TECHNICKÝ A SKÚŠOBNÝ ÚSTAV STAVEBNÝ, n. o.
Test laboratory
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Reg. No. 004/S-045

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TEST REPORT No. 90-15-0108

JOB

No.: 90150017

Client: MARIS POLYMERS S.A.
Industrial Area of Inofita
GR-32011 Inofita
Greece

OBJECT OF TESTING

Product: Liquid-applied water impermeable product **MARISEAL 670**

Manufacturer: manufacturer is the client

Manufacturing plant: at the manufacturer's address

Standard of product: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation

PRODUCT SAMPLE

Description of sample: - one-component material
- Batch no. 15015089, date production: 23.11.2014, 2 pcs of 1,0 kg

Sampler: client

Place and date of delivery: Laboratory branch in Tatranská Štrba, on 28th January 2015

Designation of sample by lab.: 032/15

Preparation of test specimens:

MARISEAL 670 was applied to the surface of the substrate in accordance with the manufacturer's instruction in composition:

System	Number of layer	Consumption /layer	Recoating interval
MARISEAL 670	2	750 g/m^2 / 1 layer	24 h

a) Test specimens for tensile adhesion tests were prepared according to EN 14891, Clause A.6:
- After drying 24 h the ceramic tile adhesive was applied to the layer MARISEAL 670. After five minutes nine ceramic tiles were placed and loaded with (20 ± 0,05) N for 30 s.
- Ceramic tile adhesive: type C2 complying with EN 12004
- Ceramic tile adhesive: type V1 complying with EN 14411, with a water absorption ≤ 0,5 % by mass, unglazed, with facial dimensions (50 ± 1) mm x (50 ± 1) mm
- Substrate: concrete slabs complying with EN 1323
- For bonding pull head plates to the tiles two-component epoxy adhesive was used. Curing time 24 h
- Pull-head steel square plates with dimensions 50 mm x 50 mm, thickness 10 mm
- Conversion rate of pull-off tester x (314 / area of pull head plates)

b) Test specimens for waterproofing were prepared according to EN 14891, Clause A.7:
- Substrate: concrete slabs complying with EN 14891, Clause A.7, with dimensions (150x150x100) mm
- Water absorption weight gain of control test blocks: 426 g after 7 d at 150 kPa
- 24 h before waterproofing test sealing of remaining faces of the test specimens with two-component epoxy varnish

c) Test specimens for crack bridging ability were prepared according to EN 14891, Clause A.8.

TESTS

Initial tensile adhesion strength

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.6.2

Description of test specimens:
- Three pieces of concrete slabs, as described above
- 28 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Deviations from the standard: none

Date of test: 04th March 2015

Test personnel: Milan Ševčík

Tensile adhesion after water contact

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.6.4

Description of test specimens:
- Three pieces of concrete slabs, as described above
- Remaining faces of the test specimens were sealed with two-component epoxy varnish
- 7 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity
- 21 days immersion in water at standard temperature (23±2)°C

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Deviations from the standard: none

Date of test: 04th March 2015

Test personnel: Milan Ševčík

Tensile adhesion after heat ageing

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.6.5

Description of test specimens:
- Three pieces of concrete slabs, as described above
- 14 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity
- 14 days storage in air-circulating oven at temperature (70±3)°C

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Deviations from the standard: none

Date of test: 05th March 2015

Test personnel: Milan Ševčík

Tensile adhesion after freeze-thaw cycles

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.6.6

Description of test specimens:
- Three pieces of concrete slabs, as described above
- Remaining faces of the test specimens were sealed with two-component epoxy varnish
- 7 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity
- 21 days immersion in water at standard temperature (23±2)°C

Then test specimens were subjected to 25 freeze-thaw cycles.
One freeze-thaw cycle took 6 h and comprised the following stages:
- 2 h cooling with air at (-15±3)°C
- 2 h storage at (-15±3)°C:
- 2 h immersion in water at (15±3)°C

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Deviations from the standard: none

Date of test: 12th March 2015

Test personnel: Milan Ševčík

Tensile adhesion strength after contact with lime

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.6.9

Description of test specimens: - Three pieces of concrete slabs, as described above
- Remaining faces of the test specimens were sealed with two-component epoxy varnish
- 28 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity
- 7 days immersion in satured lime water at temperature 40°C

