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The accreditation is valid for tests listed in annex of certificate D-PL-11217-01-01.

Test Report

project:	**P 12481-E**
order:	Tests on composite system of the waterproofing kit based on **HUMISTOP WP170** according to ETAG 005, category W3
sample description:	Liquid applied roof waterproofing kit
This test report comprises:	18 pages 1 enclosure with 6 pages

Flörsheim, 20-03-2020

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C O N T E N T S

1 SUBJECT

Polymer Institut was charged by *ARDEX CEMENTO S.A.*, Les Franqueses del Vallès/ Spain, to carry out tests on the liquid applied roof waterproofing kit based on

HUMISTOP WP170

according to

ETAG No. 005
Version march 2000
Revision 2004
Guideline for the European technical approval
for
liquid applied roof waterproofing kits
Part 1 - General
Part 6 – Special provisions for kits based on polyurethane

The test program was agreed with the client.

The ETAG no. 005 guideline requires the proof of performance characteristics as a guide for the assessment of usefulness of the „liquid applied roof waterproofing kit“ (LARWK).

- Classification for use by the client:

Useful life:	category W3, expected useful life 25 years
Climate zones:	category M & S, moderate and severe climate category TL3, severe low temperature category TH4, severe high temperature
Roof Slope:	category S1 – S4 Slope (<5 till >30) %
User load:	category P3, normal

If not specified otherwise all in the following overview listed table were performed at standard temperature according to DIN 23270.

Overview 1: test on the liquid applied roof waterproofing kit

test	reference	date*
content of non-volatile components / solid content	DIN EN ISO 3251	06-2008
infrared spectrum	DIN EN 1767	09-1999
density	DIN EN ISO 2811-2	06-2011
dynamic viscosity	DIN EN ISO 3219	10-1994
ash content	DIN EN ISO 3451-1	11-2008
mass per unit area / strength of the reinforcement	DIN EN 29073-1 DIN EN 29073-3	08-1992
water vapour permeability	DIN EN 1931	03-2001
water tightness	TR-003	05-2004
resistance to wind loads	TR-004	05-2004
resistance to dynamic indentation	TR-006	05-2004
resistance to static indentation	TR-007	05-2004
resistance to fatigue movement	TR-008	05-2004
resistance to low temperature	TR-006	05-2004
resistance to high temperature	TR-007	05-2004
resistance to heat ageing	TR-011	05-2004
resistance to dynamic indentation	TR-006	05-2004
resistance to fatigue movement	TR-008	05-2004
tensile properties	DIN EN ISO 527-1	06-2012
resistance to UV-ageing	TR-010	05-2004
resistance to dynamic indentation	TR-006	05-2004
tensile properties	DIN EN ISO 527-1	06-2012
resistance to water ageing	TR-012	05-2004
resistance to static indentation	TR-007	05-2004
resistance to wind loads	TR-004	05-2004
effects of days joint	TR-004	05-2004
minimal / maximal application temperature	ETAG 005 part 6	05-2004
resistance to dynamic indentation	TR-006	05-2004
tensile properties	DIN EN ISO 527-1	06-2012

* *accredited test*

The test results are included in the chapter results.

2 RECEIPT OF SAMPLES

The following samples were delivered to Polymer Institut by a forwarding agency:

Table 1: receipt of samples

no	substance	batch	amount
1	HUMISTOP WP170	A004M5B003	3 x 6kg
2	ADIPOX WP	E702GB5010	2 kg
3	ADIMATT 110	-	1 roll

A Description of the test liquid applied roof waterproofing kit can be seen in the following overview.

Overview: composition of the system

components of the kit	trade name	description of the substance*
primer	ADIPOX WP	Waterborne primer for mineral substrates
waterproofing layer	HUMISTOP WP170	Liquid applied one component waterborne coating
reinforcement	ADIMATT 110	Nonwoven Polypropylene fleece, grammage 110 g/m^2
waterproofing layer	HUMISTOP WP170	Liquid applied one component waterborne coating

* *declaration of the producer*

3 PREPARATION OF THE TEST SPECIMEN

If not specified otherwise the mixture and the application of the system as stated above were done at standard temperature by a representative of the client at the location of Polymer Institut according DIN EN 23270.

The consumption mean values for the primer and the waterproofing layer can be seen in the following overview.

