




Vulmproepox

CO₂

-  ENVIRONMENTALLY FRIENDLY PRODUCT
-  WATER-BASED COATING
-  HEALTHY – ELIMINATION OF HARMFUL EFFECTS ON HUMAN HEALTH

Product description:

Vulmproepox CO₂ is a two-component water-based coating consisting of component A (aqueous dispersion, epoxy resin containing additives, pigments and fillers) and component B (polyamine hardener).

Use:

Vulmproepox CO₂ is a coating designed for tunnels, where it prevents the build-up of CO₂. It is also used on concrete surfaces and also on uninsulated surfaces, iron construction, etc. The coating is very resilient, hard and resistant to abrasion. It resists to water, chemicals and detergent solutions. The coating has normal to moderate load on concrete and cement screeds.

Benefits:

- easy maintenance and application
- resilient and hard surface
- good chemical and mechanical resistance
- good anti-skid properties
- resists penetration of liquids
- adhesive even to a slightly greasy surface
- possibility to achieve a greater thickness in one coating

Test data:

Conformity Certificate	1301-CPD-0199
TSÚS 151/2005	STN EN 1062-3 (67 2020)
	STN EN 1062-6 (67 2020)
	STN EN 1062-11 (67 2020), art. 4.2
	STN EN 1062-11 (67 2020), art. 4.1
	STN EN ISO 7783-2 (67 3093)
	STN EN 13687-2 (73 2124)
	STN EN 13687-1 (73 2124)
	STN EN 1542 (73 2115)

Product data:

colour:	RAL according to customer's choice
appearance:	matte, semi-gloss
shelf life:	12 months in original packaging in dry conditions at the temperature 10 – 35 °C

Physical data:

binder content:	15 %
solids content:	70 %
water content:	15 %
flow:	15,9 cm

hardness:	after 24 hours	60 Shore D
	3 days	70 Shore D
	7 days	78 Shore D
	28 days	82 Shore D
	at a relative air humidity of 65 % and temperature of 20 °C	
abrasion resistance:	156 md/1000 cycles	
handling time:	45 minutes	
density:		
component A:	2,37 g/ml	
component B:	1,08 g/ml	
component A + B:	2,07 g/ml	

Processing temperature:

minimum temperature of the substrate:	5 °C
maximum temperature of the substrate:	30 °C
ideal temperature for processing:	20 °C
maximum relative air humidity:	85 %

Theoretical capacity:

Coating

4 m²/kg at a thickness of about 250 µm of dry film in 2 – 3 layers (0,25 – 0,3 kg/m² per layer depending on the grading of the substrate)

Self-levelling

1,1 – 1,6 kg/m² for self-levelling by discharge at a thickness of 1 mm (1,15 kg/m² binder + 0,45 kg/m² quartz sand)

Application methods:

roller, brush, spray

Instructions for use:

Impregnation:

Impregnate a dry or wet surface by **Vulmpropox**; the mixture of components A and B are in the ratio 10 : 1 (by weight – 1 kg of component A and 0.1 kg of component B). Mixing of the reactive components takes 2 – 3 minutes, but ends after achieving a homogeneous mixture. Viscosity may be adjusted by the addition of water (15 - 50 %) The prepared material is applied by a brush or roller. After 2 – 5 hours, we can apply a second coat.

Coating application:

The mixture of components A and B is in a ratio of 10 : 2 (by weight – 1 kg of component A and 0.2 kg of component B). Mixing of the reactive components takes 2 – 3 minutes, but ends after achieving a homogeneous mixture. Viscosity may be adjusted by the addition of water (10 – 15 %). The coating is applied in two layers.

After 2 – 5 hours, we can apply a second coat.

Substrate:

The substrate must be sufficiently coherent and supporting. Surface must be flat, solid, free of dirt and loose particles. It may contain max. of 35% humidity, which should be measured by a hygrometer. The coating can be applied on slightly oily surfaces. Surface must be dusted and without rough particles, preferably cleaned by pressurized water. Degreasing is not necessary.

Time data for application:

processability of the mixed material:	approx. 45 minutes
dry to touch and re-coating interval:	2 – 5 hours
walkable:	24 hours
fully loadable:	approx. 3 days
at a relative air humidity of 65 % and temperature of 20 °C	

Cleaning of tools:

Immediately after use, with water.

