

Certificate No : 21-ATM-096
Request No : Req-2021-0988

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
14.3	14.307	14.31	-0.003	0.21
15.0	15.004	14.94	0.064	0.22
15.0	15.305	15.72	0.085	0.23
16.6	16.007	16.30	0.107	0.24
18.3	18.305	18.19	0.115	0.26

Note
STD : Standard
UUC : Unit Under Calibration
* Indicates non accredited

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-ATM-01 Rev.00 Issue 03/05/20

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Certificate No : 21-BHM-063
Request No : Req-2021-0988

Calibration Results : Without Adjustment
Temperature Calibration : Filter Temperature (T_F)

Temperature Range °C	Without Adjustment (°C)			Uncertainty °C
	STD Reading °C	UUC Reading °C	Correction °C	
20	19.999	20.2	-0.201	0.10
25	24.997	25.2	-0.203	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.1	-0.206	0.10

Temperature Calibration : Ambient Temperature (T_A)

Temperature Range °C	Without Adjustment (°C)			Uncertainty °C
	STD Reading °C	UUC Reading °C	Correction °C	
20	19.999	20.2	-0.201	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.0	0.000	0.10
35	35.003	34.9	0.103	0.10
40	40.004	39.9	0.104	0.10

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-BHM-01 Rev.00 Issue date 03/05/20

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 21-BHM-063
Request No : Req-2021-0988

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

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGE
Model : detsCal DC1
Serial Number : 160491
ID : UAE-FPM-175-2561
Resolution : 0.1 °C
Sensor Model : 2182 (T_F)
Sensor SN : MRG-010469-002
Sensor ID : UAE-FPM-175-2561
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 0.5 °C
Humidity : 55 %RH ± 20 %RH
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration By : Mr. Sirichok Jirapaksadon
Location of Calibration : LAB 2 Temperature
Calibration Method : In-house method CP-TBM-01 by Comparison With Standard Relative Humidity Meter and Standard
Thermometer with RTD Probe in Humidity / Temperature Chamber

Reference Standard

Standard Thermometer Model: GT11, S/N: 12600077, Which was calibration on 30 March 2021, Calibration of Certificate No. : QR21-0719
and Relative Humidity Meter, Model: HP23-A, S/N: 61629979, Which was calibration on 28 September 2020, Calibration of Certificate No. :
QR20-1431

Traceability

This Certificate is traceable to SI Unit through Qualify Roben Co., Ltd., NSC-ONSC Accreditation No. Calibration 0203

Note

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

Calibrated By :
Service Calibration Engineer

Approved By :
Calibration Engineer Supervisor
Issue Date : 1 September 2021

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-FPM-01 Rev.00 Issue date 03/05/20

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 WITANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3889-34 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 21P2499
Page : 1 of 2

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

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.

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WBC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1000 mbar

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

81 Soi Udomsak 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-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 | DP142 | 1422505046 | MP-0033-21 | 08 Apr 2022 |
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 instrument was used clean air as pressure media.
5. The certificate is valid only to the item calibrated on date and place of calibration.
6. This Certification is traceable to the International System of Unit maintained at -
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussamee
Issue Date : 22 July 2021

Approved Signatory :
[Signature]
[Signature]
[Signature]

เอกสารไม่ควบคุม

0264462



Cert.No.: 21P2499
Page: 2 of 2

Result of calibration: Without adjustment
Function: Absolute Pressure Measurement

Range: 900 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	957.55	959.27	960.15	960.48	1000.89	1010.75	1020.58	1029.49
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.34	0.73	-0.15	-0.48	-0.89	-0.75	-0.68	0.51

Decreasing Pressure

Applied Pressure (hPa)	1029.61	1020.69	1010.80	1000.75	990.59	980.30	969.41	957.79
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	0.39	-0.69	-0.80	-0.75	-0.59	-0.30	0.59	2.21

The uncertainty of measurement was ± 0.30 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 %.

