

Report No. 811

Paint - Round 19

Proficiency Testing Program

June 2013

ACKNOWLEDGMENTS

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1. **FOREWORD**

This report summarises the results of the nineteenth round of a proficiency testing program covering a series of paint tests (to AS1580).

Proficiency Testing Australia (PTA) conducted the program in April 2013. The Program Coordinator was Dr M Li. The Technical Adviser was Mr K. Lofhelm, Manager, CSIRO Verification Services, Executive Officer, APAS & PCCP, and President, Surface Coatings Association Australia (SCAA). This report was authorised by Mr P Briggs, General Manager, PTA. The aim of the program was to assess laboratories' ability to competently perform the prescribed analyses.

2. **STATISTICAL DESIGN OF THE PROGRAM**

For each statistically analysed test, robust statistical procedures were used to generate the z-scores and summary statistics for each test - number of results, median, uncertainty of the median, normalised interquartile range (IQR), robust coefficient of variation (CV), minimum, maximum and range.

3. **FEATURES OF THE PROGRAM**

- (a) A total of 17 laboratories received samples, and all laboratories returned results.
- (b) Each participant was supplied with two 500ml tins of water based paint labelled "Sample A" and "Sample B".
- (c) Laboratories were asked to perform the following consistency analyses on both samples A and B:
 - (i) AS 1580.202.1 - density
 - (ii) AS 1580.214.5 - consistency by Brookfield
 - (ii) AS 1580.301.1 - non-volatile content by mass
 - (iv) AS 1580.204.1 - fineness of grind
- (d) Homogeneity was analysed for randomly selected samples. Based on this testing, it was concluded that the samples were sufficiently homogeneous. Therefore any results identified as outliers could not be attributed to sample variability (Appendix B).
- (e) Participating laboratories were requested to perform their tests according to the "Instructions to Participants" and to record their results on the

accompanying "Results Sheets". They were distributed to participants with the samples (Appendix C).

- (f) Each laboratory was randomly allocated a unique code number for the program to enable confidentiality of results. Reference to each laboratory in this report is made by its code number.

4. **SUMMARY OF RESULTS**

TABLE A: SUMMARY OF RESULTS

Analyses	Sample	Median	Robust CV	No. of Results
Density (kg/L)	A	1.330	0.6%	18
	B	1.330	0.5%	18
Consistency by Brookfield (cP)	A	740.0	17.7%	15
	B	745.0	12.2%	15
Non-volatile Content by Mass	A	64.770	1.4%	17
	B	64.670	1.7%	17
Fineness of Grind (μm)	A	14.0	33.1%	16
	B	14.5	39.6%	16

5 **STATISTICAL OUTLIER RESULTS**

In order to achieve the program's aim of assessing laboratories' testing performance, a robust statistical approach, which uses z-scores has been utilised. The z-score is a measure of how far the result(s) is from the consensus value - a normalised value which gives a "score" to each result relative to the other results in the group. Therefore a z-score close to zero means that the result agrees well with those from other laboratories. An outlier will be any result(s) which has an absolute z-score value greater than or equal to 3.0.

For further information on the calculation and interpretation of z-scores, please see the *Guide to Proficiency Testing Australia 2012* (reference [1]).

TABLE B: OUTLIER RESULTS

Test	Z-Score Outlier Laboratory Codes
Density	Nil
Consistency by Brookfield	1, 2, 14
Non-volatile Content by Mass	13
Fineness of Grind	13

6. **PTA AND TECHNICAL ADVISER'S COMMENTS**

Metrological Traceability and Measurement Uncertainty of Assigned Values

Consensus values (median) derived from the participants' results are used in this program. These values are not metrologically traceable to an external reference.

As the assigned value for this program is the median of the results submitted by the participants, the uncertainty of the median has been calculated and is presented in Appendix A

Analysis of Results by Method Groups

All participants were required to use AS1580 Paints and Related Materials – Test Methods, therefore, results were analysed without method groups.