Overview: consumption mean values [g/m²]

substrate [mm x mm]	ADIPOX WP	HUMISTOP WP170				
		1. layer	2. layer	3. layer	4. layer	total
concrete slab [400 x 400]	110	1020	1200	610	620	3450
bituminous sheeting applied on insulation material [300 x 300]	-	1000	1200	630	620	3450
concrete slab [400 x 400] "1 mm gap"	120	1010	1180	650	630	3470
separating foil* [500 x 300]	-	1010	1200	630	650	3490

* *free films and steel slabs were produced also at minimal application temperature (5 °C) and maximal application temperature (40 °C)*

The waiting time between the primer and the first layer of the waterproofing membrane amounts about 24 hours. After another 24 hours the 2nd and 3rd layer of the waterproofing membrane was applied fresh in fresh with the fleece embedded. Followed by another 24 hours the last layer of the waterproofing membrane was applied.

4 TESTS

4.1 Content of non-volatile components / solid content

Content of nonvolatile components was determined according to DIN EN ISO 3251 *"Coating substances and plastics - determination of the content in non-volatile components"* with the following conditions in a triple determination

heat cabinet: air circulation heating cabinet
used shell: tin lid ∅ 74 mm

4.2 Infrared spectrum

The infrared spectra were recorded in accordance with DIN EN 1767 "*Products and systems for the protection and maintenance of concrete structures - test methods - infrared analysis*" with FTIR spectrometer from ALPHA (Fa. Bruker), ATR technique in the wavenumber range 4000-500 cm^{-1}.

4.3 Density

The density was determined according to DIN EN ISO 2811-2 "*Coating substances - determination of density - Part 2: Immersed body method"* in two separate tests with a solid sphere (10 cm^3) in each instance at 23 °C

4.4 Dynamic viscosity

The dynamic viscosity was determined using a rotational viscosimeter of the company Anton Paar with a ball-plate system according to DIN ISO 3219 "*Plastic - polymer/resins in liquid state or as emulsions or dispersions - determination of viscosity using a rotational viscosimeter with defined shear rate"* at a test temperature of 23 °C. The measurement was carried out twice.

test device:	rotational viscosimeter company Anton Paar (type MCR 51)
measurement system:	given in chapter results
increase in shear rate:	constant
evaluation / measurement time:	automatic interpolation, shear rate given in chapter results

4.5 Ash content

The solid content of the mixed substances was determined according to DIN EN ISO 3451-1 *"Plastics - determination of ash"* after 24-hour storage in normal climate according DIN 23270. The drying time and the temperature is given in the chapter results.

4.6 Mass per unit area / strength of the reinforcement

The mass per unit area of the reinforcement was tested according to DIN EN 29073-1 *„Determination of mass per unit area"*. For the test of the mass per unit area three specimens with the dimension of (250 x 200) mm^2 were cut out according to DIN EN ISO 186" *Paper and board. Sampling to determine average quality"*.

The strength of the reinforcement was determined according to DIN EN 29073-3 *„Determination of tensile strength and elongation" with* the following testing parameters:

Testing machine:	UPM 1445 with trav. displacement transducer
Distance between clamps:	200 mm
Load cell:	load cell 2 kN, class 1
Testing temperature:	standard temperature according DIN EN 23270

<u>Specimen:</u>

- Amount:	5
- Wide:	50 mm
- Distance measuring points:	200 mm (automatically recorded)
- Testing speed:	100 mm/min

4.7 Water vapour permeability

The determination of the water vapor permeability was carried out according to DIN EN 1931 *„Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water vapour transmission properties"*
The test bodies (diameter 90 mm) were drilled from the film and conditioned for 24 hours at standard conditions according to DIN EN 23270.
Then they were bonded steam tight in a diffusion cup which contains waterfree Calciumchloride to get a relative humidity of 0 %.

The cups were weighed and stored in a desiccator which contains saturated Natriumchloride to get a relative humidity of 75%. They were weighed until they reached a steady state.

4.8 Water tightness

The water tightness of the system was tested according to the EOTA Technical Report 003 *„Determination of the watertightness“.* The test specimens were impinged on the upper side with a head of water of 1000 mm which corresponds to 0.1 bar at 23 °C. As a hygroscopic indicator a mixture of bromophenol blue (0.5 %) with powdered sugar (99.5 %) was used. Before the test the mixture was sieved with a 0.063 mm diameter sieve and stored in a desiccator.
The hygroscopic indicator was embedded between two filter papers, which lay between the upper side of the test specimen and the test apparatus. The test is passed, when no discoloration is detected.

