

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ



บริษัท ยูโนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3540	Jiranatee Associates Co., Ltd.	COF-045-67	4 Nov 24	3 Nov 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1252	11 Apr 24	10 Apr 25	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co., Ltd.	24-AFM-173	28 Aug 24	27 Aug 25	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1367	22 Apr 24	21 Apr 25	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H753	10 Apr 24	9 Apr 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thermo Scientific	GS2312-10105-1 2010-06	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
2	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thermo Scientific	GS2312-10105-1 2010-17	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
3	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Enviromental	TE-5170DX 1049	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
4	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Enviromental	TE-5170DX 1050	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
5	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Enviromental	TE-5170DX 1051	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
6	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1 2010-01	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
7	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1 2010-03	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
8	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1 2010-04	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
9	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1 2010-05	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-
10	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1	Jiranatee Associates Co., Ltd.	Ref. No.3540	4 Nov 24	3 Nov 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 42C-0508011076	UAE Consultant Co.,Ltd.	04102024	4 Oct 24	3 Oct 25	-
2	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Electron	42C 0517512001	UAE Consultant Co.,Ltd.	111102024	11 Oct 24	10 Oct 25	-
3	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co.,Ltd.	17092024	17 Sep 24	16 Sep 25	-
4	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co.,Ltd.	20092024	20 Sep 24	19 Sep 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co.,Ltd.	17092024	17 Sep 24	16 Sep 25	-
6	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387061	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
2	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
3	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387066	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
4	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387067	UAE Consultant Co.,Ltd.	15052024	15 May 24	14 May 25	-
5	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
6	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Wind Speed/Wind Direction	WS/WD	Met One Instruments	034B / 466A N3282 / X4726	Thai Meteorological Department	176/24	16 Apr 24	15 Apr 25	-
2	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	05103-5 309017844	Thai Meteorological Department	173/24	11 Apr 24	10 Apr 25	-
3	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	05103-5 309019236	Thai Meteorological Department	174/24	11 Apr 24	10 Apr 25	-
4	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	119/24	13 Mar 24	12 Mar 25	-
5	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	098/24	22 Feb 24	21 Feb 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	24-ACT-077	30 May 24	29 May 25	-
2	Sound Level Meter	$L_{Aeq, 24\text{ hours}}$ L_{Amax} L_{A99} L_{A95}	Larson Davis	LxT2 0006692	Innovative Instrument Co.,Ltd.	24-SLM-228	9 Jul 24	8 Jul 25	-
3	Sound Level Meter	$L_{Aeq, 24\text{ hours}}$ L_{Amax} L_{A99} L_{A95}	Larson Davis	LxT2 0006699	Innovative Instrument Co.,Ltd.	24-SLM-230	10 Jul 24	9 Jul 25	-

CERTIFICATE OF CALIBRATION

Certificate No. : CDF-045-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TSCH
MODEL/TYPE : TE-9025A
SERIAL NUMBER : 3540
ID NUMBER : UAE-EFM.376/2563
CONDITION AS-RECEIVED : Used Item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 24 Oct 2024
MEASUREMENT DATE : 04 Nov 2024
ISSUE DATE : 05 Nov 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1020 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.7 °C and 49.7 %RH.

NOTED: the certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model 665/INAC/WZdp. The #B-CI-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the NMV (National Metrology Institute of Thailand) via Certificate number: NMV-0063-23.

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM "Evaluation of measurement data - Guide to the expression of uncertainty in measurement".

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Q _s] m ³ /min
1	0.702	755.241	23.67	22.27	57.134	1.612	1.268	0.651
2	1.000	755.312	23.55	22.21	61.323	1.248	1.801	0.920
3	1.117	755.324	23.36	22.72	41.180	4.809	2.075	1.057
4	1.353	755.363	23.37	22.77	30.028	4.806	2.392	1.319
5	1.417	755.397	23.65	23.10	29.199	7.191	2.680	1.363

Slope (m): 1.58279
Intercept (b): -0.02316
Correlation coefficient (r): 0.99988
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Q _s] m ³ /min
3	0.702	755.241	23.67	22.27	57.134	1.612	0.796	0.652
2	1.000	755.312	23.55	22.21	61.323	1.248	1.129	0.921
3	1.117	755.324	23.36	22.72	41.180	4.809	1.301	1.058
4	1.353	755.363	23.37	22.77	30.028	4.806	1.574	1.319
5	1.417	755.397	23.65	23.10	29.199	7.191	1.681	1.365

Slope (m): 1.24186
Intercept (b): -0.01654
Correlation coefficient (r): 0.99988
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☐ Mr. Sornrat Thachalad
☒ Mr. Jiraporn Lertsomphol



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 24P1252
Page : 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.078/2566

Condition As-Received: Used Item
Received Date: 03 April 2024
Calibration Date: 11 April 2024

Reference: 2404-0118WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1011 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inH₂O
- This instrument was used clean air as pressure media.
- This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
- This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology (Thailand), NSC-ONSAC Accredited No. Calibration 0144

Calibrated by : Suksan Khankaew
Issue Date : 17 April 2024

Approved Signatory :
[] Phalinee Prabpaipal
[] Sura Suwannasri
[✓] Attapol Panurach

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Cert.No.: 24P1252
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

Range : 0 inH₂O to 36 inH₂O
Scale Interval : 0.1 inH₂O (The Second Estimate)

Applied Pressure	High-port side	UUC Indication	Low-port side	ΔP	Error
0.00	0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00	0.00
4.00	2.00	-2.00	4.00	0.00	0.00
6.00	3.00	-3.00	6.00	0.00	0.00
8.00	4.00	-4.00	8.00	0.00	0.00
10.00	5.00	-5.00	10.00	0.00	0.00
12.00	6.00	-6.00	12.00	0.00	0.00
14.00	7.00	-7.05	14.05	0.05	0.05
16.00	8.00	-8.05	16.05	0.05	0.05
18.00	9.00	-9.05	18.05	0.05	0.05
20.00	10.00	-10.10	20.10	0.10	0.10
22.00	11.00	-11.10	22.10	0.10	0.10
24.00	12.00	-12.10	24.10	0.10	0.10
26.00	13.00	-13.10	26.10	0.10	0.10
28.00	14.00	-14.10	28.10	0.10	0.10
30.00	15.00	-15.10	30.10	0.10	0.10
32.00	16.00	-16.10	32.10	0.10	0.10
34.00	17.05	-17.10	34.15	0.15	0.15
35.80	18.00	-18.00	36.00	0.20	0.20

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95 %.

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Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udornak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-AFM-173
Request No : Req-2024-1833

Unit Under Calibration Details
Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
ID : UAE.EFM.038/2561

Accuracy : 0.75% of Reading
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 15 August 2024
Calibration Date : 28 August 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 High flow	18501012012	Sensidyne	1 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne AZLA Accreditation No. 3943.01

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pachi Mathavorn
Calibration Engineer Supervisor
Issue Date : 28 August 2024

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev 04 Issue date 17/6/24

Certificate No : 24-AFM-173

Request No : Req-2024-1833

Decision Rule for Statements of Conformity

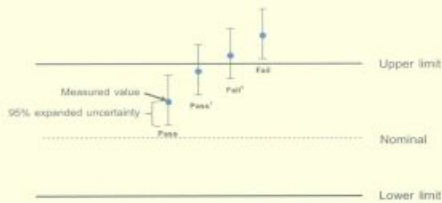
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G5:09 2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev 04 Issue date 17/6/24

Certificate No : 24-AFM-173

Request No : Req-2024-1833

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
25.60	99.80	14.50	14.46	-0.04	0.20	0.109	N/A
25.60	99.80	15.00	14.95	-0.05	0.21	0.113	N/A
25.50	99.70	15.80	15.73	-0.07	0.22	0.119	N/A
25.40	99.60	16.67	16.59	-0.08	0.23	0.125	N/A
25.50	99.50	18.30	18.20	-0.10	0.26	0.137	N/A

Note
STD : Standard
UUC : Unit Under Calibration
= UUC Reference Condition : 25 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate
P = Absolute Pressure
T = Absolute Temperature
Meas = Measurement Condition
ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev 04 Issue date 17/6/24

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udornak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-TPM-390
Request No : Req-2024-1833
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
Resolution : 0.1 °C
ID Number : UAE.EFM.038/2561

Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 15 August 2024
Calibrated Date : 29 August 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11-RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Approved By : 
Mr. Noppadon Luangart
Technical Manager
Issue Date : 29 August 2024

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-508-TPM-01 Rev.01 Issue date 13/02/20



Cert. No.: 24H753
Page.: 2 of 2

Result of Calibration:- Without Adjustment
Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	43	2.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

Result of Calibration:- Without Adjustment
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.0	-0.014	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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JIRANATEE ASSOCIATES CO., LTD.
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Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TSI-TS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department



NSC-TSI-TS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDF-045-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TSCH
MODEL/TYPE : TE-9025A
SERIAL NUMBER : 3540
ID NUMBER : UAE EFM.176/2563
CONDITION AS-RECEIVED : Used Item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 24 Oct 2024
MEASUREMENT DATE : 04 Nov 2024
ISSUE DATE : 05 Nov 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1030 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.7 °C and 49.7 %RH.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/1AC/1024g. The 95-CL-004 was used as a calibration gas.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the AIMT (National Metrology Institute of Thailand) via Certificate number: M66063-23.

Uncertainty of Measurement:
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement

NOTE: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☐ Mr. Sorawat Thachulad
☒ Mr. Parinya Booncharoen



Approved signature

Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

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Continuation of Certificate of Calibration Number CDF-045-67

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Orifice mmHg	Y	Standard Flow [Qs] m ³ /min
1	0.702	755.245	23.67	22.27	57.134	1.612	1.268	0.651
2	1.000	755.312	23.55	22.71	61.323	1.248	1.801	0.900
3	1.217	755.334	23.36	22.72	61.180	4.508	2.070	1.057
4	1.363	755.361	23.37	22.77	60.028	4.806	2.392	1.119
5	1.417	755.397	23.05	23.10	29.199	7.191	2.680	1.363

Slope (s): 1.98270
Intercept (i): -0.02316
Correlation coefficient (r): 0.99988
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Orifice mmHg	Y	Standard Flow [Qs] m ³ /min
1	0.702	755.245	23.67	22.27	57.134	1.612	0.796	0.652
2	1.000	755.312	23.55	22.71	61.323	1.248	1.129	0.901
3	1.217	755.334	23.36	22.72	61.180	4.509	1.503	1.058
4	1.363	755.361	23.37	22.77	60.028	4.806	1.744	1.119
5	1.417	755.397	23.05	23.10	29.199	7.191	1.681	1.365

Slope (s): 1.24186
Intercept (i): -0.01654
Correlation coefficient (r): 0.99988
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration



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United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

Standard Gas Concentration

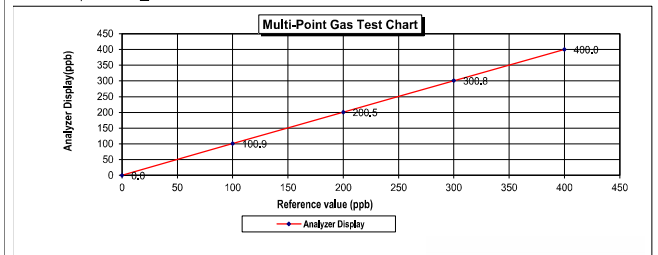
Sulphur Dioxide (SO₂) : 42.89 PPM
Nitric Oxide (NO) : 46.77 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 965.9 PPM
Cylinder No. : EB0159156
Expiration Date : Nov 6, 2026

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			Average Difference (%)	0.28
:Acceptable Limit ± 5%					



Calculate by
Gurkhai S.
4 10 2567

Approve by
P. Booncharoen
4 Oct 2024

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MULTI-POINT GAS TEST REPORT

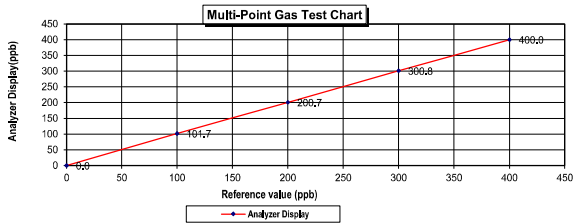
Test Date : Oct 11, 2024

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512001

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	965.9				
Cylinder No. :	EB0159156				
Expiration Date :	Nov 6, 2026				

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.7	1.70	1.67	1.67
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)			0.46



Calculate by
Gachai C.
11 / 10 / 2567

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Ratan K.
11 / Oct / 2024

MULTI-POINT GAS TEST REPORT

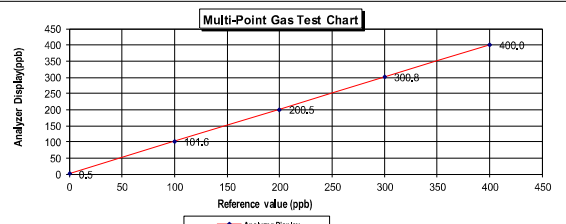
Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM08130002

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	965.9				
Cylinder No. :	EB0159156				
Expiration Date :	Nov 6, 2026				

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	101.6	1.60	1.57	1.57
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.52	



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Gachai C.
17 / 9 / 2567

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Ratan K.
17 / Sep / 2024

MULTI-POINT GAS TEST REPORT

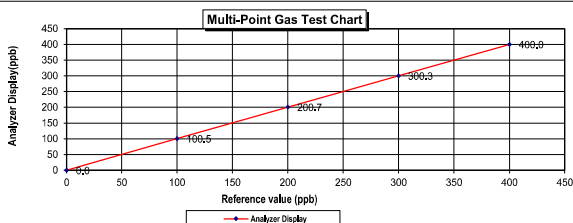
Test Date : May 7, 2025

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	965.9				
Cylinder No. :	EB0159156				
Expiration Date :	Nov 6, 2026				

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.50	0.50
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.3	0.30	0.10	0.10
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.19



Calculate by
Gachai C.
7 / 05 / 2025

Approve by
Ratan K.
7 / May / 2025

MULTI-POINT GAS TEST REPORT

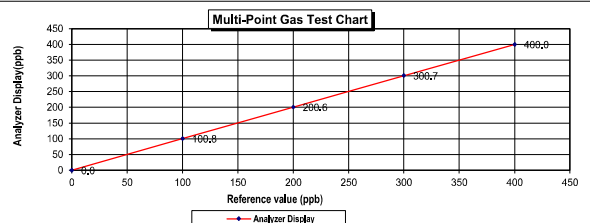
Test Date : Sep 17, 2024

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	965.9				
Cylinder No. :	EB0159156				
Expiration Date :	Nov 06, 2026				

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.8	0.80	0.79
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.27



Calculate by
Gachai C.
17 / 9 / 2567

Approve by
Ratan K.
17 / Sep / 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
LTD.-
Part Number: E05N191E15A0014 Reference Number: 180-40272205-1
Cylinder Number: E80162121 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2016 PSIG
PGVP Number: A12023 Valve Outlet: 660
Gas Code: CO, CO2, NO, NOX, SO2, BALN Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "CFA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	±0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	±0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	±1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	±0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	±1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMS	194202308	CC754264	98.36 PPM NITRIC OXIDE/NITROGEN	±0.4%	Jan 04, 2031
PRM	C2219101	APE1514548	100.19 PPM NITRIC OXIDE/NITROGEN	±0.3%	Feb 28, 2025
GMS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	±0.4%	Apr 25, 2031
PRM	12408	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	±1.5%	Feb 17, 2023
GMS	15340020202	EB0130037	9.893 PPM NITROGEN DIOXIDE/NITROGEN	±1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	±0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	±0.3%	Dec 09, 2028
NTRM	130605-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	±0.6%	May 14, 2025

The SRM, NTRM, PRM, or RGM listed above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR		Jun 15, 2023
SIEMENS ULTRAMATE N1-C8-180	NDIR		Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR		Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR		Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR		Jun 08, 2023