Comments

There were four laboratories with outliers. The participants should investigate the cause of the outliers, such as interferences from the matrix, instrument conditions, transcription and calculation errors, sample preparation errors and human errors. On the whole, the study should provide valuable information to the participants on the performance of the methods and equipment used.

Density results are good, and no outlier was reported.

Consistency by Brookfield, Laboratory codes 1, 2 and 14 reported outliers.

Laboratory code 13 reported outliers for both non-volatile content by mass and fineness of grind.

Considering that the samples are sufficiently homogeneous, all laboratories reporting outlier results should conduct an investigation.

7. **REFERENCES**

[1] *Guide to Proficiency Testing Australia, 2012.*

This document can be found on the PTA website at www.pta.asn.au

APPENDIX A

Results and Data Analysis

Density	A1
Consistency by Brookfield	A3
Non-volatile Content by Mass	A5
Fineness of Grind	A7

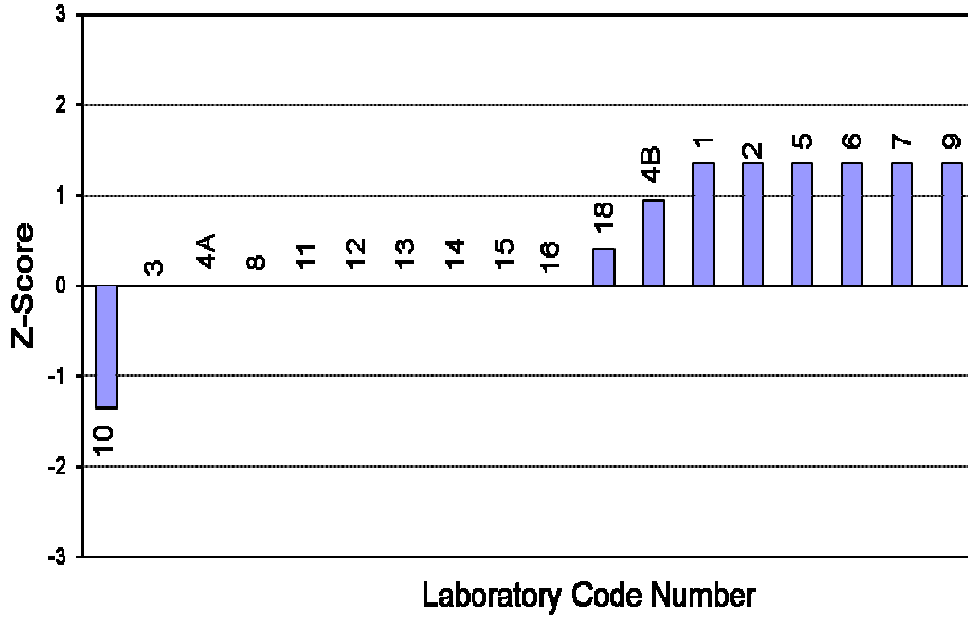
Density - AS 1580 202.1

Results by Laboratory Code

Lab Code	Results (kg/L)		Sample A Robust Z-score	Sample B Robust Z-score
	Sample A	Sample B		
1	1.34	1.34	1.35	1.46
2	1.34	1.34	1.35	1.46
3	1.33	1.33	0.00	0.00
4A	1.33	1.33	0.00	0.00
4B	1.337	1.337	0.94	1.02
5	1.34	1.33	1.35	0.00
6	1.34	1.34	1.35	1.46
7	1.34	1.34	1.35	1.46
8	1.33	1.33	0.00	0.00
9	1.34	1.34	1.35	1.46
10	1.32	1.33	-1.35	0.00
11	1.33	1.33	0.00	0.00
12	1.33	1.33	0.00	0.00
13	1.33	1.33	0.00	0.00
14	1.33	1.33	0.00	0.00
15	1.33	1.33	0.00	0.00
16	1.33	1.33	0.00	0.00
18	1.333	1.336	0.40	0.88
No of Results:	18	18		
Median:	1.330	1.330		
Normalised IQR:	0.007	0.007		
Robust CV:	0.6%	0.5%		
Minimum:	1.32	1.33		
Maximum:	1.34	1.34		
Range:	0.02	0.01		
Uncertainty: (Median)	0.002	0.002		

