

Consultancy Report

Lightfast Testing and ΔE Measurements on Print Samples

Prepared for OKI Europe Ltd.

By Chris Marjoram
Senior Technologist
Print and Security

11th June 2019

Reference: 19-154818

Commercial in confidence

Smithers Pira
Cleeve Road, Leatherhead
Surrey KT22 7RU, United Kingdom
Telephone: +44 (0) 1372 802000
Fax: +44 (0) 1372 802245

www.smitherspira.com

Registered number: 5761324

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1 Objective

To assess any colour change and report on any change in the appearance of the print samples after exposure to artificial daylight. Conduct ΔE measurements at each Blue Wool stage and report on any colour shift.

2 Samples received

Samples received 18th May 2019 as detailed below:

- Dura-ID Laser Polyplas
- Dura-ID PP Laser (Perm)
- Dura-ID Polyolefin (BS5609)

Figure 1 – Samples received



3 Test methods

All materials were conditioned at $23 \pm 2^{\circ}\text{C}$, $50 \pm 5\%$ rh for a minimum of 24 hours prior to testing.

3.1 Colour fastness

The colour fastness of the print was determined using a Xenon Arc Light and Weather Fastness Tester in accordance with BS EN ISO 105-B02:1999.

Print areas of approximately 45mm x 135mm were exposed to accelerated, artificial sunlight in a Xenon Arc Light and Weather Fastness Tester. A set of blue wool reference standards was similarly exposed.

The lamp irradiance was set to $1.10 \text{ W/m}^2 \cdot \text{nm}$ at 420 nm and the insulated black panel temperature set at $47 \pm 3^{\circ}\text{C}$.

The samples measured for ΔE against an untested sample when they reached Blue Wool 3, 4, 5 and 6 (Grey Scale 4) using an X-rite eXact colour spectrophotometer (2mm aperture) and any observations reported.

The ΔE was measured on the 100% colour density section for each of the base colours (black, yellow, magenta and cyan).

Three replicates were tested.

4 Results

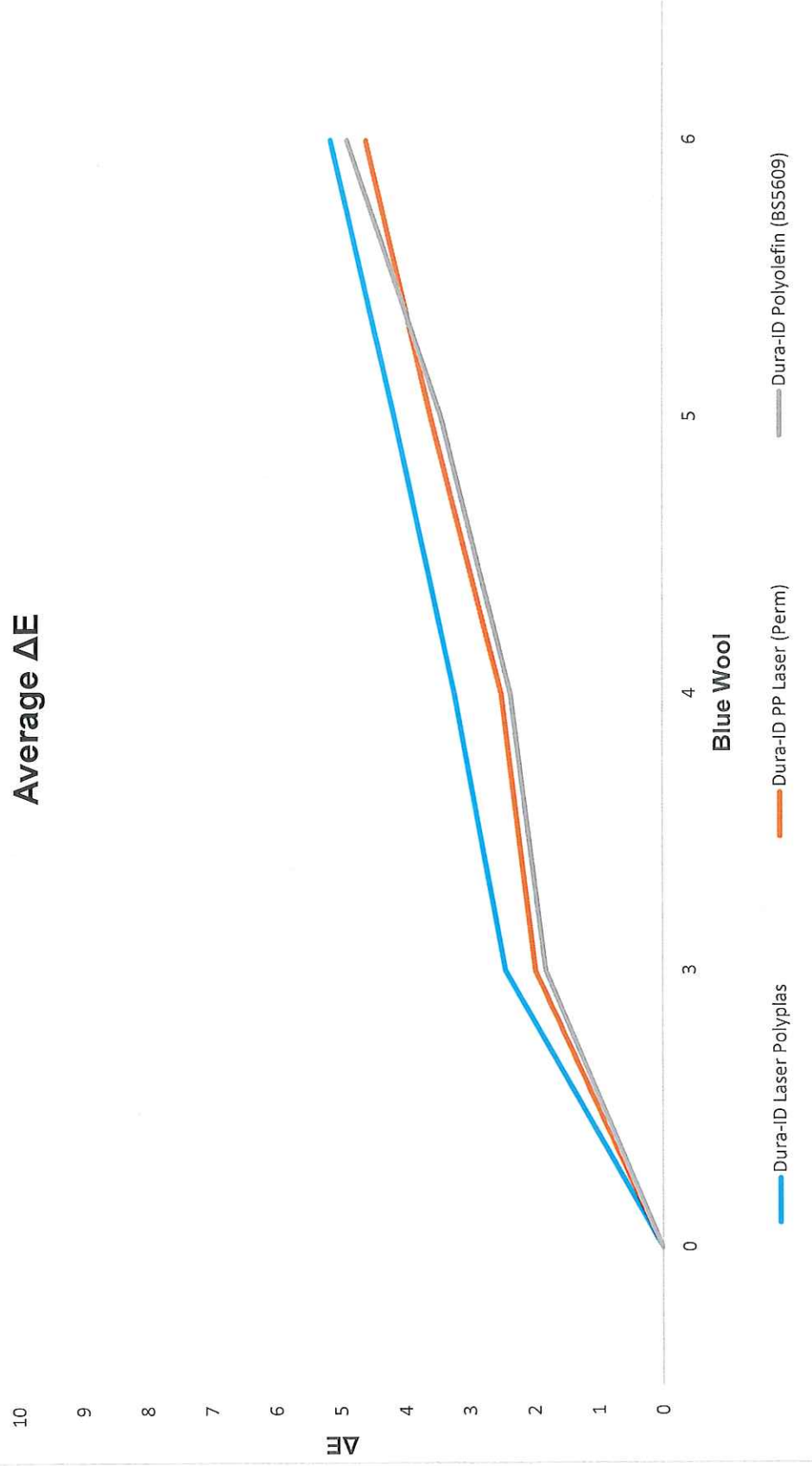
Table 1 and Graph 1 below detail the average of all ΔE measurements made on each sample type across all four colours measured (a lower ΔE value indicates better colour fastness).

