



# TEST-REPORT

**PENETRATION OF WATER UNDER PRESSURE  
IN HARDENED CONCRETE C25/30**

**SAMPLES WITH ANCHOR ROD HIT V-R M12x150  
INSTALLED WITH HIT-RE 500**

EN 12390-8:2009: Testing hardened concrete -  
Part 8: Depth of penetration of water under pressure

description of order

Ordering party	Hilti Entwicklungsgesellschaft mbH Product Care Chemical Anchors Development Chemical Anchors
Address of ordering party	Hiltistr. 6 86916 KAUFERING GERMANY
Date of order Order No.	March 25, 2009 4505965763
Test material	HIT-RE 500 Injection Adhesive ANCHOR ROD HIT V-R M12x150
Receipt of test material	April 21, 2009

Test Report No.	176/09a
Date of issue	June 23, 2009
This report consists of:	Text            6 pages Appendix 1    1 page Appendix 2    2 pages

The reported test results relate only to the tested items.

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The Testing Laboratory at the HTL Rankweil (Bautechnische Versuchsanstalt) is attached to the HTBLuVA Rankweil. The Testing Laboratory is accredited by BMWFJ-92.714/0231-I/12/2009, dated April 14, 2009 and OIB ZL-OIB-180-001/02-034 dated October 24, 2006 as Testing Laboratory/Inspecting body (Id.No. 115).

## 1 MISCELLANEOUS

The Hilti Entwicklungsgesellschaft mbH contracted the Testing Laboratory at the HTL Rankweil (Bautechnische Versuchsanstalt an der HTL Rankweil) to conduct tests to determine the depth of penetration of water under pressure in hardened concrete, when anchor rods HIT V-R M12x150 are installed with the adhesive mortar HIT-RE 500.

Following test procedure was agreed upon between the ordering party and the Testing Laboratory:

- casting of 5 concrete samples using C25/30  $D_{max}$  22, cubes with 200 mm edge-length;
- installation of the anchor rod HIT V-R M12x150 with HIT-RE 500 according to the instructions given by the ordering party;
- testing the samples according to EN 12390-8:2009 respectively to ISO 1920-5:2004 by applying a water presser of  $(500 \pm 50)$  kPa for the duration of  $(72 \pm 2)$  hours.

It was agreed upon, that the specimens in which the anchors were installed are not water-cured for the whole period between demolding and testing.

In addition to the above described test procedure a series of 3 samples concrete cubes were fabricated and their compressive strength was determined according to the Austrian Standard ÖNORM B 3303 respectively to ÖNORM EN 12390-3.

To get informations on the penetration of water under pressure in to the plain concrete, concrete samples with the dimension 200x200x120 mm were casted with the same mix design, water-cured till the age of 28 days and then tested according to EN 12390-8.

Tested adhesive anchor:



HIT-RE 500 and HIT V-R M12x150

## ONCRETE MIX DESIGN - CASTING OF CONCRETE SAMPLES

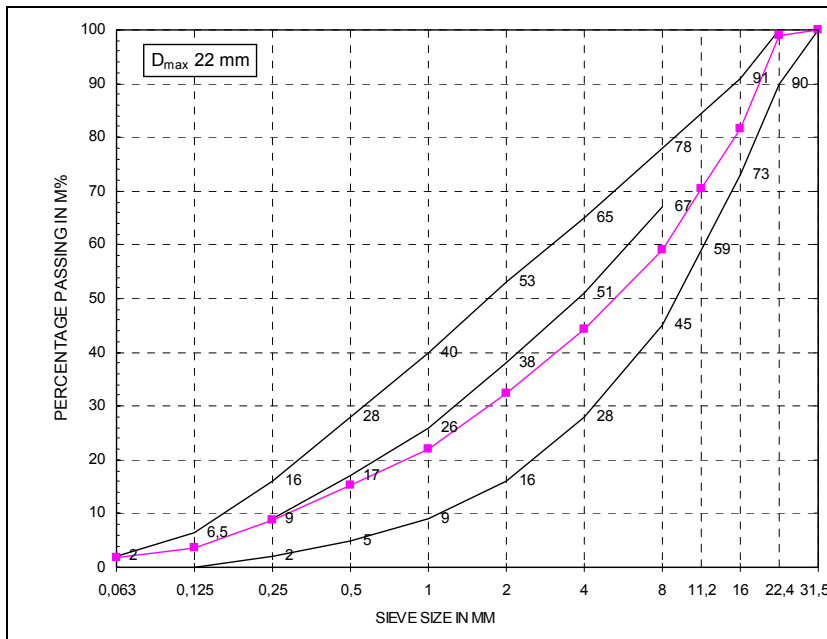
### 2.1 CONCRETE MIX DESIGN

Cement: 345 kg/m<sup>3</sup> CEM II/A-LL 32,5 R, Heidelberger Cement  
Water: drinking water 189 kg/m<sup>3</sup>  
W/C - ratio: 0,55

Aggregate - natural rounded gravel

0/4:	831 kg/m <sup>3</sup>	Zech-Kies GmbH
4/8:	269 kg/m <sup>3</sup>	Zech-Kies GmbH
8/16:	461 kg/m <sup>3</sup>	Zech-Kies GmbH
16/32:	346 kg/m <sup>3</sup>	Zech-Kies GmbH

Grading of the aggregates:



2.2 CASTING OF CONCRETE SPECIMENS

The concrete components were mixed with a laboratory compulsory mixer. After adding the water the concrete was mixed for 2 minutes. Subsequent to the mixing the concrete flow and the density of fresh concrete were tested.

Properties of the fresh concrete

date of casting	20.03.2009	27.03.2009
concrete flow	440 mm	465 mm
density of fresh concrete	2466 kg/m <sup>3</sup>	2479 kg/m <sup>3</sup>
temperature of fresh concrete	18,7 °C	20,7 °C
fabricated specimens	09.04801 - 09.04806	09.04832 - 09.04836

The moulds were filled and the concrete was compacted with a vibrating table at 7500 R/min during 30 sec.

**Storing and curing the specimens:**

All samples were stored 24 hours within the mould at room temperature (20 ± 2) °C and the concrete surface was covered with plastic foil.

After remoulding the specimen were stored as follows:

cubes for compressive-strength test (150 mm edge-length) to the age of 7 days under water at a temperature of (20 ± 2) °C;  
 subsequently till testing at room temperature (20 ± 2) °C.

slabs for the water-penetration test (200x200x120 mm)  
 till the start of testing under water at a temperature of (20 ± 2) °C.

cubes to test water-penetration of concrete with installed adhesive anchors  
 till the age of 7 days under water at a temperature of (20 ± 2) °C;  
 subsequently till installing the anchors and testing the water penetration at room temperature (20 ± 2) °C.

### 3 TEST PROCEDURE AND TEST RESULTS

#### 3.1 COMPRESSIVE STRENGTH

Test procedure: ÖNORM EN 12390-2 and ÖNORM B 3303, chapter 7.2

Details of the test results

Specimen No	mass kg	length mm	width mm	height mm	ultimate load kN	bulk density <sup>1)</sup> kg/m <sup>3</sup>	compressive strength MPa
09.04801	8,144	150,1	149,5	149,5	1002	2428	44,7
09.04802	8,176	149,9	149,6	149,5	1038	2439	46,3
09.04803	8,198	150,5	150,0	149,9	1015	2423	45,0
date of testing: 17 April, 2009		age of concrete: 28 days		mean value:		<b>2430</b>	<b>45,3</b>

<sup>1)</sup> calculated from measured values determined on specimens without preparation or conditioning.

