

ภาคผนวกที่ 41
เอกสารสอบเทียบเครื่องมือ



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)	Thermo Scientific	G25A 1270	Jiranatee Associates Co., Ltd.	CO-004-66	12 Jun 23	11 Jun 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1396	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1855	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920008	UAE Consultant Co.,Ltd.	22032023	22 Mar 23	21 Mar 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920009	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920010	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 Mar 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920011	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387062	UAE Consultant Co.,Ltd.	07032023	7 Mar 23	6 Mar 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387064	UAE Consultant Co.,Ltd.	14022023	14 Feb 23	13 Feb 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	01092023	9 Jan 23	8 Jan 24	-

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									
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
15	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0058	Thai Meteorological Department	162/23	11 Apr 23	10 Apr 24	-
16	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Thai Meteorological Department	163/23	17 Apr 23	16 Apr 24	-
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0116	Thai Meteorological Department	164/23	17 Apr 23	16 Apr 24	-
18	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2301DR0024	Thai Meteorological Department	176/23	10 Apr 23	9 Apr 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
20	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{Adn} , เสียงรบกวน	Larson Davis	LxT1 0007310	Larson Davis-A PCB Piezotronics Div.	2023003673	24 Mar 23	23 Mar 25	-
21	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{Adn} , เสียงรบกวน		LxT1 0007311					
22	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{Adn} , เสียงรบกวน	Larson Davis	LxT1 0007312	Larson Davis-A PCB Piezotronics Div.	2023003676	24 Mar 23	23 Mar 25	-
23	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{Adn} , เสียงรบกวน		LxT1 0007313					

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0A0005	Technology Promotion Association (Thailand-Japan)	23CH280	1 Mar 23	28 Feb 24	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE9M0028	Technology Promotion Association (Thailand-Japan)	23TW47	28 Feb 23	27 Feb 24	-
3	Conductivity Meter	Conductivity	Horiba	LAQUA-EC210 HC9L0015	Technology Promotion Association (Thailand-Japan)	23CH430	29 Mar 23	28 Mar 24	-

CERTIFICATE OF CALIBRATION

Certificate No. : CO-004-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : Anderson Instruments
MODEL/TYPE : G25A
SERIAL NUMBER : 1270
ID NUMBER : UAE ANV.009/2542
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 : 02 Jun 2023
MEASUREMENT DATE : 12 Jun 2023
ISSUE DATE : 12 Jun 2023

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 : 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.3 °C and 55.0%RH.

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.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2-0p. The W6-GJ-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 NMI (National Metrology Institute of Netherlands) via Certificate number: G2215901

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 [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Qs] m ³ /min
1	0.705	755.787	24.17	23.48	47.401	1.708	1.305	0.661
2	0.999	755.849	23.95	23.54	51.522	3.383	1.837	0.930
3	1.119	755.810	23.39	22.98	35.502	4.448	2.109	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	2.235	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	2.725	1.376

Slope (m): 1.98581
Intercept (b): -0.00879
Correlation coefficient (r): 0.99984
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	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Qs] m ³ /min
1	0.705	755.787	24.17	23.48	47.401	1.708	0.820	0.663
2	0.999	755.849	23.95	23.54	51.522	3.383	1.153	0.933
3	1.119	755.810	23.39	22.98	35.502	4.448	1.321	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	1.401	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	1.708	1.377

Slope (m): 1.24382
Intercept (b): -0.00554
Correlation coefficient (r): 0.99984
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION IS GRANTED BY THE LABORATORY. เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3009-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1396
Page : 1 of 2

Equipment: U Tube Manometer

Manufacturer: Dwyer

Model: 1221-36-W/M

Serial No.: -

ID No.: UAE.EMA2.094/2555

Condition As-Received: Used Item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 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 in-house calibration procedure CP-P04, using " DKD-R 6-1 " Calibration of Pressure Gauges, Edition 03/2014 " 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-0137-22	24 Aug 2023

2. This result of calibration was made on requested at the point specified by customer.

3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4. This instrument was used clean air as pressure media.

5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussamee
Issue Date : 11 May 2023

Approved Signatory : Attapol P.
[] Phalinsee Prabpalpal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0314238



Cert.No.: 23P1396
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 Fifth Estimate)

Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.00	10.00	0.00
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	9.98	-10.04	20.02	0.02
22.00	10.98	-11.04	22.02	0.02
24.00	11.98	-12.04	24.02	0.02
26.00	12.98	-13.04	26.02	0.02
28.00	13.98	-14.04	28.02	0.02
30.00	14.98	-15.06	30.04	0.04
32.00	15.98	-16.06	32.04	0.04
34.00	16.98	-17.08	34.06	0.06
35.00	17.98	-18.00	35.96	0.16

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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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Attapol P.
a 1160345

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Certificate of Calibration

Certificate No.: 23P1855
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.122/2550

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 : Calibration of Pressure
Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3. This result of calibration was made on requested at the point specified by customer.

4. This result of calibration instrument was in absolute pressure.

5. This instrument was used clean air as pressure media.

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

7. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankaew
Issue Date: 06 June 2023

Approved Signatory: *Attapol R.*
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0316955



Result of calibration:- Without adjustment

Range: 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	958.50	969.59	980.35	990.39	1001.01	1011.15	1020.94	1031.45
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	1.50	0.41	-0.35	-0.39	-1.01	-1.15	-0.94	-1.45

Decreasing Pressure

Applied Pressure (hPa)	1031.45	1021.61	1012.16	1002.38	992.17	982.20	970.69	959.32
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-1.45	-1.61	-2.16	-2.38	-2.17	-2.20	-0.69	0.68

The uncertainty of measurement was ± 0.39 hPa

* 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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Attapol R.
เอกสารไม่ควบคุม
a 1165504



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.130/2550

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison
with standard chilled mirror sensor for humidity measurement function and comparison with standard
temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024

2. The 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 maintained through:-

-National Institute of Standards and Technology (NIST) , The United States of America
-Technology Promotion Association (Thailand-Japan), NSG-ONSG Accredited No. Calibration 0008

Calibrated by: Somchai Durmoo
Issue Date: 07 June 2023

Approved Signatory: *Chakrit Waewwanjua*
[x] Chakrit Waewwanjua
[] Ponthippa Tameyaku
[] Viporn Tantiyawutti

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B 0316274



Result of Calibration:-

Before 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	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

After 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	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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a 1165295

MULTI-POINT GAS TEST REPORT

Test Date : Mar 22, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920008

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail

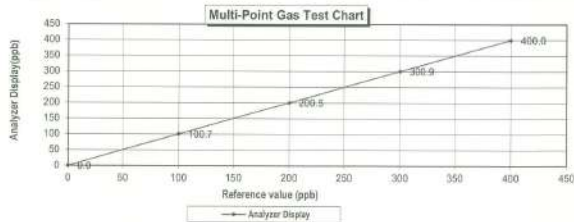
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.5	0.25	0.25
Level 4 60.00%	300.0	300.9	0.30	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.25



Calculate by

Sinchari Sangsri
22/3/23

Approve by

Pattana N
22/3/23

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920009

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail

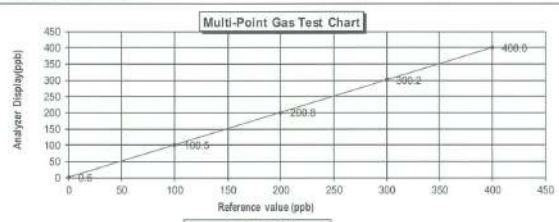
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.6	0.60	0.60	0.60
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	200.8	0.40	0.40
Level 4 60.00%	300.0	300.2	0.07	0.07
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.31



Calculate by

Aphiwat K.
15/02/23

Approve by

Pattana N
15/2/23

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920010

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail

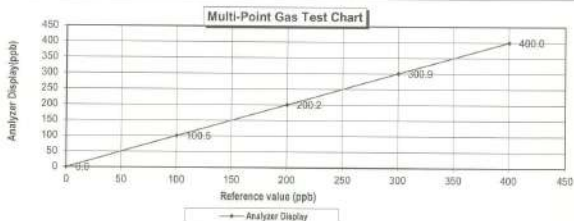
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	200.2	0.10	0.10
Level 4 60.00%	300.0	300.9	0.30	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.18



Calculate by

Aphiwat K.
3/5/23

Approve by

Pattana N
3/5/23

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920011

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail

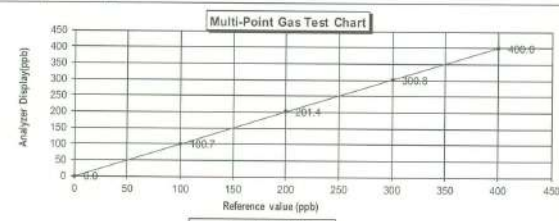
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	201.4	0.70	0.70
Level 4 60.00%	300.0	300.8	0.27	0.27
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Average Difference (%) 0.33



Calculate by

Aphiwat K.
2/4/23

Approve by

Pattana N
2/4/23

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: ED4N190E5A0103 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SA2) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B2202 Valve Outlet: S60
Gas Code: CO,NO,NOX,SC2,BALN Certification Date: Jun 21, 2023
Expiration Date: Jun 21, 2024

Declaration: performed in accordance with EPA Testability Protocol for Analytical Certification of Stationary Sources (May 2012) approved EPA, GCPR-16161, using the assay procedures under Analytical Validation does not include a disclaimer for analytical verification. The analyzer has a special designed capability to detect leakage at a confidence level of 95%. There are no significant impacts or risk allow the use of this calibration inclusive. All concentrations are in ppmv unless otherwise noted. Do Not Use This Label Below 100ppm, i.e. 0.7% oxygen.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.50 PPM	G1	+/- 1.5% NIST Traceable	08/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021, 06/21/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NTM	2051112	CC7M308	49.35 PPM NITRIC OXIDE/NITROGEN	+/- 1.3%	Feb 02, 2025
PRM	7386	CC6S055	9.91 PPM SULFUR DIOXIDE/NITROGEN	+/- 2.3%	Feb 20, 2020
GMS	0014232102	CC6S051	4.43 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Feb 08, 2023
NTM	16011043	CC473277	45.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTM	14031118	CC454277	350.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 16, 2025

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Model: 9700 AHR800-533 CO	FTIR	Jun 03, 2024
Model: 9700 AHR800-533 NO	FTIR	Jun 03, 2024
Model: 9700 AHR800-533 NO2	FTIR	Jun 03, 2024
Model: 9700 AHR800-533 SO2	FTIR	Jun 03, 2024

Tried Data Available Upon Request

NOTES: PO #522-007407

GROSS WT: 23.40kg

NET WT: 4.72kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release

CERT 3082.01
เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Mar 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387062

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) -
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

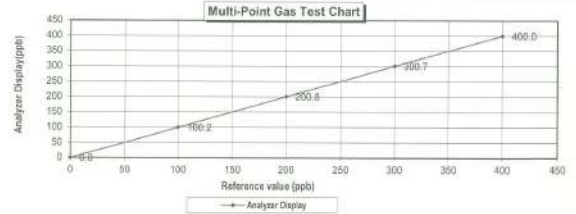
Diluter Detail

Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	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	0.20	0.20	0.20
Level 3	40.00%	200.8	0.80	0.40	0.40
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%
Average Difference (%) 0.17



Calculate by
Aphawat K.
2 3 16

Approve by
P. Monm.
7 16 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387063

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) -
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

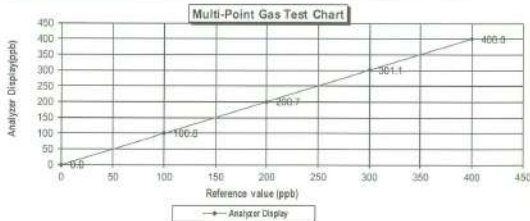
Diluter Detail

Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	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	0.80	0.79	0.79
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	301.1	1.10	0.37	0.37
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%
Average Difference (%) 0.30



Calculate by

Aphawat K.
2 4 16

Approve by

P. Monm.
7 16 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 14, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387064

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) -
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

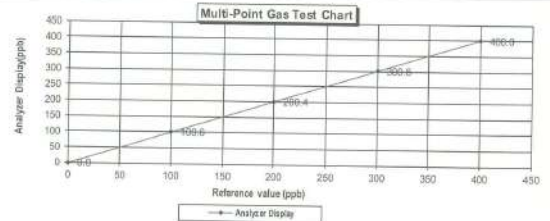
Diluter Detail

Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	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	0.60	0.60	0.60
Level 3	40.00%	200.6	0.60	0.30	0.30
Level 4	60.00%	300.6	0.60	0.20	0.20
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%
Average Difference (%) 0.20



Calculate by

Prachan Sangmanee
14 2 16

Approve by

P. Monm.
14 Feb 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

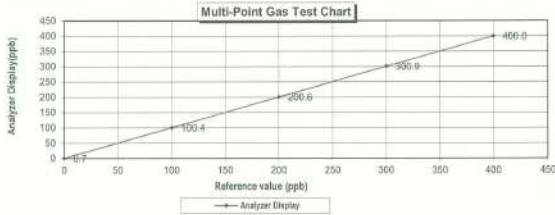
Test Date : Jan 9, 2023

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

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 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.0	0.40	0.40	0.40
Level 3	40.00%	200.0	0.60	0.30	0.30
Level 4	60.00%	300.0	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	0.34	
		Acceptable Limit ± 5%			



Calculate by

9/1/23

Approve by

10 Jan 2023

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: ED4N100E15A0105 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAF) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B2202 Valve Outlet: 560
Gas Code: CO, NO, NOX, SO₂, BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Standard Calibration Gases (May 2012) approved EPA GCR-16-016. During the assay procedure, analytical methodology does not require correction for analytical interference. This cylinder has a special designed secondary standard backup with a calibration level of 0.5%. This cylinder is not for use in applications that require the use of this calibration gas in a special designed secondary standard backup with a calibration level of 0.5%. This cylinder is not for use in applications that require the use of this calibration gas in a special designed secondary standard backup with a calibration level of 0.5%.