4.9 Resistance to wind loads

The resistance to wind loads of the system has been tested following the EOTA Technical Report 004 *„Determination of the resistance to delamination“.* Differing from EOTA Technical Report 004 the coating of the test specimens was drilled wet with a core driller at 5 testing areas (∅ 50 mm) to a depth of 10 mm into the substrate. Afterwards the surplus water was removed and the testing areas were cleaned. Before testing, the bond strength stamps were bonded with a 2 component PU-adhesive on the drilled surface. After a cure time of about 20 hours the test took place at a temperature of 23 °C with a calibrated testing machine.

Testing conditions:

Testing device:	Bond strength testing device of firm Wennigsen Easy M, Type F10D, max. force 10 kN
Testing speed:	300 N/s
Bond strength stamp:	steel stamp (∅ 50 mm)
Adhesive:	2-component PU-adhesive
Testing temperature:	23 °C

4.10 Resistance to dynamic indentation

The test was carried out using test specimens with the most and the less compressible substrate according to EOTA Technical Report 006 “*Determination of the resistance to dynamic indentation”*. The detection of water tightness was done by visual inspection and in case of doubts with a coloured water column of 100mm.

Testing device and parameters:

Testing machine:	Erichsen impact-testing machine model 304 with 1 kg-body und 1 kg-additional weight
Drop height:	30.4 cm
Drop mass:	1.98 kg
Load:	5.9 J (impact energy)
Temperature	23 °C
Indentors depending on classification	I_4= ∅6 mm, I_3= ∅10 mm, I_2= ∅20 mm, I_1= ∅30 mm

4.11 Resistance to static indentation

The test was carried out using test specimens with the most and less compressible substrate according to EOTA Technical Report 007 *„Determination of the resistance to static indentation“* under standard conditions according to DIN EN 23270, unless shown otherwise. On three marked areas the test specimen gets a load type of different weight in combination with a spherical steel indentor. In this test 3 spherical indentors with a diameter of 10 mm were used at the same time to transfer the weight.
After the test was finished the detection of water tightness was performed with the help of optical measuring and if doubtful, with a head of 100 mm water.

Load
depending on classification: L_4=250 N, L_3=200 N, L_2= 150 N, L_1= 70 N

4.12 Resistance to fatigue movement

The test of the resistance to fatigue movement was carried out according to EOTA Technical Report 008 *„Determination of the resistance to fatigue movement”* at 3 concrete prisms with the dimensions of 150 mm x 50 mm x 50 mm. To realize a change in the distance of the crack, there was a gap holder of 1 mm thickness between the sawn ends of the concrete test specimens. This gap was sealed up to the bottom. During the test a tensile load produced a 2 mm gap inside of the concrete test specimens, started from the 1 mm gap. Afterwards the test specimens were compressed to a gap with a width of 0 mm. These both processes were one cycle.
During the test of the determination of the resistance to fatigue movement this cycle was repeated 1000 times.

After the test ended, the test specimens were examined visually to crack formation or debondings. For this the specimens were lighted from the rear cover with a source of light. If the result was doubtful the watertightness of the roof waterproofing kit was detected using a pipe of sufficient size to impose a head of water of 100 mm during 24 hours.

Testing device and parameters:

Testing device:	servo-hydraulic testing device S59 with cylinder 2 (100 kN) including an automatic cooling to reach a temperature of -20 °C
Testing speed:	16 mm/h = 0,001 Hz
Testing temperature:	-10 °C
Starting gap:	1.0 mm = zero value for displacement transducer

4.13 Resistance to low temperature

The test was carried out using test specimens with the less compressible substrate according to Technical Report 006 “*Determination of the resistance to dynamic indentation”* at TL classification.

Testing device and parameter see chapter 4.10.

4.14 Resistance to high temperature

The resistance of the system to high temperatures was carried out at TH classification on the less compressible substrate according to EOTA Technical Report 007 *„Determination of the resistance to static indentation".*

Execution, testing device and parameter see chapter 4.11.