surface conditions of samples: air-dry

preparation of loading areas: none

#### 3.2 PENETRATION OF WATER UNDER PRESSURE - PLAIN CONCRETE

Test procedure: EN 12390-8:2009, section 6  
ISO 1920-5:2004, section 5.4

Details of test:

date of start of the test: 17.04.2009  
age of concrete at start of test: 28 days  
direction of application of water pressure: on bottom of the specimen perpendicular to the direction of casting  
applied water pressure: (500 ± 50) kPa during (72 ± 2) h  
concrete area exposed to the water pressure: according to a circle with 100 mm diameter  
specimens: prismatic slabs with dimensions of 200x200x120 mm

specimen no	09.04804		09.04805		09.04806	
maximum depth of penetration	16 mm	17 mm	28 mm	34 mm	25 mm	27 mm
deviation of the water penetration from the acceptable one	none		none		none	
leakage	none		none		none	
penetration front curve	see appendix 1 page 1					

### 3.3 SETTING THE ADHESIVE ANCHORS

#### USED ANCHORING SYSTEM

Adhesive Mortar: **HIT-RE 500**  
A: 3006224  
B: 3106048  
article no: 305074

Anchor rod: **HIT V-R M12x150**  
article no: 387081

#### SETTING DETAILS

Drill bit: TE-C3X 14

Cutting diameter of used drill bit:  $d_{\text{cut}} = 14,28 \text{ mm}$

Depth of bore hole:  $h = 110 \text{ mm}$

Rotary hammer drill: TE 25

Bore hole cleaning: brushing 3 times - dust removal with vacuum cleaner,  
brushing 3 times - dust removal with vacuum cleaner.

#### SETTING PROCEDURE

The hole was drilled vertically downwards in the centre of a casted surface perpendicular to the direction of casting. The bore hole was cleaned and diameter and depth were measured. Then the adhesive was injected using the dispenser MD 2000 and the anchor rod was inserted.

Five samples were prepared and setting was done on 21.04.2009 at 09:55. After setting the anchors, the adhesive was allowed to cure for > 24 hours at room temperature ( $20 \pm 2$ ) °C.



Specimen with installed anchor

specimen no	bore hole diameter mm	bore hole depth mm	depth of embedment mm
09.04832	13,6	111	111
09.04833	13,5	114	114
09.04834	13,6	111	111
09.04835	13,6	112	112
09.04836	13,6	113	113

3.4 PENETRATION OF WATER UNDER PRESSURE  
 SAMPLES WITH HIT-RE 500

Test procedure: EN 12390-8:2009, section 6  
 ISO 1920-5:2004, section 5.4

Deviation from the standard test method:  
 curing of the concrete under water only to the age of 7 days

Details of test:

date of start of the test: 24.04.2009, 14:30  
 age of concrete at start of test: 28 days  
 direction of application of water pressure: on bottom of the specimen perpendicular to the direction of casting and parallel to the axis of the adhesive anchor.  
 applied water pressure: (500 ± 50) kPa during (72 ± 2) h  
 exposed concrete area: the surface with the installed anchor was exposed to the water pressure; an area according to a circle with 100 mm diameter with the anchor in its centre was exposed to the water pressure.  
 specimens: cubes with 200 mm edge-length.

specimen no	09.04832		09.04833		09.04834		09.04835		09.04836	
maximum depth of penetration mm	62	61	68	68	54	61	48	50	51	49
deviation of the water penetration from the acceptable one	none		none		none		none		none	
leakage	none		none		none		none		none	
opposite surface after testing	dry		dry		dry		dry		dry	
penetration front curve	see appendix 2, page 1 and 2									

Rankweil, June 23 2009



Responsible for testing

*W. Wechner*

Dipl.-Ing. W. Wechner  
 Departement Manger

### PENETRATION FRONT CURVE - PLAIN CONCRETE



### PENETRATION FRONT CURVE

Samples with adhesive mortar HIT-RE 500



### PENETRATION FRONT CURVE

Samples with adhesive mortar HIT-RE 500