Photographs of exposed and untested specimens as well as the raw data for the tables and graphs are included in the appendix to this report.

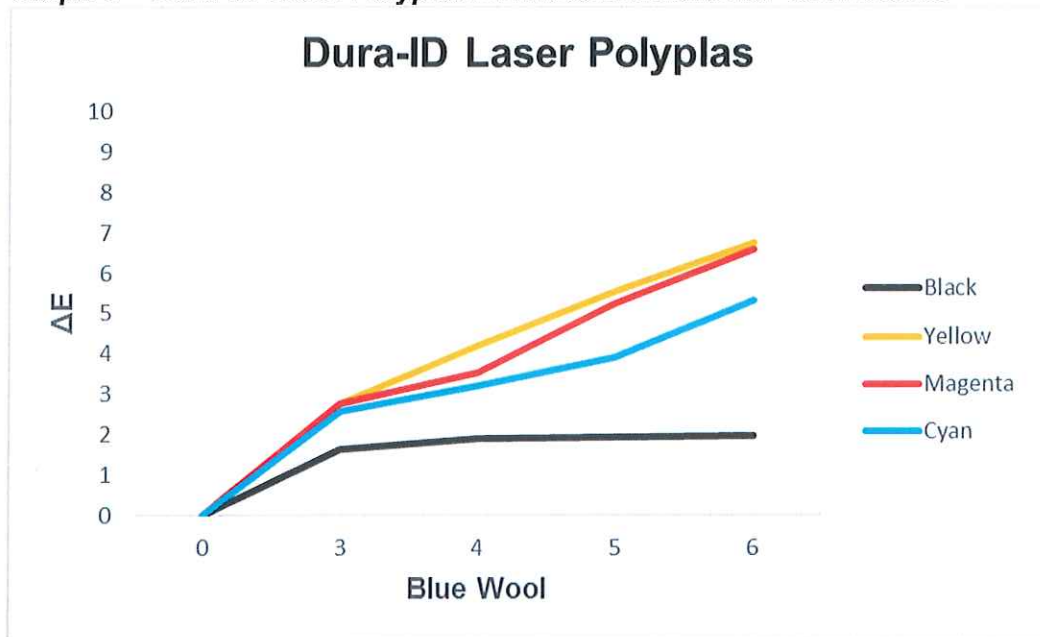
Table 1 – Average ΔE measurements

Sample	Average ΔE			
	BW3	BW4	BW5	BW6
Dura-ID Laser Polyplas	2.44	3.22	4.16	5.16
Dura-ID PP Laser (Perm)	1.97	2.50	3.60	4.61
Dura-ID Polyolefin (BS5609)	1.82	2.36	3.44	4.90