4.15 Resistance to heat ageing

The effect of the heat ageing to the resistance of the liquid applied roof waterproofing kit against mechanical damage was tested referring to the classification of the customer which is given in the chapter results.
The system applied on concrete slabs and free films were heat aged according to the EOTA Technical Report 011 *„Exposure procedure for accelerated ageing by heat"* at a temperature of 80 ± 2 °C for a period given in the chapter results.

4.15.1 Resistance to dynamic indentation

The resistance to dynamic indentation after heat ageing was carried out on the less compressible substrate according to EOTA Technical Report 006 "*Determination of the resistance to dynamic indentation"* at TL classification.

Execution, testing device and parameter see chapter 4.10.

4.15.2 Resistance to fatigue movement

The test of the resistance to fatigue movement after heat ageing was carried out according to EOTA Technical Report 008 *„Determination of the resistance to fatigue movement"* at 3 concrete prisms with the dimensions of 150 mm x 50 mm x 50 mm.

Testing temperature:	-10 °C
Amount of cycles:	50

Execution, testing device and parameter see chapter 4.12.

4.15.3 Tensile properties

The tensile properties of free films were determined according to EN 527-2 "*Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics".* Five tension bars were tested after and before heat ageing to get a comparison.

Testing device and parameter:

Testing device:	universal testing machine UPM 1445, Fa. Zwick
Specimen's type:	1B according to EN 527-2
Test temperature:	23 °C
Test speed:	200 mm/min

4.16 Resistance to UV-ageing

For testing aging effects of UV-radiation in the presence of moisture the liquid applied roof waterproofing kit was tested corresponding to the specified characteristics of the system according to the test conditions for the climatic zone given in the chapter results according to EOTA Technical Report 010 "*Exposure procedure for artificial weathering"* using fluorescent tubes (UV-A) with the following conditions:
Testing device and parameter:

Testing device:	Weiss UV-Global UV3-200
Sample number/ type:	3 free films, 3 coated concrete slabs
Sample rotation:	reordering every 2 weeks

Test parameters for UV-radiation:

Light source type:	fluorescent light source, according to EN ISO 4892-3
Illuminance:	40 W/m^2
Standard-black-temperature:	60 °C ± 3 °C
Spray cycle:	1 h spraying at 23 °C
	5 h dry period at 60 °C and 10 % r.h.

4.16.1 Resistance to dynamic indentation

The resistance to dynamic indentation after heat ageing was carried out on the less compressible substrate according to EOTA Technical Report 006 "*Determination of the resistance to dynamic indentation"* at -10 °C.

Execution, testing device and parameter see chapter 4.10.

4.16.2 Tensile properties

The tensile properties of free films were determined according to EN 527-2 "*Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics".* Five tension bars were tested after and before UV-aging to get a comparison.

Execution, testing device and parameter see chapter 4.15.3.

4.17 Resistance to water ageing

For testing aging effects of water aging the liquid applied roof waterproofing kit was tested corresponding to the working life category of the system according to the test conditions for the climatic zone given in the chapter results at 60 ± 2 °C according to EOTA Technical Report 012 *„Exposure procedure for accelerated ageing by hot water"* .

4.17.1 Resistance to static indentation

The test was carried out using test specimens with the less compressible substrate according to EOTA Technical Report 007 *„Determination of the resistance to static indentation"* at TH classification.

Execution, testing device and parameter see chapter 4.11.

4.17.2 Resistance to wind loads

The resistance to wind loads of the system has been tested following the EOTA Technical Report 004 *„Determination of the resistance to delamination“* on water aged specimens.

Execution, testing device and parameter see chapter 4.9.

4.18 Effects of days joint

For the test of the effect of day joints a concrete slab was applied two times. Between both layers there was a waiting period of 28 days. Afterwards the test of the resistance to wind loads was determined following the EOTA Technical Report 004 *„Determination of the resistance to delamination“.*

Execution, testing device and parameter see chapter 4.9.

4.19 Minimal / maximal application temperature

In order to check if it’s possible to get a satisfactory bonded system also at the minimal and maximal application temperature comparative tests to the tensile strength and the dynamic indentation were done.

4.19.1 Resistance to dynamic indentation

The resistance to dynamic indentation on specimen which were produced at minimal and maximal application temperature was carried out on the less compressible substrate according to EOTA Technical Report 006 “*Determination of the resistance to dynamic indentation”*.

