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INSPECTION AND TESTING REPORT
Brand QUALIDECO
New homologations
LABORATORY TESTS
(c. 141-07)

COMPANY: DECORAL SYSTEM

Report No.: 5120

Date of Report: 02/20/2008

The Director
R. Boi

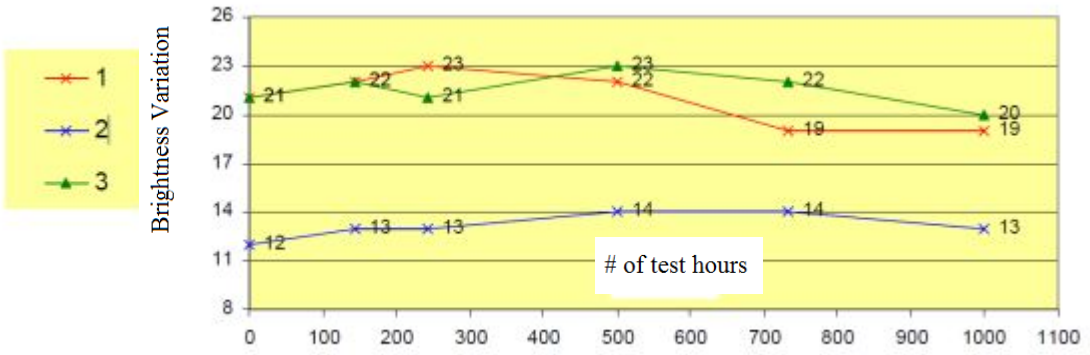
PART 1 – HOMOLOGATION TESTS - BRAND QUALIDECO - DECORATIONS HORIZON

CUSTOMER:	**DECORAL SYSTEM**
CONTRACT No.:	**141-07**
DATE:	**06-20-2008**
SYSTEM:	**HORIZON**

	DECORATIONS		
TESTS PERFORMED	**1**	**2**	**3**
	H 2-1	**H 2-3**	**H 2-7**
POWDER COATING			
POWDER PROD.	GI COLOR	GI COLOR	GI COLOR
POWDER COD.	6.647.3202 HJM	6.647.3202 HJM	6.647.3202 HJM
LYCENCE QUALICOAT	P-0785	P-0785	P-0785
GRAIN INK COD.	03B0016B	09B0020B	10B0021B
a. **Brightness (UNI EN ISO 2813:2001)**			
Gloss	21	19	20
b. **Thickness (UNI EN ISO 2360:2004)**			
e.s. > 60 µm v.m. (µm)	68	71	73
c. **Accelerated Aging (UNI EN ISO 11341:2005)** e.s. > 60 µm	58	62	67
Initial gloss	21	12	21
Final gloss	19	13	20
Residual value (not less than 50%)	**90%**	**108%**	**95%**
Contrast gray scale *(between exposed area and sample)*	**4-5**	**4-5**	**4-5**
Final evaluation *(based on contrast between exposed area and no-exposed area)*	**ACCETABLE**	**ACCETABLE**	**ACCETABLE**
d. **Light Resistance (UNI 4529:1990)**			
e.s. > 60 µm	73	76	82
Change of color ΔE	0.65	1	0.81
Rating scale of blue ≥ 7	**>8**	**>8**	**>8**
e. **Resistance to humid atmospheres containing SO2 (UNI EN ISO 3231:1999)**			
e.s. > 60 µm	71	74	72
No separation or penetration within 1 mm	yes	yes	yes
No color change or bubbles			
f. **Oven Test(212°F x 48 hours - shielding)**			
e.s. > 60 um	72	71	73
Color variation ΔE	0.32	0.34	0.27
Visual assessment: Color	No color change	No color change	No color change

Accelerated aging:

For each of the three finishes, we report the brightness variation trend in function of hours of testing.