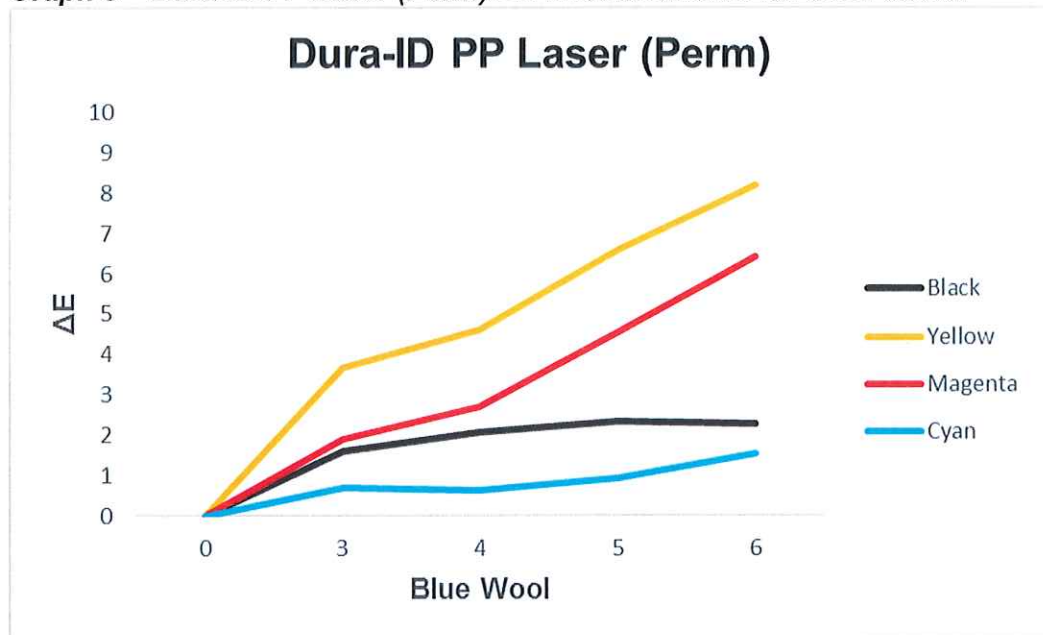
Graph 1 – Average ΔE measurements

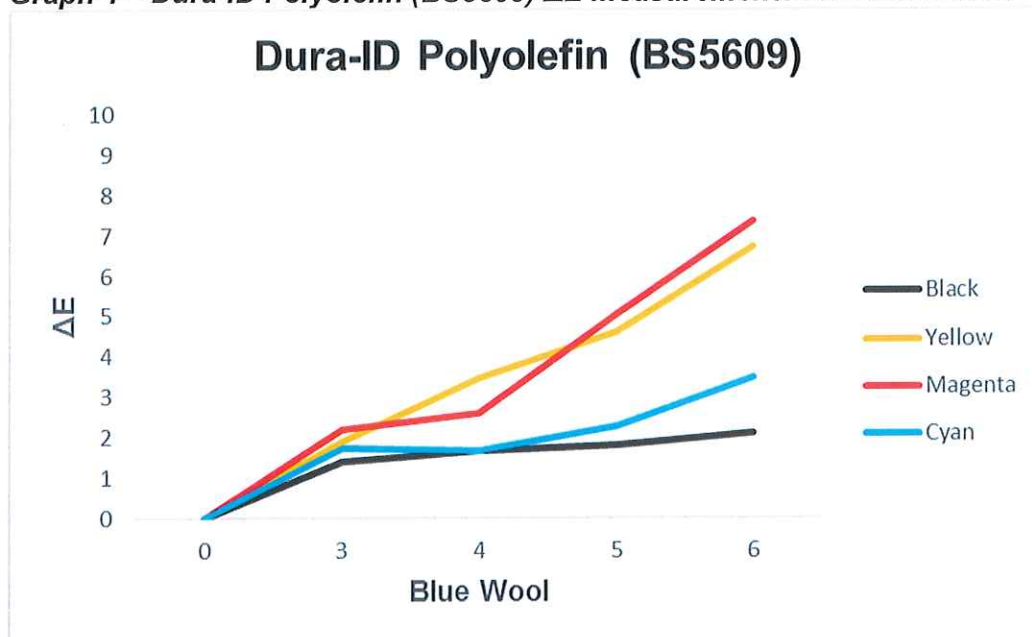


Graph 2 – Dura-ID Laser Polyplas ΔE measurements for each colour



Graph 3 – Dura-ID PP Laser (Perm) ΔE measurements for each colour



Graph 4 – Dura-ID Polyolefin (BS5609) ΔE measurements for each colour

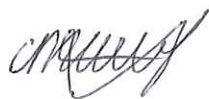
Graphs 2 to 4 above detail the ΔE measurement for the individual colours for each sample variant measured at Blue Wool 3, 4, 5 and 6 (at Grey Scale 4).

Table 2 below shows the sample variants ranked in order of average ΔE measured across all the colours sampled after