Execution, testing device and parameter see chapter 4.10.

4.19.2 Tensile properties

The tensile properties of free films produced at minimal and maximal application temperature were determined according to EN 527-2 “*Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics”.*

Execution, testing device and parameter see chapter 4.15.3.

5 RESULTS

Table 2: content of non-volatile components

substance	drying	content of nonvolatile components / solid content [M.-%]	
		single values	mean value
ADIPOX WP	3 h at 105 °C	25.4 ; 25.4 ; 25.7	**25.5**
HUMISTOP WP170		63.3 ; 63.4 ; 63.6	**63.4**

Table 3: Infrared spectrum - pre-treatment

substance	comp.	pre-treatment	figure in enclosure
ADIPOX WP	1K	dried	1
HUMISTOP WP170		as delivered	2

Table 4: density

substance	comp.	density [g/cm³]	
		single values	mean value
ADIPOX WP	1K	1.021 ; 1.021	**1.021**
HUMISTOP WP170		1.422 ; 1.422	**1.422**

Table 5: dynamic viscosity

substance	system / Shear rate	comp.	dynamic viscosity [mPas]	
			single values	mean value
ADIPOX WP	CP 50-1 / 2000 s^{-1}	1K	3 ; 3	**3**
HUMISTOP WP170	CP 50-1 / 500 s^{-1}		250 ; 250	**250**

The matching diagrams can be seen in the enclosure figure 3 - 4.

Table 6: ash content

substance	temperature [°C]	ash content [M.-%]	
		single values	mean value
ADIPOX WP	550	0.1 ; 0.1 ; 0.2	**0.1**
HUMISTOP WP170		29.9 ; 29.8 ; 29.8	**29.8**

Table 7: water vapour permeability – HUMISTOP WP170

No.	moisture flow density g [g/(m²·d)]	diffusion-equivalent air layer thickness s_d [m]	mean layer thickness d [mm]	water vapour diffusion resistance factor μ [ ]
1	6.9	5	1.57	3250
2	6.8	5	1.56	3320
3	6.1	6	1.49	3920
4	7.3	5	1.47	3290
5	7.7	5	1.40	3290
mean value	**7.0**	**5**	**1.50**	**3410**

Table 8: water tightness

substance	test parameters	result
HUMISTOP WP170	0.1 bar / 24 h	watertight

Table 9: resistance to wind loads

substrate	storage	bond strength [kPa]		
		single values	mean value	area of failure
concrete	standard temperature	1910 2040 1930 1750 2080	**1940**	90 % cohesion polypropylene fleece 10 % cohesion waterproofing membrane
bituminous sheeting applied on insulation material		120 160 110 170 160	**140**	100 % cohesion insulation material
concrete	90 days water ageing (W2)	2970 2650 1950 3010 1850	**2690**	40 % adhesion primer 50 % cohesion polypropylene fleece 10 % cohesion waterproofing membrane
	180 days water ageing (W3)	3020 3370 3480 3400 2830	**3220**	20 % adhesion primer 80 % cohesion waterproofing membrane

continuation Table 9: resistance to wind loads

substrate	storage	bond strength [kPa]		
		single values	mean value	area of failure
concrete	day joints	1850 1900 2040 1970 2060	**1960**	80 % cohesion polypropylene fleece 20 % cohesion waterproofing membrane

Table 10: dynamic indentations

remark	substrate	temp.	result
initial	concrete	23 °C	I_3
initial	bituminous sheeting applied on insulation material	23 °C	I_3
low temperature	concrete	-20 °C	TL_3 / I_3
100 days, 80 °C heat ageing (W2)			W2 / TL_3 / I_3
200 days, 80 °C heat ageing (W3)		-20 °C	W3 / TL_3 / I_4
2667 hours UV-ageing 400 MJ/m² (W2)		-10 °C	W2 / I_3
6614 hours UV-ageing 1000 MJ/m² (W3)		-10 °C	W3 / I_4
minimal application temperature (5 °C)		23 °C	I_3
maximal application temperature (40 °C)			I_3

Table 11: static indentations

remark	substrate	temp.	result
initial	concrete	23 °C	L_3
initial	bituminous sheeting applied on insulation material	23 °C	L_3
high Temperature	concrete	+90 °C	TH_4 / L_3
90 days, 60 °C water ageing (W2)			W2 / TH_4 / L_3
180 days, 60 °C water ageing (W3)			W3 / TH_4 / L_3