Approved for Release

Page 1 of 1

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MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387061

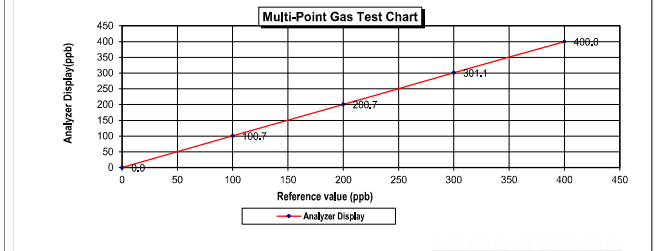
Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.1	1.10	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit ± 5%

Average Difference (%) 0.28



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6/9/2567

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6 Sep 2024

Page 1 of 1

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MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

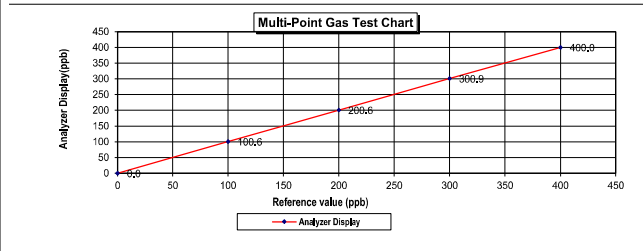
Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit ± 5%

Average Difference (%) 0.24



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6/9/2567

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6 Sep 2024

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MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387066

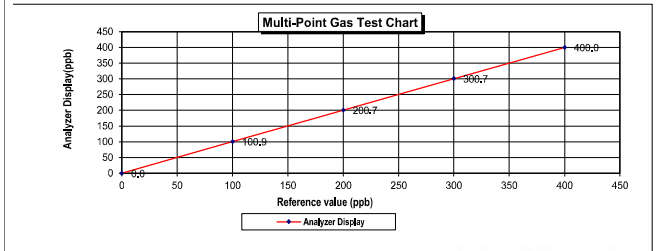
Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit ± 5%

Average Difference (%) 0.29



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6/9/2567

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6 Sep 2024

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MULTI-POINT GAS TEST REPORT

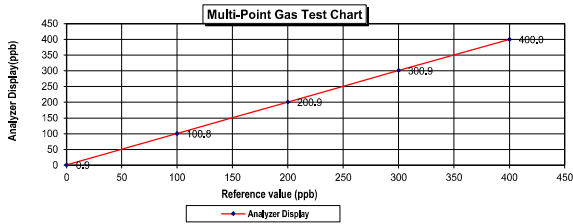
Test Date : May 15, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387067

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 24, 2024			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	100.8	0.80	0.79	0.79
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)		0.49



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15/05/2567

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15 May 2024

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MULTI-POINT GAS TEST REPORT

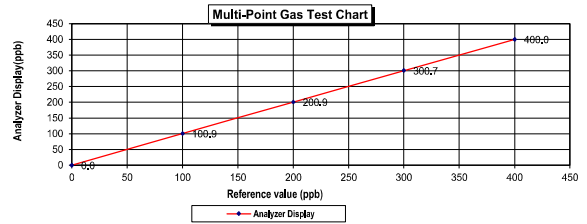
Test Date : Sep 6, 2024

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9			
Cylinder No. :	EB01159156			
Expiration Date :	Nov 06, 2026			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.31



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6 Sep 2024

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Airgas Specialty Gases
Airgas USA LLC
6141 Bantam Road
Plymouthville, PA 15949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
LTD.-
Part Number: E05NI91E15A0014
Cylinder Number: E0162121
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN
Reference Number: 180-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 680
Certification Date: Jul 06, 2023
Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gases" (May 2012) document EPA 800/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	$\pm 0.3\%$ NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	$\pm 1.2\%$ NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMS	194202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jan 04, 2031
PRM	C2219101	APF1514048	100.19 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Feb 28, 2025
GMS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	$\pm 1.6\%$	Feb 17, 2023
GMS	153400202002	EB0130037	9.893 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.6\%$	Sep 29, 2025
NTRM	160102-32	KAL093820	97.69 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$	Dec 09, 2028
NTRM	130906-22	CC411730	13.358 % CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$	May 14, 2025

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration	
Nicolet iS50 FTIR AUP2010245 CO ₂	FTIR	Jun 15, 2023	
SIEMENS ULTRAMATE N1-C8-180	NDIR	Jun 14, 2023	
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023	
Nicolet iS50 FTIR AUP2010245 NO ₂	FTIR	Jun 15, 2023	
Nicolet iS50 FTIR AUP2010245 SO ₂	FTIR	Jun 08, 2023	

Approved for Release

Page 1 of 1

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THAI METEOROLOGICAL DEPARTMENT



4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 16 April, 2024

Certification No. 176/24

Page : 1 of 2

Object : Weather Station
Manufacturer : Met One Instruments
Mode No. : Data Logger 466A Wind Sensor 034B
Mfg Code : Data Logger X4726 Wind Sensor N3282
Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : Hattapong

Mr. Watchapol Subwat

Mechanical Engineer

Signed :

Mr. Pisod Promsut

(Authorised Signatory)

for this time

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 176/24

16 April, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum inches	Pressure inches	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.00	0.00
3.02	-	-	-	3.03	-0.01
5.00	-	-	-	5.05	-0.05
7.00	-	-	-	7.09	-0.09
9.02	-	-	-	9.11	-0.09
11.01	-	-	-	11.13	-0.12
13.01	-	-	-	13.16	-0.15
15.01	-	-	-	15.20	-0.19
17.02	-	-	-	17.14	-0.12
20.02	-	-	-	20.16	-0.14

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91.2
180	181.1
270	278.2

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 11 April, 2024

Certification No. 173/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG
Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 29505 Basic Datalogger : 309017844

Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisod Promsut

(Authorized Signatory)
เอกสารไม่ควบคุม
Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 173/24

11 April, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum inches	Pressure inches	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.80	0.20
3.02	-	-	-	2.98	0.04
5.00	-	-	-	5.02	-0.02
7.04	-	-	-	6.99	0.05
9.02	-	-	-	8.95	0.07
11.01	-	-	-	10.99	0.02
13.01	-	-	-	12.95	0.06
15.01	-	-	-	15.05	-0.04
17.02	-	-	-	17.00	0.02
20.02	-	-	-	20.26	-0.24

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	90
180.0	180
270.0	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 11 April, 2024

Certification No. 174/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG
Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 79424 Basic Datalogger : 309019236

Customer : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisod Promsut

(Authorized Signatory)
เอกสารไม่ควบคุม
Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 174/24

11 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	inches	inches	hPa	m/sec	m/sec
m/sec					
1.00	-	-	-	0.90	0.10
3.02	-	-	-	3.00	0.02
5.00	-	-	-	4.98	0.02
7.04	-	-	-	7.02	0.02
9.02	-	-	-	8.94	0.08
11.01	-	-	-	10.98	0.03
13.01	-	-	-	12.96	0.05
15.01	-	-	-	15.00	0.01
17.02	-	-	-	17.04	-0.02
20.02	-	-	-	20.10	-0.08

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	91
180.0	182
270.0	271

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 March, 2024

Certification No. 119/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0041

Wind Sensor 2111DT0041

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrichs : Dry No. 8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02948057 : Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PTB330 No. 24320001

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer

Signed :

Mr. Pisod Promsat

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	m/sec	m/sec	m/sec
m/sec					
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.99	1009	0.99
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.06	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average 0.04

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.68	758	0.68
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28

Average

0.02

Calibrated by :

Natharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45	0.1
30.2	30	0.2
15.4	15	0.4

Calibrated by :

Natharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. : 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 : 30 m/sec

: Ultrasonic Anemometer Model QA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : ThermoSchneider No.918902

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB355-HW No. V1320001

Calibrated by :

Natharapol

Signed :

Mr. Pisodt Promsot

(Authorized Signatory)

for the Chief

Mr. Watcharapol Subwat

Mechanical Engineer

Sub-Standard Instrument

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.9	0.12
20.02	-	-	-	19.9	0.12

Wind Aloft Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Natharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม




The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1010	0.60
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.78	1013	-0.21
1012.85	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.05	1012	0.05
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49
Average		0.08

Calibrated by : 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



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
The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
756.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
756.67	760	-0.33
756.98	760	-0.02
760.18	760	0.18
Average		0.02

Calibrated by : 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



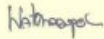
The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.3	30	0.3
15.8	15	0.8

Calibrated by : 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
719 MOO 13, SOI SUTINSAKORN 11 TAMBON BANG KARD
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0669-2116-5999-1 FAX: 0669-2116-7140



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73246
ID : UAE.EFM.104/2561

Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 23 May 2024
Calibration Date : 30 May 2024
Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 30 May 2024

เอกสารไม่ควบคุม

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Deviated value	Measured (%)	Deviated value		
94 dB / 1000 Hz	0.09	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	-	-	0.40	2.5

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

- Acceptorance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibration pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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ISM-708-ACT-02 Rev.01 Issue date: 6/23

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udonrak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok
10260

Certificate No : 24-SLM-228
Request No : Req-2024-1447

Unit Under Calibration Details

Measurement item : Sound Level Meter
Microphone Class : 2
Manufacturer : Larson Davis
Microphone Model : 375A04
Model : LxT2
Microphone S/N : 335075
Serial Number : 0006692
Preamplifier Model : PH04.072C
ID : UAE.FPM.132-2565
Preamplifier S/N : 071560
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 July 2024
Calibrated Date : 9 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electromechanics > Sound level meters > Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	Svan401	131	8 October 2024	WKC Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By :

Mr. Pachi Mathavom
Calibration Engineer Supervisor

Issue Date : 9 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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ISM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228
Request No : Req-2024-1447

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
	Level	UUC	ERR	UUC	ERR			
		(dB)	(dB)	(dB)	(dB)			
Calibrator Setting								
1000 Hz 114 dB	113.76	114.8	1.04	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting (dB)	(dB)	(± dB)
A	28.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting (dB)	(dB)	(± dB)
A	28.7	0.10
C	28.4	0.10
Z	33.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
125 Hz	0.2	0.3	0.2	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.5	0.6	0.60	3.0	Pass
8000 Hz	1.0	1.0	1.1	0.70	3.0	Pass

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ISM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228
Request No : Req-2024-1447

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.1	0.0		1.5	Pass
250 Hz	0.0	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.1	0.1	0.1		2.0	Pass
4000 Hz	0.0	0.1	0.1		3.0	Pass
8000 Hz	0.0	0.0	0.1		3.0	Pass
16000 Hz	0.0	0.0	-0.1		+5,-INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
UUC Weighting	REF (dB)	UUC (dB)	ERR (dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting 37-139 / A	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
UUC Time Response	REF (dB)	UUC (dB)	ERR (dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

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ISM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228

Request No : Req-2024-1447

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR	Limit	
STD dB	(dB)	(dB)	(dB)	(± dB)	
130.00	130	130.0	0.0	1.1	Pass
134.00	134	134.0	0.0	1.1	Pass
129.00	129	129.0	0.0	1.1	Pass
124.00	124	124.0	0.0	1.1	Pass
119.00	119	119.0	0.0	1.1	Pass
114.00	114	114.0	0.0	1.1	Pass
109.00	109	109.0	0.0	1.1	Pass
104.00	104	104.0	0.0	1.1	Pass
99.00	99	98.9	-0.1	1.1	Pass
94.00	94	93.9	-0.1	1.1	Pass
89.00	89	88.9	-0.1	1.1	Pass
84.00	84	83.9	-0.1	1.1	Pass
79.00	79	78.9	-0.1	1.1	Pass
74.00	74	73.9	-0.1	1.1	Pass
69.00	69	68.9	-0.1	1.1	Pass
64.00	64	63.9	-0.1	1.1	Pass
59.00	59	58.9	-0.1	1.1	Pass
54.00	54	53.9	-0.1	1.1	Pass
49.00	49	49.0	0.0	1.1	Pass
44.00	44	44.0	0.0	1.1	Pass
39.00	39	39.3	0.3	1.1	Pass
34.00	34	34.4	0.4	1.1	Pass

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ISM-700-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228

Request No : Req-2024-1447

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	Limit	
UUC Range	(dB)	(dB)	(dB)	(± dB)	
37-139	43.90	44.0	0.1	1.1	Pass
	134	114.0	0.0	1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	
Fast	200	135.0	135.0	0.0	1.0	Pass
	2	118.0	117.8	-0.2	+1.0, -2.5	Pass
	0.25	109.0	108.8	-0.2	+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1	1.0	Pass
	2	109.0	108.9	-0.1	+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0	1.0	Pass
	2	109.0	109.0	0.0	+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0	+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR	Limit	
STD Setting	(dB)	(dB)	(dB)	(± dB)	
Complete cycle	137.4	136.7	-0.70	3.0	Pass
Positive half cycle	136.4	136.2	-0.20	2.0	Pass
Negative half cycle	136.4	136.2	-0.20	2.0	Pass

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ISM-700-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228

Request No : Req-2024-1447

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	142.8			
Negative one-half cycle	142.6			
Deviated	0.2	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

* Acceptance limit and Maximum-permitted Uncertainty was IEC 61072-1:2013

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ISM-700-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-228

Request No : Req-2024-1447

Decision Rule for Statements of Conformity

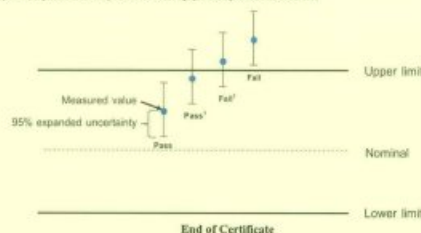
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass – The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ – The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail² – The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail – The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of

เอกสารไม่ควบคุม

ISM-700-SLM-01 Rev.04 Issue date 5/6/24



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.
Address : 81 Soi Udomsook 47, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 24-SLM-230
Request No : Req-2024-1449

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : Larson Davis
Model : LxT2
Serial Number : 0006699
ID : UAE/BPM.1302565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 11792
Preamplifier Model : P9MLxT2C
Preamplifier S/N : 071509
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 July 2024
Calibrated Date : 10 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Scan401	131	8 October 2024	WK Electric

Note:
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By :
Mr. Pait Mathavorn
Calibration Engineer Supervisor
Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
เอกสารไม่ควบคุม

FSM-708-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-230
Request No : Req-2024-1449

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
1000 Hz 114 dB	113.76	112.9	-0.86	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN. 38079

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
Calibrator Setting (dB)	(dB)	(± dB)
A	31.2	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
Calibrator Setting (dB)	(dB)	(± dB)
A	31.0	0.10
C	30.5	0.10
Z	34.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting FAST / 37-139	Deviation from various Frequencies Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.2	0.2	0.2	0.60	3.0	Pass
8000 Hz	-0.1	0.0	0.0	0.70	5.0	Pass

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-230
Request No : Req-2024-1449

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting						
65 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	REF (dB)	UUC (dB)	ERR (dB)			
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting 37-139 / A	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	REF (dB)	UUC (dB)	ERR (dB)			
UUC Time Response						
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Lsq	114.00	114.0	0.0		0.10	Pass

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-230
Request No : Req-2024-1449

7. Long Term Stability

UUC Setting FAST / A / 37-139	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
Initial	114.0			
Final	114.0			
Deviated	0.0			
		0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	REF (dB)	UUC (dB)	ERR (dB)			
STD dB						
118.00	118	118.0	0.0	0.30	1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
128.00	128	128.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
116.00	116	116.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
108.00	108	108.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
43.00	43	43.2	0.2		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
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FSM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-230
Request No : Req-2024-1449

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A		REF	UUC		ERR	
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)	
37-139	46.20	46.3	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting		STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance	Result
A / 27-139		Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response		(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass	
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass	
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass	
Slow	200	128.6	128.4	-0.2		1.0	Pass	
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass	
	200	129.0	129.0	0.0		1.0	Pass	
SEL	2	109.0	109.1	+0.1		+1.0, -2.5	Pass	
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass	

