



Report No.1013

Paint - Round 25

Proficiency Testing Program

March 2017

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, Valspar Paint Australia, for supplying the samples.

© **COPYRIGHT PROFICIENCY TESTING AUSTRALIA 2017**

PO Box 7507, Silverwater NSW 2128, Australia

CONTENTS

	Page
1 Foreword	1
2 Statistical Design of the Program	1
3 Features of the Program	1
4 Summary of Results	2
5 Statistical Outlier Results	2
6 PTA and Technical Adviser's Comments	3
7 References	4
APPENDIX A - Results and Data Analysis	
Determination of pencil hardness of a paint film	A1
Resistance to impact – Falling weight test	A2
Adhesion (cross cut)	A3
Measurement of specular gloss (60°)	A4
Measurement of specular gloss (85°)	A6
APPENDIX B - Sample Homogeneity	
Homogeneity Testing	B1
APPENDIX B - Documentation	
Instructions to Participants	C1
Results Sheets	C3

1. **FOREWORD**

This report summarises the results of the 25th round of a proficiency testing program covering a series of paint tests (to AS1580).

Proficiency Testing Australia (PTA) conducted the program in December 2016. 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 Coordinator/Senior Scientific Officer. The aim of the program was to assess laboratories' ability to competently perform the prescribed analyses.

2. **STATISTICAL DESIGN OF THE PROGRAM**

For the Measurement of specular gloss tests, robust statistical procedures were used to generate the z-scores and summary statistics - number of results, median, normalised interquartile range, robust coefficient of variation, minimum, maximum and range.

3. **FEATURES OF THE PROGRAM**

- (a) A total of fifteen laboratories received samples, with fourteen laboratories returning results.
- (b) Each participant was supplied with two pre-coated panels labelled "Sample A" and "Sample B"
- (c) Laboratories were asked to perform the following consistency analyses on both samples A and B:
 - (i) AS1580.405.1 Determination of pencil hardness of a paint film
 - (ii) AS1580.406.1 Resistance to impact - Falling weight test (Gardner type)
 - (iii) AS1580.408.4 Adhesion (crosscut)
 - (iv) AS1580.602.2 Measurement of specular gloss
- (d) Prior to sample distribution, eight randomly selected samples were analysed for homogeneity (See 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.

Copies of the "Instructions to Participants" and "Results Sheets" are given in Appendix C.

4. SUMMARY OF RESULTS

TABLE A: SUMMARY OF RESULTS

Analyses	Sample	Median	Robust CV	No. of Results
Determination of pencil hardness of a paint film	A	n/a	n/a	13
	B	n/a	n/a	13
Resistance to impact – Fallingweight test (m/kg)	A	n/a	n/a	10
	B	n/a	n/a	10
Adhesion (cross cut)	A	n/a	n/a	12
	B	n/a	n/a	12
Measurement of specular gloss (60°)	A	39.70	2.1%	17
	B	39.70	1.9%	17
Measurement of specular gloss (85°)	A	75.00	1.9%	13
	B	75.00	2.0%	13

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 (2016)*¹.

TABLE B: OUTLIER RESULTS

Test	Z-Score Outlier (Laboratory Codes)	
	Sample A	Sample B
Determination of pencil hardness of a paint film	n/a	n/a
Resistance to impact – Falling weight test	10A,10B,10C	10A,10B,10C
Adhesion (cross cut)	10A,10B,10C,10D	10A,10B,10C,10D
Measurement of specular gloss (60°)	5, 6, 15	5, 6, 15
Measurement of specular gloss (85°)	5, 6, 15	2, 5, 6, 15

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 below.

Test	Uncertainty of the Median	
	Sample A	Sample B
Measurement of specular gloss(60°)	Sample A	0.25
	Sample B	0.23
Measurement of specular gloss(85°)	Sample A	0.49
	Sample B	0.52

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 eight laboratories with outliers. These 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.

Laboratory codes 5, 6 and 15 reported six z-score outliers for the measurement of specular gloss (60°). Laboratory codes 2, 5, 6 and 15 reported six z-score outliers for the measurement of specular gloss (85°).

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

Statistical analysis was not performed on the Determination of pencil hardness of paint film, Resistance to impact - Falling weight test, or Adhesion due to their nature. The results for these tests are tabulated for comparison between laboratories only.