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Deviations from the standard: none

Date of test: 12th March 2015

Test personnel: Milan Ševčík

Waterproofing

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.7

Description of test specimens: - Three pieces of concrete slabs, as described above

Test specimens prepared by: Milan Ševčík, 04th February 2015

Test conditions: - Water pressure of 150 kPa for seven days

Deviations from the standard: none

Date of test: from 06th March to 13th March 2015

Test personnel: Milan Ševčík

Crack bridging ability under standard conditions

Test procedure: EN 14891: 2012 /AC: 2012 Liquid-applied water impermeable products for use beneath ceramic tiling bonded with adhesives - Requirements, test methods, evaluation of conformity, classification and designation. Clause A.8.2

Description of test specimens: - Three pieces of concrete slabs, as described above
- 28 days storage under standard conditions (23±2)°C and (50±5)% Relative Humidity

Test specimens prepared by: Milan Ševčík, 26th February 2015

Test conditions: - Test speed of 0,15 mm/min

Deviations from the standard: none

Date of test: 26th March 2015

Test personnel: Milan Ševčík

Applied instrumentation:

ID	Name	Range	Unit	Division
M900007	Calliper	(0 - 250,00)	mm	0,01
M900008	Pull-off tester ERICHSEN 417	0 až 47,00	MPa	0,5
M900009	Balance Kern PRJ 6200-2NM	0 až 6200	g	0,01
M900011	Stopwatch	(0 - 1800)	s	0,1
M900031	Digital calliper	(0 - 150,00)	mm	0,01
M900044	Automatic recorder of temperature and humidity	((-25) - 45)	°C	0,1
		(15 - 95)	%	1,0
Z900002	Laboratory ventilated oven STERIMAT 354.3	+20 až +250	°C	1
Z900017	Apparatus for testing of water impermeablity			
Z900037	Programmable climatic cabinet			
Z900043	Moulds for preparing concrete cubes			
Z900045	Moulds for preparing concrete plates			
Z900047	Concrete mixer 125 l			
Z900049	Moulds for preparing prismatic specimens			
Z900050	Scarecrows electric table for compacting concrete			
2 kg Weight				

RESULTS

Initial tensile adhesion strength

Number of measurement	Tensile adhesion strength			Type of Failure
	Measured value	Value after conversion (N/mm^2)	Values in range of ± 20 % from mean value (N/mm^2)	
1.	16,0	2,0	2,0	100 % AF-T
2.	15,0	1,9	1,9	100 % AF-T
3.	13,0	1,6	1,6	100 % AF-T
4.	17,5	2,2	2,2	100 % AF-T
5.	14,5	1,8	1,8	100 % AF-T
6.	13,5	1,7	1,7	100 % AF-T
7.	15,5	1,9	1,9	100 % AF-T
8.	16,0	2,0	2,0	100 % AF-T
9.	14,5	1,8	1,8	100 % AF-T
Average	-	1,9	**1,9**	**-**
Extended uncertainty U	-	-	± 0,2	-

Note:
AF-T – Adhesion failure between the adhesive and tile

Tensile adhesion after water contact

Number of measurement	Tensile adhesion strength			Type of Failure
	Measured value	Value after conversion (N/mm^2)	Values in range of ± 20 % from mean value (N/mm^2)	
1.	13,5	1,7	1,7	100 % AF-T
2.	11,5	1,4	1,4	100 % AF-T
3.	10,3	1,3	1,3	100 % AF-T
4.	13,5	1,7	1,7	100 % AF-T
5.	13,0	1,6	1,6	100 % AF-T
6.	10,4	1,3	1,3	100 % AF-T
7.	12,5	1,6	1,6	100 % AF-T
8.	11,0	1,4	1,4	100 % AF-T
9.	10,5	1,3	1,3	100 % AF-T
Average	-	1,5	**1,5**	**-**
Extended uncertainty U	-	-	± 0,1	-