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / C / 95-142	REF (dB)	UUC (dB)	ERR (dB)			
STD Setting						
Complete cycle	137.4	136.7	-0.70	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

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FSI-700-SLM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-SLM-230
Request No : Req-2024-1449

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	145.0			
Negative one-half cycle	144.9			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		(± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.15 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum permitted Uncertainty was IEC 61872-1:2013

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FSI-700-SLM-01 Rev.04 Issue date 5/9/24

Certificate No : 24-SLM-230
Request No : Req-2024-1449

Decision Rule for Statements of Conformity

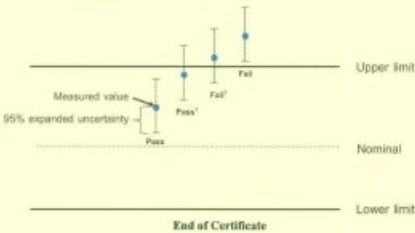
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
FSI-700-SLM-01 Rev.04 Issue date 5/9/24

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	CADMIUM CHROMIUM CHROMIUM TRIVALENT COPPER LEAD MANGANESE MERCURY NICKEL ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAde 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14/5/2024	13/5/2025
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11/5/2024	10/5/2025
4	Analytical Balance	TOTAL SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2/4/2024	1/4/2025
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
			Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2/4/2024	1/4/2025
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18/2/2025	18/2/2026

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
7	Gas Chromatography	a-BHC ALDRIN b-BHC d-BHC DIELDRIN ENDOSULFAN I ENDOSULFAN II ENDOSULFAN SULFATE ENDRIN ENDRIN ALDEHYDE g-BHC HEPTACHLOR HEPTACHLOR EPOXIDE pp-DDD pp-DDE pp-DDT	Agilent	GC 7890A / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	18/2/2025	17/2/2026
8	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Inc.(Romania)	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2427-0942	17/2024	30/6/2025
9	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8/10/2024	7/10/2025
10	Hot Air Oven	TOTAL SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1/4/2024	31/3/2025
11	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1/4/2024	31/3/2025
12	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
13	Spectrophotometer	CHROMIUM HEXVALENT COLOUR (pH 7.0) COLOUR (pH Sample)	Agilent	Cary 60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7/5/2024	6/5/2025

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
14	UV/VIS Spectrophotometer	CHEMICAL OXYGEN DEMAND PHENOLS	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services>

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

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Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections: Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

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Instrument Maintenance

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	240 FS AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 9432 A	11 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. ☒
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the *SVD Power Supply diagnostic*.
- ☒ For Dual Beam Instruments - Confirm RBC frequency using the *SVD RBC frequency diagnostic*.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform *Mono Wavelength Correction*.
- ☒ Use SVD and perform *Slit Calibration*.
- ☒ Use SVD and perform *Grating Squareness Diagnostic*.
- ☒ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☒ Use SVD and perform *Wavelength Repeatability*.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode.

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the *SVD interlock monitoring diagnostic*.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes..
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

☐ Section NOT Applicable

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

☒ Section NOT Applicable

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.559%
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.2 %
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	—
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSRP%	≥ 70 %	—

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/mL, 100mL	5190-8279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Completion

Service request number: 6007549143
Date service completed: 30 Jan 2025
Agilent signature: Kanyakorn S.
Customer signature: David Y.
Total number of pages in this document: 13

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Frequency:

Averaging Period: 30.0
Datapoint Count: 20
Upper Limit: 51.00
Lower Limit: 49.00
Average Frequency: 50.00
Highest Measured Frequency: 50.00
Lowest Measured Frequency: 50.00
Result: **Passed**

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	270.00	326.00	341.00	Passed

SVD Results Report



Report ID: Diagnostic Start Time: 1/30/2025 9:14:26 AM Diagnostic End Time: 1/30/2025 9:14:26 AM
Customer: UAE
Address: Soi Udomsuk 41, Sukhumvit Rd. Bangkok
Service Engineer: Kanyakorn S.
Contact Details: 02637636381

Configuration:

Serial Number: MY13160001
Instrument Model: Varian AA140/240/280
Flame Instrument: True
Furnace Instrument: True
Zeeman Present: False
Internal Zeeman: False
Internal UltraAA: False
Optics Type: Double Beam
D2 BG Correction Fitted: True
Boot Block Version: 1.09
Turret Type: Automatic
Number Of Lamps: 4
Mono Type: Automatic
Gasbox Type: 'Y' Gas Box
Auto Burner Adjuster: False
Mains Frequency: 50
Firmware Version: 2.11
Photomultiplier Type: Normal(900nm)
PWB Version: 45

EEPROM Data:

Instrument Run Hours: 69819.100
Zero Wavelength Offset: 36.133
Mono Correction: 0.770
Flame Hours: 32411.834
D2 Run Hours: 53396.500
D2 Serial Number: not set
D2 Install Date: 1/1/1970
D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Report Generated At: 1/30/2025 9:47:25 AM

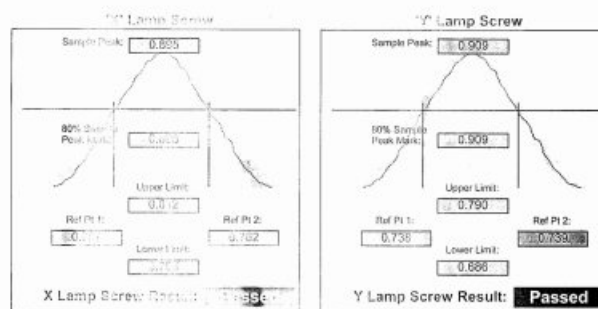
1

SVD Results Report

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3
Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Setup

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(A): 4.00
Grating Width(mm): 0.5
Grating Center Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-9.10	0.00	9.10	Passed
First Order	324.65	324.75	325.15	Passed
Second Order	649.29	649.51	649.97	Passed

Report Generated At: 1/30/2025 9:47:25 AM

2

SVD Results Report

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Report Generated At: 1/30/2025 9:47:25 AM

3

SVD Results Report

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Wavelength (Repeat):

Lamp Used: Copper
Peak Used(nm): 324.759
Connected to Socket: 3

Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment:

Lower Limit(nm) 324.758 324.888 Upper Limit(nm)

(Typical from Zero Drive) (Typical from end)

Sample 1: 324.823 Sample 2: 324.823
Sample 3: 324.823 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.819
Sample 7: 324.819 Sample 8: 324.819
Sample 9: 324.823 Sample 10: 324.819

Mean: 324.823 Standard Deviation: 0.003

Result:

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Auto Lamp Recognition:

Lamp 1: Unidentified Lamp/Not Connected Lamp 5: Not Supported
Lamp 2: 67 - Silver Cadmium Lamp/One UltraViolet Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: Unidentified Lamp/Not Connected Lamp 8: Not Supported

Result:

GTA Temperature Readings:

Notes:

Signatures:

30 Jan 2025
Kanyakorn S. Date

เอกสารไม่ควบคุม

Manual:

Wavelength Drive:

Slit Drive:

Turret Drive:

Auto Gunner/Injector Drive:

Microprocessor:

Signal Processing Linearity:

Calibrate: New Data Mode

	Lower Limit	Actual	Upper Limit	Result:
S2	114	1	297	
S4	116	14	191	
S5	271	10	332	
S2	474	7	579	
S4	916	13	1008	
S5	1406	19	1754	
S2	2408	100	3053	
S2	4547	1001	5313	

Interlocks:

Gunner Filled: Flame Detect:
H2O Gunner Filled: GCU Active:
Flame Gunner Closed: Oxidant Pressure:
Gas Control Filled: Oxidant Changeover:
Pressure Release During Filled: Ignition:
Liquid Trap Filled:

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Sequential by time report 1/30/2025 10:53 AM SpectrAA
Page 1 of 1

Analyst:
Date Started: 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Worksheet: Sensitivity Test 01
Comment:
Methods: Cu
Computer name: DESKTOP-R9UJF8S
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs		
CAL ZIRFO	0.000	38.8	0.0002		
Readings	0.0002	0.0003	0.0001	1/30/2025	10:51:46 AM
STANDARD 1	5.000	0.1	0.5571		
Readings	0.5574	0.5563	0.5575	1/30/2025	10:52:22 AM

Abs Linear Origin - Cal Set 1

Curve Fit = Linear Origin
Characteristic Conc = 0.020 mg/L
r = 1.0000
Calculated Conc = 0.002 5.000
Residuals = -0.002 0.000

Abs = 0.1141 x C

5 ppm Cu	5.000	0.3	0.5596		
Readings	0.5592	0.5596	0.5615	1/30/2025	10:52:54 AM

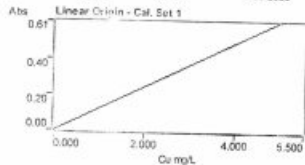
เอกสารไม่ควบคุม

Analyst
Date Started 1/30/2025 10:33 AM GMT; 1/30/2025 3:33 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-ISURFS
Serial Number MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	64.1	-0.0002
Readings	-0.0003	-0.0003	-0.0001
STANDARD 1	5.000	0.3	0.6052
Readings	0.6035	0.6073	0.6047

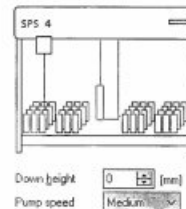
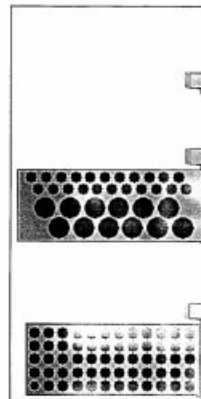
1/30/2025 10:48:52 AM
1/30/2025 10:47:24 AM



Curve Fit = Linear Origin
Characteristic Conc = 0.039 mg/L
r = 1.0000
Calculated Conc = -0.002 5.000
Residuals = 0.002 0.000

Abs = 0.12105 x C

5 ppm Cu	5.007	0.2	0.0051
Readings	0.6065	0.6052	0.6047
	0.6035	0.6076	0.6054
			0.6079
			1/30/2025 10:48:32 AM



Down height 0 (mm)
Pump speed Medium

Key to tube colors

Sample

Calibration

Calibration/QC

Sample/QC

Not Assigned

Goto Tube

Back 1

Type 1

Goto Tube

Align Probe

Purge

Stop/Freeze

Park

HC Lamp

1.30

1.00

0.90

0.80

0.70

0.60

0.50

0.40

0.30

0.20

0.10

0.00

0.917

Optimize Gain

Optimize Slope

Rescale

Init Zero

Gain 49 %

Ok

Sensitivity Check 1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

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เอกสารไม่ควบคุม



PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,

Phra Khanong, Bangkok 10260

Instrument Serial No.: PFBS20031902

Date: 14-May-2024

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	United Analyst and Engineering Consultant Co., LTD.		
Address (Instrument Location):	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
Serial Number:	PFBS20031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanon	Service Order Number:	WO-02787590
Date PM Performed: (DD-MM-YYYY)	14-May-2024	Next PM Due Date: (DD-MM-YYYY)	14-Nov-2024
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date
09370145 Rev.9	A	January 2018



Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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เอกสารไม่ควบคุม

Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcLe900F	PFBS20031902	Syngistix V.4.0.1.1935
Flas100(New Install)	100S24040501	

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301734	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	Apr 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 mL	AR	AR
N/A	0.5% HNO ₃	250 mL	AR	AR

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Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

☒ Review the instrument performance with the customer and document any recent problems.

☒ Inspect the customer log book and make any appropriate PM entries.

☒ Perform general inspection of system for cleanliness.
2. PC Instrument Software:

☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.
3. Mechanical:

☒ Inspect and clean all fans and filters. Replace filters if necessary.

☒ Inspect all gas lines for leaks and/or wear. Replace if needed.

☒ Clean exterior of the instrument.

☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.

☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification

☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.

☒ Check the drain system for signs of wear. Replace worn or damaged parts.

☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).
4. Electrical:

☒ Inspect PC boards. Clean if necessary.

☒ Carefully check all internal and external cable connections.

☒ Check instrument firmware revisions upgrade to current levels (if necessary)

☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.
5. Optics:

☒ Inspect and clean the sample compartment windows, if needed.

☒ Inspect optics. Clean or replace if necessary.
6. Gasses:

☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcLe 900 Series Pre-installation Checklist S08.

☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

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Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020

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7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.002	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

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8.4 D₃ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.030	0.0001	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.002	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0022	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.8005	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date: 14-May-2024 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 14-May-2024 (DD-MM-YYYY)

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 24MM292
Page: 1 of 3

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S/FACT
Serial No. : 1129361010
ID No. : UAE.WAS.002/2552
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room (108)
Received order : 11 May 2024
Calibration Date : 11 May 2024
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 80 %
Calibrated by : Khit Ruttanaprapachai
Approved by : Kunchit
() Porpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0168OC-1
Procedure used :-

Cert.No.: 24MM292
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0013-24	25 Jan 2026

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
100	100.0000	0.0000	0.19	2.03
200	200.0008	-0.0006	0.30	2

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

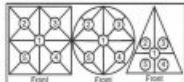
Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0168OC-1
Result of calibration

Cert.No.: 24MM292
Page: 3 of 3



Maximum difference between off-center and central loading

Position 1	Position 2	Position 3	Position 4	Position 5	
(g)	(g)	(g)	(g)	(g)	(g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-

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เพื่อส่งเสริมผู้ประกอบการ
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565

Order No.: 2402283
Operation No.: 2402283-002
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

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Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505347572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Raborn	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
100	0.000048
200	0.000048

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

F-CS-012 Revision: 01 Date: 20-04-65

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เพื่อส่งเสริมผู้ประกอบการ
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.001011	-0.000008	0.0000089	2.00
0.005	0.005003	0.005020	-0.000017	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	0.000004	0.0000096	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500001	0.000015	0.000014	2.00
1	1.000007	1.000002	-0.000005	0.000016	2.00
2	2.000023	2.000001	-0.000022	0.000017	2.00
5	5.000017	5.000002	-0.000015	0.000020	2.00
10	10.000009	10.000000	-0.000009	0.000026	2.00
20	20.000031	20.000000	-0.000031	0.000037	2.00
30	30.000040	30.000001	-0.000039	0.000050	2.00
50	50.000028	50.000002	-0.000026	0.000068	2.00
80	80.000068	80.000002	-0.000066	0.00011	2.00

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)
Calibration Range: 81 - 200 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

2008 โซอิมโรด 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Aun Aroon Road, Bang Yikhan Subdistrict, Bang Phat District, Bangkok 10703, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545



Calibration Certificate

Certificate No.: 2502226-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2502226

Operation No.: 2502226-002

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by *Mr. N. Nijphat*
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

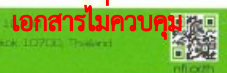
Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

2008 โซอิมโรด 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Aun Aroon Road, Bang Yikhan Subdistrict, Bang Phat District, Bangkok 10703, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 82 g / 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 20 March 2025 Page 2 of 4

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 46 ± 3.5 %
Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-house Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8503567572	TCS	M04041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NF1.8TH 017/23	Quality Reborn	QR25-0542	10 February 2025

3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

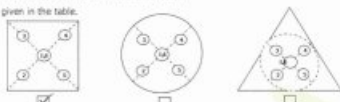
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000042
100	0.000000
200	0.000000

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

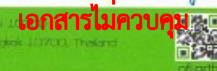
The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

F-CS-012 Revision: 01 Date: 20-04-65

2008 โซอิมโรด 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Aun Aroon Road, Bang Yikhan Subdistrict, Bang Phat District, Bangkok 10703, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 82 g / 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 20 March 2025 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

