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MIEMBRO DE LA EOTA

REPORT ON THE EVALUATION OF THE TEST RESULTS

for

EUROPEAN TECHNICAL APPROVAL

N° ETA 07/0242

on

**Liquid Applied Roof Waterproofing Kits
"MAXELASTIC"**

(English language translation, the original version is in Spanish language)

English
preparation



1. GENERAL

The performed tests were performed on the liquid applied roof waterproofing kit, based on water dispersible polymers "MAXELASTIC", manufactured by the company DRIZORO, S.A.

The tests were carried out at the laboratories of the Instituto Ciencias de la Construcción Eduardo Torroja.

The assessment of the fitness for use of the liquid waterproofing kit "MAXELASTIC" according to the Essential Requirements nº 2, 3 and 4 was carried out in compliance with "Guideline for European Technical Approval of Liquid Applied Roof Waterproofing Kits", ETAG 005, edition 2000, Part 1 "General" and Part 8 "Specific stipulations for kits based on water dispersible polymers".

2. DESCRIPTION OF PRODUCT

The liquid waterproofing kit MAXELASTIC is constituted by acrylic resins, which once polymerised conforms elastic lining, in form of a layer completely bonded to the support (concrete, mortar, fibre-cement).

MAXELASTIC kit is constituted for:

- Waterproofing liquid constituted by a water dispersible styrene - acrylic copolymers, with loads and pigments mineral, and additives (anti-air entering, biocides, etc.).

The raw materials constituents of this kit are enclosed in the MTD placed in the IETcc.

3. PREPARATION OF SAMPLES

The test specimens were made according to ETAG 005 with respect to size and number.

The manufacturer performed the roof waterproofing on the substrates in presence of the testing laboratory (IETcc).

The amount of material used to performance the sample was of 3 kg/m². The final layer is obtained by applying two coats. The layer thickness obtained was between 1,3 -1,7 mm.

To perform specific test and verifications it was necessary to prepare free film samples of system. The most appropriated method to performance free samples, it was applying the product over a plastic sheet without creases and wrinkles.

The product was cured for 21 days (prescribed by the manufacture) at temperature of 23°C (±2) and 50%(±5) relative humidity.

The tests were carried out at curing conditions indicated above, except in those indicated cases.



4. RESULTS AND ASSESMENT OF PERFORMED TEST

4.1 ER.2 Safety in case of fire

4.1.1 External fire performance

The external fire performance of the systems of mechanically fastened flexible roof waterproofing membranes was tested according to ENV 1187: and according to EN 13501-5, is classified as B_{roof}(t1). Test report nº 1041T06-2. AFITI LICOF Centro de Ensayos e Investigación del Fuego.

4.1.2 Fire reaction

The classification of this LARWK with respect to reaction fire is undertaken in accordance with EN 13501-1 and its Euroclass is F: NPD.

4.2 ER.3 Hygiene, health and environment

4.2.1 Resistance to water vapour (EN 1931)

The value of the water vapour diffusion coefficient $\mu > 1.000$ declared by the manufacturer was confirmed.

The examination was conducted on 5 test specimens at 23°C and 90-95 % relative air humidity.

The amount of water vapour passed through the waterproof kit was:

Samples	g/(m ² /d)
1	11.8
2	13
3	12.7
4	12.9
5	13.4
Average value	13
Standard deviation	6

The value of the water vapour resistance factor obtained was $\mu = 2.300$.

4.2.2 Watertightness

The test was performed according to Technical report 003 (TR-003) "Determination of the Watertightness" of the EOTA. The examination was conducted on 3 test specimens at a hydrostatic pressure of 1 m water column during 24 hours. The roof waterproofing remained watertight after the test.

4.2.3 Resistance to delamination

The test was performed according to Technical report 004 (TR-004) "Determination of the resistance to delamination" of the EOTA. The examination was conducted on 5 test specimens.



SUPPORT	ADHERENCE (KPa)	
	Values	Mean value
Concrete (slab concrete 40 x 40 cm)	974	1.216
	1430	
	1606	
	869	
	1200	
Ceramic brick	744	811
	799	
	1219	
	684	
	611	

The delamination strength of the assembled system shall exceed 50 KPa according to EOTA.

