

Reference: 1611017-01 a 06  
Order sheet: 21602652

## **TESTS REPORT nº 220.I.1703.184.EN.02**

### **ON THE REQUEST OF:**

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### **CONCERNING:**

**SAMPLES: PEEL AND STICK STONE VENEERS**

**TESTS: CHARACTERIZATION OF PEEL AND STICK VENEERS**

<b>DATE OF THE RECEPTION OF SAMPLES:</b>	<b>02/11/2016</b>
	<b>16/11/2016</b>
<b>STARTING DATE:</b>	<b>17/11/2016</b>
<b>FINISHING DATE:</b>	<b>15/03/2017</b>

**Document digitally signed by legal electronic signature**

**THIS REPORT CONSISTS OF 19 PAGES NUMBERED ACCORDINGLY, PLUS A 2-PAGES ANNEX.**

**The test samples will remain at AIDIMME over a period of three months from the date of issuing this report. That period having expired, it will be destroyed, so any claim on it must be made within these limits.**

## 1. DESCRIPTION AND IDENTIFICATION OF THE TESTED OBJECT. EXAMINATION PRIOR TO TESTING

Twenty pieces of 600 mm × 150 mm of five different peel and stick veneer samples, four of each of them. They consist of natural stone veneer laminated to a fiberglass/polyester substrate bonded with a polyethylene foam double-sided adhesive tape. Each sample has different thicknesses, from 1,5 to 6 mm, and is provided in sheet form. These sheets are back coated with a protective plastic film. The samples are ready to use by just peeling the protective film and applying straight on the substrate.



*Client reference: DS P&S 1 (DB)*

*This sample is labelled by AIDIMME as 1611017-01*



*Client reference: DS P&S 2 (IA)*

*This sample is labelled by AIDIMME as 1611017-02*



*Client reference: DS P&S 3 (M)*

*This sample is labelled by AIDIMME as 1611017-03*



*Client reference: DS P&S 4 (RKB)*

*This sample is labelled by AIDIMME as 1611017-04*



*Client reference: DS P&S 5 (SG)*

*This sample is labelled by AIDIMME as 1611017-05*

A sample of the sealer *Protelite 105H* (sample is labelled by AIDIMME as 1611017-06) was sent by a client's supplier. Following the client's instructions, two coats of the sealer was applied by brush in accordance with the procedure referred to in the manufacturer technical data sheet.

## **2. ORIGIN OF THE SAMPLES**

The samples were sent by client.

## **3. TESTS REQUIRED**

Characterization of the peel and stick veneer samples, with the sealer previously applied, for their use as wall coverings by means of the following tests:

- Resistance to artificial weathering
- Lightfastness
- Determination of adhesion
- Determination of shear adhesion strength
- Resistance to wet conditions
- Resistance to high humidity conditions
- Resistance to elevated temperature
- Ageing of the bonded joints
- Resistance to thermal shock
- Resistance to water vapor
- Resistance to immersion in boiling water
- Resistance to water

#### 4. ADAPTATION OF THE TEST, METHOD OR PROCEDURE TO STANDARD

The test methods are carried out according to the following standards:

Resistance to artificial weathering	EN ISO 16474-3. Method A
Lightfastness	EN 438-2. Clause 27
Determination of tensile adhesion strength	EN 1348
Determination of shear adhesion strength	In-house method
Resistance to wet conditions	EN 438-2. Clause 15
Resistance to high humidity conditions	In-house method
Resistance to elevated temperature	EN ISO 13894-1. Clause 12
Ageing of the bonded joints	EN ISO 9142. Cycle D2
Resistance to thermal shock	In-house method
Resistance to water vapor	UNE 56867. Clause 5.4
Resistance to immersion in boiling water	EN 438-2. Clause 12
Resistance to water	UNE 56868. Clause 7

#### 5. TEST METHOD

##### RESISTANCE TO ARTIFICIAL WEATHERING

The samples are exposed to ultraviolet radiation, temperature and condensation phase in an accelerated weathering tester according to EN ISO 16474-3, method A, cycle number 1.