Table 12: resistance to fatigue movement

remark	cycles	temp.	visual inspection	result
initial	1000	-10 °C	no cracks and no debonding	W2
100 days, 80 °C heat ageing (W2)	50			
200 days, 80°C heat ageing (W3)	50		no cracks and no debonding	W3

Table 13: tensile properties

remark	tensile force [N]*		elongation at tensile force [%]*		layer thickness [mm]
	single values	mean value	single values	mean value	
Initial	78.4 77.2 70.0 78.2 78.8	**76.5**	66.3 69.2 63.8 67.3 72.9	**67.9**	1.51 1.40 1.45 1.55 1.40
100 days, 80 °C heat ageing (W2)	91.4 94.0 99.4 104 101	**97.9**	42.3 44.5 43.6 45.5 43.1	**43.8**	1.45 1.41 1.49 1.47 1.56
200 days, 80 °C heat ageing (W3)	118 115 120 109 110	**115**	38.0 40.9 43.2 37.0 41.9	**40,2**	1.49 1.70 1.62 1.81 1.61
2667 hours UV-ageing 400 MJ/m^2 (W2)	115 108 113 107 121	**112**	44.6 39.0 43.2 47.4 46.8	**44.2**	1.60 1.58 1.59 1.57 1.58
6614 hours UV-ageing 1000 MJ/m^2 (W3)	121 122 130 126 124	**125**	39.7 39.3 43.9 42.1 41.2	**41,2**	1.48 1.52 1.47 1.34 1.45
minimal application temperature (5 °C)	78.5 85.3 86.2 68.7 74.2	**78.5**	63.4 67.9 73.9 59.5 63.6	**65.6**	1.64 1.68 1.49 1.42 1.40
maximal application temperature (40 °C)	96.3 93.2 90.5 82.9 86.4	**89.8**	51.7 52.8 45.6 45.9 44.1	**48.0**	1.53 1.56 1.54 1.64 1.56

remark	tensile force [N]*		elongation at tensile force [%]*		layer thickness [mm]
	single values	mean value	single values	mean value	
ADIMATT 110 lengthwise	191 199 176 210 209	**197**	423 403 421 371 403	**404**	0.5
ADIMATT 110, crosswise	131 140 132 142 149	**138**	284 319 275 318 312	**301**	0.5

* *information takes place of three value indicating digits*

The matching diagrams can be seen in the enclosure figure 5 – 11.

Table 14: mass per unit area reinforcement

substance	mass per unit area*	
	single values [g/m²]	mean value [g/m²]
ADIMATT 110	119 ; 120 ; 115	**118**

* *information takes place of three value indicating digits*

Table 15: visual inspection of sample after storages

storage	conditions	classification	visual inspection
heat ageing	100 days 80 °C	W2	no visual changes
	200 days 80 °C	W3	
water ageing	90 days 60 °C	W2	
	180 days 60 °C	W3	
UV-ageing	2667 hours, 400 MJ/m²	W2	
	6614 hours, 1000 MJ/m²	W3	

Table 16: layer thicknesses

test	mean thickness [mm]
watertightness	1.5
dynamic indentation	1.6
static indentation	1.5
resistance to fatigue movement	1.3
resistance to low temperatures	1.4
resistance to high temperatures	1.6
resistance to heat ageing	1.5
resistance to water ageing	1.5
resistance to UV- ageing	1.6

6 SUMMARY

On behalf of *ARDEX CEMENTO S.A.*, Les Franqueses del Vallès/ Spain, Polymer Institut executed tests on the liquid applied roof waterproofing kit based on

HUMISTOP WP170

according to ETAG no. 005.
The results of the tests can be seen in the previous chapter.

Classification by use

In relation to the present test results the tested LARWK based on an aliphatic polyurethane of the Substance above can be classified into the following category.

- Fulfilled requirements for Classification:

Useful life:	category W3, expected useful life 25 years
Climate zones:	category M & S, moderate and severe climate category TL3, severe low temperature category TH4, severe high temperature
Roof Slope:	category S1 – S4 Slope (<5 till >30) %
User load:	category P3, normal

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Flörsheim-Wicker, 20-03-2020