Blue Wool 6 (Grey Scale 4) had been achieved (a lower ΔE value indicates better colour fastness).

Table 2 – Sample variants ranked best to worst for average ΔE at end of testing

Sample	Avg ΔE at BW6
Dura-ID PP Laser (Perm)	4.61
Dura-ID Polyolefin (BS5609)	4.90
Dura-ID Laser Polyplas	5.16

Prepared by



Chris Marjoram
Senior Technologist
Print and Security

Checked by



David Tempest
Senior Consultant
Print and Security

Appendix

**Photographs of untested samples (below) and
exposed samples (above)**

Raw data

Figure A1 – Dura-ID Laser Polyplas

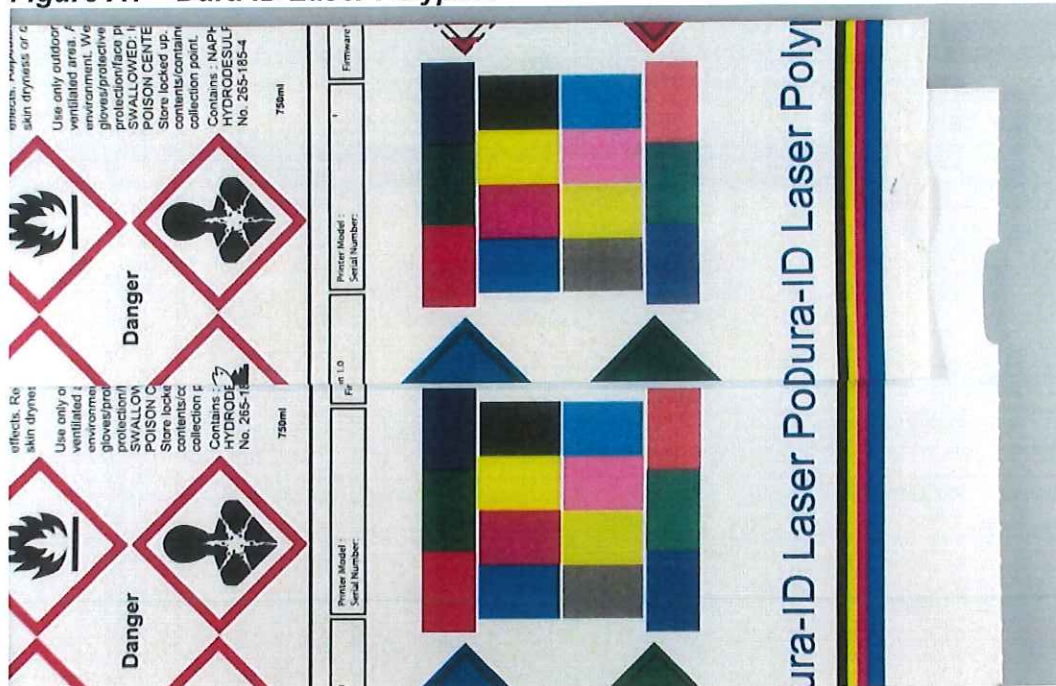


Figure A2 – Dura-ID PP Laser (Perm)