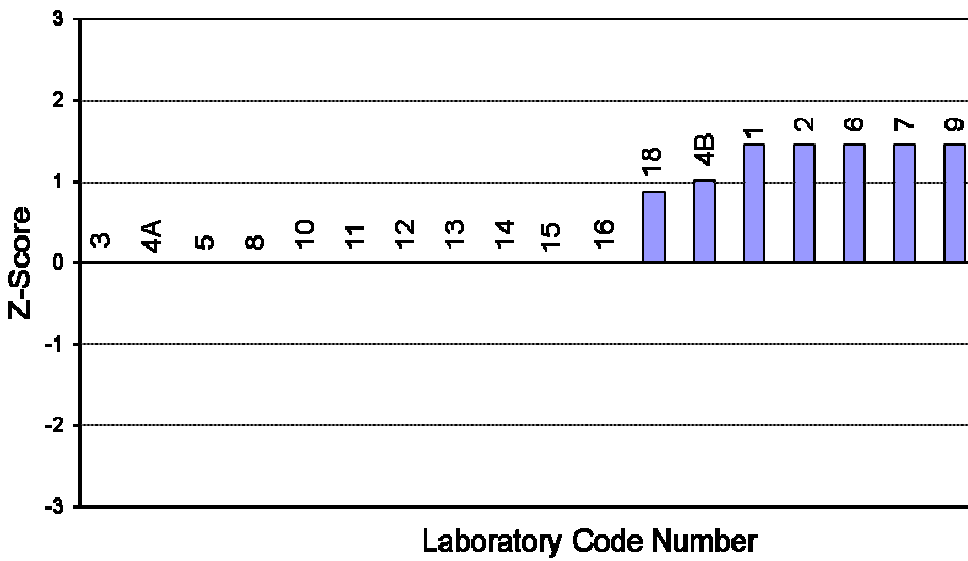
Density (kg/L)

Sample A Z-Score Charts



Density (kg/L)