Do Not Use This Cylinder below 10 psig, i.e. 0.7 megapascals

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021, 08/21/2021
NITROGEN	Balance	Balance			08/14/2021

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	2051112	CC2M308	45.94 PPM NITRIC OXIDE/NITROGEN	+/- 1.3%	Feb 02, 2025
PRM	2196	CE68525	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.3%	Feb 02, 2025
GMS	00142382182	CC65591	4.345 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Feb 02, 2025
NTRM	16011043	CC473277	45.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 15, 2025
NTRM	14081118	CC451277	350.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
N code: 9700 AHR800-533 CO	FTIR	Jun 03, 2021
N code: 9700 AHR800-533 NO	FTIR	Jun 03, 2021
N code: 9700 AHR800-533 NO2	FTIR	Jun 03, 2021
N code: 9700 AHR800-533 SO2	FTIR	Jun 03, 2021

Tried Data Available Upon Request

NOTES: PO #5921-007607

GROSS WT: 23.40kg

NET WT: 4.72kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



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, 2023

Certification No. 162/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0058

WIND SENSOR : 2111DT0058

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 1008.7 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 : 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 Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Testo, testo 645 Serial No. 02946057 : ThermoSchneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. 11220015

Digital Barometer Vaisala Type PTB330 No. 114380001

Calibrated by : Nitharapong

Signature

Authorized Signatory

Mr. Watcharapol Subwat

Mr. Pirod Promsat

for the Chief

Mechanical Engineer

Sub-Standard

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

11 April, 2023

Certification No. 162/23

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer					
m/sec	mm Hg	mm Hg	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	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
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 : Nitharapong

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 3 of 5

Standard Barometer Pressure (mbar)	Tested Barometer Pressure (mbar)	Correction (mbar)
1010.39	1010	0.39
1011.13	1011	0.13
1011.31	1011	0.31
1011.57	1011	0.57
1008.42	1009	-0.58
1008.88	1009	-0.14
1008.99	1009	-0.01
1009.36	1009	0.36
1009.94	1010	-0.06
1010.36	1010	0.36
1009.53	1010	-0.47
1009.85	1010	-0.15
1010.06	1010	0.06
1010.23	1010	0.23
1009.06	1009	0.06
1009.21	1009	0.21
1009.71	1010	-0.29
1010.32	1010	0.32
1011.21	1011	0.21
1011.50	1011	0.50

Average

0.16

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 4 of 5

Standard Barometer Pressure (mmHg)	Tested Barometer Pressure (mmHg)	Correction (mmHg)
757.85	758	-0.15
758.41	758	0.41
758.54	758	0.54
758.74	759	-0.26
758.38	758	0.38
756.71	756	0.71
756.80	757	-0.20
757.08	757	0.08
757.52	757	0.52
757.83	758	-0.17
757.21	757	0.21
757.45	758	-0.55
757.81	758	-0.39
757.73	758	-0.27
756.86	757	-0.14
756.97	757	-0.03
757.34	757	0.34
757.80	758	-0.20
758.47	759	-0.53
758.69	759	-0.31

Average

0.00

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45.1	0.02
31.24	31.3	-0.06
15.82	15.9	-0.08

Calibrated by :

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 : 17 April, 2023

Certification No. : 163/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2205DR0114

WIND SENSOR : 2205DT0114

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 1008.5 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 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-850-3TV (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. 02648057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PPS220 No. 1920015

: Digital Barometer Vaisala Type PTB330 No. 84320001

Calibrated by :

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsat

Mechanical Engineer

(Authorized Signature)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration


Certification No. 163/23

17 April, 2023

Page : 2 of 5

Standard	HOOK GAGE NO. 1425		TESTED ANEMOMETER		
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches H2O	inches H2O	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	-	-	-	9.0	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
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 : 
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

The Result of Calibration

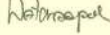
Certification No. 163/23

17 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mbar)	Pressure (mbar)	(mbar)
1011.56	1011	0.56
1011.31	1011	0.31
1010.68	1011	-0.32
1010.29	1010	0.29
1007.21	1007	0.21
1007.60	1007	0.60
1008.36	1008	0.36
1007.98	1008	-0.02
1008.32	1008	0.32
1007.88	1008	-0.12
1008.07	1008	0.07
1008.42	1008	0.42
1008.61	1009	-0.39
1009.33	1009	0.33
1009.68	1010	-0.32
1009.84	1010	-0.16
1009.90	1010	-0.10
1010.19	1010	0.19
1010.34	1010	0.34
1007.25	1007	0.25

Average

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

The Result of Calibration

Certification No. 163/23

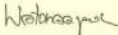
17 April, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mmHg)	Pressure (mmHg)	(mmHg)
758.73	759	-0.27
758.54	759	-0.46
758.07	758	0.07
757.78	758	-0.22
755.47	755	0.47
755.76	756	-0.24
756.33	756	0.33
756.05	756	0.05
756.30	756	0.30
756.97	756	-0.03
756.11	756	-0.11
756.38	756	0.38
756.52	757	-0.48
757.06	757	0.06
757.32	757	0.32
757.44	757	0.44
757.49	758	-0.51
757.70	758	-0.30
757.82	758	-0.18
756.50	756	-0.50

Average

0.03

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


The Result of Calibration

Certification No. 163/23

17 April, 2023

Page : 5 of 5

Standard	Temperature Sensor Reading	
	Reading	Correction
Temp. °C	°C	°C
45.26	45.3	-0.04
30.18	30.2	-0.02
16.32	16.4	-0.08

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 : 17 April, 2023

Certification No. : 164/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2205DR0116

WIND SENSOR : 2205DT0116

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

B1 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 hPa

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

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.J.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 120829586)

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. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. 843200015

: Digital Barometer Vaisala Type PTB330 No. 84320001

Calibrated by : Mr. Watchapol Subwat

Signed : Mr. Pisoot Promsat

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

Mechanical Engineer

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

17 April, 2023

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Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	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	-	-	-	9.0	0.02
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	

Calibrated by : Mr. Watchapol Subwat

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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The Result of Calibration

Certification No. 164/23

17 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mbar)	Pressure (mbar)	(mbar)
1011.56	1012	-0.44
1011.31	1011	0.31
1010.68	1011	-0.32
1010.29	1010	0.29
1007.21	1007	0.21
1007.60	1008	-0.40
1008.36	1008	0.36
1007.98	1006	-0.02
1008.32	1008	0.32
1007.88	1008	-0.12
1008.07	1008	0.07
1008.42	1008	0.42
1008.61	1009	-0.39
1009.33	1009	0.33
1009.68	1010	-0.32
1009.84	1010	-0.16
1009.90	1010	-0.10
1010.19	1010	0.19
1010.34	1010	0.34
1007.25	1007	0.25

Average

0.05

Calibrated by : Mr. Watchapol Subwat

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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The Result of Calibration

17 April, 2023

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Standard Barometer	Tested Barometer	Correction
Pressure (mmHg)	Pressure (mmHg)	(mmHg)
758.73	759	-0.27
758.54	758	0.54
758.07	759	0.07
757.78	758	-0.22
755.47	756	-0.53
755.76	756	-0.24
756.33	756	0.33
756.06	756	0.06
756.30	756	0.30
755.97	756	-0.03
756.11	756	0.11
756.38	756	0.38
756.52	756	0.52
757.06	757	0.06
757.32	757	0.32
757.44	757	0.44
757.49	757	0.49
757.70	758	-0.30
757.82	758	-0.18
755.50	756	-0.50

Average

0.07

Calibrated by : Mr. Watchapol Subwat

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

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Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.26	45.4	-0.14
30.18	30.2	-0.02
16.32	16.3	0.02

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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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 : 10 April, 2023

Certification No. : 176/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2301DR0024

WIND SENSOR : 2301DT0024

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 1007.5 hPa

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

: HOOK GAGE NO 1425 : Wind Aloit 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

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V1220001

Calibrated by : Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Watcharapol Subwat

Mechanical Engineer

(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. 176/23

10 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	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	-	-	-	6.9	0.14
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	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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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. 176/23

10 April, 2023

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Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1013.17	1013	0.17
1013.43	1013	0.43
1014.15	1014	0.15
1014.22	1014	0.22
1009.63	1009	0.63
1009.71	1009	0.71
1009.95	1010	-0.05
1010.31	1010	0.31
1010.72	1011	-0.28
1010.80	1011	-0.20
1011.47	1011	0.47
1011.21	1011	0.21
1011.33	1011	0.33
1011.59	1012	-0.41
1011.89	1012	-0.11
1012.40	1013	-0.60
1008.64	1009	-0.36
1008.80	1009	-0.20
1009.25	1010	-0.75
1009.45	1010	-0.55

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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Calibration Certificate

Certificate Number 2023003673

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomak 41, Sukhumvit Road,
Bangchak, Phra Khanong
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8384
Serial Number	0007310	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	24 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.47 °C ± 0.25 °C
		Humidity	50.8 %RH ± 2.0 %RH
		Static Pressure	85.69 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

Larson Davis PRMLxT1, S/N 077545
PCB 377B02, S/N 345240
Larson Davis CAL200, S/N 9079
Larson Davis CAL291, S/N 0108

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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D0001.8408 Rev D

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Certificate Number 2023003673

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2023-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2023-09-28	PCB0064783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.12	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.64	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

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Certificate Number 2023003673

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.34

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

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D0001.8408 Rev D

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Calibration Certificate

Certificate Number 2023003658

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007310	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.63 °C ± 0.25 °C
		Humidity	49.6 %RH ± 2.0 %RH
		Static Pressure	86.01 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 077645 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61672:2013 Class 1	ANSI S1.25 (R2007)
IEC 61260:2001 Class 1	ANSI S1.43 (R2007) Type 1
	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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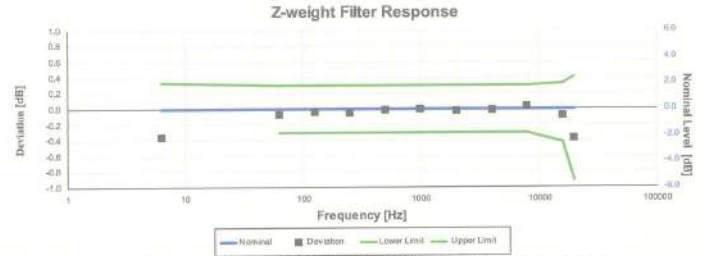
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D0001.8407 Rev D

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Description	Standards Used
Hart Scientific 2626-II Temperature Probe	Cal Date: 2021-08-25, Cal Due: 2023-05-25, Cal Standard: 006798
SRS DS360 Ultra Low Distortion Generator	Cal Date: 2022-09-02, Cal Due: 2023-09-02, Cal Standard: 007167



Electrical signal test of frequency weighing performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3, 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 9.2.1; ANSI S1.4-2014 Part 1: 5.5

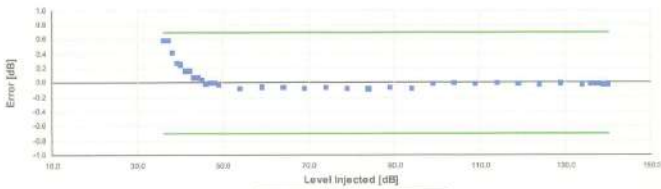
Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.36	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.38	-0.38	-0.91	0.41	0.15	Pass

— End of measurement results—

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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3, 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 5.2, IEC 61262:2002 8, ANSI S1.4 (R2006) 6.5, ANSI S1.4-2014 Part 1: 5.5, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.59	-0.70	0.70	0.16	Pass
37.00	0.58	-0.70	0.70	0.16	Pass
38.00	0.41	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.25	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.18	-0.70	0.70	0.16	Pass
43.00	0.07	-0.70	0.70	0.17	Pass
44.00	0.07	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
50.00	-0.08	-0.70	0.70	0.16	Pass
51.00	-0.06	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.08	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.08	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass
131.00	-0.07	-0.70	0.70	0.16	Pass
132.00	-0.07	-0.70	0.70	0.16	Pass
133.00	-0.07	-0.70	0.70	0.16	Pass
134.00	-0.07	-0.70	0.70	0.16	Pass
135.00	-0.07	-0.70	0.70	0.16	Pass
136.00	-0.07	-0.70	0.70	0.16	Pass
137.00	-0.07	-0.70	0.70	0.16	Pass
138.00	-0.07	-0.70	0.70	0.16	Pass
139.00	-0.07	-0.70	0.70	0.16	Pass
140.00	-0.07	-0.70	0.70	0.16	Pass

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.01	133.55	135.55	0.15	Pass
		Positive Pulse	135.00	133.52	135.52	0.15	Pass
	30	Negative Pulse	134.07	133.55	135.55	0.15	Pass
		Positive Pulse	134.07	133.52	135.52	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass

— End of measurement results—

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
106.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass

— End of measurement results—

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Certificate Number 2023003658

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
0dB Low Range	94.00	93.90	94.10	0.15	Pass
0dB Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.90	36.00	Pass
C-weight Noise Floor	26.68	35.00	Pass
Z-weight Noise Floor	32.81	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.55	135.05	136.65	0.15	Pass
THD	-66.81	-66.00	-66.00	0.01 ±	Pass
THD+N	-62.76	-66.00	-66.00	0.01 ±	Pass

— End of measurement results—

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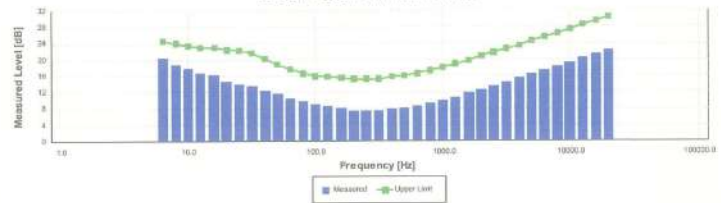
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Certificate Number 2023003658

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.34	24.60	Pass
8.00	18.79	24.00	Pass
10.00	17.87	23.50	Pass
12.50	16.87	23.00	Pass
16.00	16.25	22.90	Pass
20.00	14.64	22.40	Pass
25.00	13.98	22.30	Pass
31.50	13.39	21.50	Pass
40.00	12.35	20.20	Pass
50.00	11.55	18.80	Pass
63.00	10.50	17.60	Pass
80.00	9.71	16.60	Pass
100.00	9.02	15.90	Pass
125.00	8.51	15.70	Pass
160.00	8.14	15.50	Pass
200.00	7.51	15.20	Pass
250.00	7.42	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.14	16.00	Pass
630.00	8.66	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.07	18.10	Pass
1,250.00	10.79	18.90	Pass
1,600.00	11.74	19.90	Pass
2,000.00	12.59	20.80	Pass
2,500.00	13.50	21.70	Pass
3,150.00	14.48	22.60	Pass
4,000.00	15.43	23.50	Pass
5,000.00	16.41	24.50	Pass
6,300.00	17.40	25.50	Pass
8,000.00	18.39	26.50	Pass
10,000.00	19.37	27.40	Pass
12,500.00	20.41	28.50	Pass
16,000.00	21.38	29.50	Pass
20,000.00	22.35	30.40	Pass

— End of measurement results—

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Certificate Number 2023003658

Calibration Certificate

Certificate Number 2023003658

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1
Serial Number 0007311
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 24 Mar 2023
Temperature 23.56 °C ± 0.25 °C
Humidity 49.9 %RH ± 2.0 %RH
Static Pressure 85.89 kPa ± 0.13 kPa

Evaluation Method Tested with: Date reported in dB re 20 µPa.

Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
PCB 377B02, S/N 345617
Larson Davis PRMLxT1, S/N 077646

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61280:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the stated reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034216.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL201 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007037
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007183
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.73	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-3.89	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

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Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.32

— End of measurement results—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2023003651

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007311	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.0 °C ± 0.25 °C
		Humidity	50.3 %RH ± 2.0 %RH
		Static Pressure	86.08 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 077646 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2010-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-06-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-03-30	2023-03-30	007174

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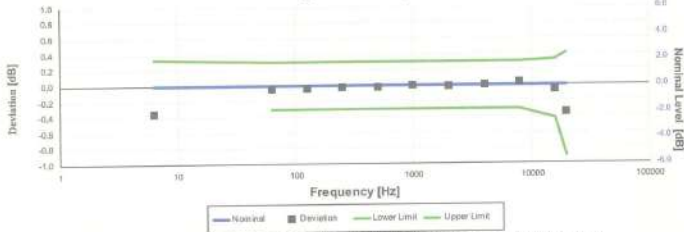
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Z-weight Filter Response



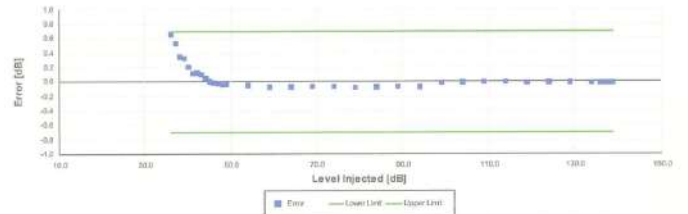
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4-1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	0.00	-0.30	0.30	0.15	Pass
3,981.07	0.00	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.82	-0.35	-0.35	-0.91	0.41	0.15	Pass

— End of measurement results—

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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.5, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 6.9, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.66	-0.70	0.70	0.16	Pass
37.00	0.53	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.32	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.12	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.03	-0.70	0.70	0.16	Pass
48.00	-0.04	-0.70	0.70	0.16	Pass
49.00	-0.04	-0.70	0.70	0.16	Pass
50.00	-0.05	-0.70	0.70	0.16	Pass
51.00	-0.07	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass
131.00	-0.07	-0.70	0.70	0.16	Pass
132.00	-0.07	-0.70	0.70	0.16	Pass
133.00	-0.07	-0.70	0.70	0.16	Pass
134.00	-0.07	-0.70	0.70	0.16	Pass
135.00	-0.07	-0.70	0.70	0.16	Pass
136.00	-0.07	-0.70	0.70	0.16	Pass
137.00	-0.07	-0.70	0.70	0.16	Pass
138.00	-0.07	-0.70	0.70	0.16	Pass
139.00	-0.07	-0.70	0.70	0.16	Pass

— End of measurement results—

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.26	133.80	0.15	Pass
		Positive Pulse	135.25	133.80	0.15	Pass
	30	Negative Pulse	134.32	133.80	0.15	Pass
		Positive Pulse	134.32	133.80	0.15	Pass

— End of measurement results—

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

— End of measurement results—

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

— End of measurement results—

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.90	94.10	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