-00-

เอกสารไม่ควบคุม
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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phraekhong, Bangkok 10260
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

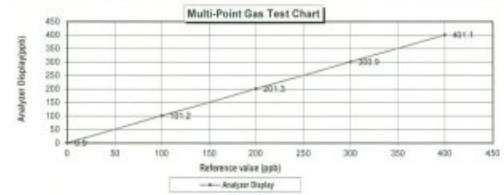
Test Date : June 30, 2021

Equipment : Gas Analyzer (NO_x) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1180540071

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.90	0.90	0.90
Level 2	20.00%	101.2	1.20	1.19	1.19
Level 3	40.00%	201.3	1.30	0.65	0.65
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	401.1	1.10	0.27	0.27
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.66	
: Acceptable Limit $\pm 5\%$					



Page 1 of 1

เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phraekhong, Bangkok 10260
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

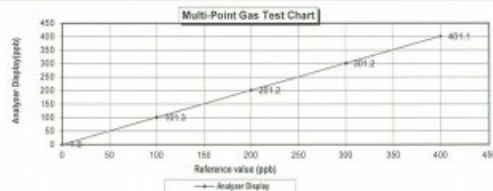
Test Date : July 19, 2021

Equipment : Gas Analyzer (NO_x) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1180540062

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	1.0	1.00	1.00	1.00
Level 2	20.00%	101.3	1.30	1.28	1.28
Level 3	40.00%	201.2	1.20	0.60	0.60
Level 4	60.00%	301.2	1.20	0.40	0.40
Level 5	80.00%	401.1	1.10	0.27	0.27
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.71	
: Acceptable Limit $\pm 5\%$					



Calculated by

16 July 2021

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Page 1 of 1



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phraekhong, Bangkok 10260
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

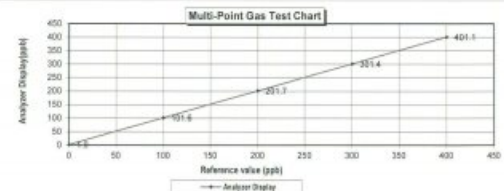
Test Date : July 9, 2021

Equipment : Gas Analyzer (NO_x) Model : 421
Manufacturer : Thermo Scientific Serial Number : 118292008

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 1461
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	1.9	1.90	1.90	1.90
Level 2	20.00%	101.6	1.60	1.57	1.57
Level 3	40.00%	201.7	1.70	0.84	0.84
Level 4	60.00%	301.4	1.40	0.46	0.46
Level 5	80.00%	401.1	1.10	0.27	0.27
Remark : Measuring Range	500.0 ppb		Average Difference (%)	1.01	
: Acceptable Limit $\pm 5\%$					



9 July 2021

เอกสารไม่ควบคุม

Page 1 of 1

MULTI-POINT GAS TEST REPORT

Test Date : July 9, 2021

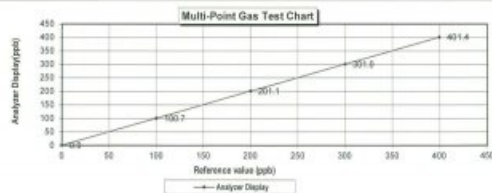
Equipment : Gas Analyzer (NO_x) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201497724

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	105.7	0.70	0.70
Level 3	40.00%	200.0	201.1	1.10	0.55
Level 4	60.00%	300.0	301.0	1.00	0.33
Level 5	80.00%	400.0	401.4	1.40	0.35
Remark : Measuring Range	500.0 ppb				
Acceptable Limit	± 5%				



Calculate by: [Signature]
10 July 2021

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A010C Reference Number: 100-401526192-1
Cylinder Number: CC159599 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2017) document EPA 8200-12-01, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration module. All concentrations are on a volumetric basis unless otherwise noted.

Do Not Use This Cylinder Below 100 psig, i.e. 6.7 barg (approx.)