For the Determination of pencil hardness of paint film test, the results should be 2H, and results between 1H and 4H are satisfactory. The results of 6H and 8H are questionable.

For the Resistance to impact - Falling weight test, the results should be no failure (cracking, adhesion loss) at 17J (lim) with the height and mass used. All but one laboratory reported the two figures for mass and height. The spread of results for limiting impact energy was 16.6 to 17.05J. One laboratory has not tested to the maximum where the film maintains integrity. This may be a limitation of the equipment. The results for defects such as 'no cracking or adhesion loss' are satisfactory. The results for defects such as 'pass' are unsatisfactory.

For the Adhesion (cross cut) test, the laboratories should report the result of the test (numerical) along with the brand name, grade and the stated adhesion strength of the tape used. The tape adhesion strength should be 6.0 to 7.5 Nm. The test results should be 0 or 1 using the scale in the method. Results of 'pass' are unsatisfactory. The result of 380 lb/inch is unusual. The use of tape with strength of 10+/-1Nm tape is incorrect. There were eight reporting errors in this test.

7. REFERENCES

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

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

[2] AS1580.405.1 *Determination of pencil hardness of a paint film.*

[3] AS1580.406.1 *Resistance to impact - Falling weight test (Gardner type).*

[4] AS1580.408.4 *Adhesion (crosscut).*

[5] AS1580.602.2 *Measurement of specular gloss.*

APPENDIX A

Results and Data Analysis

Determination of pencil hardness of a paint film	A1
Resistance to impact – Falling weight test	A2
Adhesion (cross cut)	A3
Measurement of specular gloss (60°)	A4
Measurement of specular gloss (85°)	A6

**Determination of pencil hardness
of paint film-AS 1580.405.1
Results by Laboratory Code**

Lab Code	Results			
	Sample A		Sample B	
1	4H		4H	
2	3H		3H	
4	2H		2H	
7	6H	?	6H	?
8	2H		2H	
9	4H		4H	
10A	2H		2H	
10B	2H		2H	
10C	2H		2H	
10D	2H		2H	
12	2H		2H	
13	>8H	?	>8H	?
14	3H		3H	
<i>No of Results:</i>		13		

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

"?"denotes a questionable result (i.e. 6H & 8H).

**Resistance to impact – Falling weight test
(Gardner type) (m/kg) - AS 1580.406.1
Results by Laboratory Code**

Lab Code	Results	
	Sample A	Sample B
2	Fail (stopping at 1 point or 2 points)	No defects
4	no cracking or adhesive failure	no cracking or adhesive failure
7	no removal 5/5 tests	no removal 5/5 tests
9	no removal of paint film on direct and reverse impact	no removal of paint film on direct and reverse impact
10A	pass	pass
10B	pass	pass
10C	cracking:pass	cracking:pass /adhesion pass
10D	no failure occurs at 20J(101mm 2kg)	cracking:no failure /adhesive: 2 of 3 failure
12	no cracking, crazing, stripping or loss of adhesion	no cracking, crazing, stripping or loss of adhesion
13	no failure	no failure
<i>No of Results:</i>	10	10

Statistical analysis was not performed. Results are tabulated for comparison only. "§" denotes outliers (i.e. those results which are unsatisfactory).

Adhesion (cross cut) - AS 1580.408.4

Results by Laboratory Code

Lab Code	Results			
	Sample A		Sample B	
1	0		0	
2	0		0	
7	0		0	
8	0		0	
9	0		0	
10A	pass	§	pass	§
10B	pass	§	pass	§
10C	pass	§	pass	§
10D	pass	§	pass	§
12	0		0	
13	0		0	
14	0		0	
<i>No of Results:</i>	12		12	

Statistical analysis was not performed. Results are tabulated for comparison only. "§" denotes outliers (i.e. those results which are unsatisfactory).