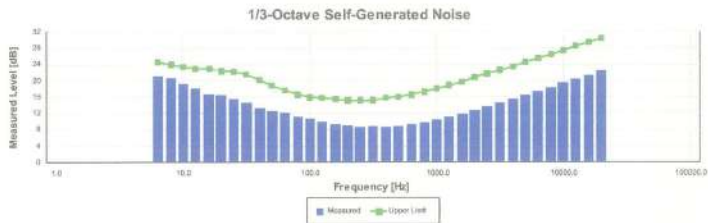
Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.01	36.00	Pass
C-weight Noise Floor	27.02	35.00	Pass
Z-weight Noise Floor	33.41	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.84	135.05	136.65	0.15	Pass
THD	-67.26	-58.00	-58.00	0.01 ±	Pass



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	21.01	24.60	Pass
8.00	20.80	24.00	Pass
10.00	19.19	23.50	Pass
12.50	18.13	23.00	Pass
16.00	16.66	22.90	Pass
20.00	16.47	22.40	Pass
25.00	15.54	22.30	Pass
31.50	14.59	21.50	Pass
40.00	13.14	20.20	Pass
50.00	12.53	18.80	Pass
63.00	12.05	17.60	Pass
80.00	11.24	16.60	Pass
100.00	10.61	15.90	Pass
125.00	10.01	15.70	Pass
160.00	9.34	15.50	Pass
200.00	9.01	15.20	Pass
250.00	8.52	15.20	Pass
315.00	8.71	15.20	Pass
400.00	8.61	15.70	Pass
500.00	8.80	16.00	Pass
630.00	9.26	16.60	Pass
800.00	9.76	17.30	Pass
1,000.00	10.40	18.10	Pass
1,250.00	11.15	18.90	Pass
1,600.00	11.94	19.80	Pass
2,000.00	12.75	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.64	22.60	Pass
4,000.00	15.55	23.50	Pass
5,000.00	16.47	24.50	Pass
6,300.00	17.47	25.50	Pass
8,000.00	18.44	26.50	Pass
10,000.00	19.44	27.40	Pass
12,500.00	20.45	28.50	Pass
16,000.00	21.42	29.50	Pass
20,000.00	22.41	30.40	Pass

— End of measurement results—

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Calibration Certificate

Certificate Number 2023003676

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8384
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	24 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.58 °C ± 0.25 °C
		Humidity	49.3 %RH ± 2.0 %RH
		Static Pressure	85.71 kPa ± 0.13 kPa

Evaluation Method	Tested with: Larson Davis CAL200, S/N 9079 PCB 377B02, S/N 345818 Larson Davis PRMLX11, S/N 077647 Larson Davis CAL291, S/N 0106	Data reported in dB re 20 µPa.
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Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1-25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a § in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

For 1/8" microphones, the Larson Davis ADP024 1/8" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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Certificate Number 2023003676

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-0304218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2023-07-21	2023-07-21	007017
Larson Davis Model 931	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007188
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 931 Type 1	2022-09-28	2023-09-28	PCB00091783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.85	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.72	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

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Certificate Number 2023003676

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.51

— End of measurement results—

— End of Report—

Signature: Jacob CannonLARSON DAVIS—A PCB DIVISION
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Calibration Certificate

Certificate Number 2023003652

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0007312

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.62 °C ± 0.25 °C

Humidity 49.6 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 077647 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.3, 2018-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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Certificate Number 2023003652

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-05-04	2023-05-04	007117

Certificate Number 2023003652



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 8; ANSI S1.4:1989 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.03	-0.03	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

— End of measurement results—

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Provo, UT 84601, United States
716-684-0001

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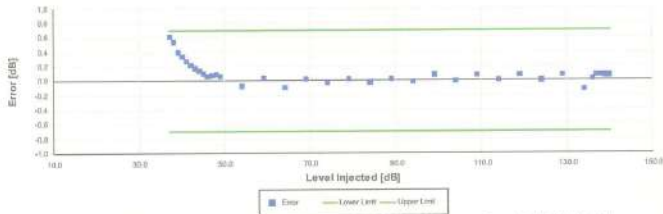


D0001.8497 Rev G

2023-3-27T16:42:12

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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 6, ANSI S1.4 (R2006) 6.3, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.61	-0.70	0.70	0.16	Pass
38.00	0.54	-0.70	0.70	0.16	Pass
39.00	0.40	-0.70	0.70	0.16	Pass
40.00	0.33	-0.70	0.70	0.16	Pass
41.00	0.27	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.18	-0.70	0.70	0.17	Pass
44.00	0.15	-0.70	0.70	0.17	Pass
45.00	0.10	-0.70	0.70	0.16	Pass
46.00	0.07	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.09	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
50.00	-0.07	-0.70	0.70	0.16	Pass
51.00	0.03	-0.70	0.70	0.16	Pass
52.00	-0.09	-0.70	0.70	0.16	Pass
53.00	0.03	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
55.00	0.02	-0.70	0.70	0.16	Pass
56.00	-0.02	-0.70	0.70	0.16	Pass
57.00	0.03	-0.70	0.70	0.16	Pass
58.00	-0.02	-0.70	0.70	0.16	Pass
59.00	0.08	-0.70	0.70	0.15	Pass
60.00	0.00	-0.70	0.70	0.15	Pass
61.00	0.08	-0.70	0.70	0.15	Pass
62.00	0.01	-0.70	0.70	0.15	Pass
63.00	0.07	-0.70	0.70	0.15	Pass
64.00	0.01	-0.70	0.70	0.15	Pass
65.00	0.08	-0.70	0.70	0.15	Pass
66.00	-0.12	-0.70	0.70	0.15	Pass
67.00	0.02	-0.70	0.70	0.15	Pass
68.00	0.07	-0.70	0.70	0.15	Pass
69.00	0.07	-0.70	0.70	0.15	Pass
70.00	0.07	-0.70	0.70	0.15	Pass
71.00	0.07	-0.70	0.70	0.15	Pass
72.00	0.07	-0.70	0.70	0.15	Pass
73.00	0.07	-0.70	0.70	0.15	Pass
74.00	0.07	-0.70	0.70	0.15	Pass
75.00	0.07	-0.70	0.70	0.15	Pass
76.00	0.07	-0.70	0.70	0.15	Pass
77.00	0.07	-0.70	0.70	0.15	Pass
78.00	0.07	-0.70	0.70	0.15	Pass
79.00	0.07	-0.70	0.70	0.15	Pass
80.00	0.07	-0.70	0.70	0.15	Pass
81.00	0.07	-0.70	0.70	0.15	Pass
82.00	0.07	-0.70	0.70	0.15	Pass
83.00	0.07	-0.70	0.70	0.15	Pass
84.00	0.07	-0.70	0.70	0.15	Pass
85.00	0.07	-0.70	0.70	0.15	Pass
86.00	0.07	-0.70	0.70	0.15	Pass
87.00	0.07	-0.70	0.70	0.15	Pass
88.00	0.07	-0.70	0.70	0.15	Pass
89.00	0.07	-0.70	0.70	0.15	Pass
90.00	0.07	-0.70	0.70	0.15	Pass
91.00	0.07	-0.70	0.70	0.15	Pass
92.00	0.07	-0.70	0.70	0.15	Pass
93.00	0.07	-0.70	0.70	0.15	Pass
94.00	0.07	-0.70	0.70	0.15	Pass
95.00	0.07	-0.70	0.70	0.15	Pass
96.00	0.07	-0.70	0.70	0.15	Pass
97.00	0.07	-0.70	0.70	0.15	Pass
98.00	0.07	-0.70	0.70	0.15	Pass
99.00	0.07	-0.70	0.70	0.15	Pass
100.00	0.07	-0.70	0.70	0.15	Pass
101.00	0.07	-0.70	0.70	0.15	Pass
102.00	0.07	-0.70	0.70	0.15	Pass
103.00	0.07	-0.70	0.70	0.15	Pass
104.00	0.07	-0.70	0.70	0.15	Pass
105.00	0.07	-0.70	0.70	0.15	Pass
106.00	0.07	-0.70	0.70	0.15	Pass
107.00	0.07	-0.70	0.70	0.15	Pass
108.00	0.07	-0.70	0.70	0.15	Pass
109.00	0.07	-0.70	0.70	0.15	Pass
110.00	0.07	-0.70	0.70	0.15	Pass
111.00	0.07	-0.70	0.70	0.15	Pass
112.00	0.07	-0.70	0.70	0.15	Pass
113.00	0.07	-0.70	0.70	0.15	Pass
114.00	0.07	-0.70	0.70	0.15	Pass
115.00	0.07	-0.70	0.70	0.15	Pass
116.00	0.07	-0.70	0.70	0.15	Pass
117.00	0.07	-0.70	0.70	0.15	Pass
118.00	0.07	-0.70	0.70	0.15	Pass
119.00	0.07	-0.70	0.70	0.15	Pass
120.00	0.07	-0.70	0.70	0.15	Pass
121.00	0.07	-0.70	0.70	0.15	Pass
122.00	0.07	-0.70	0.70	0.15	Pass
123.00	0.07	-0.70	0.70	0.15	Pass
124.00	0.07	-0.70	0.70	0.15	Pass
125.00	0.07	-0.70	0.70	0.15	Pass
126.00	0.07	-0.70	0.70	0.15	Pass
127.00	0.07	-0.70	0.70	0.15	Pass
128.00	0.07	-0.70	0.70	0.15	Pass
129.00	0.07	-0.70	0.70	0.15	Pass
130.00	0.07	-0.70	0.70	0.15	Pass
131.00	0.07	-0.70	0.70	0.15	Pass
132.00	0.07	-0.70	0.70	0.15	Pass
133.00	0.07	-0.70	0.70	0.15	Pass
134.00	0.07	-0.70	0.70	0.15	Pass
135.00	0.07	-0.70	0.70	0.15	Pass
136.00	0.07	-0.70	0.70	0.15	Pass
137.00	0.07	-0.70	0.70	0.15	Pass
138.00	0.07	-0.70	0.70	0.15	Pass
139.00	0.07	-0.70	0.70	0.15	Pass
140.00	0.07	-0.70	0.70	0.15	Pass
— End of measurement results—					

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Peak Rise Time

Peak rise time performed according to IEC 60851:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.73	133.30	135.30	0.15	Pass
		Positive Pulse	134.72	133.28	135.28	0.15	Pass
	30	Negative Pulse	133.79	133.30	135.30	0.15	Pass
		Positive Pulse	133.78	133.28	135.28	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
126.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.12	± 0.50	0.15 ±	Pass
116.85	5	-0.07	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
106.85	3	-0.16	± 0.50	0.15 ±	Pass
	5	-0.05	± 1.00	0.15 ±	Pass
10	10	-0.24	± 1.50	0.15 ±	Pass
	3	-0.19	± 0.50	0.15 ±	Pass
6	6	-0.09	± 1.00	0.15 ±	Pass
	10	-0.30	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
126.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.11	± 0.50	0.15 ±	Pass
116.85	5	-0.06	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
106.85	3	-0.10	± 0.50	0.15 ±	Pass
	5	-0.06	± 1.00	0.15 ±	Pass
10	10	-0.23	± 1.50	0.15 ±	Pass
	3	-0.18	± 0.50	0.15 ±	Pass
6	6	-0.11	± 1.00	0.15 ±	Pass
	10	-0.28	± 1.50	0.15 ±	Pass
— End of measurement results—					

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.92	93.86	94.06	0.15	Pass
0 dB Gain, Linearity	41.16	40.26	41.66	0.16	Pass
OBA Low Range	93.97	93.86	94.06	0.15	Pass
OBA Normal Range	93.96	93.20	94.80	0.15	Pass
— End of measurement results—					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.86	35.00	Pass
C-weight Noise Floor	26.56	35.00	Pass
Z-weight Noise Floor	32.28	39.00	Pass
— End of measurement results—			

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	135.05	136.65	0.15	Pass
THD	-64.53	-58.00	-58.00	0.01 ±	Pass
THD+N	-61.30	-58.00	-58.00	0.01 ±	Pass
— End of measurement results—					

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.36	24.60	Pass
8.00	18.96	24.00	Pass
10.00	17.32	23.50	Pass
12.50	16.60	23.00	Pass
16.00	15.47	22.90	Pass
20.00	14.87	22.40	Pass
25.00	13.12	22.30	Pass
31.50	12.38	21.50	Pass
40.00	11.67	20.20	Pass
50.00	10.95	19.80	Pass
63.00	10.08	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.73	15.90	Pass
125.00	8.30	15.70	Pass
160.00	7.83	15.50	Pass
200.00	7.53	15.20	Pass
250.00	7.40	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.11	16.00	Pass
630.00	8.69	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.05	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.61	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.35	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass

Calibration Certificate

Certificate Number 2023002738

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1
Serial Number 0007313
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 24 Mar 2023
Calibration Due
Temperature 23.62 °C ± 0.25 °C
Humidity 49.3 %RH ± 2.0 %RH
Static Pressure 85.7 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

PCB 377B02, S/N 345619
Larson Davis CAL291, S/N 0108
Larson Davis PRLxT1, S/N 077648
Larson Davis CAL200, S/N 9079

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61290:2001 Class 1
IEC 61672:2013 Class 1
ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a 2 in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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– End of Report –

Signatory: Jacob Cannon

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Certificate Number 2023003677

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type I	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.76	-52.44	-48.33	0.14	Pass

– End of measurement results –

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.13	0.00	-0.70	0.70	0.23	Pass
8000	-3.30	-3.00	-5.50	-1.50	0.32	Pass

– End of measurement results –

Certificate Number 2023003677

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	44.29

– End of measurement results –

– End of Report –

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2023002738

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1**Serial Number** 0007313**Test Results** Pass**Initial Condition** As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378**Technician** Jacob Cannon**Calibration Date** 23 Mar 2023**Calibration Due****Temperature** 23.66 °C ± 0.25 °C**Humidity** 49.3 %RH ± 2.0 %RH**Static Pressure** 85.98 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT1 S/N 077648 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1

IEC 60804:2000 Type 1

IEC 61252:2002

IEC 61672:2013 Class 1

IEC 61260:2001 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-23	006798
	2022-12-29	2023-12-29	007118

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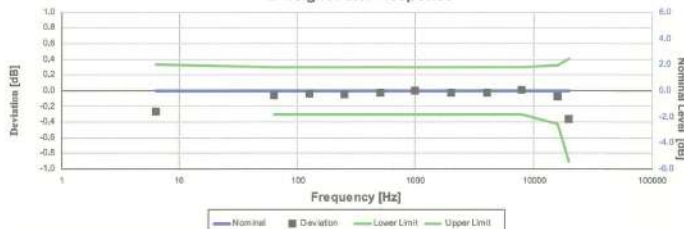


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Certificate Number 2023003662

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3. 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4-1985 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.27	-0.27	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.01	0.01	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

– End of measurement results–

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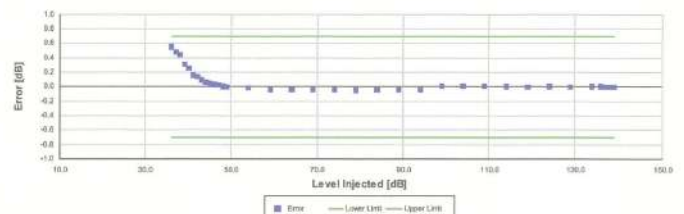


D0001.8407 Rev G

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Certificate Number 2023003662

