tests – 0,5 bar for 8,3 days.

Specimen no.	Figure	Evaluation
20.301 01		<ul style="list-style-type: none"> • no water penetration in the concrete • no water penetration in the screed

Continue of Table 1.

Specimen no.	Figure	Evaluation
20.301 05		<ul style="list-style-type: none">• no water penetration in the concrete• water penetration in the screed

Continue of Table 1.

Specimen no.	Figure	Evaluation
20.301 06		<ul style="list-style-type: none">• no water penetration in the concrete• no water penetration in the screed

For specimen no. 20.301 05, the water penetration in a small part of the screed was investigated on small pieces with and without penetrated water. Both pieces were dried “softly” at a temperature of 50°C for a duration of about 17 hours. A difference in the mass water content of 1,5 M-% was obtained (related to the mass of the dried specimens).

6. SUMMARY

Table 2 shows a summary of the results.

Table 2. Summary – test results.

Laboratory no.	anchor rod size	drilling direction	injection mortar	Evaluation of water penetration in the concrete
20.301 01	M12x160	90°	HIT-RE 500 V4	passed
20.301 05				passed
20.301 06				passed


Decision rule according to EN ISO/IEC 17025, in agreement with the ordering party:

Evaluation of the results on the basis of the **water penetration** in the **concrete**

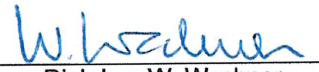
Declaration of conformity according to RVS 15.04.12:

See Table 2.

Rankweil, 31.03.2021



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