4.2.4 **Resistance to dynamic indentation**

The examination was performed in accordance with Technical report 006 (TR-006) "Determination of the resistance to dynamic indentation" on 3 test specimens each made steel (> 6mm thick) on which the roof waterproofing was applied.

The tests were carried out on specimen fully bonded to the substrate. The type of indenter I4 ($6 \pm 0,05$ mm) used did not perforate the specimens and remained watertight. The classification, according to performance level I4, in user load category is P4.

4.2.5 **Resistance to static indentation**

The examination was performed in accordance with Technical report 007 (TR-007) "Determination of the resistance to static indentation" of the EOTA on 3 test specimens each made steel (> 6mm thick) on which the roof waterproofing was applied.

The tests were carried out on specimen fully bonded to the substrate. The load 250 (± 1) N applied on the specimens did not perforate the specimens and remained watertight. The classification, according to performance level L4, in user load category is P4.

4.2.6 **Resistance to fatigue movement**

The examination was performed in accordance with Technical report 008 (TR-008) "Determination of the resistance to fatigue" on 3 test specimens of fibre cement on which the roof waterproofing was applied.

The samples were kept at least 16h at -10°C before the test. The number of cycles applied was 500 (W2), after the cycles the specimens did not show cracks, loss of adhesion or split.

4.2.7 **Resistance to low temperatures**

The examination was performed in accordance with Technical report 006 (TR-006) "Determination of the resistance to dynamic indentation" at a temperature of $-20^{\circ} \pm 2^{\circ}\text{C}$ according to TL3 categorisation, on 3 test specimens each made steel (> 6mm thick) on which the roof waterproofing was applied.

The tests were carried out on specimen fully bonded to the substrate. The type of indenter I4 ($6 \pm 0,05$ mm) used did not perforate the specimens and remained watertight. The classification, according to performance level I4, in user load category is P4.



4.2.8 **Resistance to high temperatures**

The examination was performed in accordance with Technical report 007 (TR-007) "Determination of the resistance to static" at a temperature of $90^{\circ} \pm 2^{\circ} \text{C}$ according to TH4 categorisation, on 3 test specimens each made steel (> 6mm thick) on which the roof waterproofing was applied.

The tests were carried out on specimen fully bonded to the substrate. The load 70 (± 1) N applied on the specimens did not perforate the specimens and remained watertight. The classification, according to performance level L1, in user load category is P1.

4.2.9 **Resistance to heat ageing**

The specimens were exposed to 70°C during 200 days, according to Technical report 011 (TR-011) "Exposure procedure for accelerated ageing by heat". The period time is defined by the categorisation according to the climatic zone (severe) and the categorisation according to expected working life (W2).

Following the heat ageing period the next tests were performed:

- *Dynamic indentation (TR-006)*, the test was performed at -20°C according to the TL3 categorisation on three samples.

The tests were carried out on specimen fully bonded to the substrate (steel). The type of indenter I_4 ($6 \pm 0,05$ mm) used did not perforate the specimen and remained watertight. The classification, according to performance level I4, in user load category is P4.

- *Resistance to fatigue movement (TR- 008)*, the test was performed at -10°C on 3 test specimens of fibre-cement on which the System was applied. The number of cycles was 50.

After the cycles the specimens did not show cracks, loss of adhesion, or split.

- *Tensile properties*. The test was performed in accordance with EN-ISO 527-3 on 5 samples and 5 after be exposed to heat ageing.

Samples	Tensile strength (MPa) (EN-ISO 527-3)	
	Individual values	Mean value
Heat ageing	5,3	5,3
	6,1	
	3,8	
	5,7	
	5,8	
No heat ageing	3,1	2,9
	2,6	
	3,4	
	3,0	
	2,3	



Samples	Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value
Heat ageing	70	77
	72	
	70	
	95	
	77	
No heat ageing	174	168
	137	
	173	
	238	
	118	

4.2.10 Resistance UV-radiation in the presence of moisture

The specimens were exposed to UV radiation during 2000 hours, according to Technical report 010 (TR-010) "Exposure procedure for artificial weathering". This time period is defined by the categorisation according to the climatic zone (severe) and the categorisation according to expected working life (W2).

