

**Report No. 1132**

**Paint**

**Proficiency Testing Program**

**Round 28**

**May 2019**

**ACKNOWLEDGMENTS**

PTA wishes to gratefully acknowledge the technical assistance that was provided for this program by Ms S Bartlett, Quality Systems. This assistance included preparation and input into the design of the program, technical advice and discussion in the final report. PTA would also like to thank Mr J Rodgers-Falk, the Sherwin-Williams Company, for supplying the samples and discussion in the final report.

© **COPYRIGHT PROFICIENCY TESTING AUSTRALIA 2019**  
PO Box 7507, Silverwater NSW 2128, Australia

## CONTENTS

|  | Page |
|--|------|
| 1 Foreword                             | 1    |
| 2 Features of the Program              | 1    |
| 3 Format of the Appendices             | 2    |
| 4 Statistical Design of the Program    | 2    |
| Table A: Summary of Results            | 4    |
| 5 Statistical Outlier Results          | 4    |
| 6 PTA and Technical Adviser's Comments | 5    |
| 7 References                           | 5    |

### **APPENDIX A - *Results and Data Analysis***

|   |    |
|---|----|
| Wet film thickness by gauge             | A1 |
| Application - brushing                  | A3 |
| Recoating properties                    | A4 |
| Hard dry condition - (mechanical thumb) | A5 |

### **APPENDIX B - *Sample Homogeneity***

|                                      |    |
|--------------------------------------|----|
| Homogeneity Testing                  | B1 |
| Table C: Homogeneity Testing Results | B1 |

### **APPENDIX C - *Documentation***

|                              |    |
|------------------------------|----|
| Instructions to Participants | C1 |
| Results Sheets               | C2 |

## 1. **FOREWORD**

This report summarises the results of the twenty-eighth round of a proficiency testing program covering a series of paint tests. This program is accredited to ISO/IEC 17043:2010 “*Conformity assessment - General requirements for proficiency testing*” by International Accreditation New Zealand (IANZ).

Proficiency Testing Australia (PTA) conducted the program in December 2018. The Program Coordinator was Dr M Li. The Technical Adviser was Ms S Bartlett, Quality Systems. This report was authorised by Mrs K Cividin, PTA Quality Manager. The aim of the program was to assess laboratories’ ability to competently perform the prescribed analyses.

## 2. **FEATURES OF THE PROGRAM**

- (a) Participating laboratories were each supplied with two 500ml tins of paint labelled “PTA Sample A” and “PTA Sample B”.

Laboratories were asked to perform the following consistency analyses on both Samples A and B:

Wet film thickness by gauge

Application-brushing

Recoating properties

Hard dry condition (mechanical thumb)

- (b) A total of 15 laboratories (all from Australia) received samples. Of these 15, 12 laboratories returned their results in time to be included in the final report.
- (c) Laboratories were requested to perform the tests according to the *Instructions to Participants* provided and to record their results on the accompanying *Results Sheet*, which was distributed with the samples. Copies of these documents appear in Appendix C.
- (d) Prior to distribution, randomly selected samples were tested for homogeneity. Based on the results of this testing, it was concluded that the samples were sufficiently homogeneous, and therefore, any results later identified as outliers could not be attributed to any significant sample variability (See Appendix B).
- (e) 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 only.

- (f) Results (as reported by participants) with corresponding summary statistics (i.e. number of results, median, uncertainty of the median, normalised interquartile range, robust coefficient of variation, minimum, maximum and range) are presented in Appendix A. Please note, only results for wet film thickness by gauge were statistically analysed.
- (g) A robust statistical approach, using z-scores, was utilised to assess laboratories' testing performance (see Section 4). Robust z-scores and z-score charts are presented for wet film thickness by gauge in Appendix A.
- (h) The document entitled *Guide to Proficiency Testing Australia, 2016* (reference [1]) defines the statistical terms and details the statistical procedures referred to in this report.

### 3. **FORMAT OF THE APPENDICES**

- (a) Appendix A contains the analysis of results reported by laboratories for the two samples. This section contains the following for each determinant, where appropriate:
  - a table of results and calculated z-scores;
  - a list of summary statistics; and
  - ordered z-score charts;
- (b) Appendix B contains details of the homogeneity testing.
- (c) Appendix C contains copies of the *Instructions to Participants and Results Sheet*.

