

# Technical Report

## QUV Accelerated Weather Testing

<b>TR-0002302-5   QUV Accelerated Weathering Performance Testing</b>	<b>Date:</b> 21 December 2023
<b>Assessment of Colourtuff-A90 &amp; Colourtuff-C85</b>	<b>Document Number:</b> TR-0002302-5

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## Executive Summary

The colour change is tabulated below for all products tested after 1000 hours.

Tabulated data for the series						
System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)	Visual Comment
Colourtuff-A90	1000 Hrs	-0.83	0.03	-0.21	0.85	No colour change Visually
Colourtuff-C85	1000 Hrs	-7.54	0.15	2.57	7.96	Darker
Tufflon-P80 White	1000 Hrs	-13.86	9.92	26.58	31.57	Darker, Redder, Yellower
Hybron-W90 Black	1000 Hrs	-7.03	-0.12	2.81	7.57	Darker

The following conclusion is drawn from the results.

- Colourtuff-A90 colour is unchanged after 1000 hours of QUV accelerated weathering (ASTM D154 Cycle 1).
- Colourtuff-C85 White turns slightly yellow after 1000 hours of QUV accelerated weathering (ASTM D154 Cycle 1).
- All aromatic polyurea, hybrid and polyurethane will change colour. The lighter the colour, the greater the yellowing. Yellow and black have significantly less colour change.
- All aromatic polyurea, hybrid and polyurethane will lose their gloss and chalk. The low gloss is consistent and looks good.
- Colourtuff-A90 and C85 both perform well for colour fastness. Aliphatic polyurea does not perform as well as aliphatic polyaspartic and polyurethane.

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- None of the samples experienced high levels of DFT loss.

### Introduction

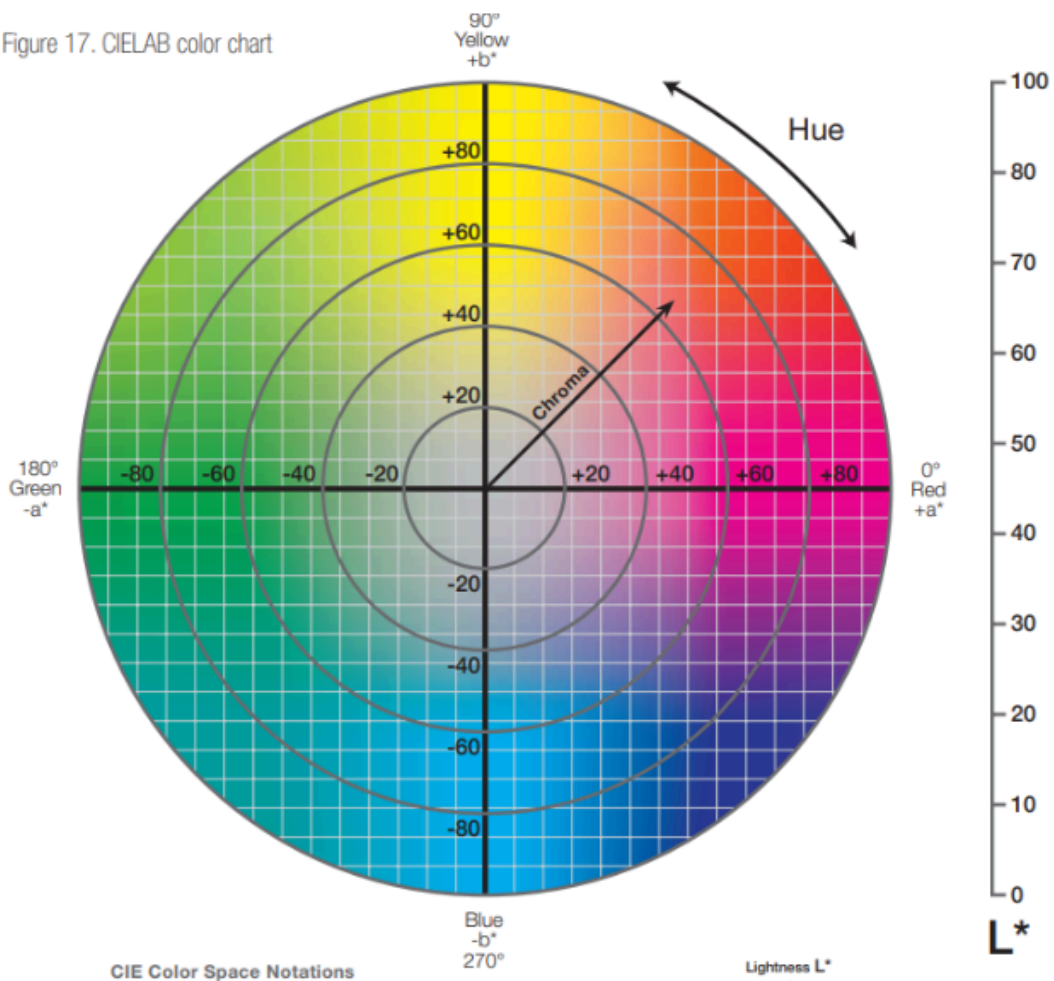
This technical report assesses the colour change, gloss change, and DFT loss after 1000 hours of accelerated weathering to ASTM D154 Cycle 1. The list of test panels in the series is tabulated in panel preparation

### Assessment

#### Colour

The colour will be assessed using a spectrophotometer (Konica Minolta - CM-36dG). A visual assessment of a colour change will support any colour data.