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3. 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 5.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.55	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.44	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.26	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.15	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.16	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.03	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	-0.02	-0.70	0.70	0.16	Pass
51.00	-0.04	-0.70	0.70	0.16	Pass
52.00	-0.04	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
55.00	-0.04	-0.70	0.70	0.16	Pass
56.00	-0.04	-0.70	0.70	0.16	Pass
57.00	-0.04	-0.70	0.70	0.16	Pass
58.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
60.00	-0.04	-0.70	0.70	0.16	Pass
61.00	-0.04	-0.70	0.70	0.16	Pass
62.00	-0.04	-0.70	0.70	0.16	Pass
63.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
65.00	-0.04	-0.70	0.70	0.16	Pass
66.00	-0.04	-0.70	0.70	0.16	Pass
67.00	-0.04	-0.70	0.70	0.16	Pass
68.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
70.00	-0.04	-0.70	0.70	0.16	Pass
71.00	-0.04	-0.70	0.70	0.16	Pass
72.00	-0.04	-0.70	0.70	0.16	Pass
73.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
75.00	-0.04	-0.70	0.70	0.16	Pass
76.00	-0.04	-0.70	0.70	0.16	Pass
77.00	-0.04	-0.70	0.70	0.16	Pass
78.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
80.00	-0.04	-0.70	0.70	0.16	Pass
81.00	-0.04	-0.70	0.70	0.16	Pass
82.00	-0.04	-0.70	0.70	0.16	Pass
83.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
85.00	-0.04	-0.70	0.70	0.16	Pass
86.00	-0.04	-0.70	0.70	0.16	Pass
87.00	-0.04	-0.70	0.70	0.16	Pass
88.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
90.00	-0.04	-0.70	0.70	0.16	Pass
91.00	-0.04	-0.70	0.70	0.16	Pass
92.00	-0.04	-0.70	0.70	0.16	Pass
93.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
95.00	-0.04	-0.70	0.70	0.16	Pass
96.00	-0.04	-0.70	0.70	0.16	Pass
97.00	-0.04	-0.70	0.70	0.16	Pass
98.00	-0.04	-0.70	0.70	0.16	Pass
99.00	-0.04	-0.70	0.70	0.16	Pass
100.00	-0.04	-0.70	0.70	0.16	Pass
101.00	-0.04	-0.70	0.70	0.16	Pass
102.00	-0.04	-0.70	0.70	0.16	Pass
103.00	-0.04	-0.70	0.70	0.16	Pass
104.00	-0.04	-0.70	0.70	0.16	Pass
105.00	-0.04	-0.70	0.70	0.16	Pass
106.00	-0.04	-0.70	0.70	0.16	Pass
107.00	-0.04	-0.70	0.70	0.16	Pass
108.00	-0.04	-0.70	0.70	0.16	Pass
109.00	-0.04	-0.70	0.70	0.16	Pass
110.00	-0.04	-0.70	0.70	0.16	Pass
111.00	-0.04	-0.70	0.70	0.16	Pass
112.00	-0.04	-0.70	0.70	0.16	Pass
113.00	-0.04	-0.70	0.70	0.16	Pass
114.00	-0.04	-0.70	0.70	0.16	Pass
115.00	-0.04	-0.70	0.70	0.16	Pass
116.00	-0.04	-0.70	0.70	0.16	Pass
117.00	-0.04	-0.70	0.70	0.16	Pass
118.00	-0.04	-0.70	0.70	0.16	Pass
119.00	-0.04	-0.70	0.70	0.16	Pass
120.00	-0.04	-0.70	0.70	0.16	Pass
121.00	-0.04	-0.70	0.70	0.16	Pass
122.00	-0.04	-0.70	0.70	0.16	Pass
123.00	-0.04	-0.70	0.70	0.16	Pass
124.00	-0.04	-0.70	0.70	0.16	Pass
125.00	-0.04	-0.70	0.70	0.16	Pass
126.00	-0.04	-0.70	0.70	0.16	Pass
127.00	-0.04	-0.70	0.70	0.16	Pass
128.00	-0.04	-0.70	0.70	0.16	Pass
129.00	-0.04	-0.70	0.70	0.16	Pass
130.00	-0.04	-0.70	0.70	0.16	Pass
131.00	-0.04	-0.70	0.70	0.16	Pass
132.00	-0.04	-0.70	0.70	0.16	Pass
133.00	-0.04	-0.70	0.70	0.16	Pass
134.00	-0.04	-0.70	0.70	0.16	Pass
135.00	-0.04	-0.70	0.70	0.16	Pass
136.00	-0.04	-0.70	0.70	0.16	Pass
137.00	-0.04	-0.70	0.70	0.16	Pass
138.00	-0.04	-0.70	0.70	0.16	Pass
139.00	-0.04	-0.70	0.70	0.16	Pass

– End of measurement results–

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.12	133.65	135.65	0.15	Pass
		Positive Pulse	135.12	133.64	136.64	0.15	Pass
	30	Negative Pulse	134.19	133.65	135.65	0.15	Pass
		Positive Pulse	134.19	133.64	135.64	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLd	± 0.50	0.15 ‡	Pass
	5	OVLd	± 1.00	0.15 ‡	Pass
	10	OVLd	± 1.50	0.15 ‡	Pass
126.85	3	-0.13	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.16 ‡	Pass
	10	OVLd	± 1.50	0.15 ‡	Pass
116.85	3	-0.14	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
	10	-0.02	± 1.50	0.15 ‡	Pass
106.85	3	-0.15	± 0.50	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
	10	-0.26	± 1.50	0.15 ‡	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Crest Factor measured according to IEC 60501-2:2007 6.4.2 and IEC 61010-1:2000 6.4.2						
Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result	
136.85	3	OVLd	± 0.50	0.15 ±	Pass	
	5	OVLd	± 1.00	0.15 ±	Pass	
	10	OVLd	± 1.50	0.15 ±	Pass	
126.85	3	-0.13	± 0.50	0.15 ±	Pass	
	5	-0.14	± 1.00	0.15 ±	Pass	
	10	OVLd	± 1.50	0.15 ±	Pass	
116.85	3	-0.14	± 0.50	0.15 ±	Pass	
	5	-0.12	± 1.00	0.15 ±	Pass	
	10	0.00	± 1.50	0.15 ±	Pass	
106.85	3	-0.15	± 0.50	0.15 ±	Pass	
	5	-0.12	± 1.00	0.15 ±	Pass	
	10	-0.28	± 1.50	0.15 ±	Pass	
— End of measurement results—						

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.09	40.30	41.70	0.16	Pass
CBA Low Range	94.00	93.90	94.10	0.15	Pass
CBA Normal Range	94.00	93.20	94.80	0.15	Pass
— End of measurement results—					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.97	36.00	Pass
C-weight Noise Floor	26.58	35.00	Pass
Z-weight Noise Floor	32.49	38.00	Pass
— End of measurement results—			

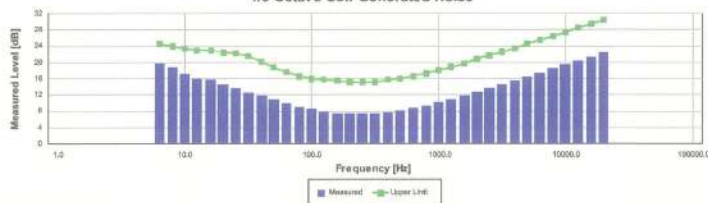
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.70	135.05	136.65	0.15	Pass
THD	-66.61	-68.00	-65.00	0.01 ±	Pass
THD+N	-62.64	-68.00	-58.00	0.01 ±	Pass
— End of measurement results—					

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.80	24.60	Pass
8.00	18.80	24.00	Pass
10.00	17.19	23.50	Pass
12.50	15.99	23.00	Pass
16.00	15.86	22.90	Pass
20.00	14.51	22.40	Pass
25.00	13.86	22.30	Pass
31.50	12.51	21.50	Pass
40.00	11.77	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.01	17.60	Pass
80.00	9.05	16.60	Pass
100.00	8.51	15.90	Pass
125.00	7.92	15.70	Pass
160.00	7.54	15.50	Pass
200.00	7.46	15.20	Pass
250.00	7.39	15.20	Pass
315.00	7.47	15.20	Pass
400.00	7.66	15.70	Pass
500.00	8.16	16.00	Pass
630.00	8.75	16.60	Pass
800.00	9.37	17.30	Pass
1,000.00	10.15	18.10	Pass
1,250.00	10.99	18.90	Pass
1,600.00	11.82	19.80	Pass
2,000.00	12.70	20.80	Pass
2,500.00	13.72	21.70	Pass
3,150.00	14.57	22.60	Pass
4,000.00	15.53	23.50	Pass
5,000.00	16.46	24.50	Pass
6,300.00	17.44	25.50	Pass
8,000.00	18.45	26.50	Pass
10,000.00	19.43	27.40	Pass
12,500.00	20.42	28.50	Pass
16,000.00	21.39	29.50	Pass
20,000.00	22.40	30.40	Pass
— End of measurement results—			

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Signatory: Jacob Cannon

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Cert.No.: 23CH280
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HAQA0005
ID No. : UAE.EFM.004/2563(EFM.pH.04/63)
Condition As-Received: Used Item
Received Date : 27 February 2023
Calibration Date : 01 March 2023
Reference : 2302-0942WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by : 
Approved Signatory

(✓) Malee Butkruea
() Saitip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 7 March 2023

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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Cert.No.: 23CH280
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4962054	110RC044	22I1306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HAQA0005	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.46	-177.2	10.01	0.058	2.00

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Cert.No.: 23CH280
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 992H0385	4.008	4.01	168.2	0.0085	2.05
	6.987	6.99	-4.2	0.011	2.00
	6.987	6.99	-7.0	0.011	2.00
	10.010	10.01	-183.2	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 992H0385

Dimension of probe;

- Length : 110 mm.
- Diameter : 16 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.001	25.1	0.099	0.13	2.00
30.0	30.001	30.1	0.099	0.13	2.00
35.0	35.002	35.1	0.098	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

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a 1150709



Cert.No.: 23TW47
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0028
ID No. : UAE.EFM.013/2563 (EFM.DO.02/63)
Received Date : 27 February 2023
Test Date : 28 February 2023
Reference : 2302-0944WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, 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 : Walailak Sirithan

Approved by : 
Approved Signatory

(✓) Malee Butkruea
() Saitip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 3 March 2023

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B 0308928



Cert.No.: 23TW47
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	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K9G0090

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.12	8.12	0.0089

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned 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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5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 23LM30
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0028
ID No. : UAE.EFM.013/2563 (EFM.DO.02/63)
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 27 February 2023
Calibrated Date : 3 March 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kunchit Promprat
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 8 March 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0051784



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2302-0944WSC-2

Cert. No.: 23LM30
Page: 2 of 2

Procedure Used :-
Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A7B843	23J24	04 Jan 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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K9G0090

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	60	24.996	25.0	0.004	0.16	2.00
30.0	60	30.006	30.0	-0.006	0.16	2.00
35.0	60	34.998	35.0	0.002	0.16	2.00

UUC* : Unit Under Calibration

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 %.

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a 1151552



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No.: 23CH430
Page: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC9L0015
ID No. : UAE.EFM.010/2563(EFM.SCT.04/63)
Condition As-Received : Used Item
Received Date : 28 March 2023
Calibration Date : 29 March 2023
Reference : 2303-0999WSC-4
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In -house method ;
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Walalak Sirithean

Approved by :
() Malee Butkruea
() Salthip Meangmai
() Warakorn Lerngatrakul

Issue Date : 31 March 2023

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 23CH430

Page.: 2 of 3

Condition of this result of calibration**1. Reference Standard Instrument :-**

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	221484	17 Apr 2023
2) Ref. Std. Thermometer	4982054	110RC044	2211306	27 Oct 2023

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI

through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 μ S/cm	CPA Chem	826595	09 July 2023
12.880 mS/cm	CPA Chem	823329	20 June 2023

- Control Conductivity calibration solution temperature by Water bath (25.0.1) °C

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

Calibration results**Function : Conductivity Measurement**(*) After Adjustment at 1413.0 μ S/cm

Conductivity Electrode Serial No.: 9B9F0277

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 μ S/cm	1384 μ S/cm	1413 μ S/cm	9.2 μ S/cm	2.00
12.880 mS/cm	12.38 mS/cm	12.72 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

Maku

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Cert.No.: 23CH430

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement**

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9383

- Serial No. : 9B9F0277

Dimension of probe;

- Length : 110 mm

- Diameter : 16 mm

- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)	Coverage factor k
25.0	25.001	25.0	-0.001	0.13	2.00
30.0	29.999	30.0	0.001	0.13	2.00
35.0	34.999	35.0	0.001	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

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Maku

เอกสารไม่ควบคุม

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองที่มีขนาดน้อยกว่าหรือเท่ากับ 10 ไมครอน (PM10)	Mettler-Toledo	AB204-S / 1128312528	Technology Promotion Association (Thailand-Japan)	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Technology Promotion Association (Thailand-Japan)	23MM332	7 Apr 23	5 Apr 24	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ/ดิน									
3	Fluorescence Spectrophotometer	ปิโตรเลียมไฮโดรคาร์บอน (TPH)	Perkin Elmer	LS 55 / 81440	Perkin Elmer Ltd.	FLR1001/2023	21 Feb 23	20 Feb 24	-
4	pH Meter	ความเป็นกรด-ด่าง (pH) อุณหภูมิน้ำ (Water Temperature)	Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2303560-001-01	26 Jun 23	24 Jun 24	-
5	Conductivity Meter	ความนำไฟฟ้า (EC) ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24230059	16 Mar 23	14 Mar 24	-
6	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอยทั้งหมด (TSS) ของแข็งละลายน้ำทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	24 Apr 24	-
7	Analytical Balance (Readability 0.01 mg)		Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	24 Apr 24	-
8	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	9 Oct 24	-
9	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	23TM373	11 Apr 23	9 Apr 24	-
10	Hot Air Oven		Memmert	UF55 / B222.2772	Thermology Co., Ltd.	23/2801	19 Jul 23	17 Jul 24	-
11	BOD Incubator	ออกซิเจนละลายน้ำ (DO) บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
12	DO Meter		YSI	5100 / 11B101863	Harikul Science	HSU012C	1 Mar 23	28 Feb 24	-
13	Atomic Absorption Spectrophotometer (AAS)	สารหนู (As) แคดเมียม (Cd) โครเมียมทั้งหมด (Total Cr) ตะกั่ว (Pb) โปรททั้งหมด (Total Hg) นิกเกิล (Ni) ซีลีเนียม (Se) แบเรียม (Ba) ทองแดง (Cu)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC. ACL. No. 387/66	2 Feb 23	1 Feb 24	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ/ดิน									
14	Atomic Absorption Spectrophotometer (AAS)	สังกะสี (Zn) เหล็ก (Fe) และแมงกานีส (Mn) โครเมียมเฮกซะวาเลนซ์ (Cr6+)	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-02273773	26 Jun 23	24 Jun 24	-
15	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	11 Nov 24	-
16	Gas Chromatography - Mass Spectrometer (GC-MS)	BTEX	Agilent Technologies	System ID: CN17100005 Intovu 9000 (G3950A) / CN17100005 5977B MSD (G7077B) / US1715M030	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GSMS-OQ	24 Apr 23	23 Apr 24	-
17	Gas Chromatography - Mass Spectrometer (GC-MS)		Agilent Technologies	System ID: US2009M037 8890 (G3542A) / CN1945A066 5977B / US2009M037	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	14 Jun 23	12 Jun 24	-
18	Incubator	ฟิคอลโคลิฟอร์มแบคทีเรีย (FCB)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
19	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	23TM194	15 Feb 23	14 Feb 24	-
20	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10 Aug 23	8 Aug 24	-
21	Analytical Balance		Mettler-Toledo	MS603S / B007010311	Technology Promotion Association (Thailand-Japan)	23MM150	7 Apr 23	5 Apr 24	-

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



Cert.No.: 23MM331
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S
Serial No. : 1128312528
ID No. : UAE.AIR.019/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-1
Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 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-0010-22 | 20 Jan 2024 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. 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	99.9999	+0.0001	0.19	2.03
200	200.0001	-0.0001	0.29	2.00

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	0.00007

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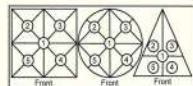
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-1

Cert.No.: 23MM331
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between off-center and central loading

Position 1	Position 2	Position 3	Position 4	Position 5	
(g)	(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0002	+0.0004	-0.0001	-0.0006	0.0005

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unload	0.0000	0.0000	0.15	2.13
0.1	0.0999	+0.0001	0.15	2.13
1	0.9999	+0.0001	0.15	2.13
5	4.9999	+0.0001	0.15	2.13
10	9.9999	+0.0001	0.15	2.11
20	20.0000	0.0000	0.15	2.11
50	50.0000	0.0000	0.16	2.06
70	69.9999	+0.0001	0.18	2.04
100	99.9999	+0.0001	0.19	2.03
150	150.0003	-0.0003	0.29	2.00
200	200.0005	-0.0005	0.29	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 %.