### 4. **STATISTICAL DESIGN OF THE PROGRAM**

- (a) Outlier Results and Z-scores

In order to assess laboratories' testing performance, a robust statistical approach, using z-scores, was utilised. Z-scores give a measure of how far a result is from the consensus value (i.e. the median), and gives a "score" to each result relative to the other results in the group.

A z-score close to zero indicates that the result agrees well with those from other laboratories, whereas a z-score with an absolute value greater than or equal to 3.0 is considered to be an outlier and is marked by the symbol "S".

## (b) Results Tables and Summary Statistics

Each of these tables contains the results returned by each laboratory, including the method used, and the robust z-score calculated for each result.

A list of summary statistics appears at the bottom of each of the tables of results and consists of:

- the number of results for that test/sample (*No. of Results*);
- the median of these results, i.e. the middle value (*Median*);
- the uncertainty of the median; a robust estimate of the standard deviation of the *Median*;
- the normalised interquartile range of the results (*Normalised IQR*);
- the robust coefficient of variation, expressed as a percentage (*Robust CV*) - i.e.  $100 \times \text{Normalised IQR} / \text{Median}$ ;
- the minimum and maximum laboratory results; and
- the range (*Maximum - Minimum*).

The median is a measure of the centre of the data.

The normalised IQR is a measure of the spread of the results. It is calculated by multiplying the interquartile range (IQR) by a correction factor which converts the IQR to an estimate of the standard deviation. The IQR is the difference between the upper and lower quartiles (i.e. the values above and below which a quarter of the results lie, respectively).

For normally distributed data, the uncertainty of the median is approximated by:

$$\sqrt{\frac{\pi}{2}} \times \frac{\text{normIQR}}{\sqrt{n}} \quad n = \text{number of results}$$

Please see reference [1] for further details on these robust summary statistics.

## (c) Ordered Z-Score Charts

On these charts each laboratory's robust z-score is shown, in order of magnitude, and is marked with its code number. From these charts, each laboratory can readily compare its performance relative to the other laboratories.

These charts contain solid lines at +3.0 and -3.0, so that outliers are clearly identifiable as those laboratories whose "bar" extends beyond these "cut-off" lines.

The y-axis of these charts has been limited, so very large z-scores appear to extend beyond the chart boundary.

Please see reference [1] for further details on these robust summary statistics.

The following table summarises the results submitted by participants for the program.

**TABLE A: SUMMARY OF RESULTS**

| <b>Analyses</b>                          | <b>Sample</b> | <b>Median</b> | <b>Robust CV</b> | <b>No. of Results</b> |
|--|---------------|---------------|------------------|-----------------------|
| Application-brushing                     | A             | n/a           | n/a              | 13                    |
|  | B             | n/a           | n/a              | 12                    |
| Recoating properties                     | A             | n/a           | n/a              | 10                    |
|  | B             | n/a           | n/a              | 10                    |
| Hard dry condition<br>(mechanical thumb) | A             | n/a           | n/a              | 5                     |
|  | B             | n/a           | n/a              | 5                     |
| Wet film thickness<br>by gauge           | A             | 100.00        | 46.3%            | 13                    |
|  | B             | 88.00         | 49.6%            | 12                    |

## **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 reference [1].

## 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.

### *Analysis of Results by Method Groups*

All participants were required to use the AS 1580 *Paints and Related Materials - Methods of Test* series, therefore, results were pooled for analysis.

### *Comments*

In this round, no outliers were detected. On the whole, the study should provide valuable information to participants on the performance of the methods and equipment used.

Wet film thickness by gauge: the results are all grouped tightly around the median. This method has good reproducibility data, which is reflected in the results. No outliers were reported.

Application-brushing: Statistical analysis was not performed. Results are tabulated for comparison only.

Recoating properties: Statistical analysis was not performed. Results are tabulated for comparison only.

Hard dry condition: Statistical analysis was not performed. Results are tabulated for comparison only.

## 7. **REFERENCES**

[1] *Guide to Proficiency Testing Australia*, 2016.