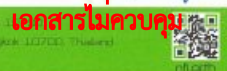
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000007	2.00
0.001	0.001003	0.00100	0.00000	0.0000090	2.00
0.005	0.005002	0.00501	-0.00001	0.0000052	2.00
0.01	0.010003	0.01002	-0.00002	0.0000089	2.00
0.05	0.049996	0.05001	-0.00001	0.0000096	2.00
0.1	0.100011	0.10002	-0.00001	0.000011	2.00
0.5	0.500016	0.50004	-0.00002	0.000014	2.00
1	1.000003	1.00005	-0.00005	0.000016	2.00
2	2.000027	2.00006	-0.00004	0.000017	2.00
5	5.000015	5.00006	-0.00005	0.000020	2.00
10	10.00009	10.00005	-0.00004	0.000026	2.00
20	20.00030	20.00007	-0.00004	0.000037	2.00
30	30.00039	30.00009	-0.00005	0.000050	2.00
50	50.00028	50.00008	-0.00005	0.000068	2.00
80	80.00067	80.00013	-0.00006	0.00011	2.00

F-CS-012 Revision: 01 Date: 20-04-65

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2008 Soi 35, Aun Aroon Road, Bang Yikhan Subdistrict, Bang Phat District, Bangkok 10703, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.00002	-0.00008	0.00015	2.00
100	100.00006	100.00001	-0.00005	0.00016	2.00
110	110.00007	110.00002	-0.00005	0.00017	2.00
120	120.00009	120.00002	-0.00007	0.00018	2.00
130	130.00010	130.00002	-0.00008	0.00019	2.00
140	140.00013	140.00002	-0.00011	0.00019	2.00
150	150.00009	150.00002	-0.00007	0.00021	2.00
160	160.00010	160.00002	-0.00008	0.00022	2.00
170	170.00012	170.00002	-0.00010	0.00023	2.00
200	200.00013	200.00002	-0.00011	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

2008 ซอย 36, ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Asoke Road, Bang Na Khru Sub-district, Bang Phai District, Bangkok 10710, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2402283-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

2008 ซอย 36, ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Asoke Road, Bang Na Khru Sub-district, Bang Phai District, Bangkok 10710, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Capacity: 220 g

Date of Calibration: 2 April 2024 Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8050567572	TCS	M23040525	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

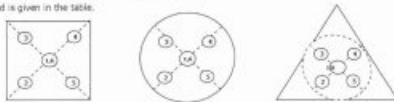
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

F-CS-012 Revision: 01 Date: 20-04-65

2008 ซอย 36, ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Asoke Road, Bang Na Khru Sub-district, Bang Phai District, Bangkok 10710, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Capacity: 220 g

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unloaded	0.000000	0.000000	0.000000	0.0000268	2.00
0.001	0.001003	0.001011	-0.000008	0.0000269	2.00
0.005	0.005003	0.004999	0.000004	0.0000269	2.00
0.01	0.010003	0.010000	0.000003	0.0000269	2.00
0.05	0.049996	0.050000	0.000004	0.0000268	2.00
0.1	0.100011	0.100000	0.000011	0.000031	2.00
0.5	0.500016	0.500001	0.000015	0.0000414	2.00
1	1.000003	1.000002	-0.000001	0.000046	2.00
2	2.000023	2.000001	0.000022	0.000047	2.00
5	5.000017	5.000002	0.000015	0.000050	2.00
10	10.000009	10.000000	0.000009	0.0000526	2.00
20	20.000031	20.000002	0.000029	0.0000537	2.00
30	30.000040	30.000003	0.000037	0.000052	2.00
50	50.000028	50.000004	-0.000024	0.0000568	2.00
80	80.000068	80.000005	0.000063	0.00011	2.00

F-CS-012 Revision: 01 Date: 20-04-65

2008 ซอย 36, ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Asoke Road, Bang Na Khru Sub-district, Bang Phai District, Bangkok 10710, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C099071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	0.00038	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

***** End *****

F-CS-012 Revision: 01 Date: 20-04-65

2008 บบสารบัญ 35 หมายเลข 35 ควบคุมการปฏิบัติงานในห้องปฏิบัติการ
2008 Soi 18, Aun Asem Road, Bang Muek Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

Certificate of Testing

Cert.No.: 25TW29
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 14 February 2025
Test Date : 17 February 2025
Reference : 2502-0473DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrahanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirirthean
Approved by : Saitthip
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saitthip Meangmai
Issue Date : 18 February 2025

เอกสารไม่ควบคุม

Cert.No.: 25TW29
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 24F100202

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



เอกสารไม่ควบคุม

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - Operation Manual**
https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - Maintaining Your GC**
https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

Revision: 2.01, Issued: September 15, 2021
Agile Document Number: D0013618
DE number: 44166.759722222
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Page 1 of 8



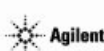
เอกสารไม่ควบคุม

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.



เอกสารไม่ควบคุม

System Information

- Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID	UAE_TOX.007
Instrument System Site and Location	Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2. G4513A	CN20030059
3. G4514A	CN20020060
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- Discuss any specific issues with the customer before starting.
- Review the instrument logbook for recorded problems and comments.
- Save instrument control settings before starting the procedure.
- Perform a general inspection of the system for cleanliness.
- Check for proper installation of parts, assemblies, sensors etc.
- Check system for required installation of components, settings as defined by current Service Notes.
- Check for required firmware updates and verify with customers if they would like them installed.
- Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.



เอกสารไม่ควบคุม

Preventive Maintenance Procedure

Clean and inspect GC

- ☑ Unplug power cord from the power source.
- ☑ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☑ Inspect internal connectors for proper contact and placement.
- ☑ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☑ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☑ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☑ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☑ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☑ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☑ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☑ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the Ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☑ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☑ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☑ Record if test passed or failed in the results table.

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เอกสารไม่ควบคุม

ALS Maintenance

- ☐ Section NOT applicable
- ☑ Check all cabling and configuration settings between GC, tray, and injectors.
- ☑ Vacuum or remove any dust, especially around fans.
- ☑ Check operation of all fans.
- ☑ Check syringe for smooth plunger operation.
- ☑ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☑ Restore the normal operating conditions or customer method using the Data System.
- ☑ Purge the system with carrier flow for 15 minutes
- ☑ Bake out the system, then restore the normal operating conditions
- ☑ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☑ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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Signature Page

Service Review

- ☑ Attach available reports/printouts of all tests to this documentation.
- ☑ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☑ Update/reset instrument maintenance counters as appropriate.
- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section if there are additional comments.
- ☑ Review with the customer this service, parts replaced, and test results obtained.
- ☑ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	313.5	313.5
Back detector output	24.5	19.3
AUX detector output	n/a	n/a
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	n/a

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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	-
PP Inlet PM kit	5188-6498	7890A/B	-
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	-
MMI Cleaning Kit	G3510-60820	7890A/B	-
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	-
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	-
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	-
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	-
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	-
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	-
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	-
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	-

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Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

- The Equipment can operate as normally.

Service Completion

Service request number 6007319635 Date service completed 18 Feb 2025
Agilent signature Adisak R. Customer signature _____
Total number of pages in this document 9

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เอกสารไม่ควบคุม

Certificate No. : HIT-2427-0942

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 Serial No. : 04500052101
Tube Heater : 25 Vial Capacity Resolution : 0.1°C
Temperature Range : (-10 to 160)°C Temperature of Reaction : 150°C
Manufacturer : Hanna Instruments Made in : Romania
Condition As-Received : Used Product Reference : RE241152
Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 26 June 2024
Calibrate date : 1 July 2024
Issue date : 3 July 2024
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : off
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

This result of calibration was found accurate on date and place of calibration only.

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Certificate No. : HIT-2427-0942

Page : 2 of 2

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	149.8	0.48

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.574	149.873	149.861	149.748	149.878
(1B)	(2B)	(3B)	(4B)	(5B)
149.490	149.940	149.954	150.103	150.048
(1C)	(2C)	(3C)	(4C)	(5C)
149.625	150.036	150.080	150.015	149.580
(1D)	(2D)	(3D)	(4D)	(5D)
149.801	149.541	149.662	150.010	149.499
(1E)	(2E)	(3E)	(4E)	(5E)
149.563	149.611	149.569	149.831	149.762

Figure: Shows the location of the temperature source.

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

** End of certificate **

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2500116-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)
Manufacturer: MEMMERT
Model: UF55
Serial No.: B216.1666
ID No.: UAE.WAO.027/2559
Order No.: 2500116
Operation No.: 2500116-001
Date of Receipt: 8 October 2024
Date of Calibration: 8 October 2024

Calibrated by Mr.Yothin Charoensuk Scientist
Approved by Mr.Pheraphat Tuanjit
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 October 2024

The uncertainties are for a confidence probability of approximately 95 %.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 Page 2 of 3

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition:
Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MYS7003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH9201-299/ RTD9201-299			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated Item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0,140.0 and 180.0 °C
Fresh air Damper ☒ Open Position ☒
☒ Close Fan 40%
☒ Not Available

- Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-C5-012 Revision: 01 Date: 20-04-65



เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 Page 3 of 3

Calibration point: 104.0,140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

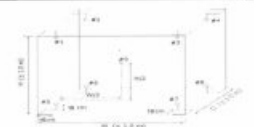


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.15	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.88
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

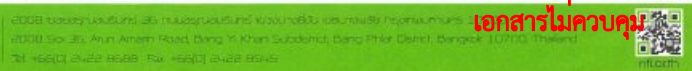
Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65



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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 24TM589
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 - 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Porpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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A 0065065



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Procedure Used :-

Cert. No.: 24TM589
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

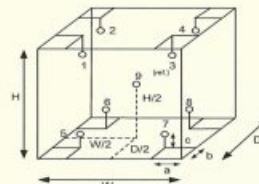
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

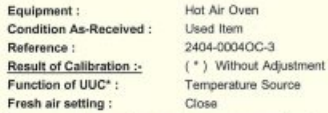
Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

Position :	Ref. Std. ID No. : @ Calibration Point	
	(120 to 180) °C	(104) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

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a 1209739





CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009


ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by : 
(Mr. Tanawat Rittidach)Approved by : 
(Ms. Chonhicha Sangnern)

Technical Manager

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.



REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

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REPORT OF CALIBRATION

Certificate No. : SP24-018

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP24-018

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

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DQE

Services

DQE Services Co.,Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 9001:2015

ISO 17025:2017

LABORATORY

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k,

which for a normal distribution corresponds to a coverage probability of approximately 99%

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021

DQE Services Co.,Ltd. 32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230 Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com	
CERTIFICATE OF CALIBRATION	
Certificate No. : SP24-028	
Page 1 of 5	
Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)	
Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260	
Location of calibration : Laboratory 315	
Equipment : UV-Vis Spectrophotometer	
Manufacturer : HITACHI	
Model : U-5100	
Serial No. : 23A4-008	
ID No. : UAE.WAS.010/2567	
Received Date : 10 September 2024	
Calibration Date : 10 September 2024	
Issue Date : 13 September 2024	
Condition Instrument : Good	
Calibrated by :  (Mr.Tanawut Ritidach)	Approved by :  (Ms.Chonthicha Sangern)
Technical Manager	
Quality Manager	
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.	
The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.	


เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



NIST-TESTING UNIT

CALIBRATION UNIT

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.

Scan Speed of UUC : 40

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021

DQE

Services

DQE Services Co.,Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

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PM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.743	0.0000 0.0039	0.0050 0.0056	2.00 2.00
257	0.0000 0.8674	0.000 0.862	0.0000 0.0054	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.291	0.0000 0.0009	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.639	0.0000 0.0040	0.0050 0.0055	2.00 2.00



REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.4	0.60	0.18	2.00
279.30	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available


- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k.

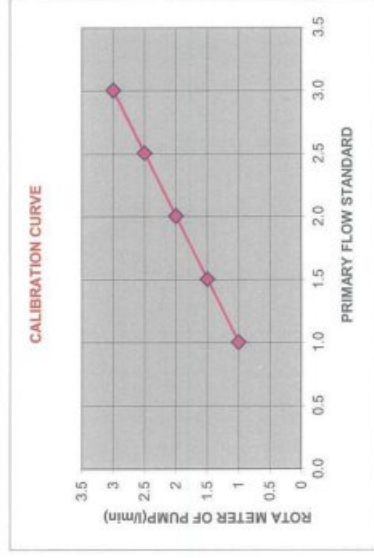
which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน)




	TPI POLYMER PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION	NO. 001/68				
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 001 MODEL : GILAIR - 5RP SERIAL NO : 16064 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 20 / JAN / 2025 NEXT DUE TIME : 20 / JUL / 2025		PAGE 1/1				
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C						
AMBIENT CONDITIONS :						
CALIBRATION DATA :						
STANDARD	ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.002	1.003	1.002	1.002	± 0.03	PASS
1.5	1.502	1.503	1.504	1.503	± 0.03	PASS
2	2.001	2.002	2.004	2.002	± 0.03	PASS
2.5	2.502	2.504	2.505	2.504	± 0.03	PASS
3	3.002	3.002	3.003	3.002	± 0.03	PASS

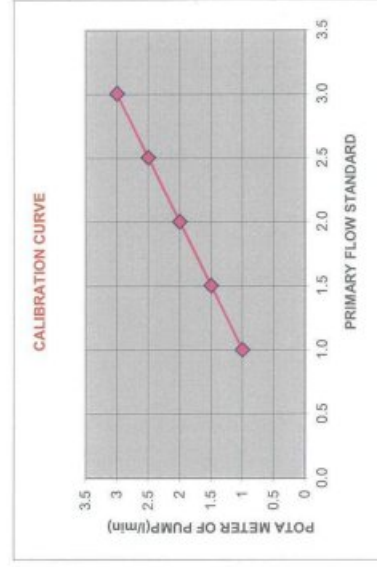


CAL BY: spg (TECHNICIAN)
21 JUL 68

CHECKED BY: JH (ENGINEER / SUPERVISOR)
21 JUL 68

APPROVED BY: [Signature] (SECTION MANAGER)
21 JUL 68


	TPI POLYENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION	NO. 004/68				
		PAGE 1/1				
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 004 MODEL : GILAIR - 5RP SERIAL NO : 15946 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 20 / JAN / 2025 NEXT DUE TIME : 20 / JUL / 2025						
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C						
CALIBRATION DATA :						
PRIMARY FLOW STANDARD	METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
1	2	3	AVERAGE			
1	1.003	1.004	1.006	1.004	± 0.03	PASS
1.5	1.503	1.505	1.505	1.504	± 0.03	PASS
2	2.005	2.004	2.005	2.005	± 0.03	PASS
2.5	2.503	2.502	2.508	2.504	± 0.03	PASS
3	3.003	3.002	3.004	3.003	± 0.03	PASS

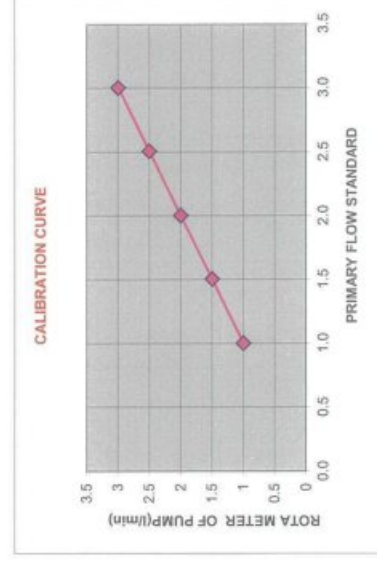


CAL BY: *2/2* (TECHNICIAN)
24 1 68

CHECKED BY: *[Signature]* (ENGINEER / SUPERVISOR)
2.1.1.1. 2568

APPROVED BY: *[Signature]* (SECTION MANAGER)
21.1.1.1. 2568


	TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION			NO. 003/68 PAGE 1/1																																													
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 003 MODEL : GILAIR - 5RP SERIAL NO : 15945 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 20 / JAN / 2025 NEXT DUE TIME : 20 / JUL / 2025																																																	
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C																																																	
CALIBRATION DATA :																																																	
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">PRIMARY FLOW STANDARD</th> <th colspan="3">METER OF PUMP</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.003</td> <td>1.005</td> <td>1.002</td> <td>1.003</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.504</td> <td>1.506</td> <td>1.504</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.002</td> <td>2.001</td> <td>2.001</td> <td>2.001</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.505</td> <td>2.507</td> <td>2.508</td> <td>2.507</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.005</td> <td>3.003</td> <td>3.004</td> <td>3.004</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table>					PRIMARY FLOW STANDARD	METER OF PUMP			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.003	1.005	1.002	1.003	± 0.03	PASS	1.5	1.502	1.504	1.506	1.504	± 0.03	PASS	2	2.002	2.001	2.001	2.001	± 0.03	PASS	2.5	2.505	2.507	2.508	2.507	± 0.03	PASS	3	3.005	3.003	3.004	3.004	± 0.03	PASS
PRIMARY FLOW STANDARD	METER OF PUMP			DEVIATION (l/min)		PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS																																										
	1	2	3																																														
1	1.003	1.005	1.002	1.003	± 0.03	PASS																																											
1.5	1.502	1.504	1.506	1.504	± 0.03	PASS																																											
2	2.002	2.001	2.001	2.001	± 0.03	PASS																																											
2.5	2.505	2.507	2.508	2.507	± 0.03	PASS																																											
3	3.005	3.003	3.004	3.004	± 0.03	PASS																																											



CAL BY: *279*
(TECHNICIAN)
21 JUL 68

CHECKED BY: *[Signature]*
(ENGINEER / SUPERVISOR)
21 JUL 68

APPROVED BY: *[Signature]* (C)
(SECTION MANAGER)
21 JUL 68



TPI POLENE PUBLIC CO.,LTD.