The result is recorded by changes in appearance or other signs of degradation. Test conditions are listed below:

Equipment	Type QUV
Lamp type	UVA - 340
Black panel temperature during UV radiation	$60 \pm 3$ °C
Black panel temperature during condensation	$50 \pm 3$ °C
Method A, cycle 1	
UV-radiation phase	4 hours (irradiance 0,83 W/m <sup>2</sup> /nm)
Condensation phase	4 hours (UV lamps off)
Exposure time	2000 h

Afterwards the exposition, a visual inspection is carried out, and the color and gloss changes suffered by the samples are assessed.

### **Colour change**

The color is measured in accordance with the standard ISO 7724-2, using the CIE 1976 color ( $L^*$   $a^*$   $b^*$ ) system, with illuminant D65 and 2° observer conditions. To define the colour of the samples, the CIELAB color system uses three chromatic coordinates:

- $L^*$ : Luminosity (0 black; -100 white)
- $a^*$ : Grade of red (+ $a^*$ ) or grade of green (- $a^*$ )
- $b^*$ : Grade of yellow (+ $b^*$ ) or grade of blue (- $b^*$ )

The differences of color are calculated by difference between the values of the chromatic coordinates of the system CIELAB of each specimen, before and after the test:

$$\Delta L^* = L_2^* - L_1^*$$

$$\Delta a^* = a_2^* - a_1^*$$

$$\Delta b^* = b_2^* - b_1^*$$

The difference of colour is calculated according to:

$$\Delta E = \sqrt{((L_2 - L_1)^2 + (a_2 - a_1)^2 + (b_2 - b_1)^2)}$$

Additionally, the color intensity change assessment is recorded according to the code of assessment shown in table 3 of EN ISO 4628.

Rating	Intensity of change
0	Unchanged, i.e. no perceptible change
1	Very slight, i.e. just perceptible change
3	Slight, i.e. clearly perceptible change
3	Moderate, i.e. very clearly perceptible change
4	Considerable, i.e. pronounced change
5	Very marked change

### **Gloss change**

The specular gloss is measured in accordance with ISO 2813 using a glossmeter at three geometries, 20°, 60° and 85°. The selection of the appropriate geometry depends on the degree of gloss of the specimen surface.

The geometry of 60° can be used in any case. For high-gloss surfaces, which give higher gloss values than about 70 gloss units for the 60° geometry, the method for the 20° geometry allows for a better differentiation. For matt surfaces where lower gloss values than 10 gloss units are measured at 60° geometry, the 85° geometry is used.

To assess gloss differences, measurements in specimens are carried out in the same points, before and after tests.

The difference of gloss ( $\Delta B$ ) between the samples before and after the test is determined as the difference between the values obtained at 60°.

$\Delta B$  positive  $\Rightarrow$  increase of gloss

$\Delta B$  negative  $\Rightarrow$  loss of gloss

## LIGHTFASTNESS

The lightfastness is tested by the exposition of the specimens to the radiation of a xenon lamp, with the following conditions:

Irradiance	60 W/m <sup>2</sup>
Black panel temperature	(65±3)°C
Relative humidity	(50±5)%
Exposure time	Till the blue wool reference 6 shows same contrast as grey scale grade 4

The assessment is carried out according to the five-step grey scale, standard ISO 105-A02, where: 5 = no change of color, 1 = strongest change.

## DETERMINATION OF TENSILE ADHESION STRENGTH

The test consists on measuring the minimum tensile strength necessary to detach or rupture the sample in a direction perpendicular to the substrate. The test is performed by securing 50 mm square metallic plates with an adhesive. After the adhesive is cured, a universal testing machine is attached to the loading fixture and aligned to apply tension perpendicular to the test surface.

The tensile adhesion strength is determined to an accuracy of 0,1 N/mm<sup>2</sup> and the type of failure is registered.

The adhesion test is carried out to initially characterize the sample, and also after some ageing test (thermal shock test, resistance to elevated temperature and after ageing of the bonded joints test).

Since the result does not depend on the face stone veneer, the test is carried out with the different kind of samples, no matter which reference, as the double-side tape, substrate and the back of the specimens are the same.

