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## BRITISH BOARD OF AGRÉMENT TEST REPORT T9/62776

### SISTEM METAL – ALBOND 9000

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Date: 10 December 2018

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Date: 17 December 2018

On behalf of the British Board of Agrément

**Client:** Sistem Metal  
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Corlu/Tekirdag  
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59860

**Requested by:** Fernando Ferrarin - BBA

**Job No:** T9 62776 (S1 62765)

**Work Period:** February 2018 – December 2018

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## 1 REPORT CONDITIONS

### 1.1 This Report:

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## 2 MASS PER UNIT AREA

### 2.1 Method

A determination of mass per unit area was conducted using a 100mm<sup>2</sup> section of material.

### 2.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/4	15	500 x 500 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/7	15	500 x 500 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176

### 2.3 Results

Lot	Specimen	Mass per unit area (g·m <sup>-2</sup> )
1	1	4550
	2	4532
	3	4519
	Mean	4534
4	1	7743
	2	7739
	3	7808
	Mean	7763
7	1	8457
	2	8414
	3	8555
	Mean	8475

### 3 BENDING STRENGTH AND ELASTIC MODULUS

#### 3.1 Method

In accordance with DIN 53293 E : 1982, *Testing of sandwiches - Bending test*.

Samples were conditioned as per Section 3.3 *Conditioning*.

Test speed was adjusted to allow a failure between 60 – 180 seconds. This was typically 5mm·min<sup>-1</sup> for lot 1 and 4, and 3mm·min<sup>-1</sup> for lot 7.

Specimens were cut to 72mm x 7.5mm for lot 1 and 96mm x 10mm for lot 1 and 4.

Support rollers of 4mm diameter were used for all tests.

#### 3.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/4	15	500 x 500 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/7	15	500 x 500 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176

#### 3.3 Conditioning

Control	-	Tested as received.
Heat rain	-	Heat rain cycles as per ETAG 34 : 2011 clause 5.4.6. Heating to + 70°C (rise for 1 hour) and maintaining at (70 ± 5) °C and 10 to 30 % RH of air for 2 hours (total of 3 hours), Spraying for 1 hour (water temperature (15 ± 5) °C, amount of water 1 l/m <sup>2</sup> min), Leave for 2 hours (drainage).
Water soak	-	Fully immersed in water at 23°C for 25 days.
Water soak / freeze thaw	-	Fully immersed in water at 23°C for 25 days, followed by freeze thaw cycles as per ETAG 34 : 2011 clause 5.7.4 (option 2) 50 cycles, 8 hours exposure to water at 23°C, followed by 16 hours exposure to temperature -20°C.

### 3.4 Results

Lot	Conditioning	Specimen	Force at failure (N)	Displacement at failure (mm)	Bending moment M (N/mm)	Compressive stress $\sigma_d$ of face 1 (MPa)	Tensile stress $\sigma$ of face 2 (MPa)	Shear stress $\tau_K$ (MPa)	Effective flexural strength $(E-J)_{eff}$ in the range of $L_s$	Effective shear rigidity $S_{eff}$ in the range of $L_B$
1	Control	1	223.90	7.24	1679.24	-35.82	35.82	5.97	0.03	-237.15
		2	227.09	7.48	1703.17	-36.33	36.33	6.06	0.03	-218.30
		3	225.03	7.58	1687.74	-36.01	36.01	6.00	0.03	-227.53
		4	220.44	6.99	1653.28	-35.27	35.27	5.88	0.03	-235.99
		5	219.75	6.77	1648.15	-35.16	35.16	5.86	0.03	-233.45
		Mean	223.24	6.21	1674.32	-35.72	35.72	5.95	0.03	-230.49
	Heat rain	1	214.57	6.30	1609.28	-34.33	34.33	5.72	0.03	-235.29
		2	216.57	6.50	1624.24	-34.65	34.65	5.78	0.03	-237.90
		3	216.84	6.73	1626.33	-34.70	34.70	5.78	0.03	-238.87
		4	215.50	6.60	1616.26	-34.48	34.48	5.75	0.03	-234.94
		5	215.58	6.48	1616.83	-34.49	34.49	5.75	0.03	-239.96
		Mean	215.81	6.52	1618.59	-34.53	34.53	5.75	0.03	-237.39
	Water soak	1	213.98	7.10	1604.82	-34.24	34.24	5.71	0.03	-248.30
		2	213.13	6.40	1598.45	-34.10	34.10	5.68	0.03	-235.25
		3	213.44	6.38	1600.81	-34.15	34.15	5.69	0.03	-237.97
		4	214.46	6.75	1608.45	-34.31	34.31	5.72	0.03	-235.13
		5	214.89	6.45	1611.69	-34.38	34.38	5.73	0.03	-235.28
		Mean	213.98	6.62	1604.85	-34.24	34.24	5.71	0.03	-238.39
	Water soak / freeze thaw	1	217.05	6.50	1627.86	-34.73	34.73	5.79	0.03	-235.89
		2	221.91	6.67	1664.32	-35.51	35.51	5.92	0.03	-245.90
		3	211.83	6.53	1588.69	-33.89	33.89	5.65	0.03	-248.53
		4	217.45	6.63	1630.89	-34.79	34.79	5.80	0.03	-247.85
		5	213.69	6.78	1602.64	-34.19	34.19	5.70	0.03	-240.65
		Mean	216.38	6.62	1622.88	-34.62	34.62	5.77	0.03	-243.76