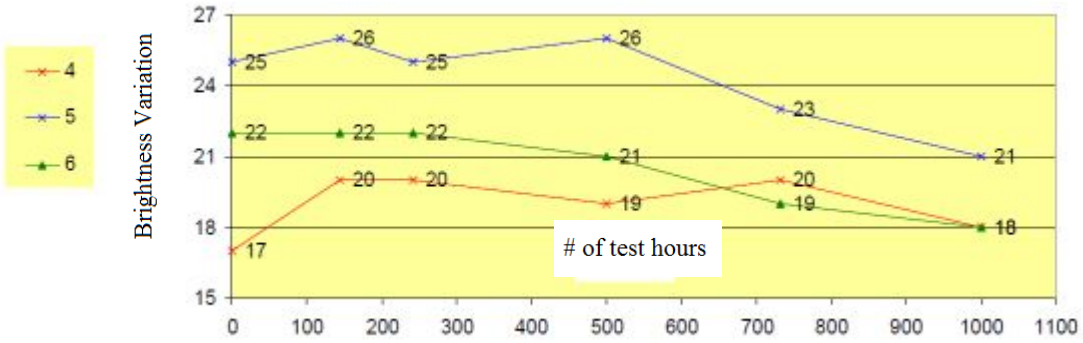


	DECORATIONS		
TESTS PERFORMED **POWDER COATING** **POWDER PROD.** **POWDER COD.** **LYCENCE QUALICOAT** **GRAIN INK COD.**	**4** **H 2-7/A** GI COLOR 6.647.3202 HJM P-0785 03B0016B	**5** **H 8-1** GI COLOR 6.647.3203 HJM P-0785 07B0018B	**6** **H 8-7** GI COLOR 6.647.3203 HJM P-0785 07B0018B
a. **Brightness (UNI EN ISO 2813:2001)** Gloss	15	25	18
b. **Thickness (UNI EN ISO 2360:2004)** e.s. > 60 µm v.m. (µm)	59	69	68
c. **Accelerated Aging** **(UNI EN ISO 11341:2005)** e.s. > 60 µm Initial gloss Final gloss Residual value (not less than 50%) Contrast gray scale *(between exposed area and sample)* Final evaluation *(based on contrast between exposed area and no-exposed area)*	52 17 18 **106%** **4-5** **ACCETABLE**	62 25 21 **84%** **4-5** **ACCETABLE**	67 22 18 **82%** **4-5** **ACCETABLE**

d. **Light Resistance (UNI 4529:1990)** e.s. > 60 µm Change of color ΔE Rating scale of blue ≥ 7	 64 0.7 **>8**	 67 0.13 **>8**	 60 0.52 **>8**
e. **Resistance to humid atmospheres containing SO2 (UNI EN ISO 3231:1999)** e.s. > 60 µm No separation or penetration within 1 mm No color change or bubbles	 64 yes	 71 yes	 74 yes
f. **Oven Test(212°F x 48 hours - shielding)** e.s. > 60 um	55	74	72
Color variation ΔE	0.23	0.2	0.37
Visual assessment: Color	No color change	No color change	No color change

Accelerated aging:

For each of the three finishes, we report the brightness variation trend in function of hours of testing.

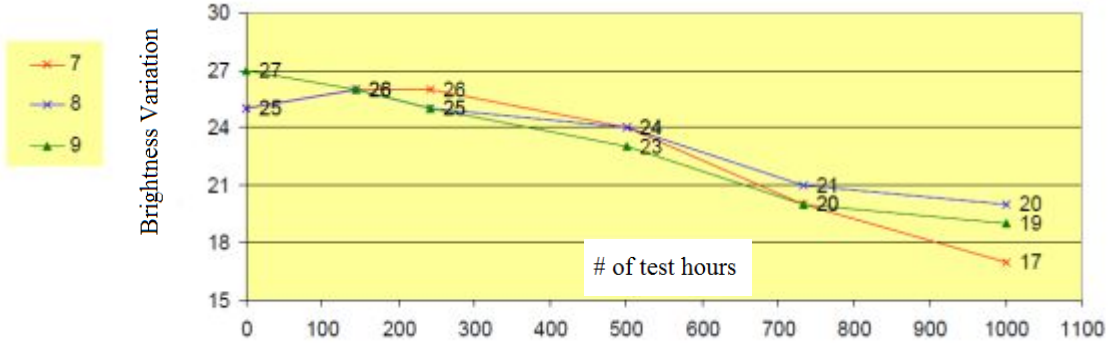


	DECORATIONS		
TESTS PERFORMED **POWDER COATING** **POWDER PROD.** **POWDER COD.** **LYCENCE QUALICOAT** **GRAIN INK COD.**	**7** **H 9-2** GI COLOR 6.647.1200 HJM P-0785 04B0012B	**8** **H 10-4** GI COLOR 6.647.3204 HJM P-0785 01B0013B	**9** **H 11-4** GI COLOR 6.647.3206 HJM P-0785 01B0013B
a. **Brightness (UNI EN ISO 2813:2001)** Gloss	 26	 25	 27