### DETERMINATION OF SHEAR ADHESION STRENGTH

Lab-joint testing is performed with a universal testing machine with a testing speed of 50 mm/min. Test specimens with 150 × 50 mm × thickness dimensions were prepared, with single laps of 50 mm × 50 mm to the substrate selected.

The tensile shear strength of lap-joint specimens was calculated as follows:

$$\tau = \frac{F_{max}}{A} = \frac{F_{max}}{a \times b}$$

Where;  $\tau$  is the tensile shear strength (N/mm<sup>2</sup>),  $F_{max}$  is the maximum load (N) observed,  $A$  is the bonding surface of the specimen in mm<sup>2</sup> ( $a$  is the width of bonded face, and  $b$  is the length of bonded face).

### RESISTANCE TO WET CONDITIONS

Test specimens, each 150 mm square are submerged in water at (65± 2)°C for 48 hours, and then cooled in distilled water at 23°C for 15 minutes before being wiped. A visual inspection for change in appearance is undertaken, giving a rating of 1 to 5 as described below:

- Rating 5: No visible change
- Rating 4: Slight change of gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change of gloss and/or colour
- Rating 2: Marked change of gloss and/or colour
- Rating 1: Blistering and/or delamination

### RESISTANCE TO HIGH HUMIDITY CONDITIONS

Test specimens are subjected to 3 weeks of exposition in a climatic chamber in an atmosphere of (40 ± 3) °C and (90 ± 5)% relative humidity.

After the test, samples are examined for signs of damage, change in appearance and loss of adhesion.

## RESISTANCE TO ELEVATED TEMPERATURE

Test specimens, with dimensions 300 mm × 100 mm, are subjected to elevated temperature ( $70 \pm 2$ )°C in a heated oven for a prescribed length of time (16 hours), followed by a cooling period of 1 hour at ambient temperature and a visual inspection for defects.

## AGEING OF THE BONDED JOINTS

Test specimens are exposed to multi-variable atmospheric ageing conditions according to the UNE-EN ISO 9142, D2 cycle (heat, cold and humidity).

Cycle	D2
Every cycle consist on:	
( $40 \pm 2$ ) °C temperature and ( $90 \pm 5$ ) relative humidity	( $16 \pm 1$ ) h
( $-20 \pm 3$ ) °C temperature	( $3 \pm 1$ ) h
( $70 \pm 3$ ) °C temperature and ( $90 \pm 5$ ) relative humidity	( $5 \pm 1$ ) h
N° cycles	20

At the end of the test period, a visual assessment of defects is carried out.

## THERMAL SHOCK TEST

Test specimens are subjected to 40 cycles of sudden changes in temperature in an automatic chamber, each consisting of:

- 1 hour ( $60 \pm 2$ ) °C in forced air oven
- 1 hour ( $-20 \pm 3$ ) °C in refrigerator
- 15 minutes at room temperature

After the test, the samples are examined for signs of damage appearance or loss of adhesion.

## WATER VAPOUR RESISTANCE

Test specimens, each 100 mm square, are placed over the mouth of a flask containing boiling water, so that the surface test is exposed to water vapour. After ( $60 \pm 2$ ) minutes, remove the specimen and remove the excess water from the surface using filter paper or tissue. Allow the specimen to recover 24 hours in normal ambient before examination for any change in appearance.



The result of the assessment for change in appearance is expressed in accordance with the following rating scale:

- Rating 5: No visible change
- Rating 4: Slight change of gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change of gloss and/or colour
- Rating 2: Marked change of gloss and/or colour
- Rating 1: Blistering and/or delamination

## **RESISTANCE TO THE IMMERSION IN BOILING WATER**

Squared specimens of 50 mm of side are introduced in boiling water for 2 hours and then cooled in water for 15 minutes.

The effect is assessed by examination for change in appearance according with the following rating scale:

- Rating 5: No visible change
- Rating 4: Slight change of gloss and/or colour, only visible at certain viewing angles
- Rating 3: Moderate change of gloss and/or colour
- Rating 2: Marked change of gloss and/or colour
- Rating 1: Blistering and/or delamination

## **RESISTANCE TO WATER**

Test specimens are subjected to water immersion up to 10 mm high for 8 hours. Then specimens are allowed to recover for one week.

