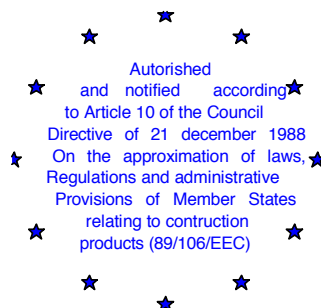


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REPORT ON THE EVALUATION OF THE TEST RESULTS

for

EUROPEAN TECHNICAL APPROVAL

N° ETA 11/0357

on

Liquid Applied Roof Waterproofing Kits
"Dayson Polyurea %100"

1. GENERAL

The performed tests was performed on the liquid applied roof waterproofing kit, based on polyureas “**Dayson Polyurea %100**”, manufactured by the company DAYSON

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 **Dayson Polyurea %100** 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 6 “Specific stipulations for kits based on polyurethane”.

2. DESCRIPTION OF PRODUCT

The liquid applied roof waterproofing kit, based on polyurethane “**Dayson Polyurea %100**” consists of a pure polyurea resins, bi-component, elastomeric without internal protection layer; which once polymerised conforms an elastic lining, in form of a layer completely bonded to the support (concrete, mortar, ceramic, extruded polystyrene).

Dayson Polyurea %100 kit is constituted for:

- Waterproofing liquid constituted by polyols and isocyanates, with loads and pigments mineral, and additives (anti-air entering, biocides, etc.).
- DAYSON PRIMER 200 gr/m², depending to the support.
- UV protection, DAYSON TOPCOAT 2C 250 gr/m². when the kit is exposed to UV radiation.

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 1,5 kg/m². The final layer is obtained by applying only one coat. The layer thickness average obtained was between 1,4-1,6 mm.

The application was carried out:

- Application of DAYSON PRIMER with consume of 200 g/m², the product settle for 1day.
- Mechanical application of the **Dayson Polyurea %100**, using a specific machine, which mixes the two components at 80°C temperature approximately. The material became dry very fast (minutes).
- The next day, the DAYSON TOPCOAT 2C is applied (200 g/m²) on the necessary samples.

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 7 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. The working life is for 25 years.

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 with the UV protection was tested according to EN 1187: and according to EN 13501-5, is classified as B_{roof}(t1). Test report n° 10/101536-1074. Certification Technological Center Applus.

The product is applied on a thermal panel of calcium silicate, fire reaction classification A1, thickness 10 mm, density 680 kg/m³. The pitch of the test was 15°.

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 $\mu > 2.000$ declared by the manufacturer was confirmed.

The examination was conducted on 5 test specimens at 22°C and 90-95 % relative air humidity. The amount of water vapour passed through the waterproof kit was:

Samples	g/(m ² /d)
1	12
2	15
3	14
4	14
5	16
Average	14

The value of the water vapour resistance factor obtained was $\mu = 2.279$.

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 (MPa)	
	Values	Values
Concrete	1,9	1,85
	1,9	
	1,3	
	1,8	
	1,8	
Steel	0,76	0,75
	0,90	
	0,70	
	0,7	
	0,7	
Expanded poliurethane	0,089	0,1
	0,1	
	0,1	
	0,14	
	0,09	
Extruded polystyrene	0,045	0,062
	0,095	
	0,059	
	0,058	
	0,052	

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 fully bonded to the substrate. The type of indenter used did not perforate the specimens and remained watertight.

Support	Indenter (mm)	Resistance Level
Steel	6	I4
Expanded poliurethane	6	I4
Extruded polystyrene	6	I4

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 fully bonded to the substrate.

Support	Load (N))	Resistance Level
Steel	250	L4
Expanded poliurethane	250	L4
Extruded polystyrene	250	L4

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 1000 (W3), after the cycles the specimens did not show cracks, loss of adhesion or split. The test was performed at -10°C temperature.

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 fully bonded to the substrate. The type of indenter used did not perforate the specimens and remained watertight.

Support	Indenter (mm)	Resistance Level
Steel	6	I4
Expanded poliurethane	6	I4
Extruded polystyrene	6	I4

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° and $60^{\circ} \pm 2^{\circ} \text{C}$ according to TH4 and TH2 categorisation, on 3 test specimens each fully bonded to the substrate. The load applied on the specimens did not perforate the specimens.

Temperature °C	Support	Load (N)	Resistance Level
60°	Steel	250	L4
	Expanded poliurethane	250	L4
	Extruded polystyrene	250	L4
90°	Steel	250	L4
	Expanded poliurethane	250	L4
	Extruded polystyrene	250	L4

4.2.9 Resistance to heat ageing

The specimens were exposed to 80°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 (W3). 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. The type of indenter used did not perforate the specimen and remained watertight.

Age	Support	Indenter (mm)	Resistance Level
200 d	Extruded polystyrene	6	I4
	Steel	6	I4

- 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)		Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value	Individual values	Mean value
Inicial	23	23	356	315729
	23		267	
	22		327	
	21,5		295	
	23		328	
Envejecida 25 años (W3)	17	17	293	326
	17		311	
	18		408	
	17		301	
	17		318	

4.2.10 Resistance UV-radiation in the presence of moisture (DAYSON TOPCOAT2C)

The specimens were exposed to UV radiation during 5.000 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 (W3). Following the UV radiation the next tests were performed:

- Dynamic indentation (TR-006), the test was carried out on three specimens adhered on the substrate -10°C. The type of indenter used did not perforate the specimen and remain watertight.

