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ASTM E1086

ANALYSIS OF AUSTENITIC STAINLESS STEEL BY SPARK ATOMIC EMISSION SPECTROMETRY

Program: SQ-0072

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Prepared by:  cn=SERGIO E. ANDRADA, o=PT SOUTH QUALITY SAS, ou=PT SOUTH QUALITY SAS, email=tech@ptsouthquality .com, c=AR 2026.09.03 14:23:39 -03'00'	Reviewed by:  cn=ALFREDO M. SCHMIDT, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=aschmidt@ptsouthq uality.com, c=AR 2026.09.04 10:19:13 -03'00'	Approved by:  cn=Emiliano Medina, o=SOUTH QUALITY, ou=PT SOUTH QUALITY SAS, email=quality@ptsouthqua lity.com, c=ES 2026.09.04 16:50:40 -03'00'
Sergio Andrada Assistant Technician	Eng. Alfredo Schmidt Metallurgical expert	Eng. Emiliano Medina Quality Assurance Lead

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1. FOREWORD

This report summarizes the results of the **SQ-0072** proficiency testing program on the determination of the composition of austenitic stainless steel by spark atomic emission spectrometry. This program is conducted in a bilateral format, following the “split-sample” design described in clause A.4.2 of ISO/IEC 17043: 2023 (Alternative interlaboratory comparisons).

South Quality conducted the testing program in August 2026 with the aim of assessing the laboratory's ability to competently perform the designated tests.

2. ORGANIZATION

Program Coordinator:	Eng. Alfredo Schmidt
Assistant Technician:	Sergio Andrada
Statistics:	Lic. Manuel Tozaki
Supervision:	Eng. Emiliano Medina

3. OBJECTIVE

The objective of this proficiency testing program is to determine the composition of austenitic stainless steels, using the following standard:

Standard
ASTM E1086: 2022

To verify this, austenitic stainless steel samples were selected.

Participants in this program have not been previously informed about the expected values or value ranges of the samples they receive.

4. PARTICIPANT

Company:	SIRIM QAS INTERNATIONAL SDN BHD
Laboratory:	MATERIALS ENGINEERING LAB (MEL)
Country:	Malaysia
Client ID:	S326
Contact person:	Aina Afiqah Ruzide Testing Executive ainaafigah@sirim.my

5. HOMOGENEITY

Several batches were prepared identically by the staff at South Quality.

Subsequently, a homogeneity study was conducted with an ISO 17025 accredited laboratory.

The control process followed ISO 33405: 2024, clauses 7.4.1.1 / 7.4.1.2. Stratified random sampling was applied, and samples were selected using random number generation software.

The results of this test are presented below:

Size of each batch: **50 units**

Tested samples from each batch: **10 units**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM2817	BATCH: LM2818	BATCH: LM2819
MASS FRACTION	YES	YES	YES

Size of each batch: **50 units**

Tested samples from each batch: **10 units**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM2909	BATCH: LM2910	BATCH: LM2911
MASS FRACTION	YES	YES	NO

Samples for this program are taken from the selected batches identified as **LM2818** and **LM2909**.

For the indicated batches, the values determined in the homogeneity study are utilized as the assigned values.

The analysis of the test data indicated that the selected samples exhibited sufficient homogeneity for the program. Therefore, the results of participants identified as outliers cannot be attributed to sample variability.

6. SAMPLE INFORMATION

The following samples were sent for testing:

Batch:	LM2818
Sample ID:	14
Characteristics:	Austenitic stainless steel (AISI 304) - Ø 25.4 x 20 mm

Batch:	LM2909
Sample ID:	18
Characteristics:	Austenitic stainless steel (AISI 304) - 100 x 16 x 6.2 mm

7. IMAGES



8. ASSIGNED VALUES

BATCH	MASS FRACTION, % (Standard deviation)				
	CHROMIUM	NICKEL	MOLYBDENUM	MANGANESE	SILICON
LM2818	18.726 (0.725)	8.289 (0.652)	0.309 (0.025)	1.526 (0.092)	0.475 (0.048)
LM2909	17.903 (0.788)	7.605 (0.596)	0.032 (0.009)	1.519 (0.085)	0.399 (0.045)