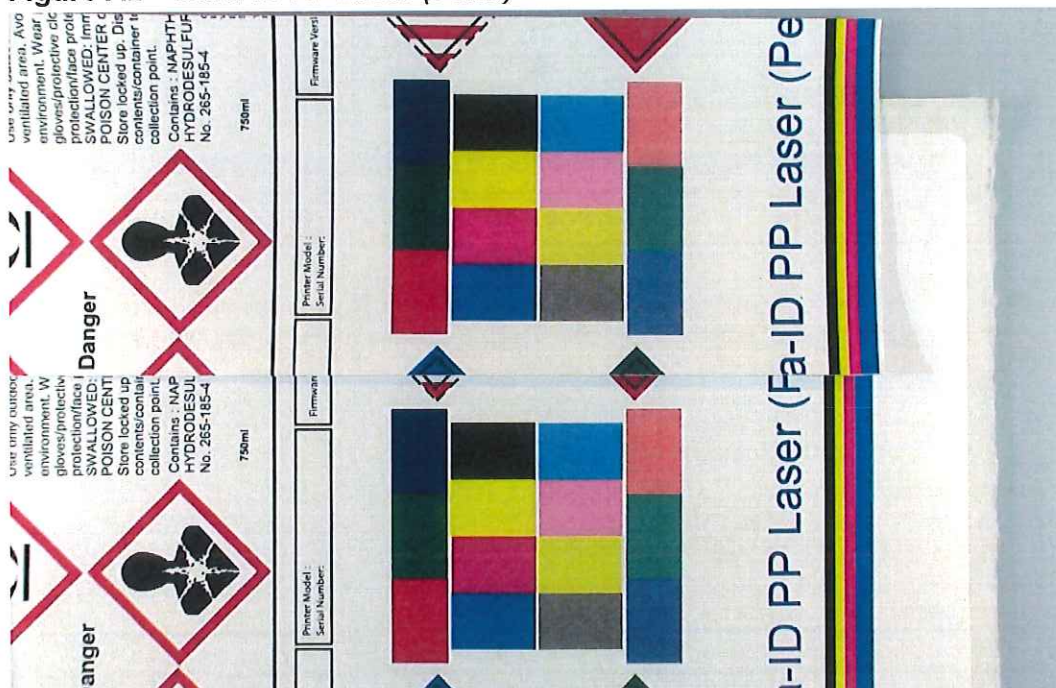
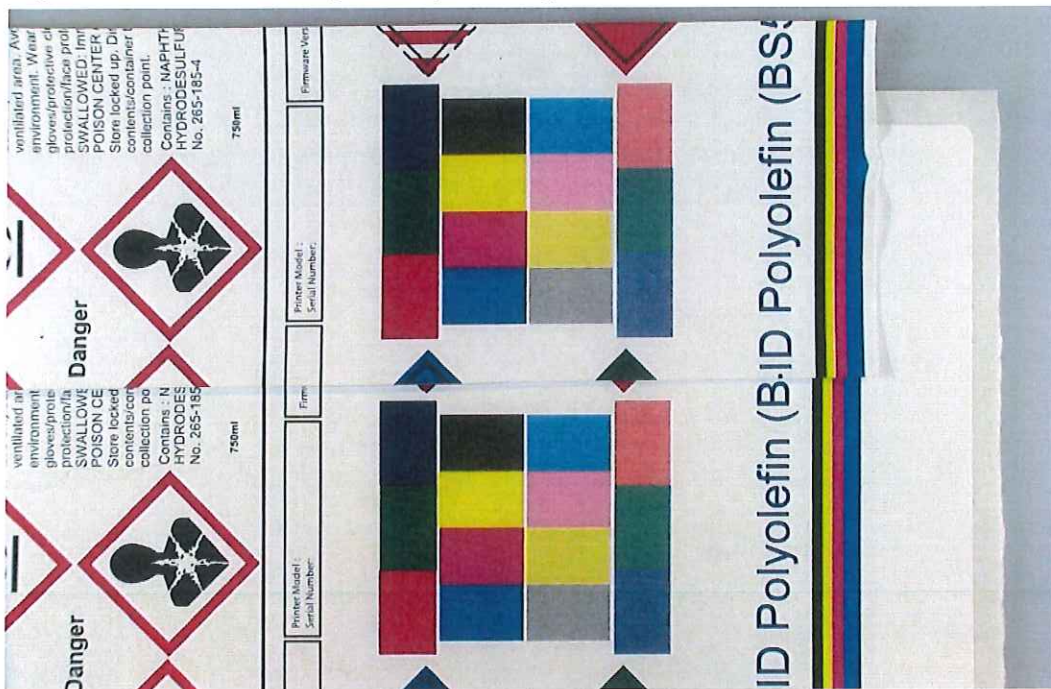