Resistance:

- withstands high mechanical loads
- resistant to chemicals, solvents, detergents and cleaners
- resistant to heat of up to 140 °C (short-term), does not change characteristics at 100 °C

Safety:

Vulmproepox CO₂ – when handling, proceed in accordance with the general safety measures, follow the safety instructions on the packaging labels and on safety data sheets. Data, specifications, directions and recommendations given in this technical data sheet are based on experience gained in modeling of supposed ways of applications, or under specially defined conditions. Their accuracy, completeness or appropriateness under the actual conditions of any intended use is not guaranteed and must be determined by the user. The manufacturer and distributor are not responsible for the results achieved, loss, direct or consequential damages arising from failure to comply with the recommended use of the product, which go beyond the conditions herein.

Name of the test, or the name of the tested characteristics and a number of a standard, or other identifier of the test method, procedure:

- | | |
|---|------------------------------------|
| - capillary absorption and water permeability | STN EN 1062-3 (67 2020) |
| - permeability CO ₂ | STN EN 1062-6 (67 2020) |
| - behaviour after artificial ageing | STN EN 1062-11 (67 2020), art. 4.2 |
| - behaviour after 7 days at 70 °C | STN EN 1062-11 (67 2020), art. 4.1 |
| - water vapour permeability | STN EN ISO 7783-2 (67 3093) |
| - resistance to changes in temperature: | |
| cyclic exposure to storm rain (thermal shock) | STN EN 13687-2 (73 2124) |
| freezing and thawing cycles with thawing salt | STN EN 13687-1 (73 2124) |
| - adhesion in pull-off test | STN EN 1542 (73 2115) |

Samples conditioning:

Laboratory temperature 23 °C ± 2 °C

Used test device, its metrological traceability:

- | | |
|---|-----------|
| - air conditioner cabinet Vötsch VC 4034 | Z 90 0001 |
| - laboratory oven STERIMAT 354.3 | Z 90 0002 |
| - Q-U-V tester | Z 90 0003 |
| - drilling rig HILTI | Z 90 0005 |
| - chamber CO ₂ | Z 90 0014 |
| - precision scales SARTORIUS | M 90 0003 |
| - Erichsen type 417 | M 90 0008 |
| - analytical scales SARTORIUS BP 300 S | M 90 0018 |
| - digital slide gauge 1 – 150 mm | M 90 0031 |
| - kit for measuring boundary conditions (temperature, humidity) | M 90 0032 |
| - PosiTest type AT-CM | M 90 0033 |
| - apparatus for measuring coat thickness by V-cut | M 90 0037 |

Deviations from the standardized test procedure and all circumstances that might affect the test result:

Composition of the coating system (coatings by a brush): – composition is the same for all tests, the thickness of the coating system specified in the results of individual tests

- 1x coat VULMPROEPOX diluted with 10 % of water
- 3 hours drying
- 2x VULMPROEPOX coat, drying interval between coats 3 hours

Capillary absorption and water permeability:

- substrate used: sample with dimensions 137 mm x 142 mm thick. 29 mm, cut from a lime-sand brick
- sealing of unpainted surfaces of samples: 2x two-component epoxy varnish EPONAL manufacturer: Chemolak, Smolenice
- samples conditioning before testing: 24 days at laboratory temperature
- after conditioning tested samples were subjected to three ageing cycles: one cycle consists of the following phases:
 - 24 h stored in water at 23 °C ± 2 °C
 - 24 h drying in an oven at 50 °C ± 2 °C
- conditioning of samples after ageing cycles: 24 h at laboratory temperature

Permeability CO₂, water vapour permeability

- substrate used: samples in circular form with a diameter of 90 mm cut from unglazed ceramic tiles thick. 6 mm
- samples conditioning before testing: 24 days at laboratory temperature
- after conditioning tested samples were subjected to three ageing cycles: one cycle consists of the following phases:
 - 24 h stored in water at 23 °C ± 2 °C
 - 24 h drying in an oven at 50 °C ± 2 °C
- conditioning of samples after ageing cycles: 24 h at laboratory temperature

Adhesion in pull-off test

substrate used: concrete sample with dimensions 300 mm x 300 mm, thick. 100 mm from concrete type C (0,70) prepared and treated in accordance with STN EN 1766

samples conditioning before testing: 7 days at laboratory temperature

Adhesion after the test of resistance to changes in temperature – Cyclic exposure to storm rain + freezing and thawing cycles with thawing salt

- substrate used: concrete samples with dimensions 300 mm x 300 mm, thick. 100 mm, from one lot of concrete type MC (0,40) prepared and treated in accordance with STN EN 1766
- sealing of unpainted surfaces of samples: 2x two-component epoxy varnish EPONAL manufacturer: Chemolak, Smolenice
- samples conditioning before testing: 24 days at laboratory temperature
- test of resistance to temperature changes according to STN EN 13687-1 and STN EN 13687-2 was performed on the same samples, beginning with a storm rain test

evaluation of coatings after testing resistance to temperature changes:

Evaluated immediately after exposure:

- degree of blistering by a method according to STN EN ISO 4628-2
- degree of cracking by a method according to STN EN ISO 4628-4
- degree of peeling by a method according to STN EN ISO 4628-5

Evaluated 7 days after the end of exposure:

- adhesion of coatings in pull-off test by a method according to STN EN 1542

Adhesion after ageing for 7 days at 70 °C

- substrate used: concrete samples with dimensions 300 mm x 300 mm, thick. 100 mm, from one lot of concrete type MC (0,40) prepared and treated in accordance with STN EN 1766
- samples conditioning before testing: 24 days at laboratory temperature

Evaluation of coatings after the exposure:

Evaluated immediately after exposure:

- degree of blistering by a method according to STN EN ISO 4628-2
- degree of cracking by a method according to STN EN ISO 4628-4
- degree of peeling by a method according to STN EN ISO 4628-5

Evaluated 24 hours after the end of exposure:

- adhesion of coatings in pull-off test by a method according to STN EN 1542

Behaviour after artificial ageing

- substrate used: fibre-cement board with dimensions: 300 mm x 150 mm
- samples conditioning before testing: 24 days at laboratory temperature

Exposure conditions:

- irradiation of the sample surface by the UV lamps at a temperature of +60 °C (type of lamps: UVA 340);
- condensation of moisture on the surface of the samples at a temperature of + 50 °C; alternating irradiation by UV radiation and condensation on the surface at 4 hour intervals

Total length of exposure: 2000 h

Evaluation of coatings after the exposure

Evaluated immediately after exposure:

- degree of blistering by a method according to STN EN ISO 4628-2
- degree of cracking by a method according to STN EN ISO 4628-4
- degree of peeling by a method according to STN EN ISO 4628-5

Information on measurement uncertainty:

They are specified in tables of measured values in the form of the extended measurement uncertainty. (Measurement uncertainties are based on the internal procedures from 1996).

Results of measurement:
Capillary absorption and water permeability

 Test area: 194,54 cm²

Sample no. [μm]	Coat thickness	Weight gain of the sample [g]					Speed coefficient of water permeability in a liquid phase [kg/(m ² .h ^{0,5})]
		after 1 h	after 2 h	after 3 h	after 6 h	after 24 h	
1	905	0,5	0,5	0,5	0,5	0,5	0
2	880	0,4	0,5	0,5	0,5	0,5	0,0007
3	895	0,3	0,3	0,3	0,3	0,3	0
Arithmetic mean	893	-	-	-	-	-	0,0002
Measurement uncertainty	14,5	-	-	-	-	-	0,006

Note: Speed coefficient of water permeability in the liquid phase is a directive of the linear part of the graph of weight gain in kg/m² as a function of the square root of time.

Permeability CO₂

Surface of the tested specimen A [m ²]	0,005
Tested samples weighing interval [h]	24
Test temperature [°C]	23
Median ambient barometric pressure during test p _{amb} [kPa]	100,5
Concentration of CO ₂ of the tested gas in [%] (V/V)	10
Diffusion coefficient of CO ₂ in air at 23 °C D _{CO₂} [m ² /day]	1,38
Difference c in concentration of air without CO ₂ and 10% concentration (V/V) at 23 °C [g/m ³]	180
Equivalent diffusion thickness of the substrate s _{D CO₂} [m]	0,1

Sample no.	Coat thickness d [m]	Change in sample weight in three consequent measurements at const. change in weight [g]	Permeability CO ₂ i [g/m ² .d]	Equivalent diffusion thickness CO ₂ sd [m]	Diffusion resistance factor CO ₂ μ [-]
1	0,000886	0,002	0,39722	624,24	0,71.106
2	0,000902	0,002	0,39722	624,24	0,69.106
3	0,000894	0,002	0,39722	624,24	0,70.106
Arithmetic mean	0,000894	0,002	0,39722	624,24	0,70.106
Measurement uncertainty	9,23.10 ⁻⁶	6.10 ⁻⁵	0,006	0,006	0,013.106

Water vapour permeability

Surface of the tested specimen A [m ²]	0,005
Tested samples weighing interval [h]	24
Test temperature [°C]	23
Relative air humidity in the test dish [%]	93
Water vapour pressure difference Δp [Pa]	1207
Median ambient barometric pressure during test p [hPa]	1000
Gas constant for water vapour R _v [Nm/(kg.K)]	462
Test temperature T [K]	296
Air permeability coefficient δ _l [g/(m.h.Pa)]	0,000711942
Water vapour permeability of a porous substrate [g/(m ² .d)]	409,6