BATCH	MASS FRACTION, % (Standard deviation)			
	COPPER	CARBON	PHOSPHORUS	SULFUR
LM2818	0.521 (0.042)	0.024 (0.003)	0.039 (0.004)	0.029 (0.006)
LM2909	0.046 (0.008)	0.026 (0.0040)	0.026 (0.005)	0.002 (0.001)

9. PARTICIPANT RESULTS (SEE APPENDIX)

CODE	MASS FRACTION, %				
	CHROMIUM	NICKEL	MOLYBDENUM	MANGANESE	SILICON
LM2818-14	18.914	8.321	0.315	1.595	0.426
LM2909-18	17.878	7.673	0.027	1.562	0.374

CODE	MASS FRACTION, %			
	COPPER	CARBON	PHOSPHORUS	SULFUR
LM2818-14	0.57	0.023	0.037	0.032
LM2909-18	0.051	0.023	0.023	0.003

10. STATISTICS

The results must be treated as quantitative.

According to B.4.1.3 of ISO 17043 the appropriate technique is to compare participant results with the assigned values. The results can be compared using z score.

$$z = \frac{x - X}{\hat{\sigma}}$$

x is the participant's result

X is the assigned value

$\hat{\sigma}$ is the standard deviation

The performance evaluation of each sample is carried out with the following criteria:

$|z| \leq 2.0$ indicates "satisfactory" performance and generates no signal;

$2.0 < |z| < 3.0$ indicates "questionable" performance and generates a warning signal;

$|z| \geq 3.0$ indicates "unsatisfactory" performance and generates an action signal;

11. EVALUATION OF PERFORMANCE

A. BATCH LM2818

ELEMENT	MASS FRACTION, %		z score	PERFORMANCE RESULT
	PARTICIPANT RESULT	ASSIGNED VALUE		
CHROMIUM	18.914	18.726	0.26	SATISFACTORY
NICKEL	8.321	8.289	0.05	SATISFACTORY
MOLYBDENUM	0.315	0.309	0.24	SATISFACTORY
MANGANESE	1.595	1.526	0.75	SATISFACTORY
SILICON	0.426	0.475	1.02	SATISFACTORY
COPPER	0.570	0.521	1.17	SATISFACTORY
CARBON	0.023	0.024	0.33	SATISFACTORY
PHOSPHORUS	0.037	0.039	0.50	SATISFACTORY
SULFUR	0.032	0.029	0.50	SATISFACTORY

B. BATCH LM2909

ELEMENT	MASS FRACTION, %		z score	PERFORMANCE RESULT
	PARTICIPANT RESULT	ASSIGNED VALUE		
CHROMIUM	17.878	17.903	0.03	SATISFACTORY
NICKEL	7.673	7.605	0.11	SATISFACTORY
MOLYBDENUM	0.027	0.032	0.56	SATISFACTORY
MANGANESE	1.562	1.519	0.51	SATISFACTORY
SILICON	0.374	0.399	0.56	SATISFACTORY
COPPER	0.051	0.046	0.63	SATISFACTORY
CARBON	0.023	0.026	0.75	SATISFACTORY
PHOSPHORUS	0.023	0.026	0.60	SATISFACTORY
SULFUR	0.003	0.002	1.00	SATISFACTORY

12. CONCLUSIONS

The overall performance on this **SQ-0072** program from the participant laboratory **SIRIM QAS INTERNATIONAL SDN BHD - MATERIALS ENGINEERING LAB (MEL)**, is **SUFFICIENT** based on expected results.

The criteria used for the evaluation of the overall performance are the following:

- **SUFFICIENT** performance: No unsatisfactory/questionable results were obtained.
- **ALMOST SUFFICIENT** performance: No unsatisfactory results were obtained, but one questionable result was found.
- **INSUFFICIENT** performance: An unsatisfactory result or two questionable results were obtained.

APPENDIX

PARTICIPANT RESULTS

(Results form)



INSTRUCTIONS & RESULTS FORM

PROGRAM:	Analysis of austenitic stainless steel by spark atomic emission spectrometry
CODE:	SQ-0072
VERSION:	-
STANDARD:	ASTM E1086
COORDINATOR:	Eng. Alfredo Schmidt (aschmidt@ptsouthquality.com)

1 - General

This document serves as a guide for managing the results of the **SQ-0072** program.