b. **Thickness (UNI EN ISO 2360:2004)** e.s. > 60 µm v.m. (µm)	64	79	92
c. **Accelerated Aging** **(UNI EN ISO 11341:2005)** e.s. > 60 µm Initial gloss Final gloss Residual value (not less than 50%) Contrast gray scale *(between exposed area and sample)* Final evaluation *(contrast between exposed area and no-exposed area)*	62 25 17 **68%** **4-5** **ACCETABLE**	77 25 20 **80%** **4** **ACCETABLE**	85 27 19 **70%** **4** **ACCETABLE**
d. **Light Resistance (UNI 4529:1990)** e.s. > 60 µm Change of color ΔE Rating scale of blue ≥ 7	62 0.37 **>8**	75 0.26 **>8**	102 0.3 **>8**
e. **Resistance to humid atmospheres containing SO2 (UNI EN ISO 3231:1999)** e.s. > 60 µm No separation or penetration within 1 mm No color change or bubbles	73 yes	81 yes	88 yes
f. **Oven Test(212°F x 48 hours - shielding)** e.s. > 60 um	62	81	92
Color variation ΔE Visual assessment: Color	0.84 No color change	0.22 No color change	0.31 No color change

Accelerated aging:

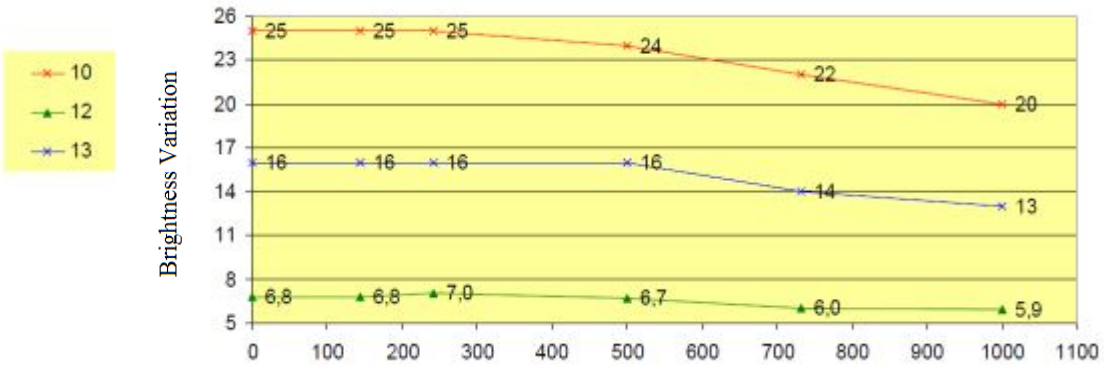
For each of the three finishes, we report the brightness variation trend in function of hours of testing.



	DECORATIONS		
TESTS PERFORMED	**10** **H 12-5**	**11** **H 10-4**	**12** **H 16-7**
POWDER COATING **POWDER PROD.**	GI COLOR	DECORAL SYSTEM	DECORAL SYSTEM
POWDER COD.	6.647.3205 HJM	DS 783	DS 787
LYCENCE QUALICOAT	P-0785	P-0617	P-0617
GRAIN INK COD.	08B0019B	01B0013B	10B0021B
a. **Brightness (UNI EN ISO 2813:2001)** Gloss	26	7	15
b. **Thickness (UNI EN ISO 2360:2004)** e.s. > 60 µm v.m. (µm)	81	81	70
c. **Accelerated Aging** **(UNI EN ISO 11341:2005)** e.s. > 60 µm	78	79	71
Initial gloss	25	6.8	16
Final gloss	20	5.9	13
Residual value (not less than 50%)	**80%**	**87%**	**81%**
Contrast gray scale *(between exposed area and sample)*	**4**	**4**	**4**
Final evaluation *(contrast between exposed area and no-exposed area)*	**ACCETABLE**	**ACCETABLE**	**ACCETABLE**
d. **Light Resistance (UNI 4529:1990)** e.s. > 60 µm	79	82	62
Change of color ΔE	0.14	0.15	0.88
Rating scale of blue ≥ 7	**>8**	**>8**	**>8**
e. **Resistance to humid atmospheres containing SO2 (UNI EN ISO 3231:1999)** e.s. > 60 µm	89	83	69
No separation or penetration within 1 mm No color change or bubbles	S	S	S
f. **Oven Test(212°F x 48 hours - shielding)** e.s. > 60 um	78	81	76
Color variation ΔE	0.21	0.1	0.25
Visual assessment: Color	No color change	No color change	No color change

Accelerated aging:

For each of the three finishes, we report the brightness variation trend in function of hours of testing.