### 3.4 Results (continued)

Lot	Conditioning	Specimen	Force at failure (N)	Displacement at failure (mm)	Bending moment M (N/mm)	Compressive stress $\sigma_d$ of face 1 (MPa)	Tensile stress $\sigma$ of face 2 (MPa)	Shear stress $\tau_K$ (MPa)	Effective flexural strength $(E \cdot J)_{eff}$ in the range of $L_s$	Effective shear rigidity $S_{eff}$ in the range of $L_B$
4	Control	1	374.78	8.90	3747.80	-29.99	29.99	5.25	0.08	-112.38
		2	372.13	8.90	3721.34	-29.78	29.78	5.21	0.08	-115.40
		3	374.04	9.50	3740.43	-29.94	29.94	5.24	0.08	-116.47
		4	372.95	9.93	3729.52	-29.85	29.85	5.22	0.08	-115.38
		5	370.87	9.49	3708.75	-29.68	29.68	5.19	0.08	-115.90
		Mean	372.96	9.34	3729.57	-29.85	29.85	5.22	0.08	-115.11
	Heat rain	1	350.86	8.58	3508.65	-28.08	28.08	4.91	0.08	-121.16
		2	356.17	8.68	3561.74	-28.51	28.51	4.99	0.08	-117.67
		3	348.49	8.42	3484.85	-27.89	27.89	4.88	0.08	-130.40
		4	347.93	7.80	3479.27	-27.85	27.85	4.87	0.09	-120.40
		5	358.05	7.55	3580.50	-28.66	28.66	5.01	0.10	-115.95
		Mean	352.30	8.21	3523.00	-28.20	28.20	4.93	0.09	-121.12
	Water soak	1	384.01	8.48	3840.09	-30.73	30.73	5.38	0.09	-112.60
		2	387.90	9.30	3879.01	-31.04	31.04	5.43	0.08	-109.97
		3	382.74	8.98	3827.45	-30.63	30.63	5.36	0.09	-113.02
		4	384.52	9.12	3845.23	-30.77	30.77	5.39	0.08	-113.32
		5	381.86	9.20	3818.57	-30.56	30.56	5.35	0.08	-110.85
		Mean	384.21	9.02	3842.07	-30.75	30.75	5.38	0.09	-111.95
	Water soak / freeze thaw	1	381.53	8.50	3815.31	-30.53	30.53	5.34	0.09	-113.91
		2	368.87	7.98	3688.74	-29.52	29.52	5.17	0.09	-128.87
		3	366.00	5.88	3659.96	-29.29	29.29	5.13	0.12	-121.72
		4	383.28	8.76	3832.83	-30.67	30.67	5.37	0.09	-111.71
		5	365.85	7.18	3658.45	-29.28	29.28	5.12	0.10	-119.00
		Mean	373.11	7.66	3731.06	-29.86	29.86	5.23	0.10	-119.04

### 3.4 Results (continued)

Lot	Conditioning	Specimen	Force at failure (N)	Displacement at failure (mm)	Bending moment M (N/mm)	Compressive stress $\sigma_d$ of face 1 (MPa)	Tensile stress $\sigma$ of face 2 (MPa)	Shear stress $\tau_K$ (MPa)	Effective flexural strength $(E \cdot J)_{eff}$ in the range of $L_s$	Effective shear rigidity $S_{eff}$ in the range of $L_B$
7	Control	1	243.61	4.10	2436.14	-19.50	19.50	3.41	0.12	-150.64
		2	241.10	4.27	2411.03	-19.30	19.30	3.38	0.11	-145.22
		3	219.43	3.59	2194.27	-17.56	17.56	3.07	0.12	-165.69
		4	226.06	3.76	2260.58	-18.09	18.09	3.17	0.12	-155.66
		5	224.75	4.30	2247.48	-17.99	17.99	3.15	0.10	-159.98
		Mean	230.99	4.00	2309.90	-18.49	18.49	3.24	0.12	-155.44
	Heat rain	1	256.58	5.07	2565.81	-20.53	20.53	3.59	0.10	-142.59
		2	257.29	5.09	2572.90	-20.59	20.59	3.60	0.10	-139.13
		3	249.11	4.72	2491.14	-19.94	19.94	3.49	0.11	-143.24
		4	248.44	4.88	2484.35	-19.88	19.88	3.48	0.10	-141.90
		5	254.44	4.93	2544.41	-20.36	20.36	3.56	0.10	-138.74
		Mean	253.17	4.94	2531.72	-20.26	20.26	3.55	0.10	-141.12
	Water soak	1	245.81	4.88	2458.08	-19.67	19.67	3.44	0.10	-141.69
		2	241.39	4.70	2413.90	-19.32	19.32	3.38	0.10	-150.19
		3	237.70	4.47	2376.98	-19.02	19.02	3.33	0.11	-149.68
		4	243.76	4.55	2437.58	-19.51	19.51	3.41	0.11	-150.45
		5	177.25	2.33	1772.54	-14.19	14.19	2.48	0.15	-224.12
		Mean	229.18	4.19	2291.82	-18.34	18.34	3.21	0.11	-163.23
	Water soak / freeze thaw	1	239.18	4.55	2391.78	-19.14	19.14	3.35	0.11	-146.99
		2	231.90	4.73	2318.96	-18.56	18.56	3.25	0.10	-153.48
		3	234.41	4.80	2344.15	-18.76	18.76	3.28	0.10	-153.93
		4	240.05	5.01	2400.46	-19.21	19.21	3.36	0.10	-147.98
		5	239.19	4.85	2391.89	-19.14	19.14	3.35	0.10	-148.99
		Mean	236.94	4.79	2369.45	-18.96	18.96	3.32	0.10	-150.27

## 4 BOND STRENGTH

### 4.1 Method

In accordance with ASTM D 1781 : 2004 - *Standard test method for climbing drum peel for adhesives*.

Samples were cut to test dimensions of 320mm x 75mm, and bonded to steel backer plates.

Samples were prepared and tested under CT room conditions of 23°C±3°C and 50%±5% RH.

Load to overcome resisting torque was conducted in accordance with section 9.1.2 of the above standard, and calculated at 153.84N.

### 4.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/4	15	500 x 500 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/7	15	500 x 500 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176

### 4.3 Conditioning

Control	- Tested as received.
Heat rain	- Heat rain cycles as per ETAG 34 : 2011 clause 5.4.6. Heating to + 70°C (rise for 1 hour) and maintaining at (70 ± 5) °C and 10 to 30 % RH of air for 2 hours (total of 3 hours), Spraying for 1 hour (water temperature (15 ± 5) °C, amount of water 1 l/m <sup>2</sup> min), Leave for 2 hours (drainage).
Water soak	- Fully immersed in water at 23°C for 25 days.
Water soak / freeze thaw	- Fully immersed in water at 23°C for 25 days, followed by freeze thaw cycles as per ETAG 34 : 2011 clause 5.7.4 (option 2) 50 cycles, 8 hours exposure to water at 23°C, followed by 16 hours exposure to temperature -20°C.