Measurement of specular gloss (60°) - AS1580.60 2.2

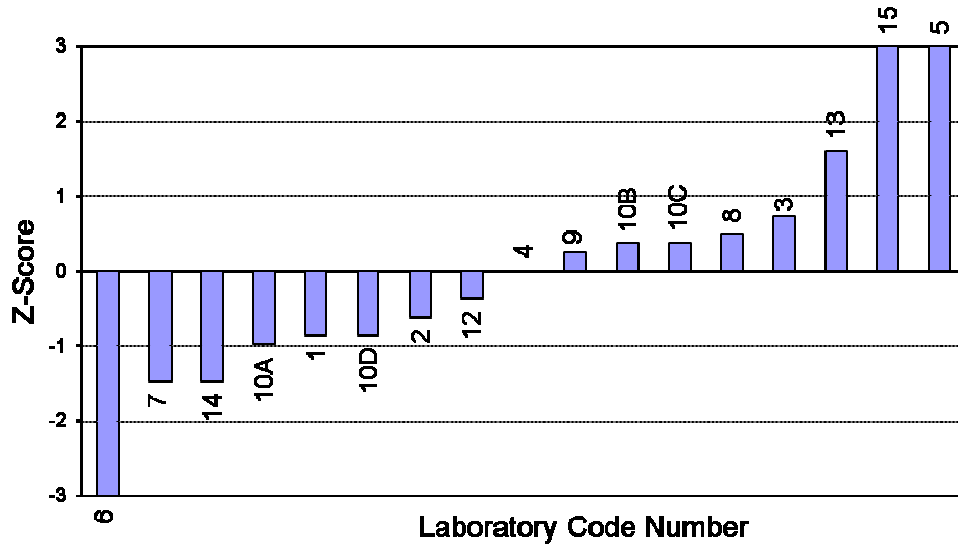
Results by Laboratory Code

Lab Code	Results		Sample A Robust Z-score ¹	Sample B Robust Z-score ¹
	Sample A	Sample B		
1	39.0	39.7	-0.86	0.00
2	39.2	38.1	-0.61	-2.16
3	40.3	40	0.74	0.40
4	39.7	40.0	0.00	0.40
5	297	297	315.54 §	347.09 §
6	9.3	10.3	-37.28 §	-39.66 §
7	38.5	38.3	-1.47	-1.89
8	40.1	39.7	0.49	0.00
9	39.9	40.3	0.25	0.81
10A	38.9	39.5	-0.98	-0.27
10B	40	39	0.37	-0.94
10C	40	39	0.37	-0.94
10D	39	40	-0.86	0.40
12	39.4	40.9	-0.37	1.62
13	41.0	39.9	1.59	0.27
14	38.5	38.4	-1.47	-1.75
15	43.9	43.6	5.15 §	5.26 §
<i>No of Results:</i>	17	17		
<i>Median:</i>	39.70	39.70		
<i>Normalised IQR:</i>	0.82	0.74		
<i>Robust CV:</i>	2.1%	1.9%		
<i>Minimum:</i>	9.3	10.3		
<i>Maximum:</i>	297	297		
<i>Range:</i>	287.7	286.7		
<i>Uncertainty (Median)</i>	0.25	0.23		

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

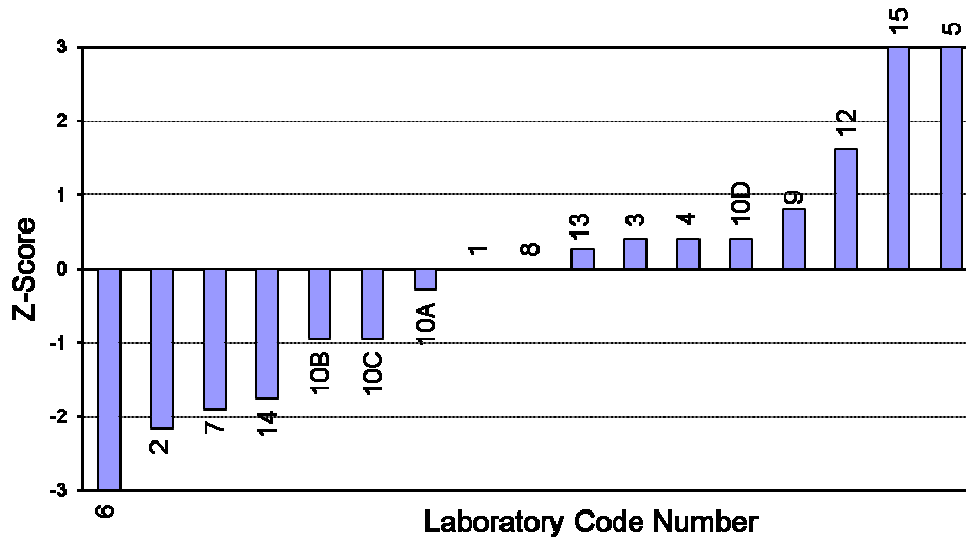
Measurement of specular gloss (60°)