CEMENT QUALITY DEPARTMENT

PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL)

CERTIFICATE OF CALIBRATION

NO. 006/68

PAGE 1/1

INSTRUMENT NAME : WORKING AREA DUST SAMPLER

INSTRUMENT CODE : Q1300 / 01 / 023 / 006

MODEL : GILAIR - 5RP

SERIAL NO : 15948

PARAMETER RANGE : 1 - 3 L / MIN

CAL DATE : 21 / JAN / 2025

NEXT DUE TIME : 21 / JUL / 2025

STANDARD USED :

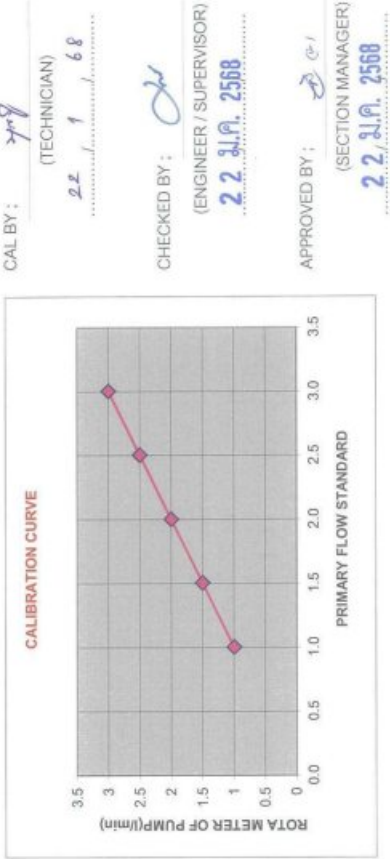
AMBIENT CONDITIONS :


PRIMARY FLOW STANDARD (DRY CELL)

TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.004	1.005	1.008	1.006	± 0.03	PASS
1.5	1.507	1.508	1.504	1.506	± 0.03	PASS
2	2.002	2.005	2.006	2.004	± 0.03	PASS
2.5	2.504	2.506	2.504	2.505	± 0.03	PASS
3	3.004	3.004	3.006	3.005	± 0.03	PASS





TPI POLENE PUBLIC CO.,LTD.

CEMENT QUALITY DEPARTMENT

PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL)

CERTIFICATE OF CALIBRATION

NO. 005/68

PAGE 1/1

INSTRUMENT NAME : WORKING AREA DUST SAMPLER

INSTRUMENT CODE : Q1300 / 01 / 023 / 005

MODEL : GILAIR - 5RP

SERIAL NO : 15947

PARAMETER RANGE : 1 - 3 L / MIN

CAL DATE : 20 / JAN / 2025

NEXT DUE TIME : 20 / JUL / 2025

STANDARD USED :

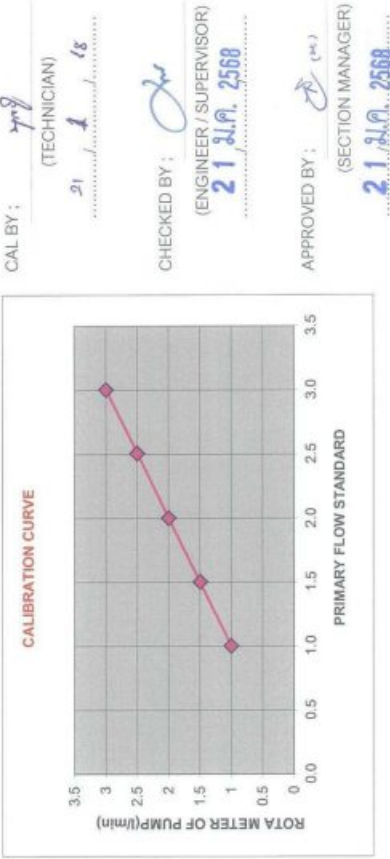
AMBIENT CONDITIONS :


PRIMARY FLOW STANDARD (DRY CELL)

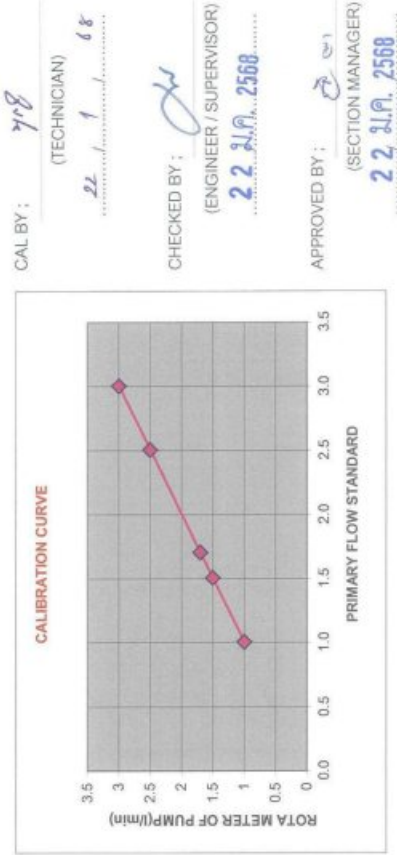
TEMPERATURE (°C) : 25 °C


CALIBRATION DATA :

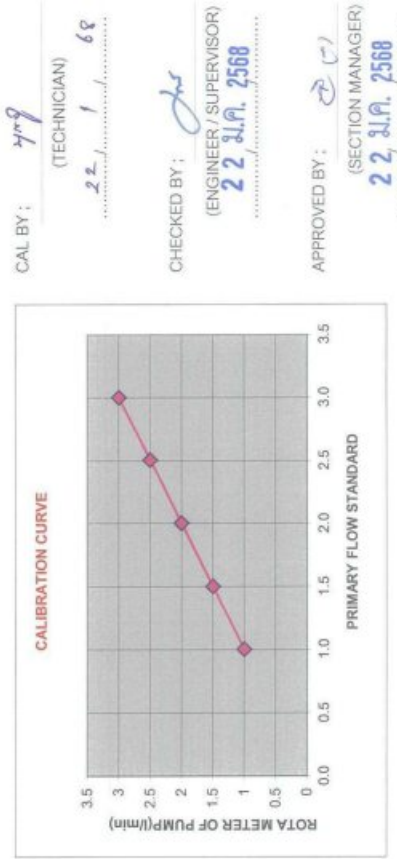
STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.005	1.007	1.004	1.005	± 0.03	PASS
1.5	1.507	1.506	1.503	1.505	± 0.03	PASS
2	2.003	2.004	2.006	2.004	± 0.03	PASS
2.5	2.503	2.506	2.507	2.505	± 0.03	PASS
3	3.007	3.006	3.005	3.006	± 0.03	PASS




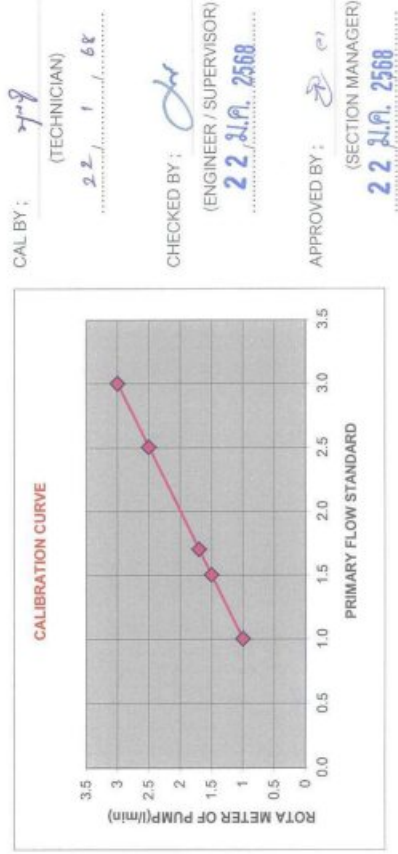
 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 008/68
PAGE 1/1		
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 008 MODEL : GILAIR - 5RP SERIAL NO : 20041202016 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 21 / JAN / 2025 NEXT DUE TIME : 21 / JUL / 2025		
STANDARD USED : AMBIENT CONDITIONS : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW STANDARD	ROTA METER OF PUMP (l/min)	PERMISSIBLE DEVIATION (l/min)
1	1.003 1.006 1.005 1.005	± 0.03
1.5	1.504 1.506 1.505 1.505	± 0.03
1.7	1.701 1.703 1.706 1.703	± 0.03
2.5	2.505 2.506 2.503 2.505	± 0.03
3	3.002 3.004 3.006 3.004	± 0.03
PASS / NOT PASS		
PASS PASS PASS PASS PASS		




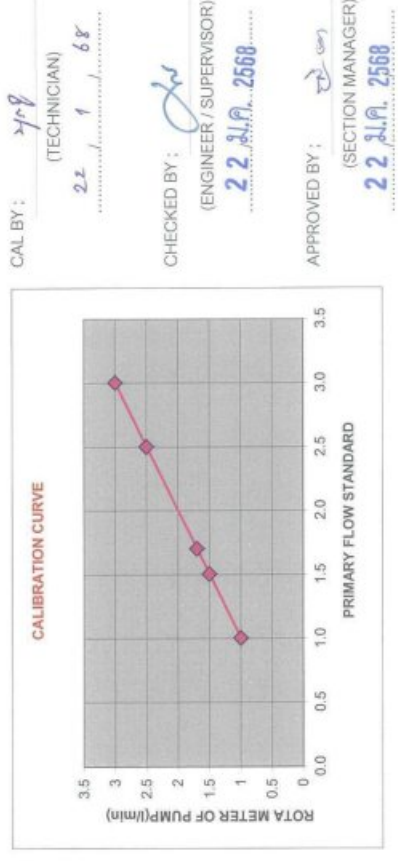
 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 007/68
PAGE 1/1		
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 007 MODEL : GILAIR - 5RP SERIAL NO : 15950 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 21 / JAN / 2025 NEXT DUE TIME : 21 / JUL / 2025		
STANDARD USED : AMBIENT CONDITIONS : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW STANDARD	ROTA METER OF PUMP (l/min)	PERMISSIBLE DEVIATION (l/min)
1	1.004 1.006 1.007 1.006	± 0.03
1.5	1.507 1.506 1.505 1.506	± 0.03
2	2.002 2.005 2.006 2.004	± 0.03
2.5	2.503 2.507 2.508 2.506	± 0.03
3	3.004 3.006 3.007 3.006	± 0.03
PASS / NOT PASS		
PASS PASS PASS PASS PASS		




 TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION	NO. 010/68 PAGE 1/1																																							
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 010 MODEL : GILAIR - 5RP SERIAL NO : 1007 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 21 / JAN / 2025 NEXT DUE TIME : 21 / JUL / 2025																																								
AMBIENT CONDITIONS : TEMPERATURE (°C) : 25 °C																																								
CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">STANDARD</th> <th colspan="3">PRIMARY FLOW ROTAMETER OF PUMP (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.005</td> <td>1.006</td> <td>1.003</td> <td>0.005</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.501</td> <td>1.506</td> <td>0.003</td> <td>PASS</td> </tr> <tr> <td>1.7</td> <td>1.702</td> <td>1.701</td> <td>1.702</td> <td>0.002</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.504</td> <td>2.507</td> <td>2.508</td> <td>0.006</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.002</td> <td>3.001</td> <td>3.002</td> <td>0.002</td> <td>PASS</td> </tr> </tbody> </table>		STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.005	1.006	1.003	0.005	PASS	1.5	1.502	1.501	1.506	0.003	PASS	1.7	1.702	1.701	1.702	0.002	PASS	2.5	2.504	2.507	2.508	0.006	PASS	3	3.002	3.001	3.002	0.002	PASS
STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS																																			
	1	2	3																																					
1	1.005	1.006	1.003	0.005	PASS																																			
1.5	1.502	1.501	1.506	0.003	PASS																																			
1.7	1.702	1.701	1.702	0.002	PASS																																			
2.5	2.504	2.507	2.508	0.006	PASS																																			
3	3.002	3.001	3.002	0.002	PASS																																			



 TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION	NO. 009/68 PAGE 1/1																																							
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 009 MODEL : GILAIR - 5RP SERIAL NO : 1000 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 21 / JAN / 2025 NEXT DUE TIME : 21 / JUL / 2025																																								
AMBIENT CONDITIONS : TEMPERATURE (°C) : 25 °C																																								
CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">STANDARD</th> <th colspan="3">PRIMARY FLOW ROTAMETER OF PUMP (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.003</td> <td>1.004</td> <td>1.005</td> <td>0.004</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.504</td> <td>1.506</td> <td>0.004</td> <td>PASS</td> </tr> <tr> <td>1.7</td> <td>1.703</td> <td>1.702</td> <td>1.704</td> <td>0.003</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.504</td> <td>2.505</td> <td>2.503</td> <td>0.004</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.003</td> <td>3.004</td> <td>3.005</td> <td>0.004</td> <td>PASS</td> </tr> </tbody> </table>		STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.003	1.004	1.005	0.004	PASS	1.5	1.502	1.504	1.506	0.004	PASS	1.7	1.703	1.702	1.704	0.003	PASS	2.5	2.504	2.505	2.503	0.004	PASS	3	3.003	3.004	3.005	0.004	PASS
STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS																																			
	1	2	3																																					
1	1.003	1.004	1.005	0.004	PASS																																			
1.5	1.502	1.504	1.506	0.004	PASS																																			
1.7	1.703	1.702	1.704	0.003	PASS																																			
2.5	2.504	2.505	2.503	0.004	PASS																																			
3	3.003	3.004	3.005	0.004	PASS																																			





TPI POLENE PUBLIC CO.,LTD.