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เอกสารไม่ควบคุม



Cert.No.: 23MM332
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S /FACT
Serial No. : B108115858
ID No. : UAE.AIR.016/2555
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment :	Electronic Balance	Cert.No.: 23MM332
Condition As-Received :	Used Item	Page: 2 of 3
Reference :	2304-0015OC-2	
Procedure used :-		
Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.		
Condition of this result of calibration		
1. Reference standard instruments:-		
Instruments	Model	Serial No.
1) Standard Weight Set (E2)	15884	24053
		70RC007
		MM-0010-22
		20 Jan 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.		
3. This result of calibration was made on requested at the point specified by customer.		
4. This certificate is not certified for any commercial transaction.		
5. 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
(g)	(g)	(g)
100	100.0002	-0.0002
200	200.0003	-0.0003
After Adjustment :		
Applied Weight	Balance Reading	Correction
(g)	(g)	(g)
100	100.0002	-0.0002
200	200.0003	-0.0003
1. Determination of the standard deviation of weighing machine (n = 10)		
Applied Weight	Standard Deviation of Reading (g)	
(g)		
100	0.00009	
200	0.00007	

เอกสารไม่ควบคุม



Equipment :	Electronic Balance	Cert.No.: 23MM332
Condition As-Received :	Used Item	Page: 3 of 3
Reference :	2304-0015OC-2	
Result of calibration		
2. Effect of off center loading		
A mass of 100 g was placed to various position on the pan.		
The weighing machine reading error obtained is given in the table		
Position 1	Position 2	Position 3
(g)	(g)	(g)
+0.0001	-0.0003	+0.0003
Position 4	Position 5	
(g)	(g)	
+0.0006	+0.0002	
Maximum difference between off-center and central loading (g)		
0.0005		
3. Departure from nominal value		
Applied Weight	Balance Reading	Correction
(g)	(g)	(g)
Unload	0.0000	0.0000
0.1	0.0999	+0.0001
1	0.9998	+0.0002
5	5.0000	0.0000
10	10.0000	0.0000
20	20.0000	0.0000
50	50.0001	-0.0001
70	70.0001	-0.0001
100	100.0002	-0.0002
150	150.0004	-0.0004
200	200.0005	-0.0005
Measurement Uncertainty (± mg)		
Coverage Factor (k)		
2.17		
2.17		
2.17		
2.17		
2.17		
2.15		
2.11		
2.07		
2.06		
2.00		
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 %.		

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เอกสารไม่ควบคุม



LS 45/50B/55 - Preventive Maintenance report			
Company Name:	United analyst and Engineering Consultant Co.,Ltd.		
Address:	3 Soi Udomsuk 41, Sukumvit Road, Phrakhanong, Bangkok 10260		
User Name :	K. Primpun	WO Number:	WO-01624974
Telephone Number :	02-763-2828	Certificate Number :	FLR1001-2023
Customer Support Engineer :	Tanongsak	P.M. Number	1 of 1
PM Performed: (DD-MMM-YYYY)	2-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	2-Feb-2024

Scope

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

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 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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Page 1



Component List

Component Model	Serial #	Software Version	Configuration Notes
LS55	81440	4.00.03	
-	-	-	-
-	-	-	-

Parts Lists

Test standard Used				
Part Number (if applicable)	Description			
C 520-7440	Stanadard Fluorence Intensity Filter			
B050 7805	Sealed Water Cell			
Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)

เอกสารไม่ควบคุม

Page 2

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.
- ☐ Perform general inspection of system for cleanliness.

2. Optical checks and Clean:

- ☐ Lamp Alignment/Intensity
- ☐ Sample Compartment and Windows
- ☐ Mirror and Grating Alignment
- ☐ Filter Wheel
- ☐ Cell Holder Alignment

3. Mechanical:

- ☐ Physical inspection – Please write any comments in the additional comments section.
- ☐ Grating Drive Mechanism.
- ☐ Slit Drive Mechanism.
- ☐ Sample Holder

4. Test:

- ☐ Emission Wavelength Accuracy.

Emission Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	254.0	± 1.0 nm
Target Peak # 2	507.3	507.4	± 1.0 nm
Target Peak # 3	626.0	625.8	± 1.0 nm

- ☐ Excitation Wavelength Accuracy.

Excitation Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	253.2	± 1.0 nm
Target Peak # 2	365.0	365.4	± 1.0 nm
Target Peak # 3	507.3	508.0	± 1.0 nm

- ☐ Emission Slit calibration.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.63	± 0.5 nm
Target Peak # 2	5.0	4.75	± 0.5 nm
Target Peak # 3	10.0	9.99	+ 1.0 / - 0.5 nm

- ☐ Excitation Wavelength Repeatability.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.57	± 0.5 nm
Target Peak # 2	5.0	5.08	± 0.5 nm
Target Peak # 3	10.0	9.80	+ 1.0 / - 0.5 nm

เอกสารไม่ควบคุม page 3

เอกสารไม่ควบคุม page 4

- ☐ Water Raman Sensitivity

	Actual Value
Signal to Noise	288 : 1
Drift	0.03

- ☐ Stray Light

	Actual Value
Stray Light at 290nm	2.64
Stray Light at 300nm	0.77

5. Accessory (where applicable):

- ☐ Micro Plate Reader
- ☐ Integrating Sphere
- ☐ Multi Cell Holder
- ☐ Water Jacketed Cell Holder
- ☐ etc.

6. Review:


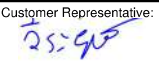
- ☐ Review with the customer PM work performed.
- ☐ Review with the customer routine maintenance procedures.
- ☐ Discuss recommended customer-supplied materials to have on hand
- ☐ Attach PM sticker.
- ☐ Update Logbook.

เอกสารไม่ควบคุม page 5

Additional Comments

Additional Comments Regarding the PM
Reference intensity low

Review

The PM checks and if applicable performance tests for LS 45/50B/55 have been completed.	
This LS 45/50B/55 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the PM.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: 	Date: 2-Feb-23 (DD-MMM-YYYY)
Authorized Customer Representative: 	Date: 2-Feb-23 (DD-MMM-YYYY)

เอกสารไม่ควบคุม page 6

Calibration Certificate

Certificate No.: 2303560-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564

Order No.: 2303560
Operation No.: 2303560-001
Date of Receipt: 23 June 2023
Date of Calibration: 26 June 2023

Calibrated by: Mr. Worapob Sooktong
Scientist
Approved by: *P. Jenghant*
(Mr. Phraphat Tuanjit) (for)
Manager, Division of Calibration Laboratory
Date of Issue: 27 June 2023
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



เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2303560-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Page 2 of 5

Date of Calibration: 26 June 2023
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (24.3 ± 1.5) °C
Condition of Equipment: Good Condition
Relative Humidity: (49 ± 3) %

Condition of this Results of Calibration

1. Calibration Method: In house method: W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	Z3E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fuke	CC-650557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFLBTH003/17	PONPE	TE 650555-01	21 September 2023
Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025

3. This certification is traceable to The International System of Unit (SI Unit)

- 3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
- 3.2 Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No.2.7 traceable to BSM RefH Hi-13 LotN 25.05.2022; BSM RefH Hi-16 LotN 02.08.2022; BSM RefH Hi-13 LotN 25.05.2022; BSM RefH Hi-16 LotN 02.08.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

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

P. Jenghant
27 June 2023



เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2303560-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Page 3 of 5

Date of Calibration: 26 June 2023
Calibration Results: 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	295	2.00	0.58	2.00
4	177.464	177	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Type: Combined Electrode
Manufacturer: Mettler Toledo
Model: InLab Expert Pro-ISM
Serial No.: 3114136
ID No.: N/A
Performance of Electrode system: (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value (25 °C pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	177	-	0.0071	2.00
6.865	6.90	9	96.26	0.0074	2.00
10.01	10.01	-168	96.20	0.0065	2.00
6.966	7.02	3	-	0.0093	2.00

P. Jenghant
27 June 2023

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



เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2303560-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Manufacturer: Mettler Toledo

Page 4 of 5

Date of Calibration: 26 June 2023
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (24.4 ± 1.0) °C
Relative Humidity: (54 ± 2) %

Condition of this results of Calibration:

- 1. Calibration Method: In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2933097	PSLT 128265	03-Nov-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	923872			

Support Equipment: Low Temperature Bath (ISOCAL-6, Model: Europa-6 Plus Basic, S/N: 341592/2)

3. This certificate is traceable to International System of Units (SI Units).

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.

6. Condition of Calibrated item: Good

7. Result of Calibration: ☒ Without adjustment ☐ After adjustment

P. Jenghant
27 June 2023

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



เอกสารไม่ควบคุม



Cert.No.: 23MM112
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 2 May 2023

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 : 2304-0459OC-1

Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 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-0010-22	20 Jan 2024

- 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 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
80	80.00005	-0.00005	0.15	2.00
200	199.9999	+0.0001	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine

Applied Weight	Standard Deviation of Reading (g)
(g)	(g)
80	0.000007
200	0.00000

(n = 10)

เอกสารไม่ควบคุม



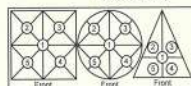
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between off-center and central loading

Position 1	Position 2	Position 3	Position 4	Position 5	
(g)	(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0001	0.0000	-0.0001	-0.0001	0.0001

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unload	0.00000	0.00000	0.014	2.13
0.05	0.05001	-0.00001	0.015	2.09
0.1	0.10001	-0.00001	0.015	2.09
1	1.00001	-0.00001	0.018	2.04
5	5.00003	-0.00003	0.026	2.00
20	20.00006	-0.00006	0.045	2.00
50	50.00006	-0.00006	0.080	2.00
80	80.00004	-0.00004	0.15	2.00
100	100.00000	0.00000	0.16	2.00
150	150.00000	0.00000	0.29	2.00
200	200.00000	0.00000	0.29	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 %.

-000-

เอกสารไม่ควบคุม



Cert.No.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C210685394
ID No. : UAE.WAO.010/2565
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 2 May 2023

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

A 0053700



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2
Procedure used :-

Cert.No.: 23MM113
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 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-0010-22	20 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. 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 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.0005	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)	
Applied Weight	Standard Deviation of Reading (g)
(g)	
80	0.000007
200	0.00004

เอกสารไม่ควบคุม

a 1159272



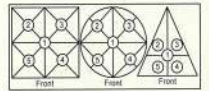
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading
(g)	(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0001	0.0000	-0.0001	-0.0001	0.0001

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.0000	0.0000	0.17	2.00
150	150.0000	0.0000	0.29	2.00
200	199.9999	+0.0001	0.29	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 %.

-00-

เอกสารไม่ควบคุม

a 1159271

Calibration Certificate

Certificate No.: 2400141-001-01
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: UF 55
Serial No.: B216.1666
ID No.: UAE.WAO.027/2559
Order No.: 2400141
Operation No.: 2400141-001
Date of Receipt: 11 October 2023
Date of Calibration: 11 October 2023

Calibrated by Mr.Worapob Sooktong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 16 October 2023

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.

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF 55
Resolution: 0.1 °C
Manufacturer: MEMMERT
Serial No.: B216.1666
ID No.: UAE.WAO.027/2559

Date of Calibration: 11 October 2023

Page 2 of 3

Location: Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (63 ± 2) %
Line Voltage (228 ± 1) 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	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
	RTD	CH201-209/ RTD#201-209			

- 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 -
X Close
Not Available

7. Result of Calibration : X Without adjustment After adjustment

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF 55 **Serial No.:** B216.1666
Resolution: 0.1 °C **ID No.:** UAE.WAO.027/2559
Manufacturer: MEMMERT

Date of Calibration: 11 October 2023 **Page 3 of 3**
Calibration point: 104.0, 140.0 and 180.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

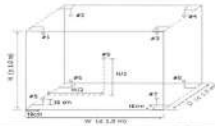


Table 1 : Reporting of Temperature

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	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	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	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

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 -----

FCS-012 Revision: 01 Date: 20-04-65

0008 ถนนสุขุมวิท 36 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110 **เอกสารไม่ควบคุม**
0009 ซอย 38, Asin Anang Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel : +66(0) 2-462-8668 ; Fax : +66(0) 2-462-8545



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.: 23TM373
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 : 11 April 2023
Calibration Date : 11 - 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : Approved Signatory

(/) Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0053359



Equipment : Hot Air Oven **Cert. No.:** 23TM373
Condition As-Received : Used Item **Page :** 2 of 3
Reference : 2304-0156OC-1

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

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

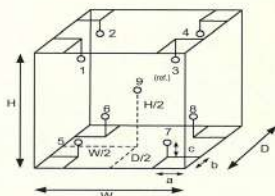
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration	
	Beginning Finished
Temp. (°C)	27 28
REL.Humid. (%)	45 44
AC Supply (Volt)	221 220



Probe Installation Details : **Dimension of Chamber :**
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	18-20TC-01	20RTD-2/1
2	18-20TC-02	20RTD-2/2
3	18-20TC-03	20RTD-2/3
4	18-20TC-04	20RTD-2/4
5	18-20TC-05	20RTD-2/5
6	18-20TC-06	20RTD-2/6
7	18-20TC-07	20RTD-2/7
8	18-20TC-08	20RTD-2/8
9 (ref.)	18-20TC-09	20RTD-2/9



Equipment : Hot Air Oven **Cert. No.:** 23TM373
Condition As-Received : Used Item **Page :** 3 of 3
Reference : 2304-0156OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.054	0.59	0.95	2
120.0	120.0	120.0	0.12	0.89	1.5	2
180.0	180.0	180.0	0.12	1.5	2.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.512	104.016	104.542	104.407	103.704	103.729	104.167	104.158	104.001	0.42
120.0	120.317	119.768	120.524	120.232	119.363	119.209	119.888	119.797	119.735	1.1
180.0	180.878	179.819	181.357	180.871	179.303	179.139	180.230	180.055	179.960	1.1

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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เอกสารไม่ควบคุม

a 1158260

เอกสารไม่ควบคุม

a 1158261



CALIBRATION CERTIFICATE

Date of Issue Jul 21, 2023 Cert No. 23/2801
Site Calibration Order No. 23070363

Customer United Analyst and Engineering Consultant Co., Ltd. (UAE)
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok, 10260

Place of Calibration 1350, 1352 Suthisarnwintchal Rd, Dindaeng, Bangkok 10400, (Calibration Room)

Description Oven
Model UF55
Serial No. B222.2772
ID.No. -
Date of Receipt Jul 19, 2023
Date of Calibration Jul 19, 2023
Environment
Temperature (Min) 24.7 °C (Max) 25.3 °C
Relative Humidity (Min) 47.3 %RH (Max) 58.9 %RH

Calibration Method

WI-17 : The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard

1) Data Acquisition with Sensor Model 34972A S/N. MY59003190, Certificate No. QR23-1303, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292, Due Date May 15, 2024.
This certificate is traceable to SI unit.

Page 1 of 4

This certificate is issued in accordance with the conditions of Thermology Laboratory. The traceability to recognised national standard and the unit of measurement realised at corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of laboratory.

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CALIBRATION CERTIFICATE

Date of Issue Jul 21, 2023 Cert No. 23/2801
Site Calibration Order No. 23070363

Results (without adjustment)

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)	Stability ± (°C)	Uniformity (°C)	Uncertainty ± (°C)
104.0	104.0	Position 1	0.091	0.971	0.38
		104.044			
		Position 2			
		104.082			
		Position 3			
		104.312			
		Position 4			
		104.311			
		Position 5			
		104.406			
		Position 6			
		104.074			
		Position 7			
		103.562			
		Position 8			
		103.937			
		Position 9			
		104.438			

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)	Stability ± (°C)	Uniformity (°C)	Uncertainty ± (°C)
180.0	180.0	Position 1	0.123	1.253	0.44
		179.769			
		Position 2			
		179.627			
		Position 3			
		180.133			
		Position 4			
		180.181			
		Position 5			
		180.495			
		Position 6			
		179.843			
		Position 7			
		179.688			
		Position 8			
		179.229			
		Position 9			
		180.440			

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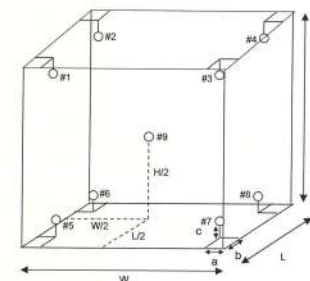
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CALIBRATION CERTIFICATE

Date of Issue Jul 21, 2023 Cert No. 23/2801
Site Calibration Order No. 23070363

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension (W x L x H) is 40 x 33 x 40 cm.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.