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NO _x	45.00 PPM	44.75 PPM	G1	+/- 0.8% NIST Traceable	07/29/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.75 PPM	G1	+/- 0.8% NIST Traceable	07/29/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	+/- 1% NIST Traceable	07/29/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	+/- 0.4% NIST Traceable	07/29/2019

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18860121	KAL004310	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	182411	KAL004307	50.00 PPM NITRIC OXIDE/NITROGEN	+/- 0.80%	Mar 12, 2024
NTRM	18860121	KAL004210	250.0 PPM NO/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	182411	KAL004301 NOX	50.00 PPM NO/NITROGEN	+/- 0.80%	Mar 12, 2024
NTRM	0141108	KAL003100	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	072508	KAL004610	670.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
CO MKS FTR 000500002	FTR	Jul 19, 2019
NO MKS FTR 000500002	FTR	Jul 22, 2019
NO MKS FTR 000500002	FTR	Jul 22, 2019
SO2 MKS FTR 000500002	FTR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN 51319-CM03
POW 5219002210
GROSS WEIGHT: 28.8 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

Page 1 of 100-401526192-1
เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : July 13, 2021

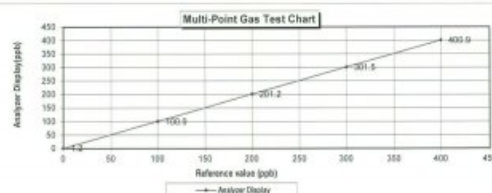
Equipment : Gas Analyzer (NO_x) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778105

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.20	1.20
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	201.2	1.20	0.60
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.9	0.90	0.22
Remark : Measuring Range	500.0 ppb				
Acceptable Limit	± 5%				



Calculate by: [Signature]
13 July 2021

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

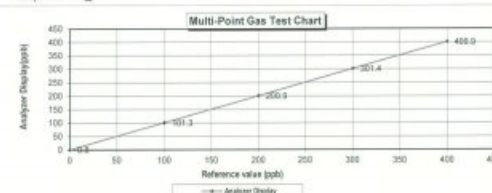
Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1201778112

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	301.4	1.40	0.46
Level 5	80.00%	400.0	400.9	0.90	0.22
Remark : Measuring Range	500.0 ppb				
Acceptable Limit	± 5%				



Calculate by: [Signature]
14 June 2021

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778116

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1201778116
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	1.4	1.40	1.40
Level 2	20.00%	100.0	101.3	1.28	1.28
Level 3	40.00%	200.0	201.4	0.79	0.79
Level 4	60.00%	300.0	301.5	0.50	0.50
Level 5	80.00%	400.0	401.5	0.37	0.37
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.87	
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by : [Signature] 10 June 2021

Approve by : [Signature] 10 June 2021

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 17, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo Scientific Serial Number : JC1606001758

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.50	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.4	0.20	0.20
Level 4	60.00%	300.0	300.7	0.23	0.23
Level 5	80.00%	400.0	400.5	0.12	0.12
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.35	
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by : [Signature] 12 Feb 2021

Approve by : [Signature] 12 Feb 2021

MULTI-POINT GAS TEST REPORT

Test Date : Feb 10, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : JC1606001757

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

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	0.50	0.50	0.50
Level 3	40.00%	200.0	0.80	0.40	0.40
Level 4	60.00%	300.0	0.70	0.23	0.23
Level 5	80.00%	400.0	0.60	0.15	0.15
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.40	
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by : [Signature] 10 Feb 2021

Approve by : [Signature] 10 Feb 2021

MULTI-POINT GAS TEST REPORT

Test Date : Feb 17, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo Scientific Serial Number : 1191503040

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.30	0.30	0.30
Level 2	20.00%	100.0	0.40	0.40	0.40
Level 3	40.00%	200.0	0.40	0.20	0.20
Level 4	60.00%	300.0	0.30	0.10	0.10
Level 5	80.00%	400.0	0.40	0.10	0.10
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.22	
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by : [Signature] 17 Feb 2021

Approve by : [Signature] 17 Feb 2021



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 : 20 May, 2021

Certification No. : 275/21

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI

Type : Data Logger E-LOG 305 wind speed and wind direction DNA 821

Serial No. : Data Logger 200410002 wind speed and wind direction 20040162

ID No. : No.2/20

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0600/0000 serial 9023

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

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-904H)

Serial Number 110730029 (sensor 120620586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : Mr. Watcharapol Subwat

Mechanical Engineer

Sig

Mr.