CEMENT QUALITY DEPARTMENT

PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL)

CERTIFICATE OF CALIBRATION

NO. 012/68

PAGE 1/1

INSTRUMENT NAME : WORKING AREA DUST SAMPLER

INSTRUMENT CODE : Q1300 / 01 / 023 / 012

MODEL : GILAIR - 5RP

SERIAL NO : 1009

PARAMETER RANGE : 1 - 3 L / MIN

CAL DATE : 22 / JAN / 2025

NEXT DUE TIME : 22 / JUL / 2025

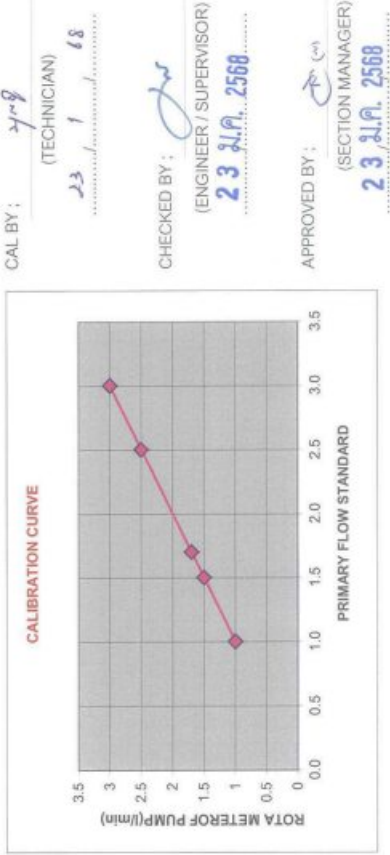
STANDARD USED :


AMBIENT CONDITIONS :

PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.003	1.002	1.007	1.004	± 0.03	PASS
1.5	1.503	1.501	1.504	1.503	± 0.03	PASS
1.7	1.706	1.702	1.704	1.704	± 0.03	PASS
2.5	2.505	2.506	2.506	2.506	± 0.03	PASS
3	3.002	3.004	3.005	3.004	± 0.03	PASS





TPI POLENE PUBLIC CO.,LTD.

CEMENT QUALITY DEPARTMENT

PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL)

CERTIFICATE OF CALIBRATION

NO. 011/68

PAGE 1/1

INSTRUMENT NAME : WORKING AREA DUST SAMPLER

INSTRUMENT CODE : Q1300 / 01 / 023 / 011

MODEL : GILAIR - 5RP

SERIAL NO : 1008

PARAMETER RANGE : 1 - 3 L / MIN

CAL DATE : 22 / JAN / 2025

NEXT DUE TIME : 22 / JUL / 2025

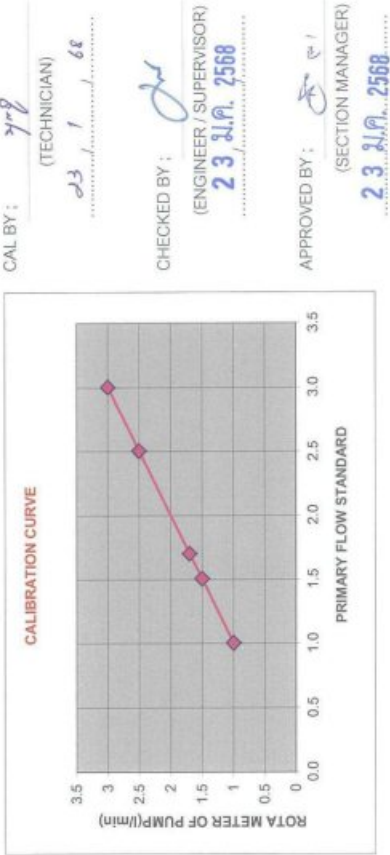
STANDARD USED :


AMBIENT CONDITIONS :

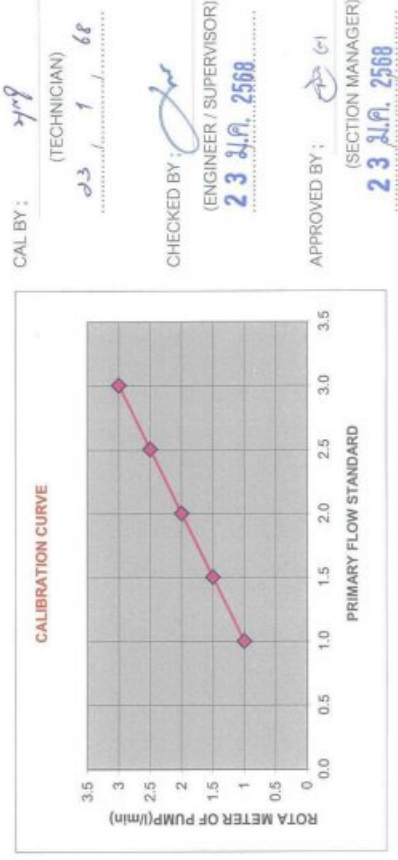
PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C


CALIBRATION DATA :

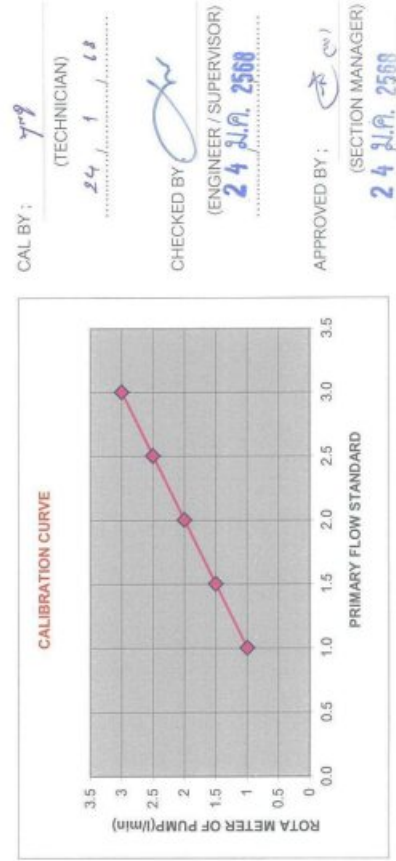
STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.004	1.002	1.006	1.004	± 0.03	PASS
1.5	1.506	1.502	1.506	1.505	± 0.03	PASS
1.7	1.702	1.704	1.701	1.702	± 0.03	PASS
2.5	2.503	2.506	2.504	2.504	± 0.03	PASS
3	3.002	3.005	3.007	3.005	± 0.03	PASS




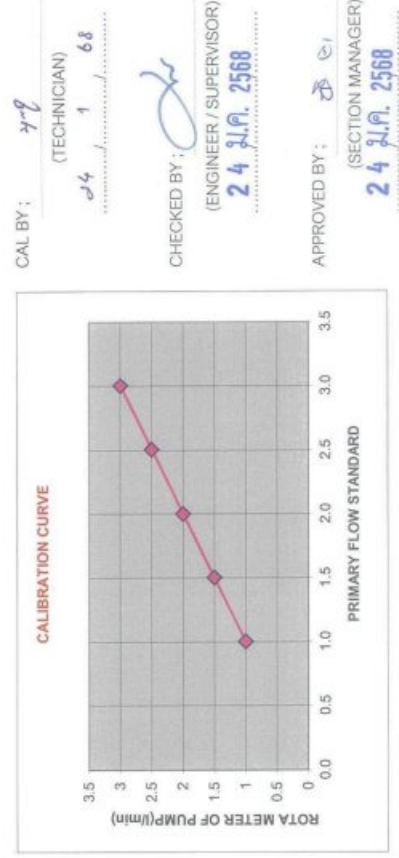
	TPI POLYENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 013/68			
			PAGE 1/1			
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 013 MODEL : GILAIR - SRP SERIAL NO : 1010 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 22 / JAN / 2025 NEXT DUE TIME : 22 / JUL / 2025						
STANDARD USED :		AMBIENT CONDITIONS : TEMPERATURE (°C) : 25 °C				
CALIBRATION DATA :						
STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3			
1	1.006	1.010	1.006	1.007	± 0.03	PASS
1.5	1.506	1.506	1.508	1.507	± 0.03	PASS
2	2.003	2.004	2.002	2.003	± 0.03	PASS
2.5	2.501	2.504	2.504	2.503	± 0.03	PASS
3	3.003	3.005	3.006	3.005	± 0.03	PASS




 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 018/68 PAGE 1/1				
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 018 MODEL : GILAIR - 5RP SERIAL NO : 20071202003 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 23 / JAN / 2025 NEXT DUE TIME : 23 / JUL / 2025						
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C						
AMBIENT CONDITIONS :						
CALIBRATION DATA :						
STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	
	1	2	3			
1	1.004	1.002	1.060	0.022	± 0.03	PASS
1.5	1.503	1.504	1.506	0.004	± 0.03	PASS
2	2.001	2.004	2.003	0.003	± 0.03	PASS
2.5	2.503	2.502	2.504	0.003	± 0.03	PASS
3	3.004	3.004	3.001	0.003	± 0.03	PASS



 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 017/68 PAGE 1/1				
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 017 MODEL : GILAIR - 5RP SERIAL NO : 20071202002 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 23 / JAN / 2025 NEXT DUE TIME : 23 / JUL / 2025						
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C						
AMBIENT CONDITIONS :						
CALIBRATION DATA :						
STANDARD	PRIMARY FLOW/ROTA METER OF PUMP (l/min)			PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	
	1	2	3			
1	1.006	1.003	1.006	0.005	± 0.03	PASS
1.5	1.504	1.502	1.510	0.005	± 0.03	PASS
2	2.005	2.004	2.001	0.003	± 0.03	PASS
2.5	2.504	2.502	2.501	0.002	± 0.03	PASS
3	3.002	3.001	3.006	0.003	± 0.03	PASS

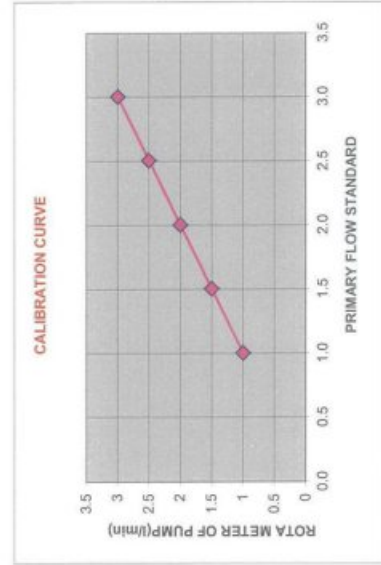



 TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 020/68
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 020 MODEL : GILAIR - 5RP SERIAL NO : 20071202005 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 23 / JAN / 2025 NEXT DUE TIME : 23 / JUL / 2025		PAGE 1/1
STANDARD USED : AMBIENT CONDITIONS : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW	ROTA METER OF PUMP (l/min)	PASS / NOT PASS
STANDARD	1 2 3 AVERAGE	
1	1.004 1.002 1.003 1.003	PASS
1.5	1.504 1.506 1.502 1.504	PASS
2	2.002 2.004 2.003 2.003	PASS
2.5	2.504 2.506 2.508 2.506	PASS
3	3.003 3.004 3.006 3.004	PASS

CAL BY :  (TECHNICIAN)
 24 / 1 / 68

CHECKED BY :  (ENGINEER / SUPERVISOR)
 24 JAN. 2568

APPROVED BY :  (SECTION MANAGER)
 24 JAN. 2568

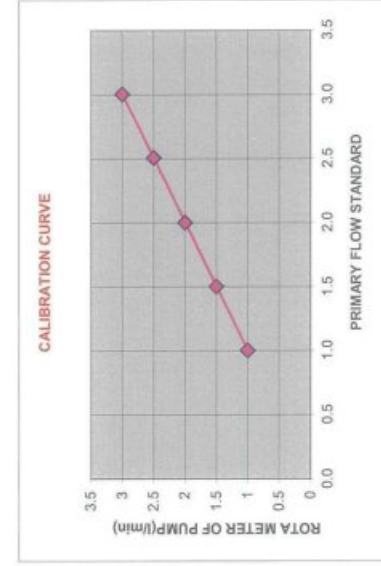



 TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 019/68
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 019 MODEL : GILAIR - 5RP SERIAL NO : 20071202004 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 23 / JAN / 2025 NEXT DUE TIME : 23 / JUL / 2025		PAGE 1/1
STANDARD USED : AMBIENT CONDITIONS : PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW	ROTA METER OF PUMP (l/min)	PASS / NOT PASS
STANDARD	1 2 3 AVERAGE	
1	1.003 1.002 1.006 1.004	PASS
1.5	1.503 1.503 1.506 1.504	PASS
2	2.001 2.003 2.002 2.002	PASS
2.5	2.503 2.504 2.502 2.503	PASS
3	3.001 3.004 3.005 3.003	PASS

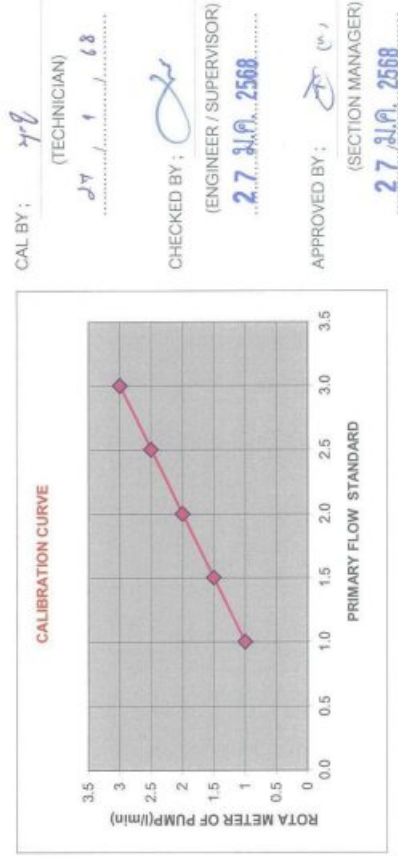
CAL BY :  (TECHNICIAN)
 24 / 1 / 68


CHECKED BY :  (ENGINEER / SUPERVISOR)
 24 JAN. 2568

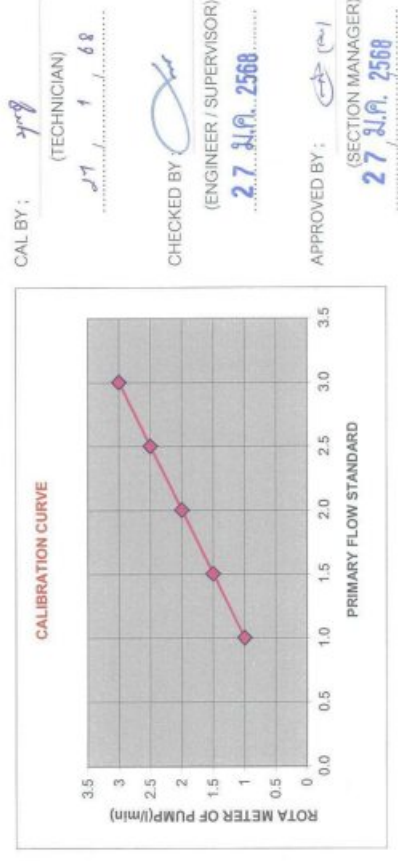
APPROVED BY :  (SECTION MANAGER)
 24 JAN. 2568




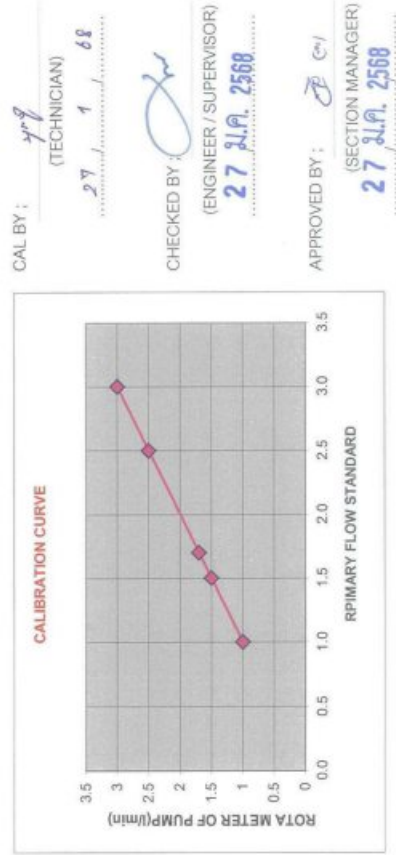
 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 022/68
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 022 MODEL : GILAIR - 5RP SERIAL NO : 20160201018 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 24 / JAN / 2025 NEXT DUE TIME : 24/ JUL / 2025		PAGE 1/1
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) AMBIENT CONDITIONS : TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW ROTA METER OF PUMP	DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)
STANDARD	1 2 3 AVERAGE	PASS / NOT PASS
1	1.002 1.004 1.003 1.003	± 0.03
1.5	1.503 1.504 1.503 1.503	± 0.03
2	2.002 2.001 2.004 2.002	± 0.03
2.5	2.502 2.504 2.502 2.503	± 0.03
3	3.005 3.002 3.001 3.003	± 0.03