#### 4.4 Results

Lot	Conditioning	Specimen	Maximum force (N)	Minimum force (N)	Average peel force (N)	Average peel torque (N)	Comment
1	Control	1	1511.21	1447.88	1491.16	223.87	Failed at bond between steel backing plate and test sample
		2	1631.04	1474.17	1583.02	239.25	
		3	1517.44	1419.99	1481.49	222.25	
		4	1646.38	1486.63	1571.95	237.39	
		5	1650.69	1425.15	1609.68	243.71	
		6	1505.25	1349.73	1458.59	218.41	
		Mean	1577.00	1423.38	1532.65	230.81	
		SD	72.37	46.42	62.99	10.54	
	Heat rain	1	1514.88	1373.94	1468.21	220.03	Failed at bond between steel backing plate and test sample
		2	1681.97	1558.73	1604.45	242.83	
		3	1636.31	1529.08	1586.53	239.83	
		4	1630.35	1435.79	1574.65	237.84	
		5	1542.52	1449.09	1495.34	224.57	
		6	1496.14	1424.49	1467.90	219.97	
		Mean	1583.70	1461.85	1532.85	230.85	
		SD	75.76	69.1	62.55	10.47	
	Water soak	1	1483.27	1422.68	1455.79	217.95	Failed at bond between steel backing plate and test sample
		2	1510.97	1382.44	1475.54	221.25	
		3	1464.10	1393.32	1436.89	214.78	
		4	1502.89	1451.75	1479.72	221.95	
		5	1519.38	1284.26	1447.03	216.48	
		6	1475.18	1408.37	1437.15	214.83	
		Mean	1492.63	1390.47	1455.35	217.87	
		SD	21.74	57.39	18.67	3.13	
	Water soak / freeze thaw	1	1557.77	1459.91	1506.89	226.50	Failed at bond between steel backing plate and test sample
		2	1692.78	1565.77	1608.86	243.57	
		3	1744.01	1421.68	1600.56	242.18	
		4	1675.27	1484.67	1626.42	246.51	
		5	1652.45	1513.18	1623.90	246.09	
		6	1740.53	1569.37	1622.58	245.87	
		Mean	1677.14	1502.43	1598.20	241.79	
		SD	68.69	58.74	45.84	7.67	

#### 4.4 Results (continued)

Lot	Conditioning	Specimen	Maximum force (N)	Minimum force (N)	Average peel force (N)	Average peel torque (N)	Comment
4	Control <sup>(1)</sup>	1	2298.01	363.70	1778.90	272.04	No peel, reached limit of equipment
		2	2318.22	446.75	1725.70	263.13	
		3	2344.26	131.27	1698.80	258.63	
		4	2548.00	300.68	1898.59	292.07	
		5	3317.81	-----	2141.69	332.77	
		6	2427.85	207.42	1880.00	288.96	
		Mean	2542.36	289.97	1853.95	284.60	
		SD	390.81	124.63	162.25	27.16	
	Heat rain <sup>(2)</sup>	1	1800.06	-----	-----	-----	No peel, reached limit of equipment
		2	1800.01	-----	-----	-----	
		3	1800.01	-----	-----	-----	
		4	1800.08	-----	-----	-----	
		5	1800.03	-----	-----	-----	
		6	1800.07	-----	-----	-----	
		Mean	1800.04	-----	-----	-----	
		SD	0.03	-----	-----	-----	
	Water soak <sup>(2)</sup>	1	1800.10	-----	-----	-----	No peel, reached limit of equipment
		2	1800.08	-----	-----	-----	
		3	1800.20	-----	-----	-----	
		4	1800.05	-----	-----	-----	
		5	1800.06	-----	-----	-----	
		6	1800.18	-----	-----	-----	
		Mean	1800.11	-----	-----	-----	
		SD	0.06	-----	-----	-----	
	Water soak / freeze thaw <sup>(2)</sup>	1	1800.02	-----	-----	-----	No peel, reached limit of equipment
		2	1800.10	-----	-----	-----	
		3	1800.00	-----	-----	-----	
		4	1800.05	-----	-----	-----	
		5	1800.05	-----	-----	-----	
		6	1800.06	-----	-----	-----	
		Mean	1800.05	-----	-----	-----	
		SD	0.04	-----	-----	-----	

Note (1) Testing ran until a peel was achieved, however this load level resulted in damage to the test equipment. The peel was also the sample from the backing plate, rather than the facer from the core.

Note (2) Testing ran until the new imposed safety load (1.8kN) before being stopped, as a result of note (1).

#### 4.4 Results (continued)

Lot	Conditioning	Specimen	Maximum force (N)	Minimum force (N)	Average peel force (N)	Average peel torque (N)	Comment
7	Control	1	518.48	457.70	492.54	56.70	Full peel of test face
		2	537.35	472.96	493.79	56.91	
		3	537.28	437.27	473.22	53.46	
		4	520.12	442.47	474.91	53.75	
		5	519.81	441.35	475.40	53.83	
		6	555.37	451.74	484.70	55.39	
		Mean	531.40	450.58	482.43	55.01	
		SD	14.65	13.27	9.24	1.55	
	Heat rain	1	287.38	229.80	263.58	18.37	Full peel of test face
		2	234.04	198.83	214.31	10.12	
		3	363.69	244.29	294.96	23.62	
		4	386.07	250.82	314.47	26.89	
		5	321.59	252.20	287.26	22.33	
		6	300.59	219.33	252.44	16.51	
		Mean	315.56	232.54	271.17	19.64	
		SD	54.75	20.87	35.61	5.96	
	Water soak	1	761.28	561.63	657.62	84.33	Full peel of test face
		2	781.88	615.31	719.11	94.63	
		3	673.54	545.72	622.54	78.46	
		4	805.66	592.95	721.05	94.95	
		5	364.04	259.51	313.33	26.70	
		6	595.72	497.59	547.55	65.91	
		Mean	663.69	512.12	596.86	74.16	
		SD	166.23	130.22	153.33	25.67	
	Water soak / freeze thaw	1	374.29	259.70	295.34	23.69	Full peel of test face
		2	312.81	222.55	247.6	15.70	
		3	341.83	249.93	289.95	22.78	
		4	343.96	270.76	305.91	25.46	
		5	366.76	233.25	258.36	17.50	
		6	353.10	237.76	263.70	18.39	
		Mean	348.79	245.66	276.81	20.58	
		SD	21.72	17.87	23.36	3.91	

## 5 PULL THROUGH RESISTANCE

### 5.1 Method

In accordance with ETAG 034 : 2012 *Guideline for European technical approval of kits for external wall claddings part 1: Ventilated cladding kits comprising cladding components and associated fixings.* Section 5.4.2.1.1.