Sample no.	Sample thick.	The change in mass of the sample per time interval, by which the line is translated	Rate of water vapour permeability per time interval	Arithmetic mean of the rate of sample permeability per time interval	Water vapour permeability	Water vapour permeability coefficient	Equivalent diffusion thickness
	d [m]	[mg]	Δmi [mg/h]	Δm [mg/h]	V [g/m ² .d]	δ [g/m ² .d.Pa]	sd [m]
1	0,000920	14,0	0,583	0,571	2,758	2,525.10 ⁻⁶	6,23
		13,4	0,558				
		19,1	0,796				
2	0,000870	19,1	0,796	0,792	3,836	3,320.10 ⁻⁶	4,48
		18,8	0,783				
		15,1	0,629				
3	0,000905	15,2	0,633	0,625	3,022	2,721.10 ⁻⁶	5,68
		14,7	0,613				
Arithmetic mean	0,000898	15,9	0,663	0,663	3,205	2,86.10 ⁻⁶	5,46
Measurement uncertainty	29,6.10 ⁻⁶	1,601	0,067	0,133	0,649	0,478.10 ⁻⁶	1,033

Adhesion of a substrate in a pull-off test

– diameter of the test roller 56,4 mm

Measurement number [N/mm ²]	Adhesion in pull-off test [N/mm ²]	Level of disruption [-]
1	4,8	A/B : B = 50 % : 50 %
2	5,0	A = 100 %
3	5,0	A = 100 %
4	4,9	A = 100 %
5	5,1	A : A/B = 60 % : 40 %
Arithmetic mean	5,0	-
Measurement uncertainty	0,102	-

Note:

- A cohesive disruption of the concrete substrate
- A/B disruption of adhesion between the substrate and coating
- B cohesive disruption in the first layer

Resistance to temperature changes – cyclic exposure to storm rain (thermal shock) + freezing and thawing cycles with thawing salt

The samples were subjected to 10 cycles of exposure to storm rain (thermal shock), where one cycle consisted of the following phases:

- location under the heating element at (60 ± 5) °C for 5 h and 45 min
- shower by water with the temperature of (12 ± 3) °C 15 min

Subsequently, the samples were subjected to 20 cycles of freezing and thawing with thawing salt, where one cycle consisted of the following phases:

- immersion in a tank containing saturated solution of NaCl at (-15 ± 2) °C for 2 h
- location in the tank with water at (21 ± 2) °C for 2 h

Sample no.	Degree of blistering STN EN ISO 4628-2	Degree of cracking STN EN ISO 4628-4	Degree of spalling STN EN ISO 4628-5	Adhesion in pull-off test [N/mm ²]	Level of disruption []
1	0 (S0)	0 (S0)	0 (S0)	4,7	A = 100 %
				4,1	A = 100 %
				4,4	A = 100 %
				4,4	A = 100 %
				4,2	A = 100 %
2	0 (S0)	0 (S0)	0 (S0)	3,6	A = 100 %
				4,3	A = 100 %
				3,9	A = 100 %
				4,2	A = 100 %
				3,7	A = 100 %
Arithmetic mean	-	-	-	4,2	-
Measurement uncertainty	-	-	-	0,214	-

Note:

A cohesive disruption of the concrete substrate

Resistance to temperature changes – behaviour after 7 days at 70 °C

Tested samples were subjected to ageing for 7 days at 70 °C

Sample no.	Degree of blistering STN EN ISO 4628-2	Degree of cracking STN EN ISO 4628-4	Degree of spalling STN EN ISO 4628-5	Adhesion in pull-off test [N/mm ²]	Level of disruption []
1	0 (S0)	0 (S0)	0 (S0)	5,4	A = 100 %
				5,1	A = 100 %
				5,3	A = 100 %
				4,9	A = 100 %
				5,1	A = 100 %
2	0 (S0)	0 (S0)	0 (S0)	4,8	A = 100 %
				5,2	A = 100 %
				5,2	A = 100 %
				4,6	A = 100 %
				5,1	A = 100 %
Arithmetic mean	-	-	-	5,1	-
Measurement uncertainty	-	-	-	0,152	-

Note:

A cohesive disruption of the concrete substrate

Artificial ageing

Total exposure time: 2000 h

Sample no.	Degree of blistering STN EN ISO 4628-2	Degree of cracking STN EN ISO 4628-4	Degree of spalling STN EN ISO 4628-5
1	0 (S0)	0 (S0)	0 (S0)
2	0 (S0)	0 (S0)	0 (S0)
Arithmetic mean	-	-	-
Measurement uncertainty	-	-	-