PART 2 - ADDITIONAL TESTS FOR ASSESSING THE QUALITY OF THE "FULL INK"

In order to evaluate the characteristics of the inks used for preparing the decorations, we have been carried out some additional tests on Q-panel samples previously prepared by the Applicant. We received "full ink" Q-panels as showed in the table:

N°	PRODUCT COD. BASE PAINT	FULL INK COD.
15	6.647.3202 HJM	03B0016B
16	6.647.3202 HJM	09B0020B
17	6.647.3202 HJM	10B0021B
18	6.647.3203 HJM	07B0018B
19	6.647.1200 HJM	04B0012B
20	6.647.3204 HJM	01B0013B
21	6.647.3206 HJM	01B0013B
22	6.647.3205 HJM	08B0019B
23	6.647.3210 HJM	08B0019B
24	DS 783	01B0013B
25	DS 787	10B0021B
26	DS 786	08B0019B

On all full ink samples were performed the following tests:

1 Artificial aging and exposure to xenon lamp radiation
2 Resistance to artificial light

While on the most representative colors (underlined in the table) were also carried out the following tests:

3 Resistance to humid atmospheres containing sulfur dioxide
4 Resistance to 212 °F oven
5 Effects of immersion in cleaning solutions

1. ARTIFICIAL AGING AND EXPOSURE TO XENON LAMP RADIATION

OPERATOR: Ballauri			HOURS OF TESTING: 1000c	
NUMBER OF SAMPLES: 12			TEST START DATE: 2007-07-09	
BULLETIN N ° 682	DATE	2007-08-13	TEST END DATE: 2007-08-13	
METHOD: UNI EN ISO 11341 - Method 1 - Cycle A			PROCEDURE IN DETAIL: MP-9	
EQUIPMENT: Solarbox 3000 RH			MATR: 090460	
MEASURING EQUIPMENT				
Glossmeter: ERICHSEN MATR.: 1004553			METHOD: UNI EN ISO 2813:01 PROCEDURE IN DETAIL: MP-1	
Spectrophotometer: X-Rite MATR.: 002099			METHOD: ISO 7724/3:1984 PROCEDURE IN DETAIL: MP-16	

RESULTS

FULL INK	**COLOR VARIATION**	**BRIGHTNESS**			**FINAL EVALUATION**
	(ISO 7724/3:1984)	(ISO 105 A02:1978)			
SAMPLE	**ΔE_{CIELAB}**	**GLOSSi**	**GLOSSf**	**% RESIDUAL GLOSS**	limits QUALIDECO % residual gloss max: 50% Contrast ≥ 4
15	1.5	27	18	67%	**ACCETABLE**
16	1.33	24	18	75%	**ACCETABLE**
17	1.00	27	21	78%	**ACCETABLE**
18	0.26	24	21	88%	**ACCETABLE**
19	0.90	26	22	85%	**ACCETABLE**
20	0.26	28	24	86%	**ACCETABLE**
21	0.06	30	26	87%	**ACCETABLE**
22	0.13	22	21	95%	**ACCETABLE**
23	0.93	24	16	67%	**ACCETABLE**
24	1.95	7.2	6.1	85%	**ACCETABLE**
25	1.18	15	13	87%	**ACCETABLE**
26	0.14	11	10	91%	**ACCETABLE**

- The value of **ΔE**$_{CIELAB}$ reported is the average of the measurements carried out in two different points of the decorated surface. The final color change evaluation of the tested samples is supplemented by visual inspection
- Preparation of samples (dimensions 35x60 mm): obtained from panels of dimensions 100x300mm
- Duration conditioning before the test: 16 hours in a laboratory environment T = 73.4 ± 36.5 °F and UR% = 50 ± 5%.
- Average conditions of the test chamber:

T_{BST}	147.2 F		$E_{\lambda=300-800nm}$	550 W/m^2
RH	49%		$E_{\lambda=300-400nm}$	60,7 W/m^2
Test conducted in continuous			$E_{\lambda=340nm}$	0,509W/(m^{2}nm)