Time	Support	Indenter (mm)	Resistance Level
5000 h	polystyrene	6	I4
	Steel	6	I4

- 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)		Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value	Individual values	Mean value
No heat ageing	23	23	356	315
	23		267	
	22		327	
	21,5		295	
	23		328	
Ageing 25 years (W3))	17	17	375	372
	17		362	
	17		375	
	17		381	
	17		365	

4.2.11 Resistance to water ageing

The upper weathering surface of the test specimens was exposed to hot water at 60°C during 60 (P3) and 180 (P4) 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 (W3). Following the hot water exposition the following tests are performed:

- Static indentation (TR-007), the test was performed at 60° and 30°C according to the TH2 y TH1 categorisation. The tests were carried out on specimen fully bonded to the substrate. The load applied on the specimens did not perforate the membrane.

Temperature °C	Support	60 D		180 D	
		Load (N)	Resistance Level	Load (N)	Resistance Level
60°	Acero	250	L4	250	L4
	Poliestireno extruído	250	L4	250	L2
90°	Acero	250	L4	250	L4
	Poliestireno extruído	250	L4	150	L2

- Resistance to delamination (TR-004). The test was performed on 5 test specimens made of concrete on which the roof waterproofing was applied (180d).

SUPPORT	ADHERENCE (KPa)	
	Values	Mean value
Concrete	2	1,6
	1,7	
	1,3	
	1,3	
	1,6	

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)		Tensile elongation (%) (EN-ISO 527-3)	
	Individual values	Mean value	Individual values	Mean value
5°C	17	19	279	274
	18		274	
	19		279	
	21		263	
	21		276	
40°C	21	21	262	263
	21		269	
	20		261	
	20		263	
	21		259	

- Dynamic indentation (TR-006), this test was performed on three samples at -10°C. The tests were carried out on specimen on the substrate (concrete and steel). The type of indenter I_4 (6 – 0,05 mm) used did not perforate the specimen and remained watertight.

4.4.2 Overlapping of day joints

The delamination strength test performed on an layer assembled over other one show a good delamination strength, being upper to required value of 50 KPa. The number of samples tested was 5.

Substrate	ADHERENCE (KPa)	
	Values	Values
Concrete	1,48	1,52
	1,57	
	1,42	
	1,64	
	1,51	

The table 1 shows the test results of the “**DAYSON POLYUREA %100**” kit.

4.5 Identification of components

The identification of components was performed according to ETAG 005 part. 6, section 5.8. The results comply with the specifications of the manufacturer.

4.5.1 DAYSON POLYUREA %100

4.5.1.1 Infrared analysis. Deposited at IETcc.

4.5.1.2 Density. This test was performed according to ISO 1675.

Properties	Component A	Tolerances	Component B	Tolerances
Density (g/cm ³)	1,1	1.1 – 5%	1,05	1,09– 5%

4.5.1.2 Dry extract. The test was performed according to ISO 1768 a 105°C.

Properties	Component A	Tolerances	Component B	Tolerances
105°C	99,85	99	99,75	99

4.5.1.4 Ash content. The test was performed according to ISO 1879 at 450°C.

Properties	Component A	Tolerances	Component B	Tolerances
Ash 450°C, (% weight) (EN 1879)	0,7	1	0,24	1

4.5.1.5 Viscosity. The test was performed according to EN UNE- ISO 2555.

Properties	Component A	Tolerances	Component B	Tolerances
Viscosity (cps), (S63, 30 rpm, 25°C)	620	600– 50	640	650– 50

4.5.2 DAYSON PRIMER

4.5.2.1 Infrared analysis. Deposited at IETcc.

4.5.2.2 Density. This test was performed according to ISO 1675.

Properties	Component A	Tolerances	Component B	Tolerances
Density (g/cm ³)	1,01	1,19 – 5%	1,03	1,03– 5%

4.5.2.3 Dry extract. The test was performed according to ISO 1768 a 105°C.

Properties	Component A	Tolerances	Component B	Tolerances
105°C	99	99	99,91	99

4.5.2.4 Ash content. The test was performed according to ISO 1879 at 450°C.

Properties	Component A	Tolerances	Component B	Tolerances
Ash 450°C, (% weight) (EN 1879)	50,14	50+- 5%	20.9	20 +- 5%

4.5.2.5. Viscosity. The test was performed according to EN UNE- ISO 2555.

Properties	Component A	Tolerances	Component B	Tolerances
Viscosity (cps), (S63, 30 rpm, 25°C)	49	450- 50	925	900 - 50

4.5.3 UV Top Coat DAYSON TOPCOAT2C

4.5.3.1 Infrared analysis. Deposited at IETcc.

4.5.3.2 Density. This test was performed according to ISO 1675.

Properties	Component A	Tolerances	Component B	Tolerances
Density (g/cm³)	1,31	1,34 - 5%	1,29	1,34 - 5%