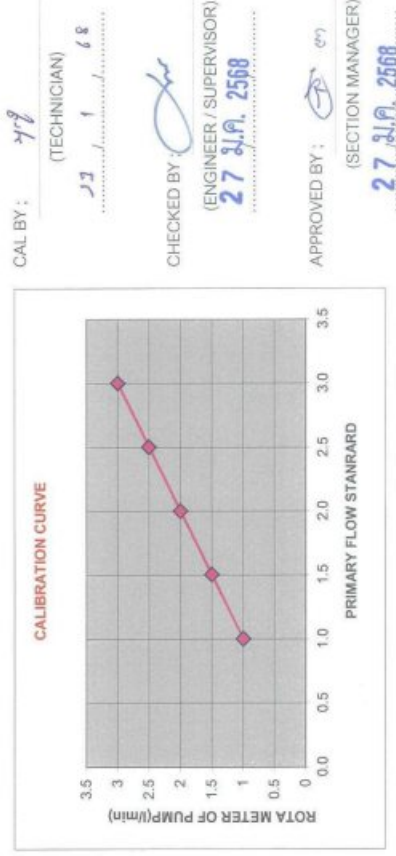
 TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION		NO. 021/68
INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 021 MODEL : GILAIR - 5RP SERIAL NO : 20160201017 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 24 / JAN / 2025 NEXT DUE TIME : 24 / JUL / 2025		PAGE 1/1
STANDARD USED : PRIMARY FLOW STANDARD (DRY CELL) AMBIENT CONDITIONS : TEMPERATURE (°C) : 25 °C		
CALIBRATION DATA :		
PRIMARY FLOW ROTA METER OF PUMP	DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)
STANDARD	1 2 3 AVERAGE	PASS / NOT PASS
1	1.002 1.004 1.005 1.004	± 0.03
1.5	1.502 1.502 1.505 1.503	± 0.03
2	2.001 2.003 2.002 2.002	± 0.03
2.5	2.502 2.504 2.503 2.503	± 0.03
3	3.004 3.001 3.002 3.002	± 0.03




 <p>TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION</p>	<p>NO. 024/68</p> <p>PAGE 1/1</p>																																													
<p>INSTRUMENT NAME : WORKING AREA DUST SAMPLER</p> <p>INSTRUMENT CODE : Q1300 / 01 / 023 / 024</p> <p>MODEL : GILAIR - 5RP</p> <p>SERIAL NO : 20160201020</p> <p>PARAMETER RANGE : 1 - 3 L / MIN</p> <p>CAL DATE : 24 / JAN / 2025</p> <p>NEXT DUE TIME : 24 / JUL / 2025</p>																																														
<p>STANDARD USED :</p> <p>PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C</p>																																														
<p>AMBIENT CONDITIONS :</p>																																														
<p>CALIBRATION DATA :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">STANDARD</th> <th colspan="3">PRIMARY FLOW ROTA METER OF PUMP (l/min)</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.002</td> <td>1.002</td> <td>1.003</td> <td>1.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.503</td> <td>1.506</td> <td>1.504</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.7</td> <td>1.701</td> <td>1.702</td> <td>1.705</td> <td>1.703</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.503</td> <td>2.501</td> <td>2.505</td> <td>2.503</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.002</td> <td>3.002</td> <td>3.004</td> <td>3.003</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table>		STANDARD	PRIMARY FLOW ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.002	1.002	1.003	1.002	± 0.03	PASS	1.5	1.502	1.503	1.506	1.504	± 0.03	PASS	1.7	1.701	1.702	1.705	1.703	± 0.03	PASS	2.5	2.503	2.501	2.505	2.503	± 0.03	PASS	3	3.002	3.002	3.004	3.003	± 0.03	PASS
STANDARD	PRIMARY FLOW ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)				PASS / NOT PASS																																					
	1	2	3																																											
1	1.002	1.002	1.003	1.002	± 0.03	PASS																																								
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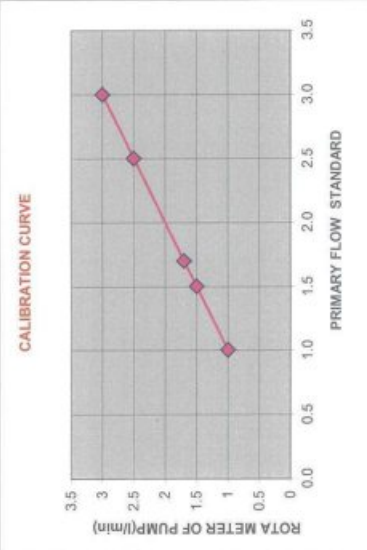



 <p>TPI POLYNE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION</p>	<p>NO. 023/68</p> <p>PAGE 1/1</p>																																													
<p>INSTRUMENT NAME : WORKING AREA DUST SAMPLER</p> <p>INSTRUMENT CODE : Q1300 / 01 / 023 / 023</p> <p>MODEL : GILAIR - 5RP</p> <p>SERIAL NO : 20160201019</p> <p>PARAMETER RANGE : 1 - 3 L / MIN</p> <p>CAL DATE : 24 / JAN / 2025</p> <p>NEXT DUE TIME : 24 / JUL / 2025</p>																																														
<p>STANDARD USED :</p> <p>PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C</p>																																														
<p>AMBIENT CONDITIONS :</p>																																														
<p>CALIBRATION DATA :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">STANDARD</th> <th colspan="3">PRIMARY FLOW ROTA METER OF PUMP (l/min)</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.002</td> <td>1.002</td> <td>1.003</td> <td>1.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.503</td> <td>1.504</td> <td>1.504</td> <td>1.504</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.002</td> <td>2.001</td> <td>2.006</td> <td>2.003</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.502</td> <td>2.504</td> <td>2.504</td> <td>2.503</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.002</td> <td>3.002</td> <td>3.001</td> <td>3.002</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table>		STANDARD	PRIMARY FLOW ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.002	1.002	1.003	1.002	± 0.03	PASS	1.5	1.503	1.504	1.504	1.504	± 0.03	PASS	2	2.002	2.001	2.006	2.003	± 0.03	PASS	2.5	2.502	2.504	2.504	2.503	± 0.03	PASS	3	3.002	3.002	3.001	3.002	± 0.03	PASS
STANDARD	PRIMARY FLOW ROTA METER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)				PASS / NOT PASS																																					
	1	2	3																																											
1	1.002	1.002	1.003	1.002	± 0.03	PASS																																								
1.5	1.503	1.504	1.504	1.504	± 0.03	PASS																																								
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2.5	2.502	2.504	2.504	2.503	± 0.03	PASS																																								
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<div></div> <div>TPI POLYMER PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION</div>		NO. 025/68																																													
		PAGE 1/1																																													
INSTRUMENT NAME : WORKING AREA DUST SAMPLER																																															
INSTRUMENT CODE : Q1300 / 01 / 023 / 025																																															
MODEL : GILAIR - 5RP																																															
SERIAL NO : 20160201021																																															
PARAMETER RANGE : 1 - 3 L / MIN																																															
CAL DATE : 24 / JAN / 2025																																															
NEXT DUE TIME : 24 / JUL / 2025																																															
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AMBIENT CONDITIONS :																																															
CALIBRATION DATA :																																															
<table><tr><th rowspan="2">STANDARD</th><th colspan="3">PRIMARY FLOW ROTAMETER OF PUMP (l/min)</th><th rowspan="2">DEVIATION (l/min)</th><th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th><th rowspan="2">PASS / NOT PASS</th></tr><tr><th>1</th><th>2</th><th>3</th></tr><tr><td>1</td><td>1.002</td><td>1.003</td><td>1.006</td><td>1.004</td><td>± 0.03</td><td>PASS</td></tr><tr><td>1.5</td><td>1.504</td><td>1.502</td><td>1.504</td><td>1.503</td><td>± 0.03</td><td>PASS</td></tr><tr><td>1.7</td><td>1.703</td><td>1.701</td><td>1.703</td><td>1.702</td><td>± 0.03</td><td>PASS</td></tr><tr><td>2.5</td><td>2.502</td><td>2.502</td><td>2.504</td><td>2.503</td><td>± 0.03</td><td>PASS</td></tr><tr><td>3</td><td>3.002</td><td>3.003</td><td>3.001</td><td>3.002</td><td>± 0.03</td><td>PASS</td></tr></table>			STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS	1	2	3	1	1.002	1.003	1.006	1.004	± 0.03	PASS	1.5	1.504	1.502	1.504	1.503	± 0.03	PASS	1.7	1.703	1.701	1.703	1.702	± 0.03	PASS	2.5	2.502	2.502	2.504	2.503	± 0.03	PASS	3	3.002	3.003	3.001	3.002	± 0.03	PASS
STANDARD	PRIMARY FLOW ROTAMETER OF PUMP (l/min)			DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS																																									
	1	2	3																																												
1	1.002	1.003	1.006	1.004	± 0.03	PASS																																									
1.5	1.504	1.502	1.504	1.503	± 0.03	PASS																																									
1.7	1.703	1.701	1.703	1.702	± 0.03	PASS																																									
2.5	2.502	2.502	2.504	2.503	± 0.03	PASS																																									
3	3.002	3.003	3.001	3.002	± 0.03	PASS																																									


CALIBRATION CURVE






CAL BY: 
(TECHNICIAN)
27 / 1 / 25


CHECKED BY: 
(ENGINEER / SUPERVISOR)
27 / 1 / 2568


APPROVED BY: 
(SECTION MANAGER)
27 / 1 / 2568





		INSTRUMENT SECTION		CERTIFICATE	
SARABURI		CERTIFICATE OF CALIBRATION		NO. OS-25-175	
PAGE 2 OF 3					
CALIBRATION METHOD : COMPARISON TECHNIQUES					
UNIT UNDER TEST (UUT)					
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (DRY TEMPERATURE PROBE ELEMENT)					
MANUFACTURE : QUEST TECHNOLOGIES					
MODEL : -					
ID NO./TAG NO. : Q1300/01/028/005					
SERIAL NO. : TEL010037					
SPECIFICATION : +/-2 DEG.C					
PARAMETER RANGE : 0 - 50 DEG.C					
DEPT. / SECT. : PRODUCT CONTROL 3					
CAL. DATE : 7 May 2025					
NEXT DUE DATE : -					
STANDARD USED (*1)					
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1					
CERTIFICATE NO.WS-25-009 DUE.DATE: Mar.28,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)					
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE.DATE:Sep.27,2025.					
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,					
THROUGH NA. CALTECHNOLOGIES CO.,LTD					
AMBIENT CONDITIONS					
TEMPERATURE : 23 +/- 2 DEG.C					
HUMIDITY : 59 +/- 10 %RH					
CALIBRATION RESULT					
ACTUAL VALUE (REFERENCE)		UNIT UNDER TEST READING		UNIT UNDER TEST DEVIATION (*3)	
23.0 DEG.C		24.0 DEG.C		+1.0 DEG.C	
				+/-2.0 DEG.C	
				PASS	
NOTES					
CAL BY : PATIPAT P. (MR.PATIPAT P.)					
CHECKED BY : (MR. THAWATCHAI S.)					
APPROVED BY : (MR. THAWATCHAI S.) (SECT. MANAGER)					
(*1) Traceable to relevant International Standards					
(*2) For Specification, See Permissible Deviation Column					
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value					


		INSTRUMENT SECTION		CERTIFICATE	
SARABURI		CERTIFICATE OF CALIBRATION		NO. OS-25-175	
PAGE 1 OF 3					
CALIBRATION METHOD : COMPARISON TECHNIQUES					
UNIT UNDER TEST (UUT)					
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (WET TEMPERATURE PROBE ELEMENT)					
MANUFACTURE : QUEST TECHNOLOGIES					
MODEL : -					
ID NO./TAG NO. : Q1300/01/028/005					
SERIAL NO. : TEL010037					
SPECIFICATION : +/-2 DEG.C					
PARAMETER RANGE : 0 - 50 DEG.C					
DEPT. / SECT. : PRODUCT CONTROL 3					
CAL. DATE : 7 May 2025					
NEXT DUE DATE : -					
STANDARD USED (*1)					
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1					
CERTIFICATE NO.WS-25-009 DUE.DATE: Mar.28,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)					
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE.DATE:Sep.27,2025.					
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,					
THROUGH NA. CALTECHNOLOGIES CO.,LTD					
AMBIENT CONDITIONS					
TEMPERATURE : 23 +/- 2 DEG.C					
HUMIDITY : 59 +/- 10 %RH					
CALIBRATION RESULT					
ACTUAL VALUE (REFERENCE)		UNIT UNDER TEST READING		UNIT UNDER TEST DEVIATION (*3)	
23.0 DEG.C		23.9 DEG.C		+0.9 DEG.C	
				+/-2.0 DEG.C	
				PASS	
NOTES					
CAL BY : PATIPAT P. (MR.PATIPAT P.)					
CHECKED BY : (MR. THAWATCHAI S.)					
APPROVED BY : (MR. THAWATCHAI S.) (SECT. MANAGER)					
(*1) Traceable to relevant International Standards					
(*2) For Specification, See Permissible Deviation Column					
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value					


	INSTRUMENT SECTION		CERTIFICATE
SARABURI	CERTIFICATE OF CALIBRATION		NO. OS-25-175
CALIBRATION METHOD : COMPARISON TECHNIQUES			PAGE 3 OF 3
UNIT UNDER TEST (UUT)			
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (GLOBE TEMPERATURE PROBE ELEMENT)			
MANUFACTURE : QUEST TECHNOLOGIES			
ID NO./TAG NO. : Q1300/01/028/005			
SPECIFICATION : +/-2 DEG.C			
PARAMETER RANGE : 0 - 50 DEG.C			
CAL. DATE : 7 May 2025			
STANDARD USED (*1)			
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) "ISOTECH" MODEL 953.14-61 S/N 16399/1			
CERTIFICATE NO.WS-25-009 DUE-DATE. Mar.26,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)			
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE-DATE.Sep.27,2025.			
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,			
THROUGH NA. CALTECHNOLOGIES CO.,LTD			
AMBIENT CONDITIONS			
TEMPERATURE : 23 +/- 2 DEG.C			
HUMIDITY : 59 +/- 10 %RH			
CALIBRATION RESULT			
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*2)	PASS/ FAIL
23.0 DEG.C	23.9 DEG.C	+0.9 DEG.C	PASS
NOTES			
(*1) Traceable to relevant International Standards			
(*2) For Specification, See Permissible Deviation Column			
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value			
CAL BY : Pa91227 P			
(MR.PATIPAT P.)			
CHECKED BY : 22			
(MR.THAWATCHAI S.)			
APPROVED BY : 			
(SEC. MANAGER)			


	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-177
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 2 OF 3
CALIBRATION METHOD : COMPARISON TECHNIQUES			
UNIT UNDER TEST (UUT)			
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (DRY TEMPERATURE PROBE ELEMENT)			
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -			
ID NO./TAG NO. : Q1300/01/028/007 SERIAL NO. : TEP110006			
SPECIFICATION : +/- 2 DEG.C			
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3			
CAL. DATE : 7 May 2025 NEXT DUE DATE : -			
STANDARD USED (*1)			
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1			
CERTIFICATE NO.WS-25-009 DUE.DATE. Mar.28,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)			
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE.DATE.Sep.27,2025.			
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,			
THROUGH NA. CALTECHNOLOGIES CO.,LTD			
AMBIENT CONDITIONS			
TEMPERATURE : 23 +/- 2 DEG.C			
HUMIDITY : 59 +/- 10 %RH			
CALIBRATION RESULT			
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PASS/ FAIL
23.0 DEG.C	23.8 DEG.C	+0.8 DEG.C	PASS
NOTES			
CAL BY : PATIPAT P (MR.PATIPAT P)			
CHECKED BY : (MR. THAWAN CHAI S.)			
APPROVED BY : (MR. THAWAN CHAI S.) (SEC. MANAGER)			