- Deviations (agreed) by the rule: Average air temperature in the chamber T = 89.6 °F.
- In the following graphs we report the trend of change in color and brightness as a function of hours of testing:

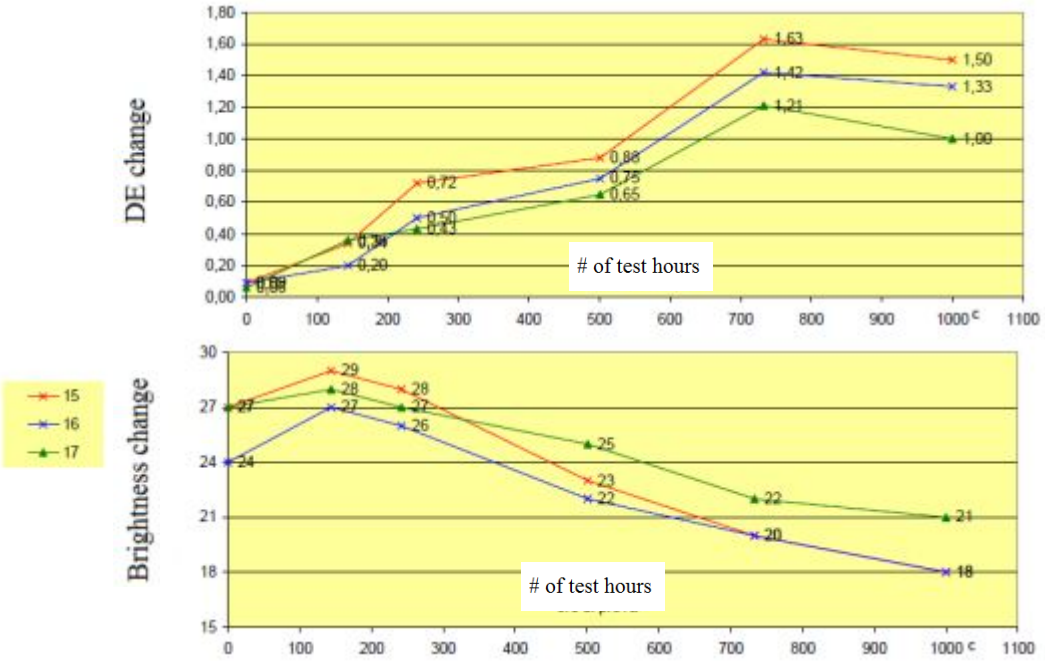


Chart1: Evolution of color change and gloss on samples 15,16,17

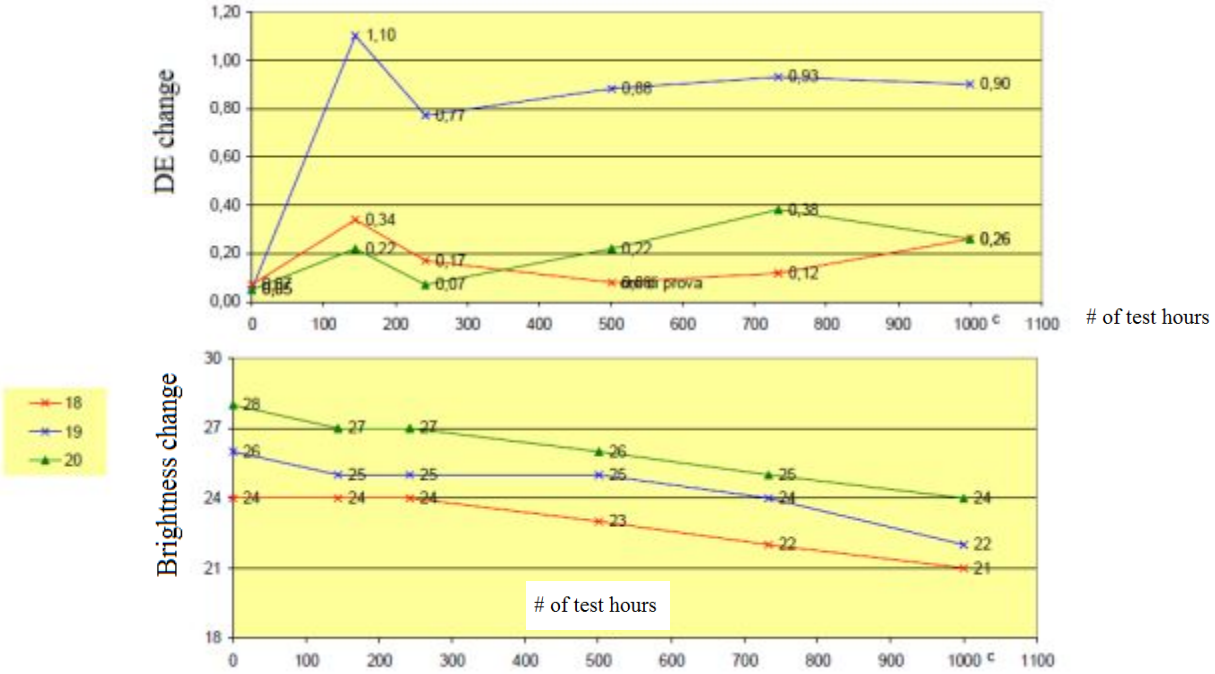


Chart2: Evolution of color change and gloss on samples 18,19,20

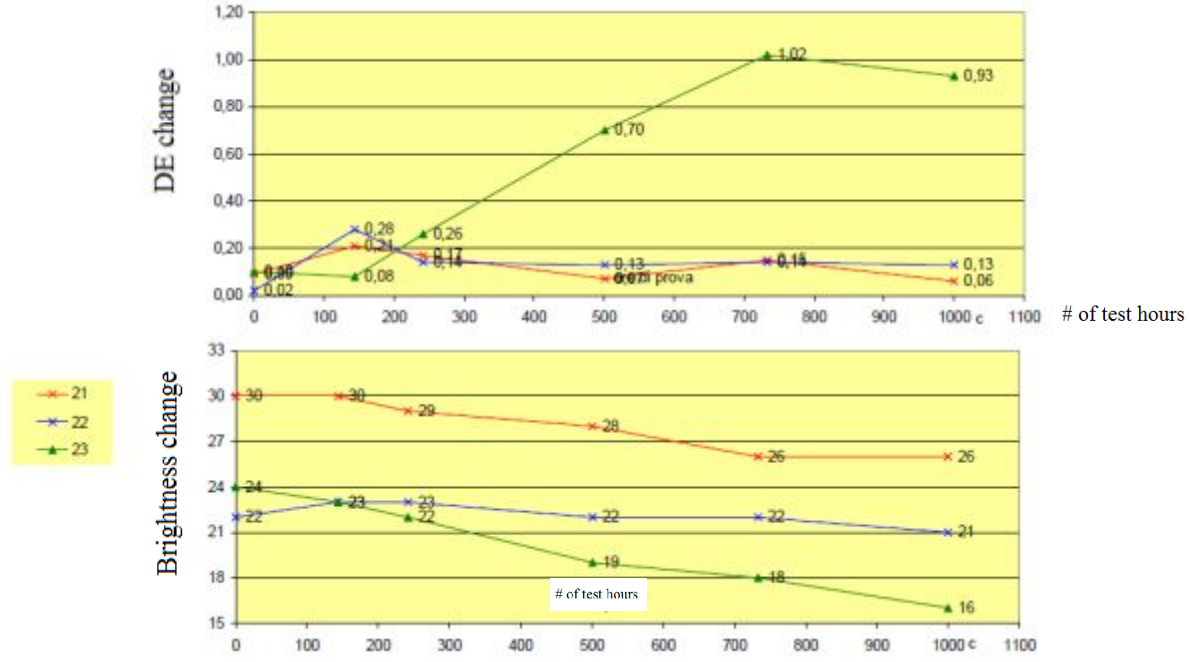


Chart3: Evolution of color change and gloss on samples 21,22,23

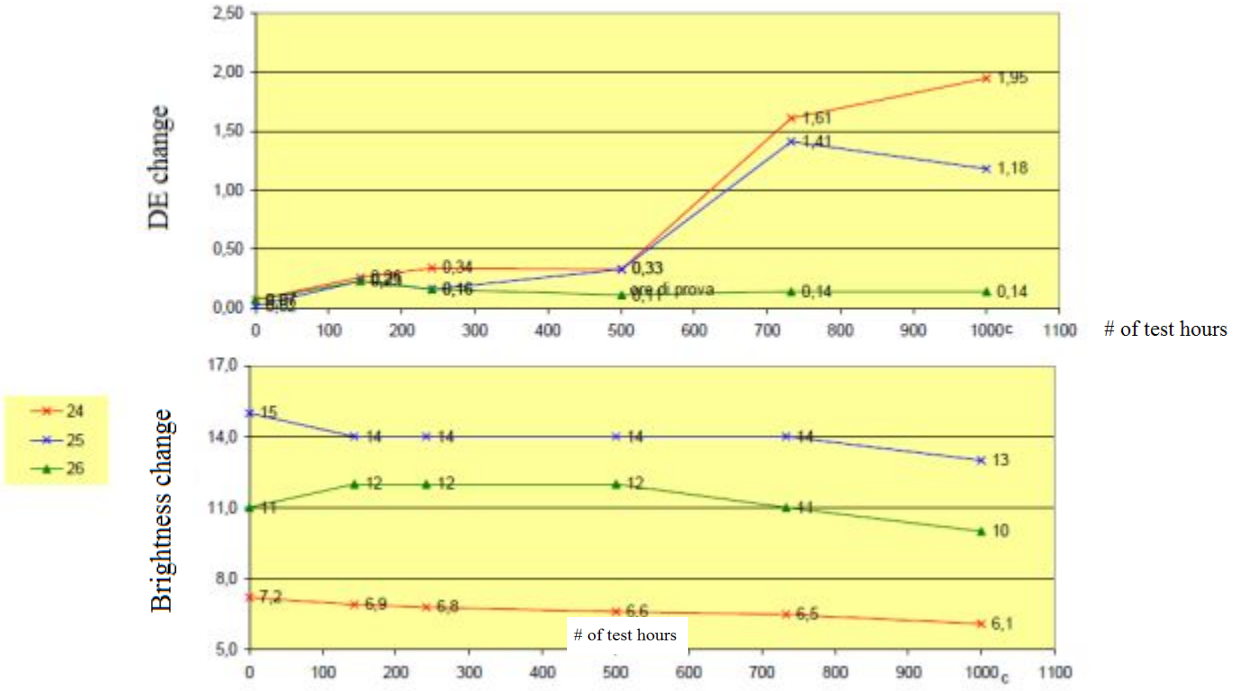


Chart4: Evolution of color change and gloss on samples 24,25,26

2. RESISTANCE TO ARTIFICIAL LIGHT

OPERATOR: Ballauri			HOURS OF TESTING: 1009
NUMBER OF SAMPLES: 12			TEST START DATE: 2007-11-05