Figure A3 – Dura-ID Polyolefin (BS5609)



Date Allocated:	28 March 2019	Time/Date In Lab:	28-May-19 11:30	Sheet Number:	1 of 4
Allocated To:	C Marjoram	TIG Print Lab		Job Number:	19-154818
Equipment ID:	QS1, SPEC1	Recal Date:	Oct 19, Jun 19		
Test:	Lightfastness - Blue Wool 3				
Customer:	OKI				

Sample	Replicate 1				Replicate 2				Replicate 3				Average			
	Black	Yellow	Magenta	Cyan	Black	Yellow	Magenta	Cyan	Black	Yellow	Magenta	Cyan	Black	Yellow	Magenta	Cyan
Dura-ID Laser Polyplas	1.05	2.73	2.08	2.28	1.05	2.06	3.19	2.89	2.78	3.49	3.09	2.59	1.63	2.76	2.79	2.59
Dura-ID PP Laser (Perm)	0.87	4.37	2.62	0.53	1.45	3.58	1.50	0.89	2.46	3.13	1.57	0.71	1.59	3.69	1.90	0.71
Dura-ID Polyolefin (BS5609)	2.07	2.81	2.08	1.52	1.05	1.36	2.35	2.06	1.13	1.55	2.19	1.62	1.42	1.91	2.21	1.73

Sample	Total Average
Dura-ID Laser Polyplas	2.44
Dura-ID PP Laser (Perm)	1.97
Dura-ID Polyolefin (BS5609)	1.82

Comments and Observations:	
Date/time of measurement:	03 Jun 2019 09:15
Date of Test:	03 June 2019
Testers Signature:	
Checked By:	
Date:	13 June 2019

Date Allocated: 28 March 2019		Time/Date In Lab: 28-May-19 11:30		Sheet Number: 2 of 4											
Allocated To: C Marjoram		TIG Print Lab		Job Number: 19-154818											
Equipment ID: QS1, SPEC1		Recal Date:		Oct 19, Jun 19											
Test:		Lightfastness - Blue Wool 4													
Customer:		OKI													
		ΔE													
Sample	Replicate 1			Replicate 2			Replicate 3			Average					
	Black	Yellow	Magenta	Cyan	Black	Yellow	Magenta	Cyan	Black	Yellow	Magenta	Cyan			
Dura-ID Laser Polyplas	1.47	4.27	2.82	3.09	1.35	3.60	3.66	3.28	2.93	4.77	4.15	3.30	4.21	3.54	3.22
Dura-ID PP Laser (Perm)	1.63	5.30	3.38	0.37	2.32	4.23	2.48	0.88	2.29	4.27	2.21	0.61	4.60	2.69	0.62
Dura-ID Polyolefin (BS5609)	2.78	4.25	2.44	1.31	0.80	2.95	2.51	2.19	1.41	3.27	2.90	1.47	3.49	2.62	1.66

Sample	Total Average
Dura-ID Laser Polyplas	3.22
Dura-ID PP Laser (Perm)	2.50
Dura-ID Polyolefin (BS5609)	2.36

Comments and Observations:

Date/time of measurement: 04 Jun 2019 10:30

Date of Test: 04 June 2019

Testers Signature: 

Checked By:  Date: 13 June 2019