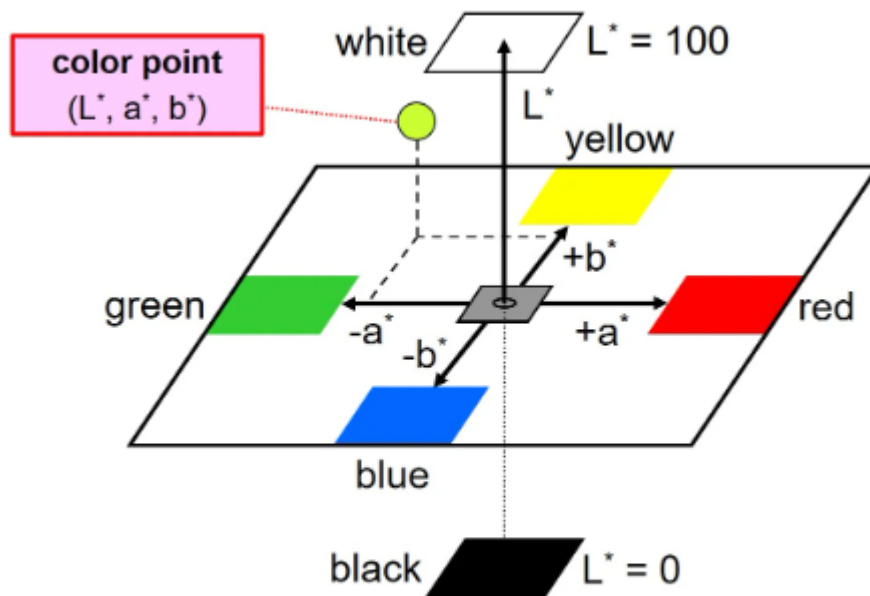
Figure 17. CIELAB color chart



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CIELAB is a three-dimensional system that triangulates and precisely defines any colour point. The initial colours of all the samples are scanned to create the standard reference. The samples are rescanned after weathering (250, 500, 750, and 1000 Hours of weathering in the QUV) to determine the changes in colour.



*The 3-dimensional CIELAB color space.*

### CIE Colour Space Notations

dL*(D65)	difference in lightness / darkness value	"+" = lighter "-" = darker
da*(D65)	difference on the red / green axis	"+" = redder "-" = greener
db*(D65)	difference on the yellow / blue axis	"+" = yellower "-" = bluer
dE*(D65)	total colour difference value	

The d or delta describes the change in colour rather than an actual colour. The dL number indicates a change in light or dark colour. The da number indicates a change in green or red, and the db indicates a change in blue or yellow. The delta (dL, da and db) numbers indicate how the colour has changed from the original colour scan. DE is the visual difference between the two colours.

### Gloss

Laboratory gloss meter used to test gloss.

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### Panel Preparation

System 00012/01 (A90)

Colourtuff-A90 Mid Grey	3000µm DFT	
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System 00013/01 (C85)

Colourtuff-C85 White	3000µm DFT	
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System 00015/01 (P80)

Tufflon-P80 White	3000µm DFT	
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System 00019/01 (W90)

Hybron-W90 Black	3000µm DFT	
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### Results

#### Colourtuff-A90

System 00012/01 (A90)

Colourtuff-A90 has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour however, at this point, it can not be detected visually. The dry film thickness has not changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Colourtuff-A90	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	-0.02	-0.01	0.07	0.08
	500 Hrs	-0.52	-0.05	-0.06	0.53
	750 Hrs	-0.69	0.00	-0.13	0.71
	1000 Hrs	-0.83	0.03	-0.21	0.85

System	QUV Hours	Gloss	DFT
Colourtuff-A90	0 Hrs	65.4	2875 µm
	1000 Hrs	63.9	2875 µm



