

TEST REPORT No. 90-15-0138

JOB

No.: 90150017
Client: MARIS POLYMERS S.A.
 Industrial Area of Inofita
 GR-32011 Inofita
 Greece

OBJECT OF TESTING

Product: Surface protection product for concrete: **MARISEAL 260**
 - Coating for principles 1 - method 1.3 of EN 1504-2

Manufacturer: manufacturer is the client

Manufacturing plant: at the manufacturer's address

Standard of product: EN 1504-2: 2004 Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. Part 2: Surface protection systems for concrete

PRODUCT SAMPLE

Description of sample: - one-component coating material
 Batch no. 14015521, date production: 15.11.2014, 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.: 036/15

Preparation of test specimens:

Test specimens were prepared in accordance with the manufacturer's instructions. Coating was applied on the concrete substrate.

Composition:

System	Number of layer	Consumption /layer	Recoating interval
MARISEAL 260	2	600 g/m ² / 1 layer	12 h

Coating was applied to clean and dry substrate. The used substrates are specified below under the relevant tests. Concrete substrates were prepared and cured according to EN 1766. The surface was sandblasted prior to treatment. Determination of dry film thickness was carried out in accordance with EN 2808, wedge cut method.

TESTS

Carbon dioxide permeability

Test procedure:	EN 1062-6: 2003 Paints and varnishes. Coating materials and coating systems for exterior masonry and concrete. Part 6: Determination of carbon dioxide permeability	
Description of test specimens:	Three treated circular test specimens with a diameter of 90 mm, the coating applied on one face	
	- Test substrate: unglazed ceramic tiles with a thickness of 6 mm	
	- Application of coating: as described on page 1	
	- Curing time after application: 7 days under standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity	
	- Conditioning prior to testing: in accordance with EN 1062-11, Clause 4.3. (The test specimens were subjected to three cycles comprising 24 h storage in water at (23± 2)°C and 24 h drying at (50± 2)°C). Afterwards the test pieces were dried over desiccant to constant mass.)	
	- Sealing compound: paraffin SASOLWAX 7837 (Manufacturer: Sasol Wax, Hamburg, Germany) mixed with refined crystalline paraffin	
	- In parallel, the diffusion resistance was determined against a CO ₂ reference film. Parallel measurement has been established without deviations from the predetermined tolerance.	
Test specimens prepared by:	Milan Ševčík, 05 th February 2015	
Test conditions:	- Method A: Gravimetric method	
	- Exposed area of the test specimen A	0,005 m ²
	- Time interval between two weighings of the test specimens	24 h
	- Used sodium hydroxide granulated for elemental analysis	
	- Test temperature	23°C
	- Test concentration of carbon dioxide in chamber	10 % (V/V)
	- Mean barometric pressure during test p_{amb}	1000,8 hPa
	- The diffusion coefficient of carbon dioxide in air D_{CO₂}	1,38 m ² /d
	- The difference in concentration of carbon dioxide Δc 	180 g/m ³
	- Diffusion-equivalent air layer thickness of the substrate	0,1 m
Deviations from the standard:	none	
Date of test:	from 24 th March to 03 rd April 2015	
Test personnel:	Milan Ševčík	

Permeability to water vapour

Test procedure:	EN ISO 7783: 2012 Paints and varnishes. Determination of water-vapour transmission properties. Cup method	
Description of test specimens:	Three treated circular test specimens with a diameter of 90 mm, the coating applied on one face.	
	- Test substrate: unglazed ceramic tiles with a thickness of 6 mm	
	- Application of coating: as described on page 1	
	- Curing time after application: 7 days under standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity	
	- Conditioning prior to testing: in accordance with EN ISO 7783, method B (The test specimens were subjected to three cycles comprising 24 h storage in water at (23± 2)°C and 24 h drying at (50± 2)°C)). Afterwards the test pieces were dried over desiccant to constant mass.	
	- Sealing compound: paraffin SASOLWAX 7837 (Manufacturer: Sasol Wax, Hamburg, Germany) mixed with refined crystalline paraffin	
Test specimens prepared by:	Milan Ševčík, 05 th February 2015	
Test conditions:	- Measuring: Wet cup method	
	- Exposed area of the test specimen A	0,005 m ²
	- Time interval between two weighings of the test specimens	12 h
	- Used saturated aqueous solution - NH ₄ H ₂ PO ₄	
	- Test temperature	23°C
	- Relative humidity in climate chamber	50%
	- Relative humidity in test cup	93%
	- Water vapour pressure difference Δp_v	1207 Pa
	- Standard barometric pressure p₀	1013,25 hPa
	- Mean barometric pressure during test p	1001,8 hPa
	- Gas constant of water vapour R_v	462 Nm/(kg.K)
	- Test temperature T	296 K
	- Water-vapour transmission rate of the substrate	409,6 g/(m ² .d)

Deviations from the standard: none
Date of test: from 24th March to 31st March 2015
Test personnel: Milan Ševčík

Capillary water absorption and water permeability water

Test procedure: EN 1062-3: 2008 Paints and varnishes – Coating materials and coating systems for exterior masonry and concrete. Part 3: Determination of liquid water permeability

Description of test specimens: Three treated test specimens with dimensions of approximately 150 mm x 150 mm, thickness 30 mm, coating applied to one face