Following the UV radiation the next tests were performed:

- *Dynamic indentation (TR-006)*, the test was carried out on three specimens on the substrate (concrete and steel) at -10°C.

The type of indenter I4 ($6 \pm 0,05$ mm) used did not perforate the specimen and remain watertight. The classification, according to performance level I4, in user load category is P4.

- *Tensile properties*. The test was performed in accordance with EN-ISO 527-3 on 5 samples and 5 after be exposed to UV-radiation.

Samples	Tensile strength (MPa) (EN-ISO 527-3)	
	Individual values	Mean value
Heat ageing	2,6	2,5
	2,8	
	1,7	
	2,5	
	3,1	
No heat ageing	3,1	2,9
	2,6	
	3,4	
	3,0	
	2,3	



Samples	Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value
Heat ageing	112	80
	68	
	77	
	72	
	71	
No heat ageing	174	168
	137	
	173	
	238	
	118	

4.2.11 Resistance to water ageing

The upper weathering surface of the test specimens was exposed to hot water at 60°C during 30 days, according to Technical report 012 (TR-012) "Exposure procedures for accelerate ageing by hot water". The period time of exposition is defined by the categorisation according to the expected working life (W2).

Following the hot water exposition the following tests are performed

- *Static indentation (TR-007)*, the test was performed at 90°C according to the TH4 categorisation, on 3 test specimens each made steel (> 6mm thick) on which the roof waterproofing was applied,

The tests were carried out on specimen fully bonded to the substrate. The load 70 (±1) N applied on the specimens did not perforate the specimens and remained watertight. The classification, according to performance level L1, in user load category is P1.

- *Resistance to delamination (TR-004)*. The test was performed on 5 test specimens made of concrete on which the roof waterproofing was applied. The mean adhesive strength value was 2.309 KPa. The cohesion failure was due to the waterproof layer.

Support	ADHERENCE (KPa)	
	Values	Mean value
Concrete	2.343	2.309
	2.129	
	2.371	
	2.582	
	2.119	

4.2.12 Resistance to plant roots

The resistance of the roof waterproofing to plant root resistance was not tested in accordance with EN 13948, therefore: NPD.

4.3 ER.4 Safety in use

4.3.1 Slipperiness

The resistance of slipperiness was not tested in accordance with SS 92 35 15, therefore: NPD.

4.4. Related aspects of serviceability

4.4.1 Effect of weather conditions

The test results determined did not indicate any significant effects on the properties of the system. The results were within the given range of tolerances when the kits were assembled and cured at 5°C and 40°C.

- *Tensile properties.* The test was performed in accordance with EN-ISO 527-3 on 5 samples.

Samples	Tensile strength (MPa) (EN-ISO 527-3)	
	Individual values	Mean value
5°C	2,4	2,4
	2,1	
	2,4	
	2,6	
	2,8	
40°C	2,2	2,4
	2,4	
	2,6	
	2,6	
	2,1	

Samples	Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value
5°C	306	249
	157	
	311	
	237	
	234	
40°C	235	238
	241	
	196	
	290	
	230	

- Dynamic indentation (TR-006). The tests were carried out on specimen on the substrate (steel) at 23°C. The type of indenter I4 ($6 \pm 0,05$ mm) used did not perforate the specimen and remained watertight. The classification, following level of performance I4, in user load category is P4.



4.4.2 **Overlapping of day joints**

The delamination strength test performed on an layer assembled over other one did not show an delamination strength decrease upper 20% of the value obtained in the layer assembled over the concrete support. The number of samples tested was 5. The minimum required value is always exceeded.

Substrate	ADHERENCE (KPa)	
	Values	Mean value
Concrete	1016	1.232
	1323	
	1049	
	1261	
	1503	

The table 1 shows the test results of the "MAXELASTIC" kit.

4.5 **Identification of components**

The identification of components was performed according to ETAG 005 part. 8, section 5.8. The results comply with the specifications of the manufacturer.

4.5.1 **Liquid component**

4.5.1.1 Infrared analysis. The IR results are deposited at IETcc.

4.5.1.2 *Density*. This test was performed according to ISO 1675. The results obtained are within the given range of tolerances: $1.250 \pm 0,05 \text{ g/cm}^3$.