Sample A Z-Score Charts



Measurement of specular gloss (60°)

Sample B Z-Score Charts



Measurement of specular gloss (85°) - AS1580.60 2.2

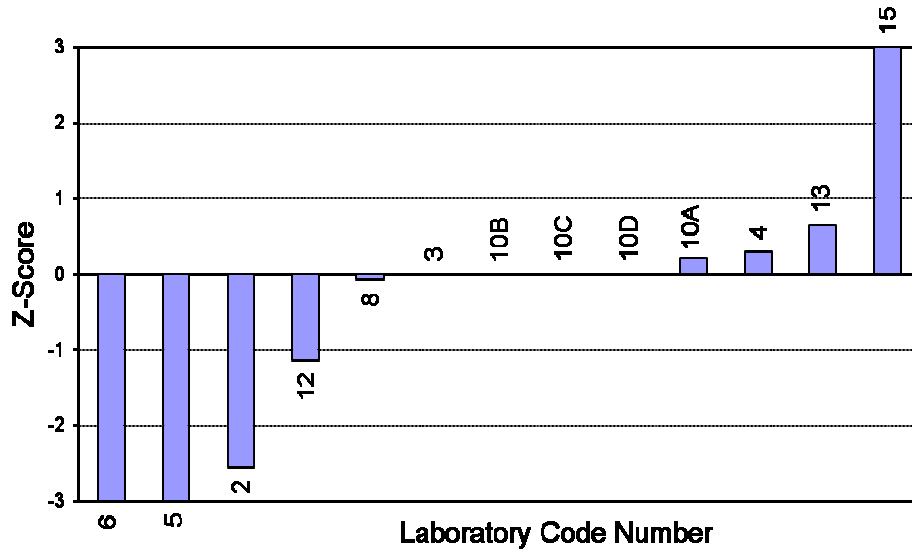
Results by Laboratory Code

Lab Code	Results		Sample A Robust Z-score ¹	Sample B Robust Z-score ¹
	Sample A	Sample B		
2	71.4	70.5	-2.56	-3.04 §
3	75	74.8	0.00	-0.13
4	75.4	76.7	0.28	1.15
5	33	32	-29.82 §	-29.00 §
6	11.6	11.7	-45.01 §	-42.70 §
8	74.9	75.4	-0.07	0.27
10A	75.3	76	0.21	0.67
10B	75	75	0.00	0.00
10C	75	75	0.00	0.00
10D	75	76	0.00	0.67
12	73.4	74.0	-1.14	-0.67
13	75.9	74.2	0.64	-0.54
15	82.9	81.6	5.61 §	4.45 §
<i>No of Results:</i>	13	13		
<i>Median:</i>	75.00	75.00		
<i>Normalised IQR:</i>	1.41	1.48		
<i>Robust CV:</i>	1.9%	2.0%		
<i>Minimum:</i>	11.6	11.7		
<i>Maximum:</i>	82.9	81.6		
<i>Range:</i>	71.3	69.9		
<i>Uncertainty (Median)</i>	0.49	0.52		

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

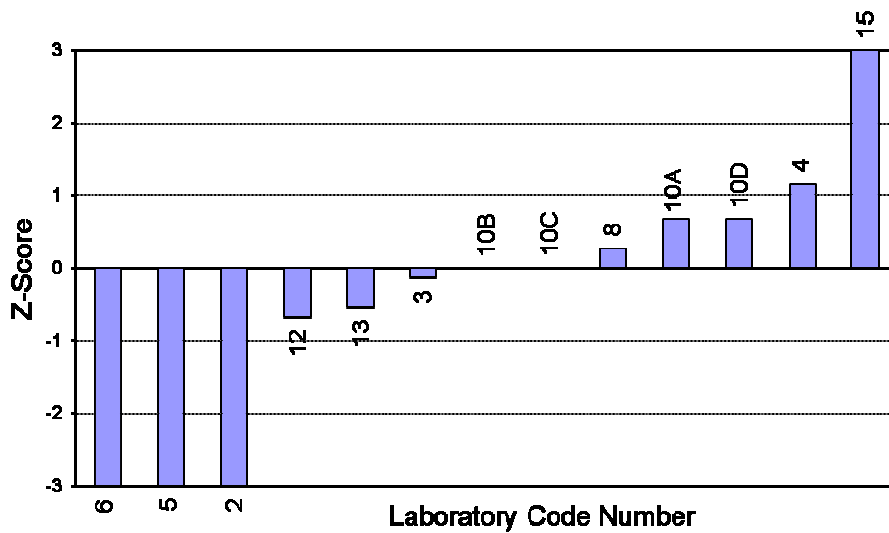
Measurement of specular gloss (85°)

