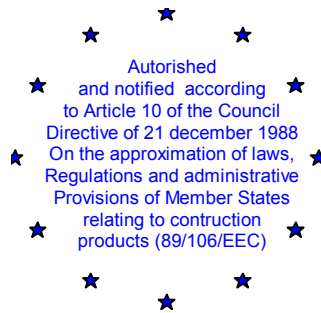


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# **REPORT ON THE EVALUATION OF THE TEST RESULTS**

for

**EUROPEAN TECHNICAL APPROVAL**

**N° ETA 10/0095**

on

**Liquid Applied Roof Waterproofing Kits  
"HYPERDESMO PB 2K"**

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

## 1. GENERAL

The performed tests was performed on the liquid applied roof waterproofing kit, based on polyurethane "HYPERDESMO PB 2K", manufactured by the company ALCHIMICA CHEMICAL 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 HYPERDESMO PB 2K 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 waterproofing kit HYPERDESMO PB 2K is constituted by polyurethane resins, which once polymerised conforms elastic lining, in form of a layer completely bonded to the support (concrete, mortar, fibre-cement).

HYPERDESMO PB 2K kit is constituted for:

- Waterproofing liquid constituted by polyols and isocyanates, 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 1.5 kg/m<sup>2</sup>. The final layer is obtained by applying only one coat. The layer thickness average obtained was 1,5 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 NPD

###### 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  $\mu > 4.000$  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 <sup>2</sup> /d)
1	0,01
2	0,02
3	0,02
4	0,02
5	0,01
<b>Average</b>	<b>0.02</b>

The value of the water vapour resistance factor obtained was  $\mu = 9.000$ .

###### 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	0,9	1
	1,02	
	1,05	
	1,05	
	1,07	

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 I<sub>4</sub> (6 ± 0,05 mm) used did not perforate the specimens and remained watertight.

**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.

**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° ± 2° 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 I<sub>4</sub> (6 ± 0,05 mm) used did not perforate the specimens and remained watertight.

**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°, 80° and 60° ± 2° C according to TH4, TH3 and TH2 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 applied on the specimens did not perforate the specimens.

T°C	Load (N)	Resistance level
60°C	250	L4
30°C	250	L4

**4.2.9 Resistance to heat ageing**

The specimens were exposed to 80°C during 100 and 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, 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 (steel). The type of indenter I4 ( $6 \pm 0,05$  mm) used did not perforate the specimen and remained watertight.

- *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
Ageing 10 years (W2)	0,962	1	257	259
	0,989		307	
	1,018		226	
	0,998		249	
	1,052		258	
Ageing 25 years (W3)	1,834	2	835	852
	1,910		745	
	2,038		730	
	2,094		970	
	1,899		980	
No heat ageing	2,589	3,7	534	563
	4,432		539	
	2,478		546	
	4,513		525	
	4,150		673	

#### 4.2.10 **Resistance UV-radiation in the presence of moisture**

NPD. The product is always ballast.

#### 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, 60, 90 and 180 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, 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, 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 applied on the specimens did not perforate the membrane.

Working life	Age	T°C	Load (N)	Resistance Level
W2	30 d	60°C	200	L3
		30°C	250	L4
	90 d	60°C	200	L3
		30°C	200	L3
W3	60 d	60°C	200	L3
		30°C	200	L3
	180 d	60°C	70	L1
		30°C	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).

	ADHERENCE (KPa)	
	Values	Mean value
Concrete	1,3	1,2
	1,3	
	0,9	
	1,3	
	1,3	

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 0°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
0°C	4,5	4,3	511,1	496
	5,1		451,35	
	3,9		550,45	
	3,9		451,75	
	4,		513,75	
40°C	3,2	3,6	644,75	689
	3,9		681,6	
	3,6		691,1	
	3,4		706	
	3,8		723,8	

- *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  $I_4$  ( $6 \pm 0,05$  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	1,1	1,1
	1,1	
	1,2	
	0,9	
	1	

The table 1 shows the test results of the “HYPERDESMO PB 2K” 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 **Liquid component**

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/cm³)	1	± 0,03	1	± 0,03

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 (% Residue)	95	≥ 95	95	≥ 95

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

Properties	Component A	Tolerances	Component B	Tolerances
Cenizas a 450°C, (% peso) (EN 1879)	1	≤ 1	1	≤ 1

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

Properties	Component A	Tolerances	Component B	Tolerances
Viscosidad	800	± 100	1000	± 100

## 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 "HYPERDESMO PB 2K" in the following performance levels:

External fire performance	NPD
Fire reaction	F
Expected working life	W3
Climatic zone of use	S (Severe)
User loads	P3
Roofs slopes	S1 – S4
Minimum surface temperatures	TL3 (- 20 °C)
Maximum surface temperatures	TH2

**Table 1.** Test results of the property values of the roof waterproofing "HYPERDESMO PB 2K"

Ref.	Properties	Particular	N° Samples	Method	Results	
4.1.1	External fire performance			EN 1187	NPD	
4.1.2	Fire reaction			EN 13501	F	
4.2.1	Resistance to water vapour		5	EN 1931	$\mu = 9.000$	
4.2.2	Watertightness		3	TR -003	Watertight	
	Release of dangerous substances	Manufacturer declaration			Do not contain	
4.2.3	Resistance to delamination (KPa)	Concrete	5	TR -004	1	
4.2.4	Resistance to dynamic indentation (23°C)	Steel	3	TR - 006	I4	
4.2.5	Resistance to dynamic indentation (23°C)	Steel	3	TR - 007	L4	
4.2.6	Resistance to fatigue movement (-10°C, 1000 cycles, W3)		3	TR - 008	Pass	
4.2.7	Resistance to low temperatures (-20°C, TL3)	I. Dynamic	Steel	3	TR - 006	I4
4.2.8	Resistance to high temperatures (60°C)	I. Static	Steel	3		L4



**Table 1. Test results of the property values of the roof waterproofing "HYPERDESMO PB 2K"**

<b>Ref.</b>	<b>Properties</b>	<b>Methods</b>	<b>Tests</b>	<b>Particular</b>	<b>N° Samples</b>	<b>Method</b>	<b>Results</b>
4.2.9	Resistance to heat ageing 80°C – 200d W3	TR-011	Resistance to fatigue (-10°C, 50C)		3	TR - 008	Pass
			P. dynamic indentation (-20°C, TL3)	Steel	3	TR - 006	I4
			Tensile strength (MPa)		5	EN-ISO 527-3	3,6
					5 after ageing		1
			Elongation strength (%)		5		563
5 after ageing	259						
4.2.10	Resistance UV-radiation in the presence of moisture 5000 h Severe climatic, W3	TR – 010	P. dynamic indentation -10°		3	TR - 006	NPD
			Tensile strength (MPa)		5	EN-ISO 527-3	
					5 after ageing		
			Elongation strength (%)		5		
5 after ageing							
4.2.11	Resistance to water ageing 30, 60d at 60°C	TR- 012	Resistance to delamination (MPa)	Concrete	5	TR –004	1,2
			P. static indentation (90°C)	Steel	3	TR -007	L3
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	0°C	P. dynamic indentation -10°C	Steel	3	TR - 006	I4 I4
			Tensile strength (MPa)		5	EN-ISO 527-3	4,3
							Elongation strength (%)
		40°C	P. dynamic indentation -10°C	Steel	3	TR - 006	I4 I4
			Tensile strength (MPa)		5	EN-ISO 527-3	3,6
							Elongation strength (%)
4.4.2	Overlapping of day joints		Resistance to delamination		5	TR -004	Pass