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 15, SOI BUNTHANAKORN 11 TAMBON BANG KAEU
AMPHOE BANG PHEI SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL : 0800-2110-7800 E FAX: 0800-2110-7140



Page 1 of 2

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Certificate No : 21-ACT-187

CONSULTANT CO., LTD.

Request No : Req-2021-0523

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator

Class : I

Manufacturer : SVANTEK

Range : 94 - 114 dB / 1000 Hz

Model : SV 35A

Instrument Status : Used

Serial Number : 73249

ID : UAE.EFM.105/2561

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (101.3 ± 0.0 hPa)

Received Date : 27 April 2021

Calibration Date : 28 May 2021

Location of Calibration : LAB 1 Acoustic

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

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

Note

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

Calibrated By :

Mr. Noppadol Luangart
Service Calibration Engineer

Approved By :

Mr. Paitt Mahavorn
Calibration Engineer Supervisor

Issue Date : 28 May 2021

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

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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. 275/21

20 May, 2021

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer					
m/sec	inches	inches	hPa	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.4	0.60
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.9	0.11
13.01	-	-	-	12.6	0.41
15.01	-	-	-	14.9	0.11
17.02	-	-	-	16.6	0.42
20.02	-	-	-	19.9	0.12

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

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 15, SOI BUNTHANAKORN 11 TAMBON BANG KAEU
AMPHOE BANG PHEI SAMUT PRAKAN PROVINCE 10140 THAILAND
TEL : 0800-2110-7800 E FAX: 0800-2110-7140



Page 2 of 2

Certificate No : 21-ACT-187

Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.81	-0.19	-	-	0.11	0.25
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.97	0.003	-	-	0.02	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.02	0.70

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.18		-		0.17	2.5
114 dB / 1000 Hz	0.04		-		0.17	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results include the calibration pressure correction
- The calibration results include the microphone volume correction

End of Calibration

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

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Certificate of Calibration

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

Certificate No : 21-TPM-226
Request No : Req-2021-0992
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : JM
Model : QT-32
Serial Number : TPQ020023
Resolution : 0.1 °C
ID Number : UAE.EFM.096/2559

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 23 July 2021
Calibrated Date : 2 August 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12900077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QR21-0719

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

Note

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

Approved By :
Mr. Sittachak Jongsakuldech
Calibration Engineer Supervisor
Issue Date : 2 August 2021

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



Certificate of Calibration

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

Certificate No : 21-TPM-225
Request No : Req-2021-0999
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : JM
Model : QT-32
Serial Number : TPQ020024
Resolution : 0.1 °C
ID Number : UAE.EFM.097/2559

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 22 July 2021
Calibrated Date : 2 August 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12900077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QR21-0719