This document can be found on the PTA website at [www.pta.asn.au](http://www.pta.asn.au)

[2] AS 1580.107.3:1997 - *Wet film thickness by gauge*

[3] AS 1580.205.1:1997 - *Application - Brushing*

[4] AS 1580.404.1:1997 - *Recoating properties*

[5] AS 1580.401.6:2002 - *Hard dry condition - (mechanical thumb)*

# APPENDIX A

## Results and Data Analysis

|   |    |
|---|----|
| Wet film thickness by gauge             | A1 |
| Application - Brushing                  | A3 |
| Recoating properties                    | A4 |
| Hard dry condition - (mechanical thumb) | A5 |



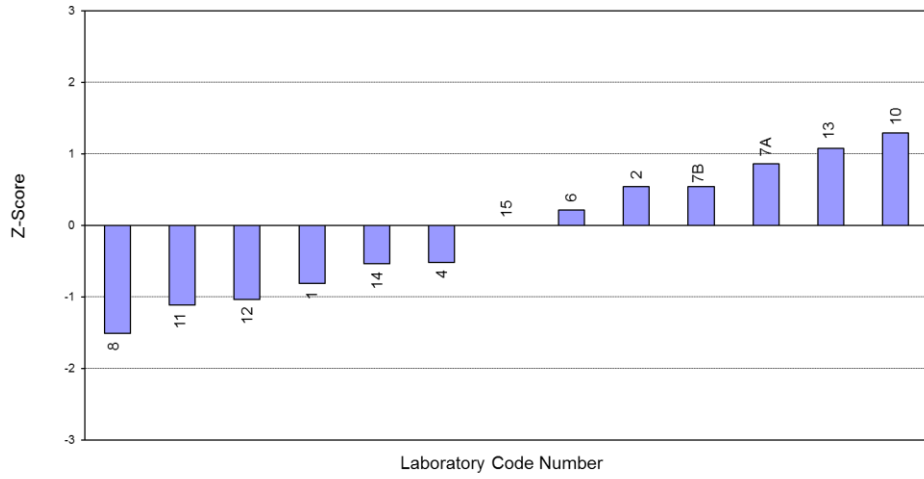
## **Wet film thickness gauge - AS1580.107.3**

### **Results by Laboratory Code**

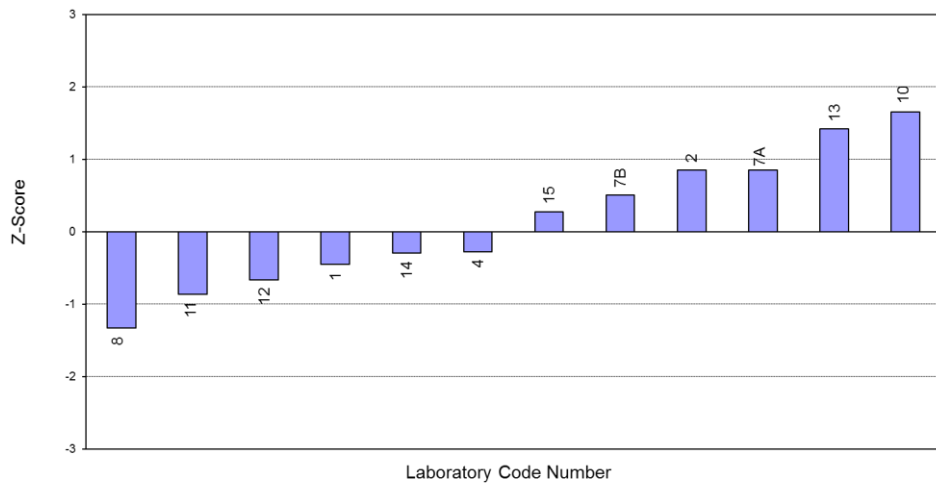
| Lab Code                    | Results  |          | Sample A<br>Robust Z-score | Sample B<br>Robust Z-score |
|-----------------------------|----------|----------|----------------------------|----------------------------|
|                             | Sample A | Sample B |                            |                            |
| 1                           | 62.5     | 68.5     | -0.81                      | -0.45                      |
| 2                           | 125      | 125      | 0.54                       | 0.85                       |
| 4                           | 76       | 76       | -0.52                      | -0.27                      |
| 6                           | 110      | *        | 0.22                       | n/a                        |
| 7A                          | 140.00   | 125.00   | 0.86                       | 0.85                       |
| 7B                          | 125.00   | 110.00   | 0.54                       | 0.50                       |
| 8                           | 30.00    | 30.00    | -1.51                      | -1.33                      |
| 10                          | 160.00   | 160.00   | 1.30                       | 1.65                       |
| 11                          | 48.25    | 50.50    | -1.12                      | -0.86                      |
| 12                          | 52       | 59       | -1.04                      | -0.66                      |
| 13                          | 150      | 150      | 1.08                       | 1.42                       |
| 14                          | 75       | 75       | -0.54                      | -0.30                      |
| 15                          | 100      | 100      | 0.00                       | 0.27                       |
| <i>No of Results:</i>       | 13       | 12       |                            |                            |
| <i>Median:</i>              | 100.00   | 88.00    |                            |                            |
| <i>Normalised IQR:</i>      | 46.33    | 43.64    |                            |                            |
| <i>Robust CV:</i>           | 46.3%    | 49.6%    |                            |                            |
| <i>Minimum:</i>             | 30.0     | 30.0     |                            |                            |
| <i>Maximum:</i>             | 160      | 160      |                            |                            |
| <i>Range:</i>               | 130.0    | 130.0    |                            |                            |
| <i>Uncertainty (Median)</i> | 16.11    | 15.79    |                            |                            |