After the test, the samples are examined for signs of damage appearance or loss of adhesion.

## 6. OBTAINED RESULTS

### RESISTANCE TO ARTIFICIAL WEATHERING

REFERENCE	Before exposition			After exposition			Difference of colour ( $\Delta E$ )
	$L_1^*$	$a_1^*$	$b_1^*$	$L_2^*$	$a_2^*$	$b_2^*$	
1611017-01	35,49	-0,71	-0,69	40,20	-0,60	0,18	4,83
1611017-02	53,34	-0,37	6,00	55,75	-0,21	5,58	2,46
1611017-03	79,94	0,22	9,07	76,84	1,82	13,43	4,36
1611017-04	31,42	-0,26	0,81	37,48	0,08	2,49	6,32
1611017-05	38,38	0,37	1,58	43,79	0,41	3,48	5,74

REFERENCE	Before exposition			After exposition			Difference of gloss (85°)
	20°	60°	85°	20°	60°	85°	
1611017-01	0,4	2,9	5,6	0,7	4,1	6,3	0,7
1611017-02	0,4	1,8	2,0	0,6	2,6	2,2	0,2
1611017-03	1,0	1,6	0,2	0,9	1,4	0,2	0,0
1611017-04	0,2	1,8	1,6	0,4	2,3	1,8	0,2
1611017-05	0,4	2,8	1,2	0,7	3,9	1,2	0,0

At the end of the test, no surface defects were detected, other than colour change, in any of the test samples such as cracking, blistering, flaking or loss of adhesion. The colour change intensity assessment was performed according to the table 3 (Rating scheme for designating the intensity of changes) of the EN ISO 4628-1.

REFERENCE	INTENSITY OF CHANGE	OBSERVATIONS
1611017-01	2	Clearly perceptible discoloration
1611017-02	1	Very slight change of colour
1611017-03	3	Very clearly perceptible yellowing
1611017-04	2	Clearly perceptible discoloration
1611017-05	3	Discoloration



*Samples 1611017-01 to 1611017-05 after lightfastness test*

## LIGHTFASTNESS

REFERENCE	RESULTS (Grey scale)	OBSERVATIONS
1611017-01	5	No visible change
1611017-02	5	No visible change
1611017-03	5	No visible change
1611017-04	5	No visible change
1611017-05	5	No visible change



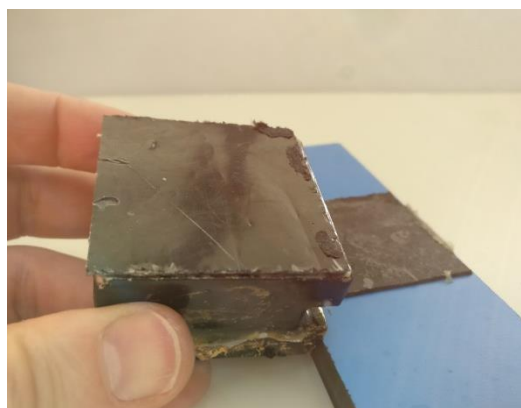
*Samples 1611017-01 to 1611017-05 after lightfastness test*

**DETERMINATION OF TENSILE ADHESION STRENGTH**

TEST SPECIMEN	RESULTS (N/mm <sup>2</sup> )			
	Initial	After ageing of the bonded joints test	After thermal shock test	After elevated temperature test
1	0,2	0,2	0,1	0,1
2	0,2	0,1	0,1	0,2
3	0,2	0,1	0,1	0,1
4	0,2	0,1	0,1	0,2
5	0,2	0,1	0,1	0,1
6	0,1	0,0	0,0	0,0
<b>Mean</b>	0,2	0,1	0,1	0,1
<b>Standard deviation</b>	0,0	0,0	0,0	0,0

Substrate: Melamine faced board

Type of failure: 25% adhesive failure between the substrate and the specimen; 75 % cohesive specimen failure (adhesive failure occurs between the double-sided adhesive tape and the stone veneer)