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

Note

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

Approved By :
Mr. Sittachak Jongsakuldech
Calibration Engineer Supervisor
Issue Date : 2 August 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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Calibration Note : UUC Adjustment : Not Adjust
Certificate No : 21-TPM-226
Request No : Req-2021-0992
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.00	20.0	-0.3	0.14
	25.00	25.1	-0.3	0.14
	30.00	30.3	-0.3	0.14
	35.00	35.3	-0.3	0.14
	40.00	40.3	-0.3	0.14
	45.00	45.3	-0.3	0.14
	50.00	50.3	-0.3	0.14
	60.00	60.3	-0.3	0.14
DRY	20.00	20.2	-0.2	0.14
	25.00	25.2	-0.2	0.14
	30.00	30.2	-0.2	0.14
	35.00	35.2	-0.2	0.14
	40.00	40.2	-0.2	0.14
	45.00	45.2	-0.2	0.14
	50.00	50.2	-0.2	0.14
	60.00	60.2	-0.2	0.14
GLOBE	20.00	20.3	-0.3	0.14
	25.00	25.5	-0.5	0.14
	30.00	30.3	-0.3	0.14
	35.00	35.5	-0.5	0.14
	40.00	40.3	-0.3	0.14
	45.00	45.5	-0.5	0.14
	50.00	50.3	-0.3	0.14
	60.00	60.3	-0.3	0.14

End of Certificate

Calibrated By :
Mr. Sittachak Jongsakuldech

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



Calibration Note : UUC Adjustment : Not Adjust
Certificate No : 21-TPM-225
Request No : Req-2021-0999
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.00	20.0	0.0	0.14
	25.00	25.0	0.0	0.14
	30.00	30.0	0.0	0.14
	35.00	35.0	0.0	0.14
	40.00	40.0	0.0	0.14
	45.00	45.0	0.0	0.14
	50.00	50.0	0.0	0.14
	60.00	60.0	0.0	0.14
DRY	20.00	20.0	0.0	0.14
	25.00	25.0	0.0	0.14
	30.00	30.0	0.0	0.14
	35.00	35.0	0.0	0.14
	40.00	40.0	0.0	0.14
	45.00	45.0	0.0	0.14
	50.00	50.0	0.0	0.14
	60.00	60.0	0.0	0.14
GLOBE	20.00	20.0	0.0	0.14
	25.00	25.0	0.0	0.14
	30.00	30.0	0.0	0.14
	35.00	35.0	0.0	0.14
	40.00	40.0	0.0	0.14
	45.00	45.0	0.0	0.14
	50.00	50.0	0.0	0.14
	60.00	60.0	0.0	0.14

End of Certificate

Calibrated By :
Mr. Sittachak Jongsakuldech

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



Certificate of Calibration

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

Certificate No : 21-TPM-224
Request No : Req-2021-0989
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : JM
Model : QT-32
Serial Number : TPQ020025
Resolution : 0.1 °C
ID Number : UAE.EFM.008/2559

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 22 July 2021
Calibrated Date : 2 August 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QRC21-0719

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

Note

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

Approved By :
Mr. Paik Mathavorn
Calibration Engineer Supervisor
Issue Date : 2 August 2021

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



Certificate of Calibration

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

Certificate No : 21-TPM-227
Request No : Req-2021-0989
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : JM
Model : QT-32
Serial Number : TPQ020022
Resolution : 0.1 °C
ID Number : UAE.EFM.005/2559

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 22 July 2021
Calibrated Date : 2 August 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QRC21-0719

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

Note

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

Approved By :
Mr. Paik Mathavorn
Calibration Engineer Supervisor
Issue Date : 2 August 2021

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



Calibration Note : UUC Adjustment : Not Adjust
Certificate No : 21-TPM-224
Request No : Req-2021-0989
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.003	20.2	-0.2	0.14
	25.003	25.2	-0.2	0.14
	30.003	30.2	-0.2	0.14
	35.007	35.2	-0.2	0.14
	40.004	40.2	-0.2	0.14
	45.004	45.2	-0.2	0.14
	50.004	50.2	-0.2	0.14
	60.007	60.2	-0.2	0.14
DRY	20.007	20.1	-0.1	0.14
	25.005	25.1	-0.1	0.14
	30.005	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.004	40.1	-0.1	0.14
	45.005	45.1	-0.1	0.14
	50.004	50.1	-0.1	0.14
	60.004	60.1	-0.1	0.14
GLOBE	20.003	20.1	-0.1	0.14
	25.004	25.1	-0.1	0.14
	30.004	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.004	40.1	-0.1	0.14
	45.004	45.2	-0.2	0.14
	50.004	50.2	-0.2	0.14
	60.007	60.2	-0.2	0.14