\*: no result report

**Wet film thickness by gauge  
(Sample A)**



**Wet film thickness by gauge  
(Sample B)**



**Application - brushing - AS 1580.205.1****Results by Laboratory Code**

| Lab Code              | Results  |   |
|-----------------------|--|---|
|                       | Sample A   | Sample B  |
| 1                     | Brush marks level off well to give a film of uniform gloss. Mild streakiness. There are some coarse particles. | Brush marks level off well to give a film of uniform gloss. Mild streakiness. There are some coarse bits. |
| 2                     | no thinner added, WFT-125µm, no defects  | no thinner added, WFT-125µm, no defects   |
| 4                     | Flow: good Drag: good Spreading: good Levelling: Good Bubbling :None Setting up of Paint: good                 | Flow: good Drag: good Spreading: good Levelling: Good Bubbling :None Setting up of Paint: good            |
| 6                     | Noticeable resistance when brushing High gloss level when dry Noticeable brush strokes on finished product     | *   |
| 7A                    | satisfactory, no thinning required   | satisfactory, no thinning required  |
| 7B                    | satisfactory, no thinning required   | satisfactory, no thinning required  |
| 8                     | satisfactory   | satisfactory  |
| 10                    | flow, drag, spreading, levelling, bubbling, setting up: there is no defect                                     | flow, drag, spreading, levelling, bubbling, setting up: there is no defect                                |
| 11                    | satisfactory, no defects   | satisfactory, no defects  |
| 12                    | satisfactory, no defects   | satisfactory, no defects  |
| 13                    | good   | good  |
| 14                    | satisfactory, some grittiness present  | satisfactory, some grittiness present   |
| 15                    | wet film thickness:100µm   | wet film thickness:100µm  |
| <i>No of Results:</i> | 13   | 12  |

Statistical analysis was not performed. Results are tabulated for comparison only.

\*: no results reported

### Recoating properties - AS 1580.404.1

#### Results by Laboratory Code

| Lab Code              | Results   |  |
|-----------------------|---|--|
|                       | Sample A  | Sample B   |
| 1                     | No lifting, cracking, wrinkling or other defects. Passes the scratch test at 1100grams (no scratch through). Adhesion by 408.4 is rated between 1 and 2. May improve with further drying. | No lifting, cracking, wrinkling or other defects. Passes the scratch test at 1000grams. Adhesion by 408.4 is rated between 1 and 2. May improve with further drying. |
| 2                     | no delamination, or cracking, knife test (0), bend test (pass), bend test = 12mm mandrel. scratch test=500g pass  | minor wrinkling, no cracking or delamination, bend test (pass)<br>bend test = 12mm mandrel. scratch test=500g pass   |
| 4                     | No lifting, cracking or wrinkling. Scratch test: pass<br>Bend test: 10mm pass Adhesion test:medium  | No lifting, cracking or wrinkling. Scratch test: pass<br>Bend test: 10mm pass Adhesion test:good   |
| 6                     | n/a   | *  |
| 7A                    | slight wrinkle@24 hrs recoat  | slight wrinkle@24 hrs recoat   |
| 7B                    | slight wrinkle@24 hrs recoat  | slight wrinkle@24 hrs recoat   |
| 8                     | scratch=4N, adhesion=1  | scratch=2N, adhesion=2   |
| 10                    | n/a   | n/a  |
| 11                    | n/a   | n/a  |
| 12                    | satisfactory no lifting, cracking or other defect   | satisfactory no lifting, cracking or other defect  |
| 13                    | bend: pass; appreance: fail; sartch:fail; adhension: pass   | bend: pass; appreance: fail; sartch:fail; adhension: pass  |
| 14                    | pass  | pass   |
| 15                    | wet film thickness: 2x100µm; fail: wrinkling@8h; pass:@20h film seedy, adhesion test: fail  | wet film thickness: 2x100µm; fail: wrinkling@8h; pass:@20h film seedy, adhesion test: fail   |
| <i>No of Results:</i> | 10  | 10   |