	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-177
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 1 OF 3
CALIBRATION METHOD : COMPARISON TECHNIQUES			
UNIT UNDER TEST (UUT)			
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (WET TEMPERATURE PROBE ELEMENT)			
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -			
ID NO./TAG NO. : Q1300/01/028/007 SERIAL NO. : TEP110006			
SPECIFICATION : +/- 2 DEG.C			
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3			
CAL. DATE : 7 May 2025 NEXT DUE DATE : -			
STANDARD USED (*1)			
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1			
CERTIFICATE NO.WS-25-009 DUE.DATE. Mar.28,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)			
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE.DATE.Sep.27,2025.			
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,			
THROUGH NA. CALTECHNOLOGIES CO.,LTD			
AMBIENT CONDITIONS			
TEMPERATURE : 23 +/- 2 DEG.C			
HUMIDITY : 59 +/- 10 %RH			
CALIBRATION RESULT			
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PASS/ FAIL
23.0 DEG.C	23.8 DEG.C	+0.8 DEG.C	PASS
NOTES			
CAL BY : PATIPAT P (MR.PATIPAT P)			
CHECKED BY : (MR. THAWAN CHAI S.)			
APPROVED BY : (MR. THAWAN CHAI S.) (SEC. MANAGER)			

	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-177	
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 3 OF 3	
CALIBRATION METHOD : COMPARISON TECHNIQUES				
UNIT UNDER TEST (UUT)				
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (GLOBE TEMPERATURE PROBE ELEMENT)				
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -				
ID NO./TAG NO. : Q1300/01/028/007 SERIAL NO. : TEP110006				
SPECIFICATION : +/-2 DEG.C				
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3				
CAL. DATE : 7 May 2025 NEXT DUE DATE : -				
STANDARD USED (*1)				
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1				
CERTIFICATE NO.WS-25-009 DUE.DATE. Mar.28,2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)				
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE.DATE.Sep.27,2025.				
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,				
THROUGH NA. CALTECHNOLOGIES CO.,LTD				
AMBIENT CONDITIONS				
TEMPERATURE : 23 +/- 2 DEG.C				
HUMIDITY : 59 +/- 10 %RH				
CALIBRATION RESULT				
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PERMISSIBLE DEVIATION (*2)	PASS/ FAIL
23.0 DEG.C	23.9 DEG.C	+0.9 DEG.C	+/-2.0 DEG.C	PASS
NOTES				
(*1) Traceable to relevant International Standards				
(*2) For Specification, See Permissible Deviation Column				
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value				
CAL BY :  (MR.PATIPAT P.)				
CHECKED BY :  (MR.THAWATCHAI S.)				
APPROVED BY :  (SECTION MANAGER)				

	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-176	
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 2 OF 3	
CALIBRATION METHOD : COMPARISON TECHNIQUES				
UNIT UNDER TEST (UUT)				
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (DRY TEMPERATURE PROBE ELEMENT)				
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -				
ID NO./TAG NO. : Q1300/01/028/006 SERIAL NO. : TEM120023				
SPECIFICATION : +/- 2 DEG.C				
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3				
CAL. DATE : 7 May 2025 NEXT DUE DATE : -				
STANDARD USED (*1)				
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1				
CERTIFICATE NO.WS-25-009 DUE DATE. Mar.28.2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)				
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE DATE.Sep.27.2025.				
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,				
THROUGH N.A. CALTECHNOLOGIES CO.,LTD				
AMBIENT CONDITIONS				
TEMPERATURE : 23 +/- 2 DEG.C				
HUMIDITY : 59 +/- 10 %RH				
CALIBRATION RESULT				
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PERMISSIBLE DEVIATION (*2)	PASS/ FAIL
23.0 DEG.C	24.1 DEG.C	+1.1 DEG.C	+/- 2.0 DEG.C	PASS
NOTES				
CAL BY : PATIPAT P (MR.PATIPAT P.)				
CHECKED BY : (MR.THAWATCHAI S.)				
APPROVED BY : (SEC. MANAGER)				
(*1) Traceable to relevant International Standards				
(*2) For Specification, See Permissible Deviation Column				
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value				

	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-176	
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 1 OF 3	
CALIBRATION METHOD : COMPARISON TECHNIQUES				
UNIT UNDER TEST (UUT)				
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (WET TEMPERATURE PROBE ELEMENT)				
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -				
ID NO./TAG NO. : Q1300/01/028/006 SERIAL NO. : TEM120023				
SPECIFICATION : +/- 2 DEG.C				
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3				
CAL. DATE : 7 May 2025 NEXT DUE DATE : -				
STANDARD USED (*1)				
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1				
CERTIFICATE NO.WS-25-009 DUE DATE. Mar.28.2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)				
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE DATE.Sep.27.2025.				
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND ,				
THROUGH N.A. CALTECHNOLOGIES CO.,LTD				
AMBIENT CONDITIONS				
TEMPERATURE : 23 +/- 2 DEG.C				
HUMIDITY : 59 +/- 10 %RH				
CALIBRATION RESULT				
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PERMISSIBLE DEVIATION (*2)	PASS/ FAIL
23.0 DEG.C	23.9 DEG.C	+0.9 DEG.C	+/- 2.0 DEG.C	PASS
NOTES				
CAL BY : PATIPAT P (MR.PATIPAT P.)				
CHECKED BY : (MR.THAWATCHAI S.)				
APPROVED BY : (SEC. MANAGER)				
(*1) Traceable to relevant International Standards				
(*2) For Specification, See Permissible Deviation Column				
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value				

	INSTRUMENT SECTION		CERTIFICATE NO. OS-25-176	
SARABURI	CERTIFICATE OF CALIBRATION		PAGE 3 OF 3	
CALIBRATION METHOD : COMPARISON TECHNIQUES				
UNIT UNDER TEST (UUT)				
EQUIPMENT NAME : THERMAL ENVIRONMENT MONITOR (GLOBE TEMPERATURE PROBE ELEMENT)				
MANUFACTURE : QUEST TECHNOLOGIES MODEL : -				
ID NO./TAG NO. : Q1300/01/028/006 SERIAL NO. : TEM120023				
SPECIFICATION : +/-2 DEG.C				
PARAMETER RANGE : 0 - 50 DEG.C DEPT. / SECT. : PRODUCT CONTROL 3				
CAL. DATE : 7 May 2025 NEXT DUE DATE : -				
STANDARD USED (*1)				
IN-041 : STANDARD RESISTANCE TEMPERATURE DETECTOR (PT100) 'ISOTECH' MODEL 953.14-61 S/N 16399/1				
CERTIFICATE NO.WS-25-009 DUE DATE. Mar.28.2026. WAS CALIBRATED AGAINST THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR). THROUGH N.M. TECHNICAL CENTER LABORATORY (NTL.)				
IN-028 : DIGITAL MULTIMETER , CERTIFICATES NO.WS-24-039 DUE DATE.Sep.27.2025.				
WAS CALIBRATED AGAINST : NATIONAL INSTITUTE OF METROLOGY (NIMT.) THAILAND .				
THROUGH NA. CALTECHNOLOGIES CO.,LTD				
AMBIENT CONDITIONS				
TEMPERATURE : 24 +/- 2 DEG.C				
HUMIDITY : 59 +/- 10 %RH				
CALIBRATION RESULT				
ACTUAL VALUE (REFERENCE)	UNIT UNDER TEST READING	UNIT UNDER TEST DEVIATION (*3)	PERMISSIBLE DEVIATION (*2)	PASS/ FAIL
23.0 DEG.C	24.3 DEG.C	+1.3 DEG.C	+/-2.0 DEG.C	PASS
NOTES				
(*1) Traceable to relevant International Standards				
(*2) For Specification, See Permissible Deviation Column				
(*3) UUT Deviation calculated from UUT. Reading minus Actual Value				
CAL BY : Patipat P (MR.PATIPAT P.)				
CHECKED BY : (MR.THANAYACHAI S.)				
APPROVED BY : (SECT. MANAGER)				

Cert. No. : ACL25007
Job No. : VC68AC0049
Pages : 2 of 9

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25007
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-43 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01142135 / 208051 / 35108
ID No.: -

Condition As Found : GOOD

Customer : TPI POLYNE PUBLIC COMPANY LIMITED.
299 MOO 5, MITRAPARP ROAD, TAMBOL TUBKWANG,
AMPHUR KANGKHROY, SARABURI 18260 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 17 DECEMBER 2024
Calibration Date : 09 JANUARY 2025
Date of Issue : 09 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchu.*
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No. : ACL25007
Job No. : VC68AC0049
Page : 4 of 9

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	12.1
C - weight	17.1
Flat	23.0

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
125	0.4	0.5	± 1.5
1000	0.1	0.1	± 1.0
8000	0.7	0.8	±5.0

T. Petch.

Cert. No. : ACL25007
Job No. : VC68AC0049
Pages : 3 of 9

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.1	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch.

Cert. No. : ACL25007
Job No. : VC68AC0049
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
63	0.0	0.0	±2.0
125	0.0	0.0	±1.5
250	0.0	-0.1	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.0	±2.0
4000	-0.1	-0.1	±3.0
8000	-0.1	-0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	89.6		

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Z. Petcha

Customer name		Reference No.		Judgment
TPI POLENE PUBLIC COMPANY LIMITED				PASS
Instrument model	Instrument serial No.	Cal. date	Due. date	
NL-42	233181	15-Aug-24	15-Aug-25	
Microphone model	Preamplifier model	Ambient conditions		
UC-52	NH-24	25°C		
Microphone serial No.	Preamplifier serial No.	Cal. Humidity		
144834	23229	58%RH		
Numerical Display		Instantaneous level		
Linearity Check Setup		A.C.Z		
Input Signal Setup		Fast/Slow		
		90-114 dB		
		Fast/Slow		
		Input 1 kHz, 1.00 V rms., Attenuation 0 dB		
Select A				
Standard	Reading	Slow	Fast	Error
Setting	Fast	Slow	Fast	Slow
94	93.9	93.9	0.1	0.1
114	114	114.0	0	0
(dB)	(dB)	(dB)	(dB)	(dB)
±0.2				
Select C				
Standard	Reading	Slow	Fast	Error
Setting	Fast	Slow	Fast	Slow
94	94.0	94.0	0.0	0.0
114	114.1	114.1	-0.1	-0.1
(dB)	(dB)	(dB)	(dB)	(dB)
±0.2				
Select Z				
Standard	Reading	Slow	Fast	Error
Setting	Fast	Slow	Fast	Slow
94	94.1	94.1	-0.1	-0.1
114	114.1	114.1	-0.1	-0.1
(dB)	(dB)	(dB)	(dB)	(dB)
±0.2				
Calibration equipment				
Acoustic calibrator Model TM-100 S/N. 200901082				
Sound pressure level 94.0 and 114 dB, frequency 1,000 Hz				
Remark:				

Actioned by: Channawan Yot-yong Approved by: Pendin

Service Engineer

Division Manager

Customer : TPI POLENE PUBLIC COMPANY LIMITED
299 Moo 5 Mitrapalr Rd., T.Tubkwaeng, A.Kangkhoy, Sanburi 18260
Thailand

Equipment Name : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial Number : 233181
ID. Number : N/A
Environmental Conditions : 25°C
Ambient Temperature : 58%
Relative Humidity : Environmental Solution Integrator Co.,Ltd.
Location of Calibration : Environmental Solution Integrator Co.,Ltd.
Received Date : 14 Aug 2024
Calibration Date : 15 Aug 2024
Recommend Due Date : 15 Aug 2025

Calibrated by : Mr.Chunniawan Yokyong
Calibration Officer

Approved by : Pendin
(Mr.Terada) Sangthong
Authorized Signatory

Environmental Solution Integrator Co., Ltd.
82/42 Moo.19 Phuthamonthon Sai2 Road
Sala Thammasop, Thawi Watthana
Bangkok 10170

Tel 0-2408-2042
Fax 0-2408-2043
E-mail info@esi-thailand.com
http://www.esi-thailand.com

63/14-15.67/35-36 ซอยเพชรเกษม 7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600
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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax +66 2324 0917



NSC-TIS-TIS 17026
CALIBRATION 0119

Certificate No.: CP20250067EA
Operation No.: CP2025020050

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: Pulsar Instruments Plc
Model/Type: 44 (Meter), PM2 (Microphone), PA40 (Preamplifier)
Serial No.: PN2458 (Meter), 022672A (Microphone), 2503 (Preamplifier)
ID No.: -
Customer: TPI Polene Public Company Limited.
Address: 229 Moo 5, Mittraphap Road Km.134, Tabkwang Sub-District,
Kaeng Koel District, Saraburi 18260
Received Date: 13 February 2025
Calibrated Date: 24 - 25 February 2025
Issued Date: 26 February 2025
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k)
providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except
with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20250067EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
18.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	Under-range
C-weighting	22.5
Z-weighting	28.8

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.8	0.8	0.7	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	2.0	2.0	1.8	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.4	0.4	0.4	±2.0
125	0.2	0.1	0.2	±1.5
250	0.1	0.0	0.1	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.3	0.4	0.2	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

Certificate No.: CP20250067EA

Calibration Report

Equipment:

Manufacturer:

Model/Type:

Serial No.:

ID No.:

Ambient Temperature:

Relative Humidity:

Pressure:

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9609027	CB20240128EA	31 July 2025
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022	20 March 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CD20240180EA	7 August 2025
			CB20250030EA	13 February 2026
			CK20240069EA	19 September 2025

2. This result of calibration was found accurate as shown on date and place of calibration only.

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20250067EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	± 1.0
	2	118.9	-0.1	$+1.0 ; -2.5$
Slow	0.25	109.8	-0.2	$+1.5 ; -5.0$
	200	129.5	-0.1	± 1.0
	2	109.9	-0.1	$+1.0 ; -5.0$
LAE	200	130.0	0.0	± 1.0
	2	109.9	-0.1	$+1.0 ; -2.5$
	0.25	100.8	-0.2	$+1.5 ; -5.0$

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	135.1	-0.3	± 3.0
Positive half cycle	134.4	134.1	-0.3	± 2.0
Negative half cycle	134.4	134.1	-0.3	± 2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	± 1.5
142.9	142.9		

Certificate No.: CP20250067EA

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	± 0.1
Slow	94.0	0.0	± 0.1
LAEq	94.0	0.0	± 0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	± 0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
139.0	139.0	0.0	± 1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1



Certificate of Calibration


Certificate Number : SPR24010025-1
Customer : TPI POLENE PUBLIC COMPANY LIMITED
299 Moo 5 Mitraparp Rd., T.Tubkwang, A.Kangkhoey, Saraburi 18260
Thailand

Page : 1 of 3

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2458
ID. Number : N/A
Environmental Conditions
Ambient Temperature : 23 °C ± 3 °C
Relative Humidity : 50 % ± 15 %
Location of Calibration : In-Lab
Calibration Procedure : SP-CPE-04-01
Received Date : 04 Jan 2024
Calibration Date : 05 Jan 2024
Recommend Due Date : 05 Jan 2025
Date of Issue : 06 Jan 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. The calibration certificate shall not be reproduced except in full without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul
Calibration Officer
Approved by : 
(Mr.Prayoon Topart)
Authorized Signatory



Certificate No.: CP20250067EA

Calibration Report

Function : 11. High-Level Stability
High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.24	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 2.
4. The coverage factor $k = 2.00$

-- End of Report --