End of Certificate

Calibrated By :
Mr. Sirichok Anupakdeewan

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



Calibration Note : UUC Adjustment : Not Adjust
Certificate No : 21-TPM-227
Request No : Req-2021-0989
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.003	19.8	+0.2	0.14
	25.004	24.9	+0.2	0.14
	30.005	29.8	+0.2	0.14
	35.005	34.8	+0.2	0.14
	40.003	39.8	+0.2	0.14
	45.005	44.8	+0.2	0.14
	50.006	49.8	+0.2	0.14
	60.007	59.8	+0.2	0.14
DRY	20.004	19.8	+0.2	0.14
	25.004	24.9	+0.2	0.14
	30.004	29.8	+0.2	0.14
	35.004	34.8	+0.2	0.14
	40.006	39.8	+0.2	0.14
	45.007	44.8	+0.2	0.14
	50.007	49.9	+0.1	0.14
	60.003	59.9	+0.1	0.14
GLOBE	20.003	19.8	+0.2	0.14
	25.004	24.8	+0.2	0.14
	30.003	29.8	+0.2	0.14
	35.007	34.8	+0.2	0.14
	40.006	39.8	+0.2	0.14
	45.003	44.8	+0.2	0.14
	50.005	49.8	+0.2	0.14
	60.006	59.8	+0.2	0.14

End of Certificate

Calibrated By :
Mr. Sirichok Anupakdeewan

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

Calibration Certificate

Certificate Number 2021000506

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi 1 Jomlek 41, Nakhonmit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0005406
Test Results Pass

Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number C0001.8378
Technician Ron Harris
Calibration Date 15 Jan 2021
Calibration Due
Temperature 23.06 °C ± 0.25 °C
Humidity 52.9 %RH ± 2.0 %RH
Static Pressure 87.56 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT2C S/N 073810 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/µPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure C0001.8354:

IEC 60661:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2006) Class 2

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, 0720:01 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

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB PIEZOTRONICS DIV.

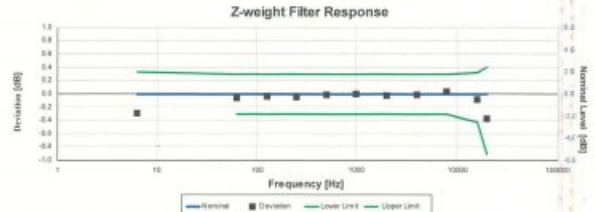
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Page 1 of 8

D0001.8407 Rev E

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Certificate Number 2021000506



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 60951:2001 6.1 and 9.2.2, IEC 60804:2000 9, 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	-0.29	-0.29	-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	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-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
15,848.83	-0.09	-0.09	-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 —

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB PIEZOTRONICS DIV.

2021-021711.57.18

Page 3 of 8

D0001.8407 Rev E

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Certificate Number 2021000506

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	000943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



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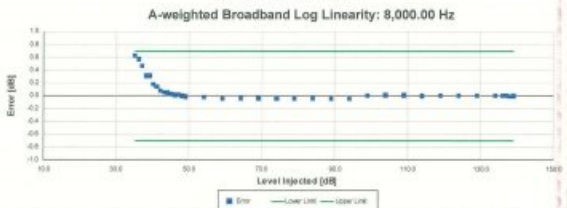
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Page 2 of 8

D0001.8407 Rev E

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Certificate Number 2021000506