Sample B Z-Score Charts



Consistency by Brookfield - AS 1580 214.5

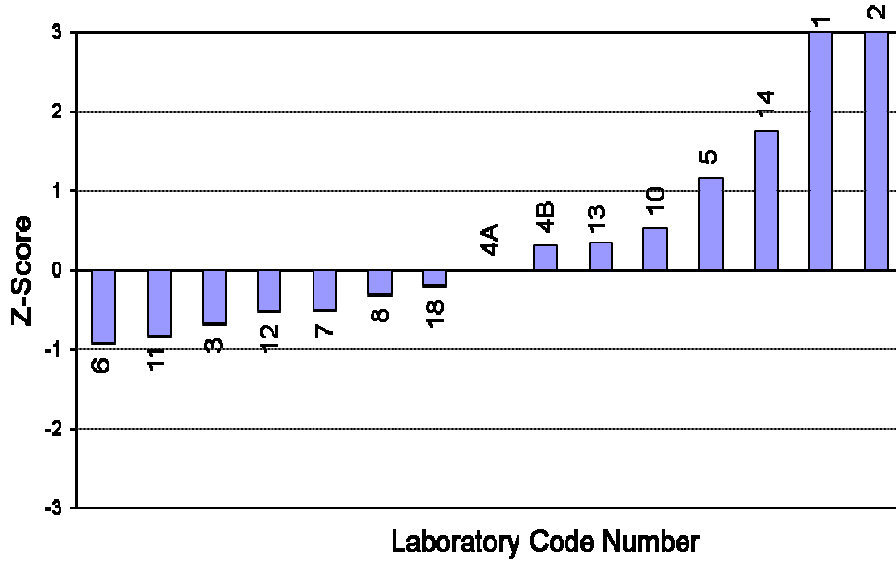
Results by Laboratory Code

Lab Code	Results (KU)		Sample A Robust Z-score ¹		Sample B Robust Z-score ¹
	Sample A	Sample B			
1	2140	2020	10.67 §	☒	14.01 §
2	3520	3600	21.20 §	☒	31.38 §
3	650.00	700.00	-0.69	☒	-0.49
4A	740	770	0.00	☒	0.27
4B	780	770	0.30	☒	0.27
5	892	776	1.16	☒	0.34
6	620.00	640.00	-0.91	☒	-1.15
7	674.16	671.09	-0.50	☒	-0.81
8	700	730	-0.30	☒	-0.16
10	808.00	820.00	0.52	☒	0.82
11	632	632	-0.82	☒	-1.24
12	672.00	672.00	-0.52	☒	-0.80
13	785	745	0.34	☒	0.00
14	970	1130	1.75	☒	4.23 §
18	713.00	678.50	-0.21	☒	-0.73
No of Results:	15	15			
Median:	740.0	745.0			
Normalised IQR:	131.2	91.0			
Robust CV:	17.7%	12.2%			
Minimum:	620.00	632			
Maximum:	3520	3600			
Range:	2900.00	2968			
Uncertainty: (Median)	42.4	29.4			

¹ "§"s denote outliers (i.e. those results for which $|z\text{-score}| \geq 3.0$).

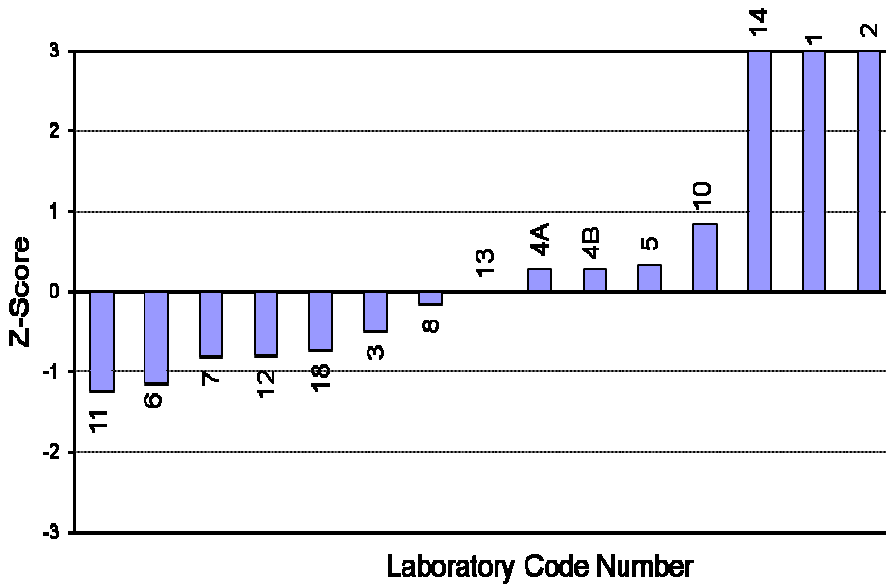
Consistency by Brookfield (cP)

Sample A Z-Score Charts



Consistency by Brookfield (cP)