BULLETIN N ° 78	DATE	2008-02-01	TEST END DATE: 2007-12-20
METHOD: UNI 4529:1990			PROCEDURE IN DETAIL: MP-25
EQUIPMENT: Q-SUN			MATR: 05-2910-21-X1S
MEASURING EQUIPMENT			
Spectrophotometer: X-Rite MATR.: 002099			METHOD: ISO 7724/3:1984 PROCEDURE IN DETAIL: MP-16

RESULTS

SAMPLE	ΔE_{CIELab}	VISUAL ASSESSMENT SCALE OF BLUE
15	0.88	**>8**
16	0.74	**>8**
17	0.36	**>8**
18	0.64	**>8**
19	0.18	**>8**
20	0.54	**>8**
21	0.14	**>8**
22	0.08	**>8**

23	0.10	**>8**
24	0.94	**>8**
25	0.21	**>8**
26	0.42	**>8**

Notes:

- The light source used is a closed Xenon arc lamp.
- Preparation of samples (dimensions 35x60 mm): obtained from panels of dimensions 100x300mm
- Test conditions: TBST = 122 ± 35.6 °F, E = 550 W / m^2 ± 10%.
- Deviations from standard (agreed): the sample holder plan is fixed

3. RESISTANCE TO HUMID ATMOSPHERES CONTAINING SULFUR DIOXIDE

OPERATOR: Ballauri			NUMBER OF CYCLES: 24
NUMBER OF SAMPLES: 5			TEST START DATE: 2007-10-12
BULLETIN N ° 77	DATE	2008-02-01	TEST END DATE: 2007-11-15
METHOD: UNI EN ISO 3231:99 (0,2 l SO_2)			PROCEDURE IN DETAIL: MP-12
EQUIPMENT: Camera Erichsen			MATR: 117

RESULTS

SAMPLE	VISUAL TEST	QUALICOAT[1)] EVALUATION
16	No change	ACCETABLE
18	No change	ACCETABLE
19	No change	ACCETABLE
23	No change	ACCETABLE
24	No change	ACCETABLE

Note:

- The test is suspended during non-working days, for more details see page 74 of the logbook
- [1)]Acceptance requirements Specifications QUALICOAT: No corrosion penetration more than 1 mm from both edges notch, no color change or bubbles of degree higher than the value 2 (S2) of EN ISO 4628-2:2003.