Statistical analysis was not performed. Results are tabulated for comparison only.

n/a: not applicable

\*: no results reported

**Hard dry condition  
(mechanical thumb) - AS 1580.401.6  
Results by Laboratory Code**

| Lab Code              | Results  |  |
|-----------------------|--|--|
|                       | Sample A                                       | Sample B   |
| 1                     | No marking after drying for 7 days at ~25 °C.  | No marking after drying for 7 days at ~25 °C. Mild marking of cloth pattern which disappears after about 30 minutes. |
| 2                     | substrate (leneta card). no marking or marring | substrate (leneta card). no marking or marring   |
| 4                     | n/a  | n/a  |
| 6                     | n/a  | *  |
| 7A                    | n/a  | n/a  |
| 7B                    | n/a  | n/a  |
| 8                     | n/a  | n/a  |
| 10                    | n/a  | n/a  |
| 11                    | n/a  | n/a  |
| 12                    | 16 hours no marking marring or distortion      | 16 hours no marking marring or distortion  |
| 13                    | fail   | fail   |
| 14                    | pass after 16 hours                            | pass after 16 hours  |
| 15                    | n/a  | n/a  |
| <i>No of Results:</i> | 5  | 5  |

Statistical analysis was not performed. Results are tabulated for comparison only.

n/a: not applicable

\*: no results reported

# **APPENDIX B**

## **Sample Homogeneity**

## **HOMOGENEITY TESTING**

The samples used in this program were supplied by the Sherwin-Williams Company. Each participant was provided with two samples, labelled Sample A and Sample B.

For this program, five samples were randomly selected, and tested for homogeneity. Statistical analysis showed that the samples were sufficiently homogeneous so that any results identified as outliers could not be attributed to sample variability.

The results of the homogeneity testing, along with the summary statistics are provided in Table C.

**TABLE C**  
**Homogeneity Testing Results**

| Sample        | Density |        |
|---------------|---------|--------|
| 1             | 1.1594  | 1.1592 |
| 2             | 1.1584  | 1.1586 |
| 3             | 1.1574  | 1.1585 |
| 4             | 1.1592  | 1.1586 |
| 5             | 1.1586  | 1.1582 |
| <i>Mean:</i>  | 1.1586  | 1.1586 |
| <i>st dev</i> | 0.001   | 0.000  |
| <i>CV</i>     | 0.1%    | 0.0%   |

# **APPENDIX C**

## **Documentation**

Instructions to Participants

C1

Results Sheets

C2



## PROFICIENCY TESTING AUSTRALIA

### Paint Proficiency Testing Program Round 28

#### INSTRUCTIONS TO PARTICIPANTS

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

Each participant will be supplied with two 500ml tins of paint. These have been labelled "PTA Sample A" and "PTA 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 1580.107.3 - wet film thickness by gauge
  - (ii) AS 1580.205.1 - application - Brushing
  - (iii) AS 1580.401.6 - hard dry condition - (mechanical thumb)
  - (iv) AS 1580.404.1 - recoating properties
- 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) 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.
- 4) Testing may commence as soon as samples are received. Please return results,

**NO LATER THAN 11 January 2019**, to:

|  |
|--|
| Dr Michael LI<br>Proficiency Testing Australia<br>PO Box 7507<br>Silverwater NSW 2128<br>Email: michael.li@pta.asn.au<br>TEL: (02) 9736 8397 FAX: (02) 9743 6664 |
|--|

**PROFICIENCY TESTING AUSTRALIA**

**Paint Proficiency Testing Program Round 28**

**Results Sheet**

**Lab «Code»**

| Test   | AS 1580 | PTA<br>Sample A | PTA<br>Sample B |
|--|---------|-----------------|-----------------|
| Application - brushing   | 205.1   |                 |                 |
| Hard dry condition (mechanical thumb)  | 401.6   |                 |                 |
| Recoating properties   | 404.1   |                 |                 |
| Wet film thickness by gauge<br>(report in $\mu\text{m}$ to 2 decimal places) | 107.3   |                 |                 |

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

Results are to be returned to PTA by 11 January 2019.

Dr Michael LI  
 Proficiency Testing Australia  
 PO Box 7507 Silverwater NSW 2128  
 Email: michael.li@pta.asn.au TEL: (02) 9736 8397 FAX: (02) 9743 6664

**-- End of Report --**