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CALIBRATION CERTIFICATE

Date of Issue Jul 21, 2023 Cert No. 23/2801
Site Calibration Order No. 23070363

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

APPROVED SIGNATORY :

[] MR. PRAJUCKETCH THONGSOOKCHOTE
[] MR. DAMRONG MULSING
[] MR. JATURAPAT THONGSOOKCHOTE

Page 4 of 4

เอกสารไม่ควบคุม



Cert. No.: 23TM249
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC4S013201
ID No. : UAE.WAO.015/2561
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 : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkrusa
() Suwit Imjai

Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0051476



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Procedure Used :-

Cert. No.: 23TM249
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

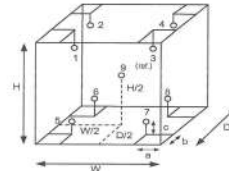
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	31
REL.Humid. (%)	63	67
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

A 4410543



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM249
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	19.3	0.32	0.57	1.0	0.60	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.086	19.916	20.386	19.976	19.973	19.836	19.837	19.821	19.949

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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เอกสารไม่ควบคุม

A 1149512



CERT.No.: HS-U012C

Calibration Date : 1 Mar 23

Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok.(Head office)

Model : YSI 5100
S/N : 11B101863
Probe : YSI 5010
S/N : 22B100125
ID NO. : -
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431
Technician : Kittipong M.

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- This certificate is issued based on the result that are found as shown on date and place of test only.
- The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- This result shall not be used for advertising purpose.

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Supreecha Sumartam)

เอกสารไม่ควบคุม



Request No. 25-66 / 0323

MTC. ACL.No. 387 / 66

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB708640

SUBMITTED BY: United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

CALIBRATION RANGE: 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr, 0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni, 0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn

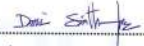

CALIBRATION DATE : 2 February 2023

REFERENCE MATERIAL : Traceable to NIST "Carlo Erba", "PanReac AppliChem"

Cadmium Lot No. 1152457, Chromium Lot No. 1793249, Copper Batch No. T117098A, Iron Batch No. T126087A, Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 58 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by 
(Mr. Danai Srithongkum)Approved by 
(Miss Sutadida Deawong)2. 
(Mr. Atipat Ratana)Senior Technical Officer
Acting Director of Analytical Chemistry Laboratory

Ref. 2015266012600366001

Issued Date : 15 February 2023

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

2. Precision

Element	Conc. (mg/l)	Absorbance	Ave. Abs.	SD	%RSD
Cd	0.02	0.0085 0.0084 0.0090 0.0089 0.0089 0.0090 0.0086 0.0092 0.0090 0.0089 0.009 0.0003 2.88			
	0.30	0.0993 0.1001 0.1007 0.1004 0.1004 0.0995 0.0997 0.0998 0.0999 0.0996 0.100 0.0005 0.45			
	0.70	0.2238 0.2229 0.2244 0.2249 0.2243 0.2233 0.2235 0.2231 0.2251 0.2240 0.224 0.0007 0.33			
Cr	0.10	0.0088 0.0087 0.0094 0.0094 0.0086 0.0086 0.0091 0.0099 0.0095 0.0076 0.0085 0.009 0.0006 7.25			
	0.30	0.0257 0.0265 0.0255 0.0270 0.0266 0.0258 0.0261 0.0262 0.0274 0.0262 0.026 0.0006 2.25			
	0.70	0.0573 0.0590 0.0580 0.0576 0.0578 0.0579 0.0593 0.0599 0.0586 0.0594 0.058 0.0009 1.51			
Cu	0.05	0.0083 0.0084 0.0084 0.0075 0.0086 0.0086 0.0081 0.0080 0.0087 0.0092 0.008 0.0005 5.45			
	0.30	0.0430 0.0444 0.0426 0.0429 0.0435 0.0432 0.0428 0.0441 0.0427 0.0436 0.043 0.0006 1.41			
	0.70	0.0981 0.0992 0.0990 0.0997 0.0977 0.0986 0.0990 0.0982 0.0988 0.0980 0.099 0.0006 0.63			
Fe	0.10	0.0109 0.0104 0.0087 0.0100 0.0087 0.0094 0.0102 0.0092 0.0094 0.0100 0.010 0.0007 7.53			
	0.50	0.0456 0.0442 0.0450 0.0444 0.0450 0.0455 0.0441 0.0446 0.0444 0.045 0.0006 1.27			
	1.00	0.0904 0.0901 0.0891 0.0876 0.0873 0.0876 0.0901 0.0876 0.0886 0.0879 0.0901 0.0012 1.38			
Pb	0.20	0.0093 0.0099 0.0104 0.0102 0.0104 0.0109 0.0102 0.0103 0.0115 0.0117 0.010 0.0007 6.85			
	0.70	0.0344 0.0336 0.0336 0.0328 0.0338 0.0346 0.0336 0.0331 0.0343 0.0350 0.034 0.0007 2.02			
	1.50	0.0709 0.0718 0.0706 0.0713 0.0698 0.0718 0.0712 0.0713 0.0715 0.0719 0.071 0.0006 0.90			
Mn	0.05	0.0115 0.0130 0.0131 0.0127 0.0135 0.0136 0.0124 0.0133 0.0124 0.0130 0.013 0.0006 4.88			
	0.30	0.0709 0.0700 0.0714 0.0704 0.0700 0.0705 0.0714 0.0698 0.0694 0.0700 0.070 0.0007 0.96			
	0.70	0.1619 0.1633 0.1646 0.1638 0.1646 0.1614 0.1632 0.1614 0.1636 0.1652 0.163 0.0014 0.83			
Ni	0.10	0.0113 0.0105 0.0113 0.0114 0.0110 0.0113 0.0117 0.0112 0.0107 0.0117 0.011 0.0004 3.45			
	0.50	0.0509 0.0517 0.0508 0.0502 0.0517 0.0516 0.0523 0.0518 0.0503 0.0501 0.0007 1.36			
	1.00	0.0997 0.1006 0.1006 0.1006 0.0996 0.0998 0.1007 0.1000 0.1013 0.0999 0.100 0.0006 0.55			
Zn	0.05	0.0315 0.0309 0.0322 0.0304 0.0329 0.0312 0.0313 0.0319 0.0308 0.0311 0.031 0.0007 2.35			
	0.30	0.1705 0.1728 0.1688 0.1693 0.1711 0.1704 0.1704 0.1707 0.1708 0.1688 0.170 0.0012 0.70			
	0.70	0.3559 0.3572 0.3548 0.3560 0.3559 0.3550 0.3579 0.3552 0.3574 0.3573 0.356 0.0011 0.31			

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0020	0.0000	0.0008	0.0000	-0.0009	0.0021	-0.0016	-0.0022
	0.0015	0.0006	0.0005	-0.0009	-0.0014	0.0018	0.0002	-0.0023
	0.0014	0.0006	0.0010	-0.0009	0.0015	0.0008	-0.0004	-0.0015
	0.0021	-0.0008	0.0013	-0.0010	0.0005	0.0005	-0.0008	-0.0004
	0.0020	-0.0012	0.0004	0.0003	-0.0004	0.0001	-0.0024	-0.001
	0.0021	-0.0011	0.0011	0.0003	0.0006	0.0009	-0.0002	-0.0013
	0.0017	-0.0009	0.0001	-0.0015	0.0010	0.0007	0.0001	-0.0016
	0.0024	-0.0012	0.0004	-0.0002	0.0008	-0.0005	-0.0012	-0.0019
	0.0011	-0.0002	0.0015	-0.0004	0.0004	0.0008	-0.0003	-0.0017
	0.0017	0.0000	0.0009	0.0004	0.0001	0.0015	-0.0009	-0.0024
	0.0019	-0.0004	0.0004	0.0000	0.0006	0.0010	-0.0005	-0.0016
	0.0016	-0.0025	0.0003	0.0005	0.0009	-0.0004	-0.0013	-0.0016
	0.0018	-0.0014	0.001	-0.0009	-0.0006	0.0010	-0.0004	-0.0017
	0.0019	-0.0006	0.0011	-0.0008	0.0011	0.0004	-0.0003	-0.0005
	0.0024	0.0003	0.0005	-0.0012	-0.0002	0.0012	-0.0006	-0.0011
	0.0023	-0.0012	0.0006	-0.0007	0.0002	0.0014	-0.0012	-0.0013
	0.0020	-0.0014	0.0009	-0.0018	0.0003	0.0012	-0.0012	-0.0013
	0.0010	-0.0015	0.0002	0.0004	0.0017	0.0011	-0.0018	-0.0013
	0.0016	-0.0011	0.0013	0.0003	0.0007	0.0026	-0.0006	-0.0006
	0.0001	-0.0007	0.0009	-0.0003	0.0008	0.0008	0.0000	-0.0001
Average Absorbance	0.002	-0.001	0.001	0.000	0.000	0.001	-0.001	-0.001

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INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

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Request No. 25-66 / 0323

3 / 5

MTC. ACL. No. 387 / 66

3. Trueness

3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02002	0.021	0.001	4.90	± 0.005
	0.30030	0.298	-0.002	0.77	± 0.005
	0.70070	0.675	-0.026	3.67	± 0.008

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1001	0.101	0.001	0.90	± 0.009
	0.3003	0.293	-0.007	2.43	± 0.012
	0.7007	0.648	-0.053	7.52	± 0.023

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.050	0.046	-0.004	8.00	± 0.003
	0.300	0.289	-0.011	3.67	± 0.009
	0.700	0.674	-0.026	3.71	± 0.020

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3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.095	-0.005	5.00	± 0.014
	0.500	0.474	-0.026	5.20	± 0.016
	1.000	0.950	-0.050	5.00	± 0.029

3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.200	0.207	0.007	3.50	± 0.014
	0.700	0.673	-0.027	3.86	± 0.030
	1.500	1.417	-0.083	5.53	± 0.061

3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04995	0.046	-0.004	7.91	± 0.005
	0.29970	0.294	-0.0057	1.90	± 0.007
	0.69930	0.694	-0.0053	0.76	± 0.014

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3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.1001	0.103	0.003	2.90	± 0.013
	0.5005	0.501	0.001	0.10	± 0.018
	1.0010	0.987	-0.014	1.40	± 0.032

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.046	-0.004	8.00	± 0.013
	0.300	0.311	0.011	3.67	± 0.013
	0.700	0.665	-0.035	5.00	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)
which gives a level of confidence of approximately 95%

Calibrated by 1. Dani Srithongkum
(Mr. Danai Srithongkum)
2. Atipat
(Mr. Atipat Ratana)

Approved by Salida Deakong
(Miss Sutadde Deakong)
Senior Technical Officer
Acting Director of
Analytical Chemistry Laboratory
Issued Date : 15 February 2023

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

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PinAAcle 900F Preventive Maintenance Report

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	UNITED ANALYST AND ENGINEERING		
Address (Instrument Location):	BANGCHAK, PRAKHANONG, BANGKOK, 10260		
Serial Number:	PFBS20031902	PM Number:	2/2
Customer Name (if applicable):	K. SATIDA	Telephone Number:	095-558-0049
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-02273773
Date PM Performed: (DD-MM-YYYY)	Jun 26, 2023	Next PM Due Date: (DD-MM-YYYY)	Dec 30, 2023
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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Component List

Component / Specific Model	Serial #	Configuration Notes

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
N9301714	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	26-87CUV1	30-Jan-2024

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 slot 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 SDB.
 - ✓ 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	MG0-252
N1013002	1.0A Neutral density filter	1	MG0-358
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

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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.	0.9798	0.9890	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1975	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	0.0009	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 D₂ Background Compensation with Copper

Description: Verifies the instrument's ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	-0.0062	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	0.0002	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	0.0014	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.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3467	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.

PinAAcle 900F Preventive Maintenance Report (PM)

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Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.



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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: 26-Jun-2023 (DD-MM-YYYY)
Authorized Customer Representative:		Date: 26-Jun-2023 (DD-MM-YYYY)

PinAAcle 900F Preventive Maintenance Report (PM)

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Agilent 5100, 5110 Preventive Maintenance Checklist

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.



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Important Customer Web Links

- 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.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- 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>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Flexible Repair Options](#) | Agilent

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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 "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system 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.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.**

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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	๖๓๐ ๖๐๖ ICP-OES
Instrument System Site and Location	UAE

List System Component Product Numbers	List the Serial Numbers of each Component
1. G ๖๐๖๐	๓๗ ๙๖๐๓๐๐๐๑
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb Conikal Other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass Other
Torch	Radial Dual View Other
Torch Type	One Piece Semi Demountable Fully Demountable Other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other

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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 and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **Not**
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

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Preventive Maintenance Procedures

Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window.
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *N/A*
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

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SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

- ☒ Service not applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check 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 edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

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ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
 - ☒ Subsystem Communications Test
 - ☒ Air Flow
 - ☒ Water Flow
 - ☒ Gas Flows
 - ☒ RF Generator
 - ☒ Camera Test
 - ☒ Optics Test
 - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

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Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. *N/A*
- ☒ Leave system in an Idle state: on and purging.
- ☒ 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.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

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Test Results

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4190.5	6849.9	4700.8	7564.2
Mn 257.610 nm SRBR	13681.0	27295.3	14569.1	29992.5
Al 396.152 nm SBR	12.1	14.6	11.5	15.6
K 766.491 nm SBR	8.0	31.2	7.4	39.7

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

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ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	225.153 VAC	220.613 VAC
Mains Current	0.090 A	0.219 A
Instrument Temperature	24.0 °C	25.1 °C
RF Air Flow (sensor speed)	15.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	39.2 °C
Water Flow Oscillator	No measurement	1.37 L/min
Water Flow Detector	0.84 L/min	0.81 L/min
Water Inlet Temperature	17.3 °C	17.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	659.52 kPa	608.63 kPa
Purge Gas Supply Pressure*1	656.41 kPa	627.71 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	166.30 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1199.5 W
RF Supply Current	No measurement	9.223 A
RF Supply Voltage	No measurement	194.481 V

*1 If option installed

เอกสารไม่ควบคุม

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-G8014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-G8015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm id	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Consumed Parts Reference

(Purchased by customer, not included as part of PM)

☐ Section Not Applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

เอกสารไม่ควบคุม

Signature Page

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 Verification

Service Request Number:

600637120

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

13 Nov 2023

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 9:18:24 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.92	
As (188.980 nm)	≤ 8.20	6.12	
C (193.027 nm)	≤ 11.50	8.31	
Mo (202.032 nm)	≤ 8.20	6.35	
Cr (206.158 nm)	≤ 13.40	8.99	
Zn (213.857 nm)	≤ 8.70	6.64	
Pb (220.353 nm)	≤ 9.50	7.06	
Co (228.615 nm)	≤ 17.20	11.68	
Ba (230.424 nm)	≤ 9.40	7.27	
Mn (257.610 nm)	≤ 13.30	9.46	
Mn (260.568 nm)	≤ 20.30	14.18	
Cr (267.716 nm)	≤ 11.00	8.01	
Cu (324.754 nm)	≤ 25.00	18.89	
Cu (327.395 nm)	≤ 14.20	11.29	
Sr (338.071 nm)	≤ 33.50	24.46	
Ba (455.403 nm)	≤ 44.00	33.62	
Sr (460.733 nm)	≤ 36.00	17.37	
Ba (493.408 nm)	≤ 36.00	25.47	
Ba (614.171 nm)	≤ 42.00	25.43	
Ar (675.283 nm)	≤ 74.00	60.50	
K (766.491 nm)	≤ 80.00	65.33	

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เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	142.0	958.5	41.7
Se (196.026 nm)	≥ 41.0	SRBR	105.9	937.4	67.5
Zn (213.857 nm)	≥ 1421.0	SRBR	4190.3	44372.5	111.6
Pb (220.353 nm)	≥ 46.0	SRBR	213.9	2521.3	125.4
Mn (257.610 nm)	≥ 3518.0	SRBR	13681.0	279651.7	416.6
Al (396.152 nm)	≥ 3.4	SBR	12.1	52269.7	3994.3
Ba (493.408 nm)	≥ 34.0	SBR	185.8	2294372.8	12280.0
K (766.491 nm)	≥ 1.8	SBR	8.0	107401.4	11876.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	189.4	2285.0	129.5
Se (196.026 nm)	≥ 159.0	SRBR	168.7	2813.7	233.8
Zn (206.200 nm)	≥ 234.0	SRBR	905.0	10158.4	123.0
Zn (213.857 nm)	≥ 1743.0	SRBR	6849.9	135760.6	390.5
Cd (214.439 nm)	≥ 4227.0	SRBR	5597.6	92921.3	273.9
Pb (220.353 nm)	≥ 320.0	SRBR	454.8	10111.2	451.1
Mn (257.610 nm)	≥ 10625.0	SRBR	27295.3	1126118.1	1697.0
Cr (267.716 nm)	≥ 1048.0	SRBR	3948.2	144875.3	1322.0
Cu (324.754 nm)	≥ 19.0	SBR	49.2	341489.7	6798.2
Al (396.152 nm)	≥ 6.0	SBR	14.6	235321.6	15043.9
Ba (493.408 nm)	≥ 60.0	SBR	183.3	8393101.3	45538.3
K (766.491 nm)	≥ 24.0	SBR	31.2	1447045.2	44917.1