### 5.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/3	60	360 x 360 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/6	60	360 x 360 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/9	60	360 x 360 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176
S1/62765/15	100	Blind rivets
S1/62765/16	100	Self-drilling screws.

### 5.3 Results

Lot	Fixing position	Specimen	Maximum load (N)	Failure mode
3 + 15	Centre	1	1966.71	Pull through of fixing.
		2	2009.12	Pull through of fixing.
		3	1990.14	Pull through of fixing.
		4	2017.53	Pull through of fixing.
		5	1914.45	Pull through of fixing.
		Mean	1979.59	
	Corner	1	1404.72	Tearing of board around support ring.
		2	1182.16	Tearing of board around support ring.
		3	1140.36	Pull through of fixing.
		4	1167.24	Tearing of board around support ring.
		5	1168.73	Tearing of board around support ring.
		Mean	1212.64	
	Edge	1	1584.86	Pull through of fixing.
		2	1568.29	Pull through of fixing.
		3	1546.44	Pull through of fixing.
		4	1536.96	Pull through of fixing.
		5	1587.76	Pull through of fixing.
		Mean	1564.86	

### 5.3 Results (continued)

Lot	Fixing position	Specimen	Maximum load (N)	Failure mode
3 + 16	Centre	1	2121.38	Pull through of fixing.
		2	1903.43	Pull through of fixing.
		3	1874.26	Pull through of fixing.
		4	2054.89	Pull through of fixing.
		5	1927.59	Pull through of fixing.
		Mean	1976.31	
	Corner	1	1160.04	Pull through of fixings
		2	1300.07	Pull through of fixings
		3	1197.07	Pull through of fixings
		4	1271.58	Pull through of fixings
		5	1313.66	Pull through of fixings
		Mean	1248.48	
	Edge	1	1595.83	Pull through of fixing.
		2	1525.31	Pull through of fixing.
		3	1403.47	Pull through of fixing.
		4	1459.09	Pull through of fixing.
		5	1479.58	Pull through of fixing.
		Mean	1492.65	
6 + 15	Centre	1	2154.33	Pull through of fixing.
		2	2272.05	Pull through of fixing.
		3	2377.2	Pull through of fixing.
		4	2268.44	Pull through of fixing.
		5	2319.22	Pull through of fixing.
		Mean	2278.25	
	Corner	1	1222.37	Tearing of board around support ring.
		2	1230.86	Tearing of board around support ring.
		3	1230.07	Tearing of board around support ring.
		4	1313.49	Tearing of board around support ring.
		5	1106.29	Tearing of board around support ring.
		Mean	1220.62	

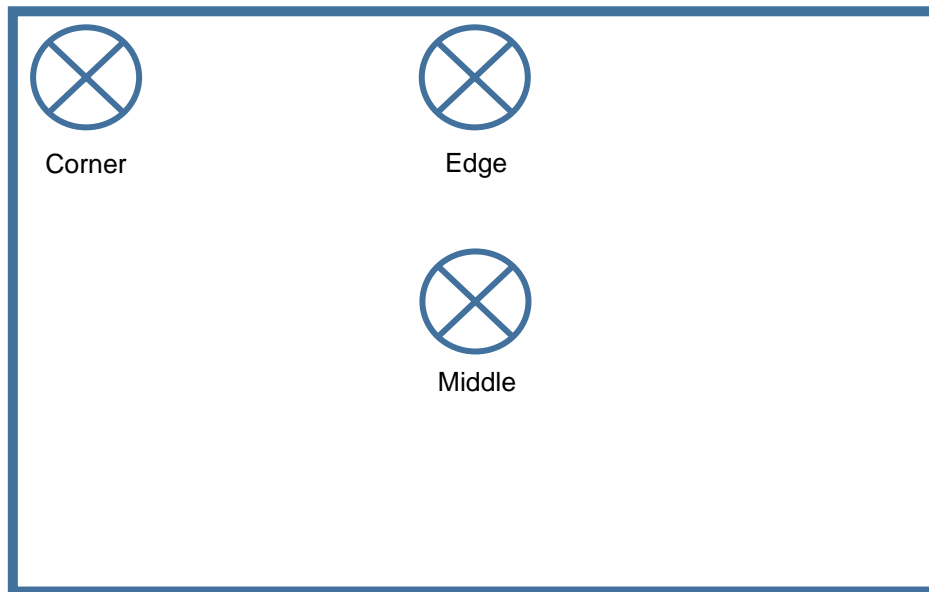
### 5.3 Results (continued)