*Example of cohesive specimen failure, the stone veneer got totally detached from adhesive tape*

**DETERMINATION OF SHEAR ADHESION STRENGTH**

TEST SPECIMEN	RESULTS (N/mm <sup>2</sup> )
	Initial
1	0,2
2	0,3
3	0,2
4	0,2
5	0,3
6	0,2
Mean	0,2
Standard deviation	0,0

Substrate: Melamine faced board

Type of failure: 30% adhesive failure between the substrate and the specimen; 70 % cohesive specimen failure (failure occurs in the foam of the double-sided adhesive tape)



*Specimen during the test and detail of the failure type*

**RESISTANCE TO WET CONDITIONS**

REFERENCE	RATING	OBSERVATIONS
1611017-01	4	Slight loss of gloss and color  Some pieces of the stone veneer got detached from double sided tape  The specimen got detached from the substrate due to adhesive failure
1611017-02	5	No visible changes  The specimen got detached from the substrate due to adhesive failure
1611017-05	2	Slight loss of gloss and important loss of colour  The specimen got detached from the substrate due to adhesive failure

*Substrate: High gloss ceramic tile*



*Specimen 1611017-01 tested (left)  
and control specimen (right)*



*Detail of detachment from  
double sided tape*



*Specimen tested 1611017-02 (left) and control specimen (right)*





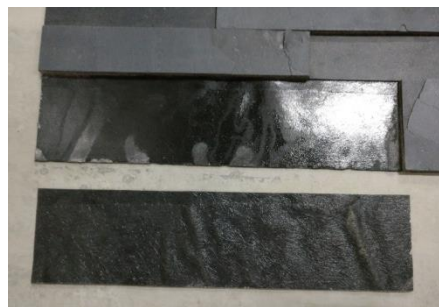
*Specimen tested 1611017-05 (left) and control specimen (right)*

## RESISTANCE TO HIGH HUMIDITY CONDITIONS

REFERENCE	RESULTS
1611017-01	At the end of the test no visible changes have been found after visually inspection with the naked eye, such as change in appearance, cracks, etc. A piece of the stone veneer got detached from double sided tape  Substrate: porcelain stoneware tile
1611017-03	At the end of the test no visible changes have been found after visually inspection with the naked eye, such as change in appearance, cracks, loss of adhesion, etc.  Substrate: hhigh gloss ceramic tile
1611017-05	At the end of the test no visible changes have been found after visually inspection with the naked eye, such as change in appearance, cracks, loss of adhesion, etc.  Substrate: hhigh gloss ceramic tile



*References 1611017-03 and 1611017-05 on ceramic tile*



*References 1611017-03 on porcelain stoneware tile*

## RESISTANCE TO ELEVATED TEMPERATURE

REFERENCE	RESULTS
1611017-04	No visible change in appearance nor loss of adhesion Substrate: melamine faced board



*Test specimen 1611017-04 tested*

## AGEING OF THE BONDED JOINTS

REFERENCE	RESULTS
1611017-01 to 05	No visible change in appearance nor loss of adhesion Substrate: melamine faced board



**THERMAL SHOCK TEST**

REFERENCE	RESULTS
1611017-01 to 05	No visible change in appearance nor loss of adhesion Substrate: melamine faced board

**WATER VAPOUR RESISTANCE**

REFERENCE	RATING	OBSERVATIONS
1611017-01	3	Moderate change of gloss and colour
1611017-02	3	Moderate change of colour
1611017-03	5	No visible change
1611017-04	3	Moderate loss of colour
1611017-05	3	Moderate loss of colour

*Substrate: Tested without substrate and adhered to melamine faced board*



*Reference 1611017-01 after the test*



*Reference 1611017-02 after the test*



*Reference 1611017-03 after the test*



*Reference 1611017-04 after the test*



*Reference 1611017-05 after the test*

**RESISTANCE TO THE IMMERSION IN BOILING WATER**

REFERENCE	RATING	OBSERVATIONS
1611017-01	5	No visible change. Adhesion failure
1611017-02	5	No visible change. Adhesion failure
1611017-03	5	No visible change. Adhesion failure
1611017-04	3	Moderate loss of colour. Adhesion failure
1611017-05	2	Important loss of colour. Adhesion failure