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.22	
Se (196.026 nm)	≤ 2.60	0.76	
Zn (213.857 nm)	≤ 1.50	0.33	
Pb (220.353 nm)	≤ 2.60	0.86	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.33	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.63	
Se (196.026 nm)	≤ 1.50	0.87	
Zn (206.200 nm)	≤ 1.50	0.59	
Zn (213.857 nm)	≤ 1.50	0.46	
Cd (214.439 nm)	≤ 1.50	0.70	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.95	
Cr (267.716 nm)	≤ 1.50	0.56	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.63	
Ba (493.408 nm)	≤ 1.50	0.86	
K (766.491 nm)	≤ 1.50	1.13	

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:10:02 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Subsystem Communications Test	Pass	
Optics Test		
	Radial	Axial
Intensity	3522064	4003312
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test		Pass
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.92
As (188.980 nm)	≤ 8.20	6.08
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.31
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.73
Pb (220.353 nm)	≤ 9.50	7.02
Co (228.615 nm)	≤ 17.20	11.65
Ba (230.424 nm)	≤ 9.40	7.38
Mn (257.610 nm)	≤ 13.30	9.46
Mn (260.568 nm)	≤ 20.30	14.05
Cr (267.716 nm)	≤ 11.00	7.92
Cu (324.754 nm)	≤ 25.00	18.84
Cu (327.395 nm)	≤ 14.20	11.31
Sr (338.071 nm)	≤ 33.50	24.18
Ba (455.403 nm)	≤ 44.00	33.28
Sr (460.733 nm)	≤ 36.00	17.41
Ba (493.408 nm)	≤ 36.00	25.43
Ba (614.171 nm)	≤ 42.00	25.27
Ar (675.283 nm)	≤ 74.00	56.87
K (766.491 nm)	≤ 80.00	65.88

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เอกสารไม่ควบคุม

Sensitivity Test		Pass			
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	168.6	1284.6	53.3
Se (196.026 nm)	≥ 41.0	SRBR	122.4	1256.0	90.7
Zn (213.857 nm)	≥ 1421.0	SRBR	4700.8	53870.1	130.7
Pb (220.353 nm)	≥ 46.0	SRBR	236.0	3100.6	155.7
Mn (257.610 nm)	≥ 3518.0	SRBR	14569.1	318398.1	476.2
Al (396.152 nm)	≥ 3.4	SBR	11.5	59510.5	4761.6
Ba (493.408 nm)	≥ 34.0	SBR	170.6	2490835.6	14514.2
K (766.491 nm)	≥ 1.8	SBR	7.4	117698.7	14024.1
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	214.5	2706.2	142.8
Se (196.026 nm)	≥ 159.0	SRBR	188.0	3262.8	255.9
Zn (206.200 nm)	≥ 234.0	SRBR	1088.2	12794.8	135.3
Zn (213.857 nm)	≥ 1743.0	SRBR	7564.2	156883.9	427.8
Cd (214.439 nm)	≥ 4227.0	SRBR	6647.3	116281.7	304.4
Pb (220.353 nm)	≥ 320.0	SRBR	519.3	12490.2	530.3
Mn (257.610 nm)	≥ 10625.0	SRBR	29992.5	1305852.5	1890.2
Cr (267.716 nm)	≥ 1048.0	SRBR	4366.6	173343.4	1547.9
Cu (324.754 nm)	≥ 19.0	SBR	46.8	361093.0	7560.5
Al (396.152 nm)	≥ 6.0	SBR	15.6	274029.5	16498.6
Ba (493.408 nm)	≥ 60.0	SBR	203.6	9028914.5	44122.1
K (766.491 nm)	≥ 24.0	SBR	39.7	1701521.4	41771.8

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.85
Se (196.026 nm)	≤ 2.60	1.26
Zn (213.857 nm)	≤ 1.50	0.42
Pb (220.353 nm)	≤ 2.60	0.54
Mn (257.610 nm)	≤ 1.50	0.60
Al (396.152 nm)	≤ 1.50	0.47
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.50
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.42
Se (196.026 nm)	≤ 1.50	0.66
Zn (206.200 nm)	≤ 1.50	0.42
Zn (213.857 nm)	≤ 1.50	0.54
Cd (214.439 nm)	≤ 1.50	0.42
Pb (220.353 nm)	≤ 1.50	0.22
Mn (257.610 nm)	≤ 1.50	0.54
Cr (267.716 nm)	≤ 1.50	0.49
Cu (324.754 nm)	≤ 1.50	0.85
Al (396.152 nm)	≤ 1.50	0.61
Ba (493.408 nm)	≤ 1.50	0.78
K (766.491 nm)	≤ 1.50	1.00

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:15:43 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	20.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.27	0.81	20.37

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เอกสารไม่ควบคุม



Agilent CrossLab Start Up Services Agilent Intuvo 9000 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

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	271.62	2.00	2.00	111.13
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	116.00	18.00	17.94	23.11
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		147.380			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.843			
Work Coil Current (A)		44.410			
RF Power Supply Current (A)		1.999			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test		1000	5.361 Passed		
Dark Current Test		6000	0.779 Passed		
Array Test		5	0.025 Passed		
Linearity Test			0.118 Passed		

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เอกสารไม่ควบคุม



Agilent Intuvo 9000 GC Preventive Maintenance Checklist

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>



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.

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System Information

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

Instrument System Name and ID

Instrument System Site and Location

UAE, Bangkok

List System Component Product Numbers

List the Serial Numbers of each Component

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

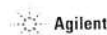
G9950A
G4513ACN 12100009
CN 17120171

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.

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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 operation of all instrument fans.

Inlet and detector consumable replacement

- ☒ For the inlet installed, perform inlet maintenance using the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace column Compression Bolts.
- ☒ Replace the split vent trap for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.
- ☒ 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. Use the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace the Guard Chip or Jumper Chip for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.

Inlet and Detector Tests

- ☒ Zero all pressure sensors.
- ☒ Perform the inlet pressure leak test.
- ☒ Perform the inlet restriction test.
- ☒ Perform the FID jet restriction test if FID installed.
- ☒ Perform the FID leakage test if FID installed.
- ☒ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Check all cabling and configuration settings between GC, tray, and injectors.
- ☐ Vacuum or removed any dust, especially around fans.
- ☐ Check operation of all fans.
- ☐ Check syringe for smooth plunger operation.
- ☐ Check for smooth operation of the needle support rod - clean if necessary
- ☐ Check for correct operation of syringe volume stops

Restore Instrument

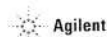
- ☒ Restore the normal operating conditions using the Keyboard Local User Interface or Data System.
- ☒ Check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine 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.

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 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.

PM Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Detector output [D1]	N/A	N/A
Detector output [D2]	N/A	N/A

Tests	Expected Result	Actual Result or N/A
Inlet Leak Test	Pass	Pass
Inlet Restriction Test	Pass	Pass
FID jet restriction test if FID installed	Pass	N/A
FID leakage test if FID installed	Pass	N/A

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เอกสารไม่ควบคุม

Agilent Preventive Maintenance Services

Agilent GCMS
Preventive Maintenance

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

เอกสารไม่ควบคุม

Intuvo Parts List Table

Note: 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/Model # where used	Quantity Consumed
FID Jet 0.11inch ID	G4591-20320	G3950A	1
Split Vent Trap Filter (2pk)	G5188-6497	G3950A	1
Bus Bolt with Washer	G4581-60260	G3950A	1
Guard Chip for SS inlet	G4587-60565	G3950A	1
Guard Chip for MMI	G4587-60665	G3950A	N/A
Jumper Chip for SS inlet	G4587-60575	G3950A	1
Jumper Chip for MMI	G4587-60675	G3950A	1

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.

Service Completion

Service request number 6006010152 Date service completed 24 Apr 23Agilent signature Su N. Customer signature _____

Total number of pages in this document _____

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Introduction

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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

- To access Agilent training and education, visit <http://www.agilent.com/chem/education> 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.

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- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilent/resources>. The following information topics are available:

Sample Prep and Containment
Chemical Standards
Analysis
Service and Support
Application Workflows

- 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>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Provide Repair Options](#) | [Agilent](#)

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 **"Service not applicable"** check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system 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.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section.
- Complete Signature Page and attach Signature Page to Service Order.

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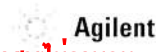
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Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. Two preventive maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.

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Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☒ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

System Information

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

Instrument System Name and ID
Instrument System Site and Location

UAE, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67077B	US1715M030
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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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 and implementation of Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

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Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- ☒ Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

Note: it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

Definition of the Task/Recommended items within the document

Task		Recommended		
Yes	No	Interim	Major	As Needed
<input checked="" type="checkbox"/>				
	<input checked="" type="checkbox"/>			
		<input checked="" type="checkbox"/>		
			<input checked="" type="checkbox"/>	
				<input checked="" type="checkbox"/>

Yes selected means that the task was done or the part was required

No selected means that the task was not done or the part was not required.

Interim selected means that this task is recommended to be done at 6-month intervals

Major selected means that this task is recommended to be done yearly, if the customer would like a service to be done at the 6-month interval then the service could be purchased

As needed selected means that the task was done or the part was used as needed. For example, there could be two types of filters that could be used and this was the one selected.

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Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating special peaks, baseline noise, peak shape, mass assignments and resolution.

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

Yes/No	Interim/Major	System Checks
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Visually inspect calibrant levels: P1 TBA PF-D1D (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input type="checkbox"/>	<input type="checkbox"/>	Verify system line voltage meets instrument specifications. Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	For HydroInert systems, verify customer is running hydrogen. Yes <input type="checkbox"/> No <input type="checkbox"/>

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

Yes/No	Interim/Major	Wet Mechanical vacuum pumps
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Wet Mechanical vacuum pumps
<input type="checkbox"/>	<input type="checkbox"/>	Description

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<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Diaphragm
<input type="checkbox"/>	<input type="checkbox"/>	Description
<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/>	<input type="checkbox"/>	Clear air flow paths of dust.
<input type="checkbox"/>	<input type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input type="checkbox"/>	<input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Scroll
<input type="checkbox"/>	<input type="checkbox"/>	Description
<input type="checkbox"/>	<input type="checkbox"/>	Replace the tips seal on the IDP pump.
<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/>	<input type="checkbox"/>	Replace the Exhaust Filter if required.
<input type="checkbox"/>	<input type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input type="checkbox"/>	<input type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input type="checkbox"/>	<input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

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Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

Yes/No	Interim/Major	Cleaning System and Filters
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Fans
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Source cleaning (all sources except HydroInert)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Re-install source and close analyzer.
<input type="checkbox"/>	<input type="checkbox"/>	HydroInert Source
<input type="checkbox"/>	<input type="checkbox"/>	Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and lens stack), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Filters
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSH1 2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSN 2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSHY 2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8", Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17973 – Gas Clean Filter, Replacement Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5190 90/1 – Methane Gas Filter – if applicable

Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

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System post-check	
Yes/No	Interim/Major
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Pump system back down. Wait until system stability has been achieved.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system vacuum reading(s) via the gauge controller.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Leak Check	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system in manual tune	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Compare against previous tune file report(s)	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Change to 1 tune and verify that all temperatures, pressures, and gas flows reach method set points	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check manually that you have calibration peaks.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EI Autotune Performed	

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

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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. Systems in a compliant environment may need additional documentation.
- ☒ Complete Signature Page and attach Signature Page to Service Order.

Test Results

Test Description	Expected Test Result	Actual Test Result
------------------	----------------------	--------------------

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Consumed PM Parts

Common MS Filters and Seals - 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	Interim	Major	As Needed
Helium gas filter - if required	RMSN-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Nitrogen gas filter - if required	RMSN-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Big Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium, Bracket, Mount and Filter - if required	CP17988		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gas Clean Filter Kit GC/MS 1/8 in (complete replacement kit) - if required	CP17974		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gas Clean GC/MS Filter - if required	CP17973		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Chemical Ionization Gas Purifier (CI systems) - if required	S190-9071		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Agilent AVF Platinum, 1 quart	S191-5851	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Gas filters need to be changed only if required				

MS Maintenance Supplies for 5973/5975/5977 Series

Part Description	Part Number	Interim	Major	As Needed
Diffusion pump fluid (Diffusion Pump Models)	6040-0809 Qiy 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Pump Models)	G7077-67018	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-3 Tip Seal Replacement Kit (no tools - CSO P/N)	S190-9561	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-3 Tip Seal Replacement Kit (no tools - VPD P/N)	IDP31S	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Filter element for IDP-3	REPLSLRFILTER 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DS42 Oil Mist Eliminator 3/4G & 3/8	SR03706556	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Exhaust oil mist trap (thread) Edwards/Pfeiffer	G1099-80039	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Repeller Insulator	G1099-20133		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lens stack insulator	G3870-20530		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lens insulator for Extractor (ring insulator)	G3870-20445		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HydroInert Extractor lens (9mm)	G7078-20909		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HydroInert Repeller	G7078-20902		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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MS Maintenance Supplies for 7000/7010 Series

Part Description	Part Number	Interim	Major	As Needed
Nitrogen gas filter	RMSN-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models)	G7004-67023		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-10 Tip Seal Replacement Kit (no tools - VPD P/N)	X3807-67000		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Oil Mist Filter RV5	G6600-80043		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Filter element for the IDP-10	REPLSLRFILTER 1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Repeller Insulator	G1099-20133		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lens stack insulator	G3870-20530		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lens insulator for Extractor (ring insulator)	G3870-20445		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HydroInert Extractor lens (9mm)	G7078-20909		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HydroInert Repeller	G7078-20902		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

MS Maintenance Supplies for 7200/7250 Series

Part Description	Part Number	Interim	Major	As Needed
Nitrogen gas filter - if required	RMSN-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RIS Probe Maintenance Kit (7200 Series only)	G7004-67023		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DS202 Oil Mist Eliminator	X3807-67000		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Pump Models)	G6600-80043		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IDP-15 Tip Seal Replacement Kit (no tools - VPD P/N)	REPLSLRFILTER 1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Filter element, for SH-110/SH-112/IDP-15 exhaust silencer	G1099-20133		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DS 3/8 MAG. PLUG AND GASKET	G3870-20530		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

MS Maintenance Supplies for JetClean

Part Description	Part Number	Interim	Major	As Needed
Big Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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Consumed Parts Reference (Purchased by customer, not included as part of PM)

Common MSD Maintenance Supplies 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	Interim	Major	As Needed
EI High Temperature Filaments	G7005-60061 Qty 2			✓
HES EI Filaments	G7002-60001			✓
LE-EI Filaments	G3850-60021			✓
CI High Temperature Filament - all MSDs	G7005-60072			✓
PFTBA GCMS Tuning Standard calibrant	05971-60571			✓
PFDTD calibrant, 1 mL	8500-8510			✓
PFET, IRM calibrant for GC QTOF 0.5 mL	5190-0531			✓

MSD Maintenance Supplies 5973/5975/5977 Series

Part Description	Part Number	Interim	Major	As Needed
CI Interface tip seal (tip and spring combo)	G1999-60412			✓
CI Interface tip seal (tip only)	G3870-20542			✓
CI Interface tip seal spring (spring only)	G1999-20023			✓
Repeller insulator	G1099-20133 Qty 2			✓
Lens insulator/holder (HES)	G7002-20074			✓
Ring heater/sensor assembly (HES)	G7002-60043			✓
Ceramic insulator for Extractor (HES)	G7002-20064			✓
Transfer-Line Tip Cap, Threaded	G3870-20547			✓
Transfer-Line Tip Base, Threaded	G3870-20548			✓
Lens stack insulator	G3870-20530			✓
Lens insulator for Extractor (ring insulator)	G3870-20445			✓
HydroInert Extractor lens (9mm)	G7078-20909			✓
HydroInert Repeller	G7078-20902			✓