Lot	Fixing position	Specimen	Maximum load (N)	Failure mode
6 + 15	Edge	1	1515.03	Pull through of fixing.
		2	1720.73	Pull through of fixing.
		3	1491.2	Pull through of fixing.
		4	1769.47	Pull through of fixing.
		5	1444.84	Pull through of fixing.
		Mean	1588.25	
6 + 16	Centre	1	2644.82	Pull through of fixing.
		2	2487.13	Pull through of fixing.
		3	2514.21	Pull through of fixing.
		4	2431.09	Pull through of fixing.
		5	2590.05	Pull through of fixing.
		Mean	2533.46	
	Corner	1	1481.29	Pull through of fixings
		2	1424.98	Pull through of fixings
		3	1546.92	Pull through of fixings
		4	1540.71	Pull through of fixings
		5	1440.75	Pull through of fixings
		Mean	1486.93	
	Edge	1	1507.29	Pull through of fixing.
		2	1566.51	Pull through of fixing.
		3	1594.24	Pull through of fixing.
		4	1625.88	Pull through of fixing.
		5	1611.02	Pull through of fixing.
		Mean	1580.99	
9 + 15	Centre	1	1998.59	Pull through of fixing.
		2	2005.94	Pull through of fixing.
		3	1994.2	Pull through of fixing.
		4	1989.71	Pull through of fixing.
		5	1909.2	Pull through of fixing.
		Mean	1979.53	

### 5.3 Results (continued)

Lot	Fixing position	Specimen	Maximum load (N)	Failure mode
9 + 15	Corner	1	1178.21	Delamination of the specimen.
		2	1155.45	Delamination of the specimen.
		3	1188.01	Delamination of the specimen.
		4	1164.33	Delamination of the specimen.
		5	961.82	Delamination of the specimen.
		Mean	1129.56	
	Edge	1	1231.98	Pull through of fixing.
		2	1278.19	Pull through of fixing.
		3	1250.3	Pull through of fixing.
		4	1312.04	Pull through of fixing.
		5	1271.67	Pull through of fixing.
		Mean	1268.84	
9 + 16	Centre	1	2165.74	Pull through of fixing.
		2	2195.55	Pull through of fixing.
		3	2152.79	Pull through of fixing.
		4	2079.71	Pull through of fixing.
		5	2207.49	Pull through of fixing.
		Mean	2160.26	
	Corner	1	1157.03	Pull through of fixings
		2	1195.94	Pull through of fixings
		3	1210.36	Pull through of fixings
		4	1172.95	Pull through of fixings
		5	1228.84	Pull through of fixings
		Mean	1193.03	
	Edge	1	1357.68	Pull through of fixings
		2	1395.86	Pull through of fixings
		3	1313.43	Pull through of fixings
		4	1262.34	Pull through of fixings
		5	1287.28	Pull through of fixings
		Mean	1323.32	

#### 5.4 Fixing position



#### 5.5 Photographs



Plate 5.5.1: Example of pull through using a screw in the centre position (post-test).



Plate 5.5.2: Example of pull through using a rivet in the corner position (post-test).



## 6 PULL THROUGH RESISTANCE UNDER SHEAR LOADS

### 6.1 Method

In accordance with ETAG 034 : 2012 *Guideline for European technical approval of kits for external wall claddings part 1: Ventilated cladding kits comprising cladding components and associated fixings.* Section 5.4.2.1.2.

The test specimen was attached to a piece of the T-profile aluminium supplied by the client.

A minimum distance from the edge of 15mm ( $a_{min}$  and  $b_{min}$ ) was specified by the client.

The test was conducted using a constant crosshead speed of 5mm·min<sup>-1</sup>.

### 6.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/3	60	360 x 360 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/6	60	360 x 360 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/9	60	360 x 360 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176
S1/62765/15	100	Blind rivets
S1/62765/16	100	Self-drilling screws.

### 6.3 Results

Lot	Fixing type	Position	Specimen	Maximum force (N)	Displacement at maximum force (mm)	Characteristic $F_{sc}$ value
3+15 (PE)	Rivet	Edge	1	3166.15	7.04	2705.403
			2	3230.23	7.73	
			3	2848.15	5.56	
			4	3036.54	5.84	
			5	2993.32	6.05	
			Mean	3054.88	6.44	
			SD	149.99	0.91	
3+15 (PE)	Rivet	Corner	1	3005.38	6.44	2829.030
			2	2897.00	6.02	
			3	2977.83	6.14	
			4	2955.11	6.46	
			5	2891.65	5.77	
			Mean	2945.39	6.17	
			SD	49.94	0.29	

### 6.3 Results (continued)

Lot	Fixing type	Position	Specimen	Maximum force (N)	Displacement at maximum force (mm)	Characteristic $F_{sc}$ value
3+16 (PE)	Screw	Edge	1	3192.26	4.27	2772.728
			2	2945.99	3.16	
			3	3264.90	4.76	
			4	3068.98	4.48	
			5	2979.86	4.00	
			Mean	3090.40	4.13	
			SD	136.34	0.61	
3+16 (PE)	Screw	Corner	1	2777.06	4.75	2616.008
			2	3212.26	5.61	
			3	3090.25	5.91	
			4	3290.15	4.49	
			5	3347.53	6.97	
			Mean	3143.45	5.55	
			SD	226.37	0.99	
6+15 (FR)	Rivet	Edge	1	3493.37	5.97	3347.510
			2	3438.24	10.13	
			3	3464.05	6.45	
			4	3464.71	5.87	
			5	3379.19	6.74	
			Mean	3447.91	7.03	
			SD	43.09	1.77	
6+15 (FR)	Rivet	Corner	1	3356.38	16.85	3174.846
			2	3387.96	6.06	
			3	3258.95	6.54	
			4	3488.51	6.14	
			5	3346.7	5.61	
			Mean	3367.7	8.24	
			SD	82.77	4.83	
6+16 (FR)	Screw	Edge	1	3705.92	6.94	3256.527
			2	3514.93	7.06	
			3	3368.87	6.42	
			4	3584.04	3.58	
			5	3529.57	6.20	
			Mean	3540.67	6.04	
			SD	121.95	1.42	