*Remarks: In all the samples the stone veneer got detached from the double sided tape. In some cases, the double sided tape got detached and shrunk. The loss of adhesion appears between the double sided tape and the stone veneer.*



*Reference 1611017-05 after the test compared with the control specimen*

**RESISTANCE TO WATER**

REFERENCE	RESULTS
1611017-03	No visible change in appearance nor loss of adhesion Substrate: high gloss ceramic tile
1611017-04	No visible change in appearance nor loss of adhesion Substrate: high gloss ceramic tile

The result of the test/s only concerns to the tested object.

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Date: March, 21<sup>st</sup> 2017

  
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# ANNEX

## GENERAL REMARKS

As there are not specific standards to test peel and stick veneers for their use as a wall coverings, related standard methods usually used for other kind of products or applications have been tested.

Even though the performance of the sample do not fit perfectly with some of the test requirements, not specific for this kind of product, it does not mean directly that the product it is not appropriate, as some of them try to test the samples subjected to extreme conditions.

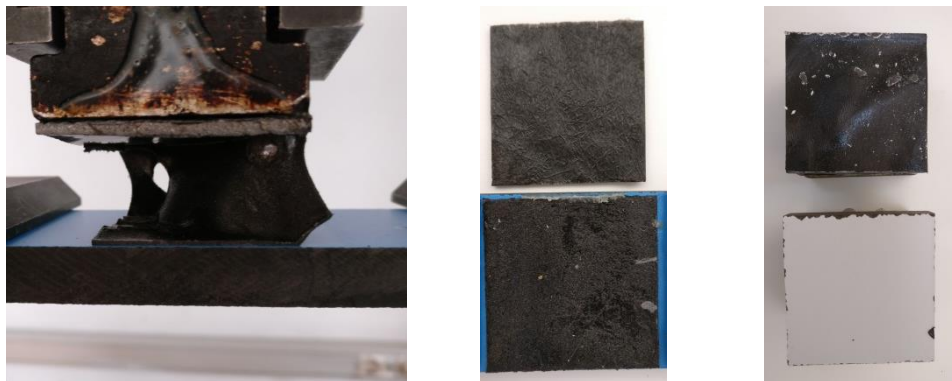
Overall, all the peel and stick veneer specimens tested show a good performance.

As a summary of the results, the peel and stick veneers have exhibit an excellent performance regarding their lightfastness ( meets requirements according to EN 438-3, specification  $\geq 4$ ), and a good behavior against artificial weathering, with just moderate changes of colour.

The samples analyzed also have demonstrated good resistance to water (meets the requirements according to UNE 56868), thermal shock, elevated temperature, ageing of the bonded joints test or high humidity atmosphere.

In the resistance to wet conditions test and in the resistance to immersion in boiling water test, although there have been adhesion detachment, due to the too much tough conditions for the adhesive used, the stone veneer shows acceptable results.

In the tensile adhesion strength test, the initial adhesion value obtained is low (0,2 MPa). While performing the test, the double-sided adhesive tape is the weakness part of the system, and the failure occurs by cohesive failure of the foam tape or by adhesive failure between the foam and the stone veneer or the substrate. Nevertheless, the different ageing of the specimens (ageing of the bonded joints test, thermal shock test or resistance to elevated temperature) do not decrease dramatically the tensile adhesion strength value.



*Specimen during the test, and examples of adhesive failures of the double-sided adhesive tape with the stone veneer and the substrate*

Apart from this, it seems that there is a worse behavior regarding the adhesion with the sample reference 1611017-01. After some ageing test (resistance to high humidity conditions and resistance to wet conditions), adhesion failures have been found between the stone veneer and the double-sided, not present in the rest of the samples.

It is noteworthy that in some of the sheets, there are some points with defects in the edges of the adhesive tape, which would appear afterwards as a lack of adhesion when adhered to the substrate.