Sample B Z-Score Charts



Non-volatile Content by Mass - AS 1580 301.1

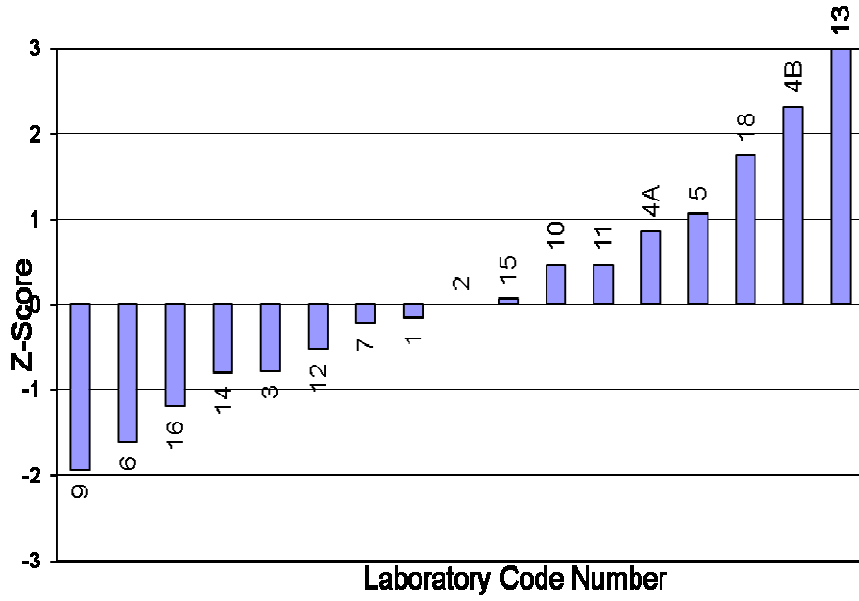
Results by Laboratory Code

Lab Code	Results		Sample A Robust Z-score ¹		Sample B Robust Z-score ¹
	Sample A	Sample B			
1	64.65	64.67	-0.16	█	0.00
2	64.77	64.73	0.00	█	0.05
3	64.18	63.84	-0.78	█	-0.75
4A	65.41	66.92	0.85	█	2.02
4B	66.51	66.87	2.31	█	1.98
5	65.57	65.42	1.06	█	0.67
6	63.56	64.20	-1.61	█	-0.42
7	64.60	64.63	-0.23	█	-0.04
9	63.31	63.32	-1.94	█	-1.21
10	65.12	65.86	0.47	█	1.07
11	65.12	65.09	0.47	█	0.38
12	64.37	64.36	-0.53	█	-0.28
13	69.61	70.42	6.43 §	█	5.17 §
14	64.17	64.64	-0.80	█	-0.03
15	64.82	64.58	0.07	█	-0.08
16	63.87	63.73	-1.20	█	-0.85
18	66.08	66.07	1.74	█	1.26
No of Results:	17	17			
Median:	64.770	64.670			
Normalised IQR:	0.752	█ 1.112			
Robust CV:	1.2%	1.7%			
Minimum:	63.31	63.32			
Maximum:	69.61	70.42			
Range:	6.30	7.10			
Uncertainty: (Median)	0.229	0.338			

¹ "§"s denote outliers (i.e. those results for which $|z\text{-score}| \geq 3.0$).