4.5.3.3 Dry extract. The test was performed according to ISO 1768 a 105°C.

Properties	Component A	Tolerances	Component B	Tolerances
105°C	99,21	99	99,98	99

4.5.3.4 Ash content. The test was performed according to ISO 1879 at 450°C.

Properties	Component A	Tolerances	Component B	Tolerances
Ash 450°C, (% weight) (EN 1879)	36	37+-3%	035,44	<1

4.5.3.5 Viscosity. The test was performed according to EN UNE- ISO 2555.

Properties	Component A	Tolerances	Component B	Tolerances
Viscosity (cps), (S63, 30 rpm, 25°C)	80	80 +-10	600	1,34 □ 5%

4.5 Control of works

The IETcc visited several works with the assembled system, with an age bigger than 5 years placed in the coast, interior areas of Spain.

5. CLASSIFICATION OF THE TEST RESULTS

The results of the tests according to ETAG 005 Part 1 and Part 6 lead to the classification of the roof waterproofing "**DAYSON POLYUREA %100**" in the following performance levels:

External fire performance	Broof (t1):Concrete NPD: Polystyrene
Expected working life	W3
Climatic zone of use	S (Severe)
User loads	P4:TH2, P3: TH4
Roofs slopes	S1 - S4
Minimum surface temperatures	TL3 (- 20 °C)
Maximum surface temperatures	TH4-TH2

Table 1. Test results of the property values of the roof waterproofing "**DAYSON POLYUREA %100**"

Ref.	Properties		Particular	Nº Samples	Method	Results
4.1.1	External fire performance				EN 1187	Broof (t1): Concrete NPD: Polystyrene
4.1.2	Fire reaction				EN 13501	F
4.2.1	Resistance to water vapour			5	EN 1931	μ = 2.279
4.2.2	Watertightness			3	TR -003	Watertight
	Release of dangerous substances		Declaración del fabricante			Do not contain
4.2.3	Resistance to delamination (KPa)		Concrete	5	TR -004	1,85
			Extruded Polystyrene			0,06
4.2.4	Resistance to dynamic indentation (23°C)		Extruded Polystyrene	3	TR - 006	I4
			Steel	3		I4
4.2.5	Resistance to static indentation (23°C)		Extruded Polystyrene	3	TR - 007	L4
			Steel	3		L4
4.2.6	Resistance to fatigue movement (-10°C, 1000 ciclos, W3)			1	TR - 008	Apt
4.2.7	Resistance to low temperatures (-20°C, TL3)	I. Dynamic	Extruded Polystyrene	3	TR - 006	I4
			Steel	3		I4
4.2.8	Resistance high temperatures (90°C, TH4)	I. Static	Extruded Polystyrene	3	TR -007	L4
			Steel	3		L4
	Resistance high temperatures (60°C, TH2)		Extruded Polystyrene	3	TR -007	L4
			Steel	3		L4

Table 1. Test results of the property values of the roof waterproofing "DAYSON POLYUREA %100"

Ref.	Properties	Methods	Tests	Particular	N° Samples	Method	Results
4.2.9	Resistance to heat ageing 80°C - 200d W3	TR-011	Resistance to fatigue (-10°C, 50C)		3	TR - 008	Pass
			I. dynamic indentation (-20°C, TL3)	Extruded Polystyrene	3	TR - 006	I4
				Steel			I4
			Tensile strength (MPa)		5	EN-ISO 527-3	23
					5 envejecidas		17
			Elongation strength (%)		5		315
					5 envejecidas		326
4.2.10	Resistance UV-radiation in the presence of moisture 5000 h Severe climatic, W3	TR - 010	I. dynamic indentation (-20°C, TL3)	Extruded Polystyrene	3	TR - 006	I4
				Steel			I4
			Tensile strength (MPa)		5	EN-ISO 527-3	23
					5 envejecidas		17
			Elongation strength (%)		5		315
					5 envejecidas		372
			4.2.11	Resistance to water ageing 180 d :P4 60d: P3	TR- 012	Resistance to delamination (MPa)	Concrete
I. static indentation (90°C) 60d /180d	Extruded Polystyrene	3				TR -007	L4 / L2
	Steel						L4 / L4
I. static indentation (60°C) 60d /180d	Extruded Polystyrene	3					L4 / L2
	Steel						L4 / L4
4.2.12	Resistance to plant roots						
4.3.1	Slipperines					SS 92 35 15 (2)	NPD
4.4.1	Effect of weather conditions	5°C	I. dynamic indentation (-20°C, TL3)	Extruded Polystyrene	3	TR - 006	I4
				Steel			I4
			Tensile strength (MPa)		5	EN-ISO 527-3	19
			Elongation strength (%)				274
		40°C	I. dynamic indentation	Extruded Polystyrene	3	TR - 006	I4
				Steel			I4
			strength (MPa)		5	EN-ISO 527-3	21
			Elongation strength (%)				263
4.4.2	Overlapping of day joints		Resistance to delamination	> 80% initial	5	TR -004	1,52