Note:
AF-T – Adhesion failure between the adhesive and tile

Tensile adhesion after heat ageing

Number of measurement	Tensile adhesion strength			Type of Failure
	Measured value	Value after conversion (N/mm^2)	Values in range of ± 20 % from mean value (N/mm^2)	
1.	12,0	1,5	1,5	20 % CF-A / 80 % AF-T
2.	14,0	1,8	1,8	20 % CF-A / 80 % AF-T
3.	16,0	2,0	2,0	100 % AF-T
4.	12,5	1,6	1,6	30 % CF-A / 70 % AF-T
5.	16,0	2,0	2,0	30 % CF-A / 70 % AF-T
6.	16,5	2,1	2,1	100 % AF-T
7.	15,0	1,9	1,9	100 % AF-T
8.	14,0	1,8	1,8	20 % CF-A / 80 % AF-T
9.	13,0	1,6	1,6	100 % AF-T
Average	-	1,8	**1,8**	**-**
Extended uncertainty U	-	-	± 0,2	-

Note:
CF-A – Cohesion failure within the adhesive
AF-T – Adhesion failure between the adhesive and tile

Tensile adhesion after freeze-thaw cycles

Number of measurement	Tensile adhesion strength			Type of Failure
	Measured value	Value after conversion (N/mm^2)	Values in range of ± 20 % from mean value (N/mm^2)	
1.	16,5	2,1	-	20 % CF-A / 80 % AF-T
2.	11,0	1,4	1,4	10%CF-A/40%AF-T/50%AF-I
3.	12,0	1,5	1,5	100 % AF-T
4.	12,5	1,6	1,6	40 % CF-A / 60 % AF-T
5.	13,5	1,7	1,7	30 % CF-A / 70 % AF-T
6.	14,0	1,8	1,8	100 % AF-T
7.	13,5	1,7	1,7	20%CF-A/40%AF-T/40%AF-I
8.	12,0	1,5	1,5	60% AF-T / 40%AF-I
9.	14,0	1,8	1,8	100 % AF-T
Average	-	1,7	**1,6**	
Extended uncertainty U	-	-	± 0,1	

Note:
CF-A – Cohesion failure within the adhesivee
AF-T – Adhesion failure between the adhesive and tile
AF-I – Adhesion failure between the adhesive and water impermeable product

Tensile adhesion strength after contact with lime

Number of measurement	Tensile adhesion strength			Type of Failure
	Measured value	Value after conversion (N/mm^2)	Values in range of ± 20 % from mean value (N/mm^2)	
1.	15,0	1,9	1,9	100 % AF-T
2.	14,0	1,8	1,8	100 % AF-T
3.	14,0	1,8	1,8	100 % AF-T
4.	16,0	2,0	2,0	100 % AF-T
5.	18,0	2,3	-	100 % AF-T
6.	16,0	2,0	2,0	100 % AF-T
7.	11,0	1,4	-	100 % AF-T
8.	13,0	1,6	1,6	100 % AF-T
9.	15,0	1,9	1,9	100 % AF-T
Average	-	1,8	**1,8**	
Extended uncertainty U	-	-	± 0,1	

Note:
AF-T – Adhesion failure between the adhesive and tile

Waterproofing

Test specimen No.	Water penetration (mm)	Weight gain (g)
1	0 (No penetration)	2,5
2	0 (No penetration)	1,8
3	0 (No penetration)	2,1
Average	**0 (No penetration)**	2,1
Extended uncertainty U	-	± 0,4

Crack bridging ability under standard conditions

Test specimen No.	Crack bridging ability (mm)
1	3,18
2	3,24
3	3,19
Average	**3,20**
Extended uncertainty U	± 0,04

Date of report: 31st March 2015

Prepared by: Ing. Erika Halčinová

Authorized by: .....

Ing. Erika Halčinová
Head of Laboratory Branch

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Notes:

- Unless the Test Laboratory makes the sampling, data on the manufacturer, its manufacturing plant and about the sampling are presented according to information provided by the client.
- Testing was carried out according to the Operational procedure No. PP-018 of the Test laboratory in compliance with the listed test procedure.
- The given extended uncertainty U is based on the standard uncertainty multiplied by the coverage factor k = 2, that in case of the normal distribution provides the reliability in the order of 95%.
- Presented results are relevant to the product sample only.
- This report shall not be reproduced except in full without written approval of the Test Laboratory.

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