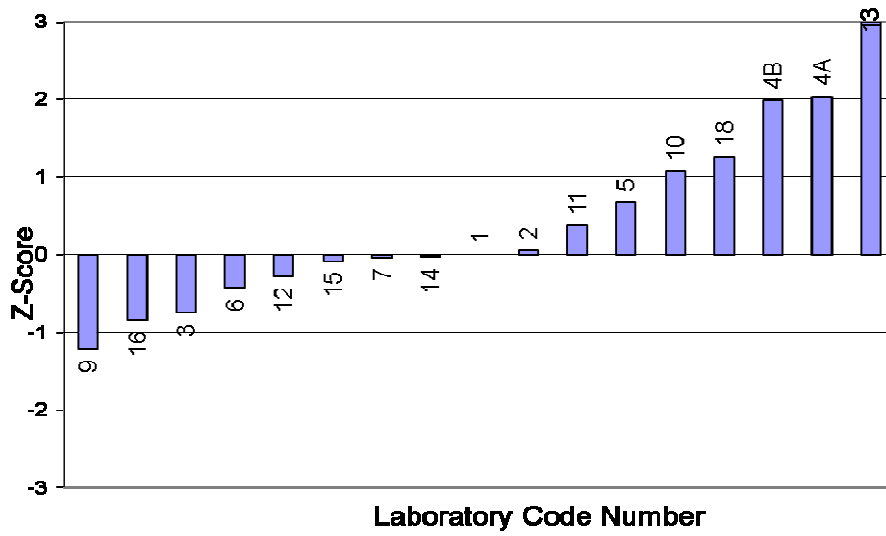
Non-volatile Content by Mass

Sample A Z-Score Charts



Non-volatile Content by Mass

Sample B Z-Score Charts



Fineness of Grind - AS 1580 204.1

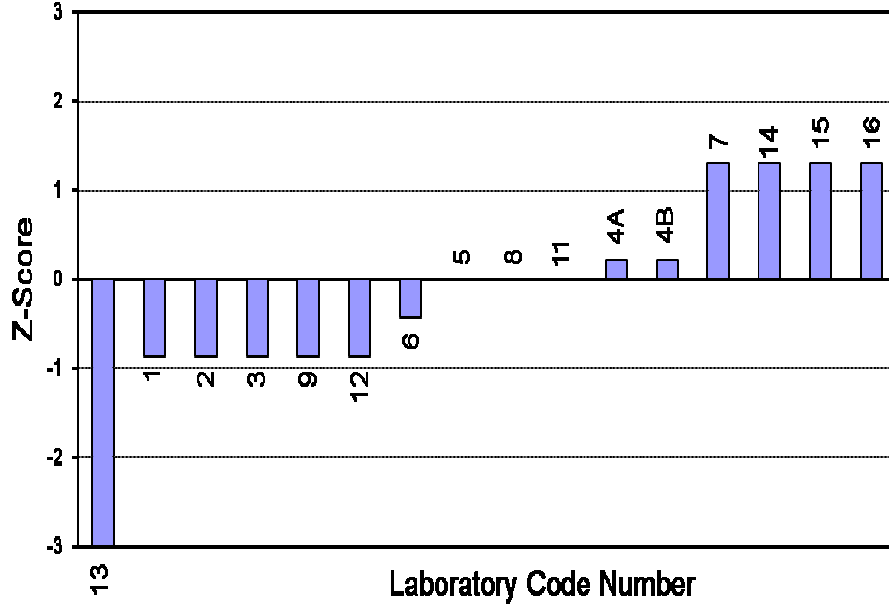
Results by Laboratory Code

Lab Code	Results (μm)		Sample A Robust Z-score ¹	Sample B Robust Z-score ¹
	Sample A	Sample B		
1	10	10	-0.86	▼
2	10	15	-0.86	▼
3	10	10	-0.86	▼
4A	15	15	0.22	▼
4B	15	15	0.22	▼
5	14	17	0.00	▼
6	12	10	-0.43	▼
7	20	20	1.30	▼
8	14	14	0.00	▼
9	10	10	-0.86	▼
11	14	14	0.00	▼
12	10	10	-0.86	▼
13	0	0	-3.02 §	▼
14	20	20	1.30	▼
15	20	20	1.30	▼
16	20	20	1.30	▼
<i>No of Results:</i>	16	16		
<i>Median:</i>	14.0	14.0		
<i>Normalised IQR:</i>	4.6	5.7		
<i>Robust CV:</i>	33.1%	41.0%		
<i>Minimum:</i>	0	0		
<i>Maximum:</i>	20	20		
<i>Range:</i>	20	20		
<i>Uncertainty: (Median)</i>	1.5	1.8		

¹ "§"s denote outliers (i.e. those results for which $|z\text{-score}| \geq 3.0$).