4. RESISTANCE TO 212 °F OVEN

OPERATOR: Ballauri			HOURS OF TESTING: 48
NUMBER OF SAMPLES: 5			TEST START DATE: 2008-01-29
BULLETIN N ° 79	DATE	2008-02-01	TEST END DATE: 2008-01-31
EQUIPMENT: OVEN (122-410)°F WTB			MATR: #991002

BINDER	
MEASURING EQUIPMENT	
Spectrophotometer: X-Rite MATR.: 002099	METHOD: ISO 7724/3:1984 PROCEDURE IN DETAIL: MP-16

RESULTS

SAMPLE	ΔE	COLOR CHANGE
16	0.07	None
18	0.05	None
19	0.87	None
23	0.39	None
24	0.27	None

Note:

- The examination of the decorated surface is visual for comparison with a sample of the same finish not tested.
- Preparation of samples (dimensions 35x60 mm): obtained from panels of dimensions 100x300mm

5. EFFECTS OF IMMERSION IN CLEANING SOLUTIONS

OPERATOR: Ballauri			HOURS OF TESTING: 72
NUMBER OF SAMPLES: 5			TEST START DATE: 2007-11-05
BULLETIN N ° 922	DATE	2007-11-21	TEST END DATE: 2007-11-08
METHOD:			AAMA 2605-02
TEST CONDITIONS			
TEST LIQUID:			3% solution of detergent as described by ASTM D2248
TEST TEMPERATURE:			100.4 °F

RESULTS

a) Color change - instrumental method			
METHOD:	ISO 7724/3:1984	PROCEDURE IN DETAIL:	MP-16
EQUIPMENT:	Spectrophotometer SP62X X-Rite	MATR.:	002099

SAMPLE	COLOR COORDINATES			COLOR CHANGE
	ΔL	Δa	Δb	ΔE_{CIELAB}
16	0.39	0.15	0.31	0.51
18	0.58	-0.01	0.06	0.58
19	0.47	0.12	-0.48	0.69

23	0.6	0.04	0.06	0.60
24	0.12	0.17	0.29	0.35

- Description color coordinates

Coordinate	Variable	Description
L	brightness	From 100 (white / total reflection) to 0 (black / total intake)
a	red/green	$\Delta a < 0 \rightarrow$ green $\Delta a > 0 \rightarrow$ red
b	yellow/blue	$\Delta b < 0 \rightarrow$ blue $\Delta b > 0 \rightarrow$ yellow
The color difference is given by: $\Delta E = [(\Delta L)_2 + (\Delta a)_2 + (\Delta b)_2]_{1/2}$		

b) Brightness change - instrumental method			
METHOD:	UNI EN ISO 2813:2001 – reflection angle 60°	PROCEDURE IN DETAIL:	MP-1
EQUIPMENT:	Glossmeter ERICHSEN 503	MATR.:	1004553

	BRIGHTNESS		
SAMPLE	**GLOSSi**	**GLOSSf**	**% RESIDUAL GLOSS**
16	21	22	**105%**
18	19	21	**110%**
19	23	23	**100%**
23	23	23	**100%**
24	6.0	5.9	**98%**

Note:
Type of substrate / coating: samples (dimensions 35x60 mm): obtained from panels of dimensions 100x300mm

Conclusions

The assessment was based on procedure P-001 developed by QUALITAL:

N.	FINISH	EVALUATION
1	H 2-1	**POSITIVE**
2	H 2-3	**POSITIVE**
3	H 2-7	**POSITIVE**
4	H 2-7/A	**POSITIVE**
5	H 8-1	**POSITIVE**
6	H 8-7	**POSITIVE**
7	H 9-2	**POSITIVE**
8	H 10-4	**POSITIVE**
9	H 11-4	**POSITIVE**
10	H 12-5	**POSITIVE**
12	HR 10-4	**POSITIVE**
13	HR 16-7	**POSITIVE**

Also the additional tests on the samples prepared with full inks have always been positive.