### 6.3 Results (continued)

Lot	Fixing type	Position	Specimen	Maximum force (N)	Displacement at maximum force (mm)	Characteristic $F_{sc}$ value
6+16 (FR)	Screw	Corner	1	3530.30	6.55	3418.856
			2	3629.86	5.46	
			3	3533.81	6.57	
			4	3697.18	6.56	
			5	3551.95	6.74	
			Mean	3588.62	6.38	
			SD	72.86	0.52	
9+15 (A2)	Rivet	Edge	1	3096.07	6.19	2752.797
			2	3105.49	6.45	
			3	3098.39	6.40	
			4	3054.59	6.02	
			5	2821.34	5.46	
			Mean	3035.17	6.10	
			SD	121.19	0.40	
9+15 (A2)	Rivet	Corner	1	2693.75	8.95	2639.461
			2	2835.65	14.38	
			3	2914.40	7.06	
			4	2857.31	12.64	
			5	2853.96	7.22	
			Mean	2831.01	10.05	
			SD	82.21	3.30	
9+16 (A2)	Screw	Edge	1	3245.21	5.48	2787.384
			2	3173.91	4.84	
			3	2905.19	6.65	
			4	3071.30	5.47	
			5	3266.08	6.66	
			Mean	3132.34	5.82	
			SD	148.05	0.80	
9+16 (A2)	Screw	Corner	1	3306.19	5.52	2831.606
			2	3121.50	5.10	
			3	3257.39	4.01	
			4	2958.88	4.80	
			5	3108.83	5.38	
			Mean	3150.56	4.96	
			SD	136.89	0.60	

### 6.3 Results (continued)

Note: The mode of failure for all specimens was elongation of the sample around the fixing. See 6.4 photographs for examples.

### 6.4 Photographs

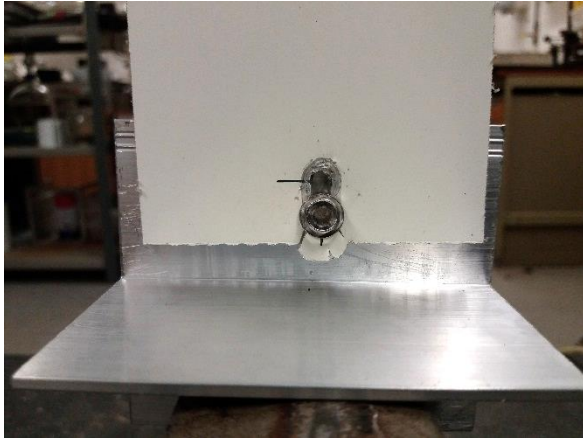


Plate 6.4.1: Example of pull through under shear using a screw in the edge position (post-test).

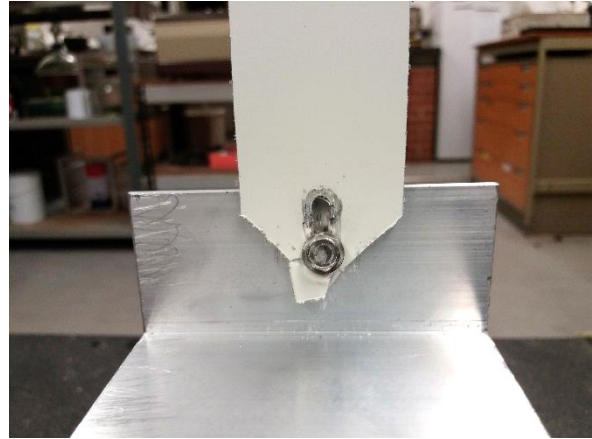


Plate 6.4.2: Example of pull through under shear using a screw in the corner position (post-test).

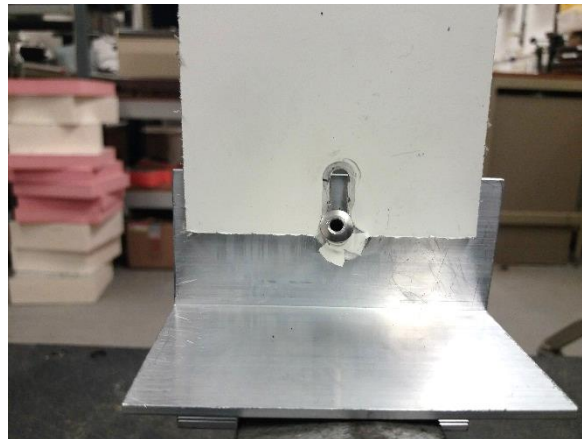


Plate 6.4.3: Example of pull through under shear using a rivet in the edge position (post-test).

## 7 RESISTANCE TO HORIZONTAL POINT LOAD

### 7.1 Method

In accordance with ETAG 034 : 2012 *Guideline for European technical approval of kits for external wall claddings part 1: Ventilated cladding kits comprising cladding components and associated fixings*. Section 5.4.3, with the following exceptions;

The test was conducted with the load applied vertically, using the support span declared by the client of 500mm.

The test was conducted with the specimen raised onto a supporting structure, to allow access underneath.

A dial gauge beneath the panel positioned centrally between the supporting beams was used to measure deflection.

### 7.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/2	3	3200 x 1500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256
S1/62765/5	3	3200 x 1500 x 4mm Albond 9000 FR (Pearl White) Prod date 7/03/2018, Lot no 253176
S1/62765/8	3	3200 x 1500 x 4mm Albond 9000 A2 (Silver) Prod date 13/01/2018, Lot no 253176

### 7.3 Results

Lot	Deflection after loading (mm)	Comment
2	-0.10	Negligible deflection, no damage to sample.
5	-0.17	Negligible deflection, no damage to sample.
8	-0.04	Negligible deflection, no damage to sample.

## 8 SALT SPRAY CORROSION RESISTANCE

### 8.1 Method

In accordance with BS EN ISO 9227 : 2017 *Corrosion tests in artificial atmospheres – Salt spray tests*, and assessments to BS EN ISO 1670 : 2007 *Building hardware – Corrosion resistance – Requirements and test methods*.

A neutral salt spray, as detailed in BS EN ISO 9227 Section 5 *Test solutions*, was used to generate a salt fog concentration of 1 -2 cm<sup>3</sup> of fog collected over an area of 80 cm<sup>2</sup> per hour, as detailed in Table 3 *Operating conditions* of the same standard.

Deionised water purity was 0.2 µS·cm<sup>-1</sup> (Standard limit is ≤ 20 µS/cm). Salt purity complies with ASTM B117-11 & BS EN ISO 9227 : 2017 and is supplied with a Certificate of Conformity No SS/4250 and SS3071 from CW Specialist Salt Ltd. The pH of the collected spray was between pH 6.6 and pH 7.0

Four 200mm x 200mm specimens were exposed for 1000 hours salt spray. Two specimens were scribed in the centre of the panel with a diagonal line 100mm in length.