Sample A Z-Score Charts



Measurement of specular gloss (85°)

Sample B Z-Score Charts



APPENDIX B

Sample Homogeneity

HOMOGENEITY TESTING

The samples utilised in this program were supplied by Valspar Paint Australia. Each participant was provided with one sample.

For this program, 8 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.

APPENDIX C

Documentation

Instructions to Participants

C1

Results Sheet

C3

PROFICIENCY TESTING AUSTRALIA

Proficiency Testing Program: Paint Round 25

INSTRUCTIONS TO PARTICIPANTS

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

Two pre-coated panels labelled "Sample A" and "Sample B" are supplied to each participant.

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) AS1580.405.1 Determination of pencil hardness of a paint film
 - (ii) AS1580.406.1 Resistance to impact - Falling weight test (Gardner type)
 - (iii) AS1580.408.4 Adhesion (crosscut)
 - (iv) AS1580.602.2 Measurement of specular gloss
- 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:
 - (i) AS1580.405.1 Determination of pencil hardness of a paint film: note item 9(d) and report the manufacturer of the leads.
 - (ii) AS1580.406.1 Resistance to impact-Falling weight test (Gardner type): the Dry Film Thickness test under 9.1 is not required; 9.2 Method A is specified; also note under item 9.2(d) shall apply (i.e. duplicate tests); note that the force required is 17J; note to report the indenter mass and drop height as per item 10 (h).
 - (iii) AS1580.408.4 Adhesion (crosscut)-step 9 (b) shall be ignored; information at 10(j) is required.
 - (iv) AS1580.602.2 Measurement of specular gloss - readings shall be taken with 60° & 85° angles of incidence as per 10.2; all readings and the mean shall be reported; the model of gloss meter shall be reported.
 - (v) With respect to the steel panels the following should be noted: care should be taken when handling steel panels as the edges may be sharp; the test panel shall be wiped with a damp cloth containing methylated spirits and allowed to dry for 15 minutes before any testing commences.

- 4) For this program your laboratory has been allocated the code number This is to allow for the confidential treatment of your results in the final report.

Results are to be returned to PTA by 23 December 2016.

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

PROFICIENCY TESTING AUSTRALIA
Paint Round 25 - Proficiency Testing Program
Lab Code: «Code»
Results Sheet

Test	Method	Sample A	Special Testing/Requirement
Determination of pencil hardness of a paint film	AS1580.405.1		manufacturer of the leads:
Resistance to impact – Falling weight test (Gardner type) (m/kg)	AS1580.406.1		indenter mass: drop height:
Adhesion (crosscut)	AS1580.408.4		brand name: grade & adhesion strength of tape:
Measurement of specular gloss (60°)	AS1580.602.2		model of gloss meter:
Measurement of specular gloss (85°)	AS1580.602.2		model of gloss meter:

Name of Operator: _____ **Signed:** _____ **Date:** _____

Results are to be returned to PTA by 23 December 2016.

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

PROFICIENCY TESTING AUSTRALIA

Paint Round 25 - Proficiency Testing Program

Lab Code: «Code»

Results Sheet

Test	Method	Sample B	Special Testing/Requirement
Determination of pencil hardness of a paint film	AS1580.405.1		manufacturer of the leads:
Resistance to impact – Falling weight test (Gardner type) (m/kg)	AS1580.406.1		indenter mass: drop height:
Adhesion (crosscut)	AS1580.408.4		brand name: grade & adhesion strength of tape:
Measurement of specular gloss (60°)	AS1580.602.2		model of gloss meter:
Measurement of specular gloss (85°)	AS1580.602.2		model of gloss meter:

Name of Operator: _____ **Signed:** _____ **Date:** _____

Results are to be returned to PTA by 23 December 2016.

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 --