4.5.1.3 *Dry extract*. The test was performed according to ISO 1768 a 105°C . The results are within the given range of tolerances: $58 \pm 4 \%$.

4.5.1.4 *Ash content*. The test was performed according to ISO 1879 at 450°C . The results are within the given range of tolerances: $26 \pm 1 \%$.

4.5.1.5 *Viscosity*. The test was performed according to EN UNE- ISO 2555, with S6 at 0.3 rpm at 40°C . The results are within the given range of tolerances: 18.000 – 40.000 cps.

5. CLASSIFICATION OF THE TEST RESULTS

The results of the tests according to ETAG 005 Part 1 and Part 8 lead to the classification of the roof waterproofing "MAXELASTIC" in the following performance levels:

Working life	W2 (10 years)
Climatic zone	S (Severe)
User load	P1
Roof slope	S1 – S4
Minimum surface temperature	TL3 (-20°C)
Maximum surface temperature	TH4 (90°C)



Resistance to spreading fire was not tested: Broof (t1).
 Reaction to fire was not tested: Euroclass F: NPD.
 Resistance to plant roots: NPD.
 Slipperiness: NPD.

Table 1. Test results of the property values of the roof waterproofing "MAXELASTIC"

Ref.	Properties	Particular	Nº samples	Method	Results	
4.1.1	External fire performance			EN 1187	Broof (t1)	
4.1.2	Fire reaction			EN 13501	Class F	
4.2.1	Resistance to water vapour	13 g/m ² d	5	EN 1931	$\mu = 2.300$	
4.2.2	Watertightness		3	TR -003	Watertight	
	Release of dangerous substances	Manufacturer declaration			Does not contain any	
4.2.3	Resistance to delamination (KPa)	Ceramic	5	TR -004	811	
		Concrete	5		1.216	
4.2.4	Resistance to dynamic indentation (23°C)	Steel	3	TR - 006	I4	
4.2.5	Resistance to static indentation (23°C)	Steel	3	TR - 007	L4	
4.2.6	Resistance to fatigue movement (-10°C, 500 ciclos, W2)		1	TR - 008	Pass	
4.2.7	Resistance to low temperatures (-20°C, TL3)	Dynamic indentation	Steel	3	TR - 006	I4
4.2.8	Resistance to high temperatures (90°C, TH4)	Static indentation	Steel	3	TR -007	L1



Table 1. Test results of the property values of the roof waterproofing "MAXELASTIC"

Ref.	Properties	Methods	Tests	Particular	Nº Samples	Method	Results
4.2.9	Resistance to heat ageing 70°C – 200d W2	TR-011	Resistance to fatigue (-10°C, 50C)		1	TR - 008	Pass
			P. dynamic indentation (-20°C, TL3)	Steel	3	TR - 006	I4
			Tensile strength (MPa)	170x15 mm	5	EN-ISO 527-3	2,9
					5 after ageing period		5,3
			Elongation strength (%)	170x15 mm	5		168
5 after ageing period	77						
4.2.10	Resistance UV-radiation in the presence of moisture 2000 h Severe climatic. W2	TR - 010	P. dynamic indentation -10°	Steel	3	TR - 006	I4
			Tensile strength (MPa)	170x15 mm	5	EN-ISO 527-3	2,9
					5 after ageing period		2,5
			Elongation strength (%)	170x15 mm	5		168
5 after ageing period	80						
4.2.11	Resistance to water ageing 30d at 60°C	TR- 012	Resistance to delamination (KPa)	Concrete	5		2.309
			P. static indentation (90°C)	Steel	3	TR -007	L1
4.2.12	Resistance to plant roots					EN 13948	NPD
4.3.1	Slipperiness					SS 92 35 15 (2)	NPD
4.4.1	Effect of weather conditions	5°C	P. dynamic indentation -10°C	Steel	3	TR - 006	I4
			Tensile strength (MPa)	170x15 mm	5	EN-ISO 527-3	2,4
							Elongation strength (%)
		30°C	P. dynamic indentation -10°C	Steel			
			Tensile strength (MPa)	170x15 mm	5	EN-ISO 527-3	2,4
							Elongation strength (%)
4.4.2	Overlapping of day joints		Resistance to delamination (KPa)	> 80% initial			