### 8.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256

### 8.3 Results

Lot	Scribed / unscribed	Observation
1	Scribed	No evidence was found of corrosion of the substrate or blistering, cracking or flaking of the coating
	Unscribed	No evidence was found of corrosion of the substrate or blistering, cracking or flaking of the coating

## 9 COLOUR STABILITY

### 9.1 Method

In accordance with BS 3900: Part D9 : 1986 *Determination of colour and colour difference: measurements*.

Specimens were tested in duplicate.

### 9.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/10	2	150 x 75 x 3mm Albond 9000 PE (Traffic White), Prod date 9/5/18, Lot no 260626.
S1/62765/11	2	150 x 75 x 3mm Albond 9000 PE (Steel Blue), Prod date 15/12/17, Lot no 244769.
S1/62765/12	2	150 x 75 x 3mm Albond 9000 PE (Ruby Red), Prod date 28/4/18, Lot no 259096.
S1/62765/13	2	150 x 75 x 3mm Albond 9000 PE (Mouse Green), Prod date 14/2/18, Lot no 250839.
S1/62765/14	2	150 x 75 x 3mm Albond 9000 PE (Black), Prod date 29/3/18, Lot no 255522.

### 9.3 Conditioning

UV aged - In accordance with BS EN ISO 4898-3 : 2016, method A. Exposed to UVA 340 lamps cycling 8 hours UV at 60°C followed by 4 hours condensation at 50°C for 1500 hours.

### 9.4 Results

Lot	Conditioning	CIE 1976 Colour reading				Observations
		$\Delta L$	$\Delta a$	$\Delta b$	$\Delta E$	
10A	UV aged, unwashed	0.06	0.02	-0.17	0.18	Lighter, less green, less yellow.
	UV aged, washed	0.14	0.01	-0.23	0.27	Lighter, less green, less yellow.
10B	UV aged, unwashed	-0.06	0.03	-0.06	0.09	Darker, less green, less yellow.
	UV aged, washed	0.02	0.02	-0.12	0.12	Lighter, less green, less yellow.
11A	UV aged, unwashed	-0.81	0.33	-1.80	2.00	Darker, redder, bluer.
	UV aged, washed	-0.61	0.27	-1.57	1.71	Darker, redder, bluer.
11B	UV aged, unwashed	-0.34	0.06	-0.87	0.94	Darker, redder, bluer.
	UV aged, washed	-0.27	0.08	-0.82	0.86	Darker, redder, bluer.
12A	UV aged, unwashed	-0.38	0.46	0.57	0.83	Darker, redder, yellower.
	UV aged, washed	-0.33	0.41	0.48	0.71	Darker, redder, yellower.
12B	UV aged, unwashed	-0.39	0.50	0.55	0.84	Darker, redder, yellower.
	UV aged, washed	-0.33	0.42	0.43	0.68	Darker, redder, yellower.

#### 9.4 Results (continued)

Lot	Conditioning	CIE 1976 Colour reading				Observations
		$\Delta L$	$\Delta a$	$\Delta b$	$\Delta E$	
13A	UV aged, unwashed	-0.44	-0.50	0.07	0.67	Darker, greener, yellower.
	UV aged, washed	-0.37	-0.48	0.05	0.61	Darker, greener, yellower.
13B	UV aged, unwashed	-0.17	-0.41	-0.06	0.45	Darker, greener, less yellow.
	UV aged, washed	-0.11	-0.36	-0.09	0.39	Darker, greener, less yellow.
14A	UV aged, unwashed	0.26	-0.03	-0.08	0.27	Lighter, greener, bluer.
	UV aged, washed	0.17	-0.02	0.00	0.17	Lighter, greener, less blue.
14B	UV aged, unwashed	0.23	0.03	-0.09	0.25	Lighter, less green, bluer.
	UV aged, washed	0.12	0.04	-0.03	0.13	Lighter, less green, bluer.



## 10 CROSS CUT

### 10.1 Method

In accordance with BS EN ISO 2409 : 2013 *Paints and varnishes – cross cut test*.

### 10.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/3	60	360 x 360 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256

### 10.3 Results

Lot	Specimen	Observation	Classification
3	1	The edges of the cut were smooth with no detachment of the lattice.	0
	2	The edges of the cut were smooth with no detachment of the lattice.	0
	3	The edges of the cut were smooth with no detachment of the lattice.	0