- Test substrate: calcium silicate bricks
- Application of coating: as described on page 1
- Curing time after application 7 days under standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity
- The reverse side and the edges of the test specimens were sealed with two layers of two-component epoxy varnish, subsequently drying for further 7 days at (23±2)°C and (50±5)% Relative Humidity
- Conditioning prior to testing: in accordance with EN 1062-3, Clause 6.4.2 (The test specimens were subjected to three cycles comprising 24 h storage in water at (23± 2)°C and 24 h drying at (50± 2)°C))

Test specimens prepared by: Milan Ševčík, 05th February 2015

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

Deviations from the standard: none

Date of test: from 05th to 06th March 2015

Test personnel: Milan Ševčík

Adhesion strength by pull-off

Test procedure: EN 1542: 1999 Products and systems for the protection and repair of concrete structures. Test methods. Measurement of bond strength by pull-off

Description of test specimens: One concrete slab with coating system applied to one face, with dimensions of 300 mm x 300 mm, thickness 100 mm

- Test substrate: concrete Type C (0,70)
- Application of coating: as described on page 1
- Curing time after application: 7 under standard laboratory conditions (23±2)°C and (50±5)% Relative Humidity

Test specimens prepared by: Milan Ševčík, 05th February 2015

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

- Pull-head plates circular cross-section with a diameter of 50 mm
- For bonding pull-head plates two-component epoxy adhesive was used. Curing time 24 h
- Conversion rate of pull-off tester x (314 / area of pull head plates)

Deviations from the standard: none

Date of test: 12th 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
M900018	Analytical balance Sartorius BP 300 S	(0 - 303,00)	g	0,0001
M900031	Digital calliper	(0 - 150,00)	mm	0,01
M900037	Coating thickness gauge PIG	0 až 2	mm	0,02
M900044	Automatic recorder of temperature and humidity	((-25) - 45) (15 - 95)	°C %	0,1 1,0
Z900001	Climatized chamber Vötsch VC 4034	-40 až +180	°C	0,1
Z900002	Laboratory ventilated oven STERIMAT 354.3	+20 až +250	°C	1
Z900015	Aluminium cups with free test area of 0,005 m ²			
Z900023	Barometer	960 až 1040	hPa	1
Z900024	Desiccator			
Z900028	Test chamber CO ₂	+20 až +250	°C	1
Z900045	Moulds for preparing concrete plates			
Z900047	Concrete mixer 125 l			
Z900050	Scarecrows electric table for compacting concrete			

TEST RESULTS

1) Carbon dioxide permeability

Test specimen No.	Mean value of the thickness (μm)	Mass difference of two weighings at constant change of mass d_m (g)	Carbon dioxide permeability i ($\text{g}/(\text{m}^2 \cdot \text{d})$)	Carbon diffusion-equivalent air layer thickness s_d (m)	Diffusion resistance number μ (-)
1	640	0,0145	2,90	85,49	$1,34 \cdot 10^5$
2	630	0,0142	2,84	87,29	$1,39 \cdot 10^5$
3	600	0,0156	3,12	79,45	$1,32 \cdot 10^5$
Average	620	0,0148	2,95	84,08	$1,35 \cdot 10^5$
Extended uncertainty U			0,34	9,65	$0,14 \cdot 10^5$

2) Permeability to water vapour

Test specimen No.	Mean value of the thickness (μm)	Mass difference of two weighings at constant change of mass (g)	Rate of flow of water vapour G_{cs} (g/h)	Water-vapour transmission rate V ($\text{g}/(\text{m}^2 \cdot \text{d})$)	Water-vapour diffusion-equivalent air layer thickness s_d (m)	Water-vapour resistance factor μ (-)
1	640	0,0757	$6,3083 \cdot 10^{-3}$	32,297	0,632	987
2	610	0,0747	$6,2250 \cdot 10^{-3}$	31,837	0,641	1050
3	690	0,0690	$5,7500 \cdot 10^{-3}$	29,234	0,698	1011
Average	650	0,0731	$6,0944 \cdot 10^{-3}$	31,123	0,66	1016
Extended uncertainty U					0,08	108

3) Capillary water absorption and water permeability water

Test specimen No.	Mean value of the thickness (μm)	Width of the test area (mm)	Length of the test area (mm)	Initial weight (g)	Weight after immersion test (g)	Weight increase (g)	Liquid water permeability w ($\text{kg}/(\text{m}^2 \cdot \text{h}^{0,5})$)
1	620	142	141	1207,99	1208,96	0,97	0,010
2	590	140	142	1176,98	1177,89	0,91	0,009
3	640	142	143	1128,06	1129,06	1,00	0,010
Average	620	141	142	1171,01	1171,97	0,96	0,010
Extended uncertainty U							0,001

4) Adhesion strength by pull-off test


Number of measurement	Adhesion strength by pull-off		Type of failure
	Measured value	Value after conversion (N/mm^2)	
1	26,0	3,3	A = 60 %, A/B = 40 %
2	22,5	2,8	A = 100 %
3	37,0	4,6	A = 100 %
4	29,0	3,6	A = 100 %
5	29,0	3,6	A = 100 %
6	33,0	4,1	A = 100 %
Average	-	3,7	-
Extended uncertainty U			-

Note:

A - cohesion failure in concrete substrate
A/B - adhesion failure

Date of report: 21st April 2015
Prepared by: Ing. Erika Halčinová



Authorized by: 
Ing. Erika Halčinová
Head of Laboratory Branch

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-007 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.

————— **End of test report** —————