Results must be typed, not handwritten.

2 - Standard

ASTM E1086: 2022

3 - Tests involved

TEST
Determination of composition of austenitic stainless steel by spark atomic emission spectrometry

4 - Samples

CODE	SAMPLE	QUANTITY
LM2818-14	Austenitic stainless steel - Ø 25.4 x 20 mm	1
LM2909-18	Austenitic stainless steel - 100 x 16 x 6.2 mm	1

5 - Notes

- a) Being a bilateral program, there is no deadline for submitting results.
- b) The tables in this document may be modified by the participant, if desired, to include data or observations.
- c) The samples are to be handled as routine lab samples, with all testing, documentation, and reporting adhering to **ASTM E1086**.
- d) For **LM2818** samples, verification can be performed on either side.
- e) For **LM2909** samples, verification must be performed on the opposite side of the ID.
- f) Participants may improve the surface to obtain better testing conditions. If so, the procedure must be detailed in the 'Observations' box.
- g) Samples must be retained until the end of the program, which concludes with the submission of the final report.
- h) To review the results, test images would be appreciated. Images can be attached at the end of this document or sent by email.
- i) Once this document is completed, it must be converted into a PDF file and sent to the program coordinator.

6 - Test conditions

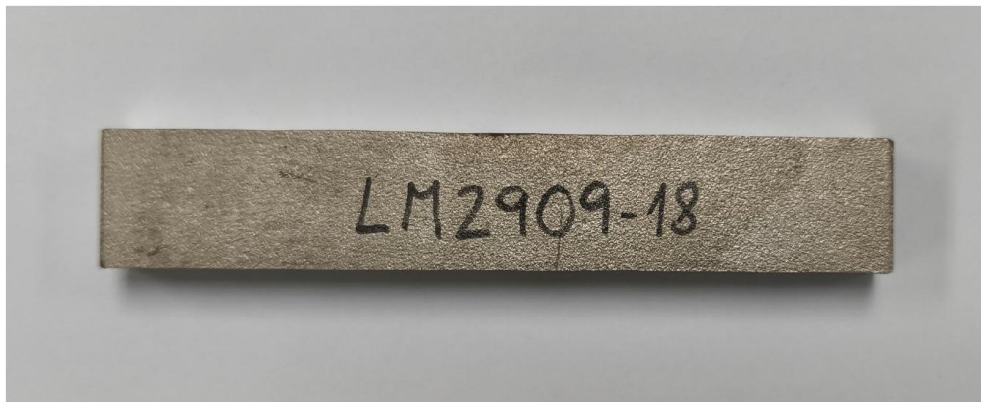
Procedure:	According to standard
Final grinding:	80-grit

7 - Test results

ELEMENT	MASS FRACTION, %	
	LM2818-14	LM2909-18
CHROMIUM	18.914	17.878
NICKEL	8.321	7.673
MOLYBDENUM	0.315	0.027
MANGANESE	1.595	1.562
SILICON	0.426	0.374
COPPER	0.570	0.051
CARBON	0.023	0.023
PHOSPHORUS	0.037	0.023
SULFUR	0.032	0.003

OBSERVATIONS
Test Procedure: - Initially, grind the specimens' surface with a 50-grit to 80-grit abrasive belt or disc (wet or dry) or mill the surface to ensure that the specimens are free from voids and pits in the region to be measured. - The specimens are refinished dry on an abrasive belt or disc before being remeasured on the same area. - Place the prepared surface of the specimen on the sample stand so that the measurement will impinge on a location known to be representative of the entire specimen. - Repeat the step 3 for at least 3 to 5 measurement and report the average results. Based on the test conducted on sample marked with LM2818-14, the value of each element is equivalent to the certified reference material (CRM) BS 304. While, for sample marked with LM2909-18, the value of each element is equivalent to CRM BS 321C. In conclusion, both samples are stainless steel since the value of Chromium and Nickel are high and its equivalent to material grade for stainless steel.

PHOTOGRAPHS



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