### 10.4 Photographs

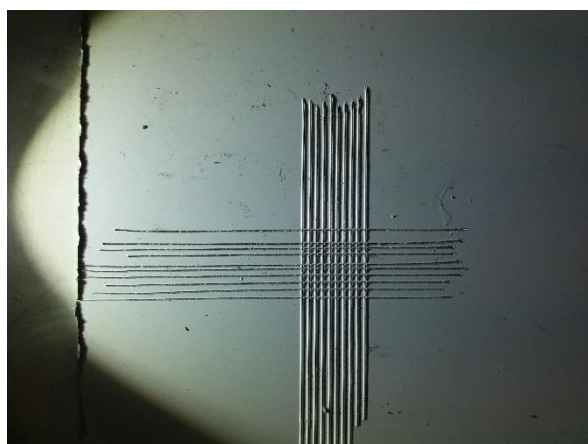


Plate 10.4.1: Specimen one after test

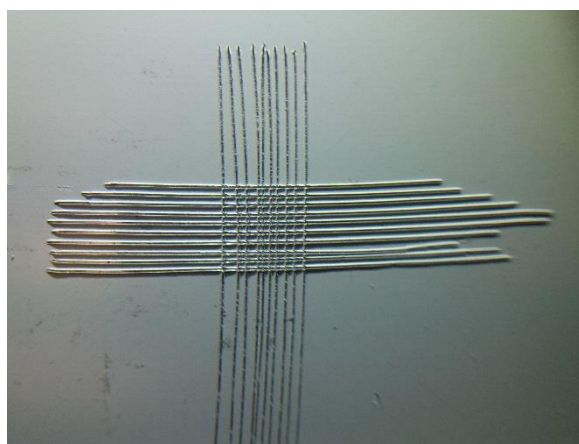


Plate 10.4.2: Specimen two after test

#### 10.4 Photographs (continued)

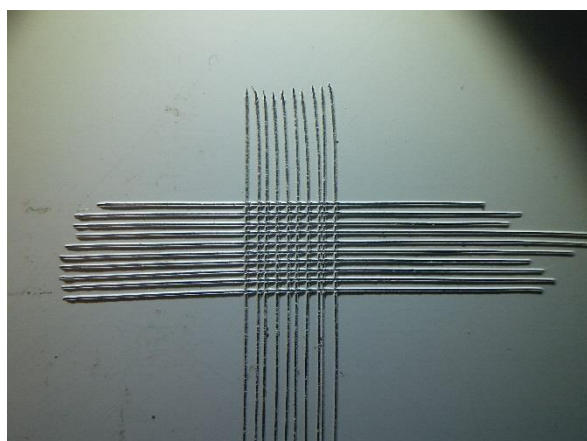


Plate 10.4.3: Specimen three after test

## 11 ABRASION RESISTANCE

### 11.1 Method

In accordance with BS EN 13523-16 : 2004 *Coil coated metals – test methods Part 16: resistance to abrasion*.

### 11.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256

### 11.3 Results

Testing was carried out on behalf of the BBA by PRA World Limited, and their Report 77780-343a, dated 31<sup>st</sup> July 2018 can be found in Appendix A - *Abrasion and scratch resistance*.

## 12 SCRATCH RESISTANCE

### 12.1 Method

In accordance with BS EN ISO 1518 : 2011 *Paints and varnishes – determination of scratch resistance Part 1: constant loading method (ISO 1518-1 : 2011)*.

### 12.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256

### 12.3 Results

Testing was carried out on behalf of the BBA by PRA World Limited, and their Report 77780-343a, dated 31<sup>st</sup> July 2018 can be found in Appendix A - *Abrasion and scratch resistance*.

## 13 T-BEND

### 13.1 Method

In accordance with BS EN ISO 17132 : 2007 *Paints and varnishes — T-bend test*. Section 8.3.2. *T-bend test around a mandrel*.

Testing was conducted on a section of the aluminium facer alone, at 0.5mm thickness.

### 13.2 Samples

BBA Ref/Lot	Quantity	Description
S1/62765/1	15	500 x 500 x 3mm Albond 9000 PE (Pure White) Prod date 14/05/2018, Lot no 261256

### 13.3 Results

Lot	Mandrel Diameter (mm)	Comment	T-bend rating ( $T_m$ )
1	10	Pass, no damage to specimen.	-
	5	Pass, no damage to specimen.	-
	2 <sup>(1)</sup>	Pass, no damage to specimen.	4

Note (1) There is no available mandrel size smaller than this.

## **APPENDIX A - ABRASION AND SCRATCH RESISTANCE**

PRA report 77780-343a, 31<sup>st</sup> July 2018

# Technical Report



## Taber Abrasion and Scratch Resistance Analysis For British Board of Agrément

### Analysis Report

### Work Carried Out By

David Marlow

### Group Leader

Steve Ryley

PRA Ref: 77780-343a

31 July 2018

[PRA World Limited](#)

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## Analysis Report

**PRA Ref. Number** 77780-343  
**Date Received** 28 June 2018  
**Date Issued** 31 July 2018  
**Client** British Board of Agrément  
Bucknalls Lane  
Watford  
Herts  
WD25 9BA  
United Kingdom

FAO: David Durrant

**Work Requested** Taber Abrasion and Scratch Hardness

**Samples Submitted** Coated Aluminium Panels

**Work Carried out by** .....  
David Marlow

**Approved by** .....  
S. Ryley  
Authorised Signatory

Results relate only to the items tested

PRA Ref: 77780-343a

31 July 2018

PRA World Limited

PRA World Limited, Pera Business Park, Nottingham Road, Melton Mowbray, Leicestershire LE13 0PB, United Kingdom  
Phone: +44 (0)1664 501212 Email: coatings@pra-world.com www.pra-world.com

Registered office as above. Registered in England 10393032



## 1 Introduction

Coated aluminium panels with the customer reference S1/62765 were submitted for testing.

## 2 Test Procedures

### 2.1 Abrasion resistance BS EN 13523-16

Test method states to use equipment as specified in ISO 7784-2 Tests carried out using CS17 abrasive wheels with a loading of 500grams for a total of 1000 cycles with intermediate inspections at intervals of 250 cycles

### 2.2 Hardness (Scratch-needle determination) ISO 1518-1-2011

Three replicate samples were labelled 1-3 by PRA and tested in accordance with BS EN ISO 1518- 1:2011. The test involves scratching the coating with a 1.0mm diameter hemispherical stylus with increasing loads until the coating is penetrated. The test environmental conditions were 23°C and 50% RH.

## 3 Results

### 3.1 Abrasion resistance BS EN 13523-16

Customer reference S1/62765	Initial weight (g)	Weight Loss at 250 cycles (mg)	Weight Loss at 500 cycles (mg)	Weight Loss at 750 cycles (mg)	Weight Loss at 1000 cycles (mg)
Panel.-1	43.5498	22.5	37.5	53.2	68.1
Panel.-2	43.7925	13.1	25.9	41.3	55.8
Panel.-3	44.0905	14.0	28.4	41.3	55.5
Average		16.5	30.6	45.3	59.8

### Template Document Amendments

Version number	Date Issued	Issued by	Changes	Approved
1.1	6 <sup>th</sup> July 2018	David Corrigan	Converted to controlled document format	Steve Ryley



## 3.2 Hardness (Scratch-needle determination) ISO 1518-1-2011

<b>Customer reference S1/62765</b>	<b>Scratch resistance- Load to Penetration (kg)</b>
<b>Panel-1</b>	1.9
<b>Panel-2</b>	2.0
<b>Panel-3</b>	1.9
<b>Minimum load to failure</b>	<b>1.9</b>

***End of report***

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