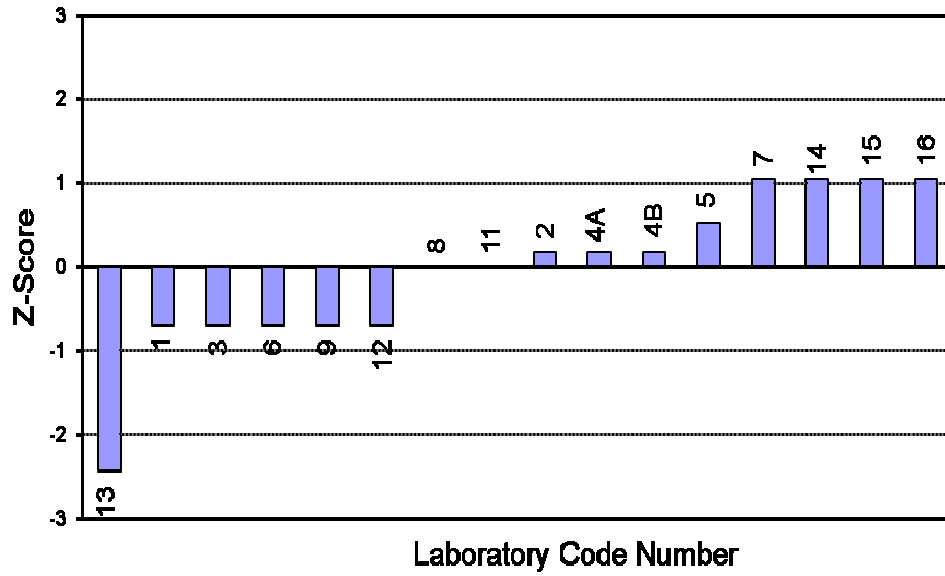
Fineness of Grind (μm)

Sample B Z-Score Charts



Fineness of Grind (μm)

Sample B Z-Score Charts



APPENDIX B

Sample Homogeneity

Prior to sample distribution, ten statistically random samples were selected from a batch of water based gloss white paint and analysed in duplicate for AS.1580.202.1 – Density. The following results were obtained for the purpose of homogeneity testing. The samples were provided and tested by PPG Industries Australia Pty Ltd.

From the statistical analysis of these results, it was considered that the samples were sufficiently homogenous for this round of the program. Therefore, any results later identified as outliers cannot be attributed to any significant sample variability.

	1	2	3	4	5	6	7	8	9	10	Average
Density	1.333	1.337	1.334	1.328	1.336	1.333	1.327	1.334	1.334	1.330	1.333
Density	1.331	1.332	1.337	1.338	1.337	1.338	1.329	1.340	1.336	1.340	1.336

APPENDIX C

Documentation

Instructions to Participants

C1

Results Sheet

C2

PROFICIENCY TESTING AUSTRALIA

Proficiency Testing Program: Paint Round 19

INSTRUCTIONS TO PARTICIPANTS

Please read the following carefully **BEFORE** commencing testing.

Each participant will be supplied with two 500ml tins of polyurethane based paint. These have been labelled "Sample A" and "Sample B".

To ensure the appropriate analysis of results, participants are asked to adhere carefully to the following instructions:

- 1) The following tests are to be performed on samples A and B as per the Results Sheet:
 - (i) AS 1580.202.1 - density
 - (ii) AS 1580.214.5 - consistency by Brookfield
 - (iii) AS 1580.301.1 - non-volatile content by mass
 - (iv) AS 1580.204.1 - fineness of grind
- 2) Determinations on each sample are to be conducted in accordance with the appropriate method (stated on the Results Sheet). All laboratories are also encouraged to attempt those tests not included as part of their routine methods.
- 3) The following specific instructions will apply:
 - a. Report the nominal volume of the pycnometer used for AS1580.202.1.
 - b. Report viscosity and viscometer model used. Report model and spindle to be uses and how many RPM used for AS1580.214.5 (Use spindle X and speed Yrpm).
 - c. For AS 1580.204.1 a 0 – 100 micron gauge should be used.
- 4) For this program your laboratory has been allocated the following code number: «Code» . This is to allow for the confidential treatment of your results in the final report.

PROFICIENCY TESTING AUSTRALIA
Paint Round 19 - Proficiency Testing Program
Results Sheet
Lab «Code»

Test	AS 1580	Sample A	Sample B
Density (report in kg/L to 2 decimal places)	202.1		
Consistency by Brookfield (report in cP to 2 decimal places)	214.5		
Non-volatile Content by Mass (report in % to 2 decimal places)	301.1		
Fineness of Grind (report to the nearest μm)	204.1		

Signed: _____

Date: _____

Results are to be returned to PTA by 29 APRIL 2013.

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