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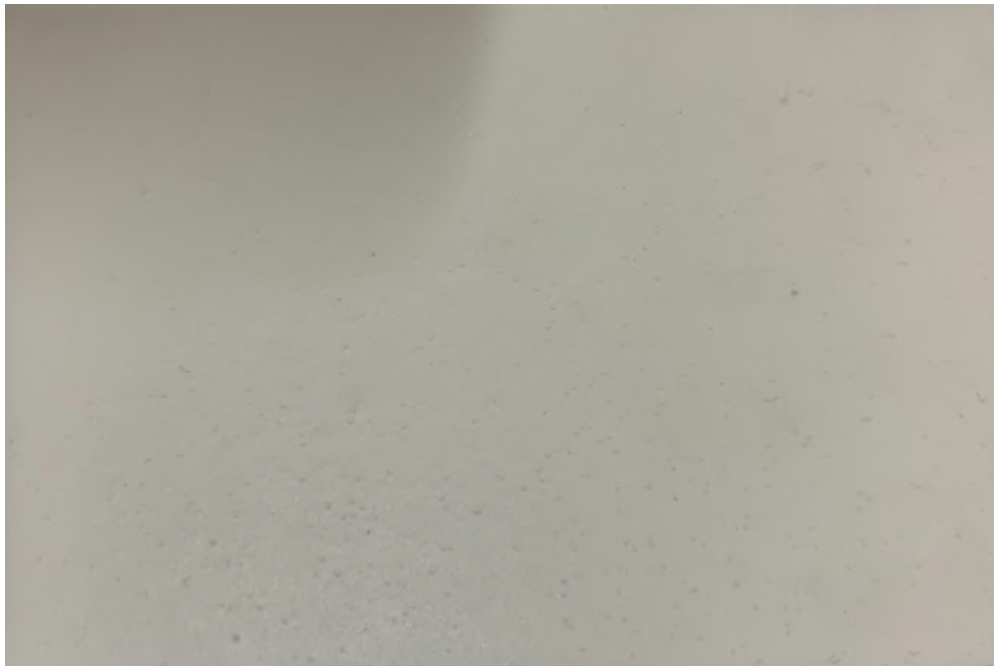
### Colourtuff-C85

System 00013/01 (C85)

Colourtuff-C85 has visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Spectrophotometer has detected a darkening of the colour. The colour change is nowhere as noticeable as standard pure polyurea. The gloss and dry film thickness have not significantly changed.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Colourtuff-C85	0 Hrs	0.00	0.00	-0.01	0.01
	250 Hrs	-1.88	0.34	4.38	4.78
	500 Hrs	-2.55	0.23	4.67	5.32
	750 Hrs	-4.78	0.15	3.81	6.11
	1000 Hrs	-7.54	0.15	2.57	7.96

System	QUV Hours	Gloss	DFT
Colourtuff-C85	0 Hrs	64.1	3120 µm
	1000 Hrs	62.3	3120 µm



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### Tufflon-P80 White

System 00015/01 (P80)

The Tufflon-P80 has significantly changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). The Tufflon-P80 colour has gotten darker, yellower and redder visually. The significant shift in colour mainly occurred within the first 250 hours and then became a more stable colour. The gloss has dropped off to matte level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Tufflon-P80 White	0 Hrs	0.00	0.00	0.00	0.01
	250 Hrs	-10.93	7.25	32.61	35.15
	500 Hrs	-12.97	9.51	31.69	35.54
	750 Hrs	-13.19	9.75	29.88	34.08
	1000 Hrs	-13.86	9.92	26.58	31.57

System	QUV Hours	Gloss	DFT
Tufflon-P80 White	0 Hrs	102	3410 µm
	1000 Hrs	0.1	3410 µm



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### Hybron-W90 Black

System 00019/01 (W90)

Hybron-W90 has not visually changed colour after 1000 hours of weathering (ASTM D154 Cycle 1). However, the spectrophotometer has detected a darkening of the Hybron-W90 colour. The shift in colour can not be detected visually, but the loss of gloss is very noticeable. The gloss has dropped to a matte level.

System	QUV Hours	dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)
Hybron-W90 Black	0 Hrs	0.01	-0.03	-0.02	0.04
	250 Hrs	-0.02	0.04	1.27	1.27
	500 Hrs	-1.24	-0.09	1.12	1.67
	750 Hrs	-3.84	-0.19	1.10	4.00
	1000 Hrs	-7.03	-0.12	2.81	7.57

System	QUV Hours	Gloss	DFT
Hybron-W90 Black	0 Hrs	35.3	4260 µm
	1000 Hrs	1.0	4260 µm



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### Conclusion

The following conclusions are drawn from the above results.

- Colourtuff-A90 colour is unchanged after 1000 hours of QUV accelerated weathering (ASTM D154 Cycle 1).
- Colourtuff-C85 White darkens after 1000 hours of QUV accelerated weathering (ASTM D154 Cycle 1).
- All aromatic polyurea, hybrid and polyurethane will change colour. The lighter the colour, the greater the yellowing. Yellow and black have significantly less colour change.
- All aromatic polyurea, hybrid and polyurethane will lose their gloss and chalk. The low gloss is consistent and looks good.
- Colourtuff-A90 and C85 both perform well for colour fastness. Aliphatic polyurea does not perform as well as aliphatic polyaspartic and polyurethane.
- None of the samples experienced high levels of DFT loss.



### Bryant Wells

B Chem Sc, MBA, Certified NACE 3  
Technical Manager

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