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MS Maintenance Supplies for 7000/7010 Series

Part Description	Part Number	Interim	Major	As Needed
CI Interface tip seal - 7000	G1999-60412			✓
CI Interface tip seal - 7010	G7002-60412			✓
CI Interface tip seal (tip only)	G3870-20542			✓
CI Interface tip seal spring (spring only)	G1999-20023			✓
Repeller insulator - 7000	G1099-20133 Qty 2			✓
Lens insulator/holder (HES)	G7002-20074			✓
Ring heater/sensor assembly (HES)	G7002-60043			✓
Ceramic insulator for Extractor (HES)	G7002-20064			✓
Transfer-Line Tip Cap, Threaded	G3870-20547			✓
Transfer-Line Tip Base, Threaded	G3870-20548			✓
Lens stack insulator	G3870-20530			✓
Lens insulator for Extractor (ring insulator)	G3870-20445			✓
HydroInert Extractor lens (9mm)	G7078-20909			✓
HydroInert Repeller	G7078-20902			✓

MS Maintenance Supplies for 7200 Series

Part Description	Part Number	Interim	Major	As Needed
Extractor Lens Insulator	G7005-20133			✓
Ion Focus Insulator	G7005-20442			✓
Ring Heater/Sensor Assembly	G7005-60110			✓
RIS Xfer Tip	G7005-20542			✓
RIS Xfer Tip Spring	G7005-20024			✓

MS Maintenance Supplies for 7250 Series

Part Description	Part Number	Interim	Major	As Needed
Lens insulator/holder (HES)	G7002-20074			✓
Ring heater/sensor assembly (HES)	G7002-60043			✓
Ceramic insulator for Extractor (HES)	G7002-20064			✓
Transfer-Line Tip Cap, Threaded	G3870-20547			✓

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Part Description	Part Number	Interim	Major	As Needed
Transfer-Line Tip Base, Threaded	G3870-20548			✓
EI Extractor Transfer Tip	G3870-20542			✓
CI Tip Compression Spring	G1999-20023			✓

MS Maintenance Supplies for Intuvo 9000 MS Series

Part Description	Part Number	Interim	Major	As Needed
Swaged MS Tail - Packaged	G4590-60009			✓
Swaged MS Tail (HES) - Packaged	G4590-60109			✓

Common MS Maintenance Supplies

Part Description	Part Number	Interim	Major	As Needed
Abrasive paper, 30 um	5061-5896			✓
Alumina powder	393706201			✓
Cloths, clean (pkg of 15)	05980-60051			✓
Cloths, cleaning (pkg of 300)	9310-4828			✓
Cotton swabs (pkg of 100)	5080-5400			✓
Gloves, clean, large	8650-0030			✓
Gloves, clean, small	8650-0029			✓

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Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number: 6016010152

Date of Service Completion: 24 Apr 2023

Service Engineer Name: S. N.

Customer Name:

Service Engineer Signature:

Total number of pages in this document:

เอกสารไม่ควบคุม

Agilent CrossLab Start Up Services

Agilent 7697A Headpace Sampler Preventive Maintenance - Standard

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

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Important Customer Web Links

- 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.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/resources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- 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>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call? <https://www.agilent.com/service>

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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 **"Service not applicable"** check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system 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
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- It is important to consult with the customer prior to a PM to determine which parts are installed in the instrument to decide if individual components need to be purchased rather than the 7697A Standard PM Kit. The 7697A Standard PM Kit contents are based off of the contents of the original shipment. Different types of deactivated treatment for the sample probe and sample loop, different sample loop sizes, and transfer line sizes may require for individual parts to be ordered to perform the PM procedure. If different parts are required, reference the Agilent supplies catalog for part numbers.
- Ask the customer to sign the **Service Verification** section including the customer's and your signature.

Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☒ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

System Information

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

Instrument System Name and ID
Instrument System Site and Location

UAE, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. 64552-19000	CN1710041
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

เอกสารไม่ควบคุม

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 and implementation of Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

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Preventive Maintenance Procedures

- ☐ Service Not Applicable

Inspect and Clean Sampler

- ☐ Service Not Applicable
- ☒ If a tray is part of the system, remove the tray and pneumatics to allow for access to the oven.
- ☒ If a tray is part of the system, check that the shutter sensor is not dusty. If it is, use air duster to remove the dust.
- ☒ Check for any debris in the carousel and clean if necessary.
- ☒ If a tray is part of the system, reinstall the tray and pneumatics unit.
- ☒ Remove the front panel of the instrument.
- ☒ Check the carousel belt for wear. If it is worn, consult with the customer to determine if it should be replaced.
- ☒ Use a dry, clean cloth to wipe the lifter rod(s) clean. Do not apply any lubricant.
- ☒ Vacuum the inside of the unit.
- ☒ Reinstall the front panel of the instrument.
- ☒ Using the Manual Operations function under the Service Mode Key on the instrument keypad, confirm that the following components work:
- o Tray Lifter (If applicable)
 - o Sampler Lifter
 - o Carousel Motor
 - o Shutter Motor (If applicable)

Pneumatic Components

- ☐ Service Not Applicable
- ☒ Remove the sample probe.
- ☒ Remove the sample loop.
- ☒ Install the new sample loop.
- ☒ Install the new sample probe.
- ☒ Remove the fused silica transfer line.
- Special note:** If OQ will be performed after the PM, remove the fused silica transfer line and do not reinstall it until the transfer line measurement is taken for the OR procedure.
- ☒ Reinstall the fused silica transfer line.

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- ☒ Use Service Reminders under the Service Mode Key on the instrument keypad to run the instrument restriction and leak test. Verify that it passes (make a note below the tests results table). If it fails, consult the customer for repair options.

Tray Components

- ☐ Service Not Applicable
- ☒ Check for any debris in the sample trays and clean if necessary.
- ☒ Check that the tray gantry rod is clean. If it is dirty or dusty, wipe it clean with a dry cloth. Do not apply any kind of lubrication.
- ☒ Check that the sensors are not dusty. If they are, use air dusters to remove the dust.
- ☒ Check the tray belts for any wear. If they are worn, consult with the customer to determine if they should be replaced.
- ☒ Verify the three LED's for the tray racks light up when the trays are installed.
- ☒ Run the tray calibration.
- ☒ Reset the counter (pressing the OFF key) of the tray calibration.

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Restore Instrument

☐ Service Not Applicable.

- ☒ Connect the headspace transfer line if it has not been already reconnected.
☒ Return instrument to initial condition.
☒ Perform system checkout procedure or test.

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.

Service Review

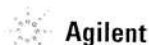
- ☒ Attach available reports/printouts of all tests to this documentation.
☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
☒ Record the PM event in the Smart Alerts logbook, if applicable.
☒ Update/reset instrument maintenance counters as appropriate.
☒ Affix the 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. Systems in a compliant environment may need additional documentation.
☒ Complete the Signature Page with both Service Engineer and Customer signatures.

7697A Headspace Sampler Test Results

Test Description	Expected Test Result	Actual Test Result
Tray Calibration	Pass	Pass
Leak Test	Pass	Pass
Chemical Checkout Test		

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7697A Headspace Sampler Parts List

Part Description	Part Number	Product or Model# where used	Quantity consumed
7697A Standard PM Kit ¹	G4556-67011	7697A HS Sampler	1
Ferrule Flexi Inert 0.53 mm Col 10/1PK NFS	G3188-27503	7697A HS Sampler AND G3S20A module	1 (Optional, not included in PM kit)

¹ Part numbers and descriptions for the kit contents

Part Description	Part Number	Quantity
Sample Probe	G4556-63825	1
Sample Loop (1mL)	G4556-80106	1
Thermal Gap Insulation Foam	G3530-00610	1
7697A Fused Silica and ProSteel Kit	G3903-61001	1
Polyimide, Valcon Ferrule, 5 pack	0100-2595	1
Nut and reducing union for 6 port valve transfer line connection	0100-2594	1
Liner, direct, 2mm ID, deactivated	5181-8818	1

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Signature Page

Service Engineer Comments (optional)

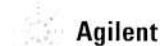
If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Verification

Service Request Number: 6006010192 Date Service Completed: 24 Apr 2023
 Service Engineer Name: Supasak N Customer Name:
 Service Engineer Signature: [Signature] Customer Signature:
 Total number of pages in this document:

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Agilent CrossLab Start Up Services

Agilent GCMS 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

Select the appropriate PM to be done and then perform the checklist under that section

- ☐ Interim Preventive Maintenance 6 months
☒ Major Preventive Maintenance Yearly

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TO	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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>
- 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.
- 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 services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.

System Information

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

Instrument System Name and ID	US2009 M037
Instrument System Site and Location	United Analyst And Engineers GCMS

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67097B	US2009M037
2.	
3.	
4.	
5.	
6.	
7.	
8.	

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 and settings as defined by current Service Notes
- Check for firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- ☒ Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

Note: it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

Definition of the Task/Recommended items within the document

Task	Recommended	
Yes	No	Interim / Major / As needed
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Yes selected means that the task was done or the part was required.
No selected means that the task was not done or the part was not required.
Interim selected means that this task is recommended to be done at 6-month intervals.
Major selected means that this task is recommended to be done yearly; if the customer would like a service to be done at the 6-month interval then the service could be purchased.
As needed selected means that the task was done or the part was used as needed. For example, there could be two types of filters that could be used and this was the one selected.

Preventive Maintenance Procedures

Yes/No	Interim/Major	Description
<input type="checkbox"/>	<input type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

Yes/No	Interim/Major	GCMS
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument model no.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument serial no.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Rough Vacuum
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Manifold Vacuum
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Type of Column installed

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vent the instrument.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Visually inspect calibrant levels – PF1/BA/PTD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the tips seal on the IDP pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the Exhaust Filter if required.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Source cleaning
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Re-install source and close analyzer.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Filters
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSG-2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSG-2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSG-2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8", Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17973 – Gas Clean Filter, Replacement Filter – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	S190-9071 – Methane Gas Filter – if applicable.

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Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system in manual tune.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Compare against previous tune file report(s).
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	El Autotune Performed

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

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook. Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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 Comment box. Systems in a compliant environment may need additional documentation.

Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result
Auto tune	pass	pass
Evaluate tune	pass	pass

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Agilent Consumed Parts List Table

☒ Section not applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

Signature Page

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 enter in this box.

Service Completion

Service request number 6009459599 Date service completed 14 June 2023

Agilent signature [Signature] Customer signature [Signature]

Total number of pages in this document 9 pages

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Agilent CrossLab Start Up Services Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure consistent 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>.

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Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
Obtain contact information that relates to the system as a reference for the visit.
- 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 in the order of the tasks listed.
- 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 modification work.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

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

Instrument System Name and ID	CN1945A066
Instrument System Site and Location	VAE GCMS (405)

List System Component Product Numbers	List the Serial Numbers of each Component
1. 8792A	CN1945A066
2.	
3.	
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.

Revision: 2.01, Issued: September 14, 2021
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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

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces 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.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☐ 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 using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: 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.

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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 Browser interface or 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.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	N/A	N/A
AUX 1 detector output	N/A	N/A
AUX 2 detector output	N/A	N/A
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Pass
Leak and Restriction Test after back inlet maintenance	Pass	N/A
Leak and Restriction Test after front inlet Split Vent Trap replacement	Pass	Pass
Leak and Restriction Test after back inlet Split Vent Trap replacement	Pass	N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	N/A

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PM Parts List Table

Note: 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, Split	5188-6496	8890 GC	1
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Inlet, Single taper with Glass Wool	5190-2295	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6496	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	8890 GC	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

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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.

Service Completion

Service request number 600 59535 97 Date service completed 14 June 2023
 Agilent signature SM Customer signature _____
 Total number of pages in this document 9 pages

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 23TM378
 Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
 Manufacturer : Memmert
 Model : IPP 260
 Serial No. : V615.0187
 ID No. : UAE.MIC.003/2559
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 11 April 2023
 Calibration Date : 12 April 2023
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Preecha Hlahib
 Approved by : Malee
 Approved Signatory
 () Pornthippa Tameyakul
 (/) Malee Butkruea
 () Suwit Imjai
 Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2304-0155OC-1
 Procedure Used :-
 Calibration were conducted using calibration procedure CP-OT02 according to direct measurement
 method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

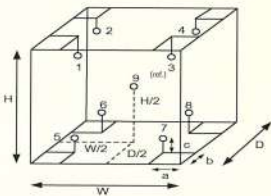
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY49001451	23LM27	25 Feb 2024

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.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

Dimension of Chamber :

a = 5.0 cm D = 0.50 m
 b = 5.0 cm W = 0.64 m
 c = 5.0 cm H = 0.80 m
 Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	57	61
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2304-0155OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 23TM378
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.052	0.53	0.60	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.092	35.148	34.817	35.149	34.894	35.323	34.773	35.058	34.802	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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เอกสารไม่ควบคุม



Cert. No.: 23TM194
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0612
ID No. : UAE.MIC.003/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Suwit Imjai
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%.

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เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-3
Procedure Used :-

Cert. No.: 23TM194
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

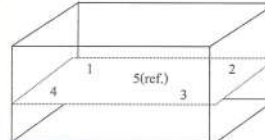
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	22	65	231
Finished of Calibration	22	63	230



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM194
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.6	44.520	44.509	44.498	44.552	44.530

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.077	0.037	0.15	2

Average* : The average of 30 values in each position.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

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เอกสารไม่ควบคุม



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



Calibration Certificate

Certificate No.: 2304203-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2304203
Operation No.: 2304203-001
Date of Receipt: 10 August 2023
Date of Calibration: 10 August 2023

Calibrated by Mr.Worapob Sooktong
Scientist
Approved by
(Mr.Pheraphat Tuantit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 August 2023

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.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 10 August 2023 Page 2 of 3

Location: 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (65 ± 2) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
- 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.

Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	S25601	NC-22-11-22-176	9-Nov-23	MADGETECH INC.
	HiTemp140-2	S25602	NC-22-11-22-175	9-Nov-23	MADGETECH INC.
	HiTemp140-2	R54918	TE 660363-01	8-Apr-24	NATIONAL FOOD INSTITUTE

- 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.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good
- UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 121 °C

8. Result of Calibration : ☒ Without adjustment
☐ After adjustment

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



Calibration Report

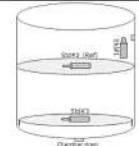
Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 10 August 2023 Page 3 of 3

Calibration point: 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	27.0	63.5	223.3
Max	28.3	67.3	225.9



Probe 1 = Attached to the top temperature probe, within 20 mm.
Probe 2 = In the upper half of the chamber.
Probe 3 = In the chamber dish, within 100 mm.

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	121.68	121.70	121.66	0.66

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
121	121	121	121	0.10	0.11	0.12	0.23

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of 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



Cert.No.: 23MM150
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : MS603S J01
Serial No. : B007010311
ID No. : UAE.TOX.008/2553
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai

Approved by :
Pornthippa Tameyakul
Malee Butkruea

Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0016OC-1
Procedure used :-

Cert.No.: 23MM150
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 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-0010-22	20 Jan 2024
2) Standard Weight (E2)	158471	-	70RC197	MM-0059-22	25 Apr 2024

- 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 620 g Resolution 0.001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
300	299.999	+0.001	1.4	2.07
600	599.997	+0.003	1.7	2.09

After Adjustment :

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

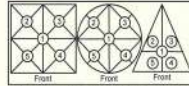
Applied Weight (g)	Standard Deviation of Reading (g)
300	0.0006
600	0.0008

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0016OC-1
Result of calibration

Cert.No.: 23MM150
Page: 3 of 3



2. Effect of off center loading

A mass of 200 g was placed at various positions on the pan.
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.001	+0.001	+0.001	-0.002	-0.002	0.002

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.000	0.000	1.3	2.09
0.5	0.499	+0.001	1.3	2.09
1	0.999	+0.001	1.3	2.09
50	50.000	0.000	1.3	2.09
100	99.999	+0.001	1.3	2.09
150	149.999	+0.001	1.3	2.09
200	199.999	+0.001	1.3	2.09
300	299.999	+0.001	1.4	2.07
400	399.999	+0.001	1.6	2.11
500	500.000	0.000	1.7	2.11
600	599.999	+0.001	1.7	2.09

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 %.

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