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) 6.6, 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
35.00	0.63	-0.70	0.70	0.16	Pass
36.00	0.57	-0.70	0.70	0.16	Pass
37.00	0.47	-0.70	0.70	0.16	Pass
38.00	0.31	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.18	-0.70	0.70	0.16	Pass
41.00	0.14	-0.70	0.70	0.16	Pass
42.00	0.08	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.01	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
50.00	-0.02	-0.70	0.70	0.16	Pass
51.00	-0.05	-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	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-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
140.00	-0.04	-0.70	0.70	0.16	Pass
141.00	-0.04	-0.70	0.70	0.16	Pass
142.00	-0.04	-0.70	0.70	0.16	Pass
143.00	-0.04	-0.70	0.70	0.16	Pass
144.00	-0.04	-0.70	0.70	0.16	Pass
145.00	-0.04	-0.70	0.70	0.16	Pass
146.00	-0.04	-0.70	0.70	0.16	Pass
147.00	-0.04	-0.70	0.70	0.16	Pass
148.00	-0.04	-0.70	0.70	0.16	Pass
149.00	-0.04	-0.70	0.70	0.16	Pass
150.00	-0.04	-0.70	0.70	0.16	Pass

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2021-021711.57.18

Page 4 of 8

D0001.8407 Rev E

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Certificate Number 2021000506

-- End of measurement results --

Peak Rise Time

Peak rise time performed according to IEC 60511:2001 8.4.4 and ANSI S1.4-1983 (P2006) 8.4.4

Amplitude [dB]	Duration [μs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result	
135.95	40	Negative Pulse	134.91	133.45	135.45	0.15	Pass
		Positive Pulse	134.91	133.44	135.44	0.15	Pass
	30	Negative Pulse	133.99	133.45	135.45	0.15	Pass
		Positive Pulse	133.99	133.44	135.44	0.15	Pass

-- End of measurement results --

Positive Pulse Crest Factor

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

Crest Factor measured according to IEC 60511:2001 8.4.2 and ANSI S1.4-1983 (P2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limit [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVL	± 1.00	0.15 \pm	Pass
	5	OVL	± 1.00	0.15 \pm	Pass
125.95	3	-0.13	± 1.00	0.15 \pm	Pass
	5	-0.13	± 1.00	0.16 \pm	Pass
115.95	3	-0.13	± 1.00	0.15 \pm	Pass
	5	-0.12	± 1.00	0.15 \pm	Pass
105.95	3	-0.12	± 1.00	0.15 \pm	Pass
	5	-0.11	± 1.00	0.15 \pm	Pass

-- End of measurement results --

Negative Pulse Crest Factor

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

Crest Factor measured according to IEC 60511:2001 8.4.2 and ANSI S1.4-1983 (P2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limit [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVL	± 1.00	0.15 \pm	Pass
	5	OVL	± 1.00	0.15 \pm	Pass
125.95	3	-0.12	± 1.00	0.15 \pm	Pass
	5	-0.12	± 1.00	0.15 \pm	Pass
115.95	3	-0.13	± 1.00	0.15 \pm	Pass
	5	-0.12	± 1.00	0.15 \pm	Pass
105.95	3	-0.13	± 1.00	0.15 \pm	Pass
	5	-0.13	± 1.00	0.15 \pm	Pass

-- End of measurement results --

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	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.28	39.39	40.79	0.16	Pass
OSA Low Range	93.99	93.89	94.09	0.15	Pass
OSA Normal Range	93.99	93.20	94.80	0.15	Pass

-- End of measurement results --

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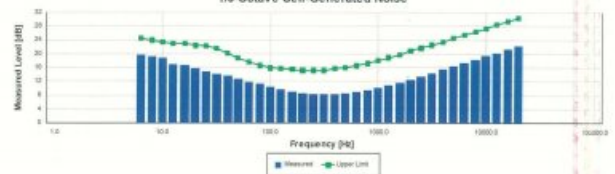
Page 5 of 8

2021-02-11 17:18

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1/3-Octave Self-Generated Noise



The GLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.71	24.60	Pass
8.00	19.34	24.00	Pass
10.00	18.75	23.50	Pass
12.50	17.50	23.00	Pass
16.00	16.72	22.90	Pass
20.00	15.71	22.40	Pass
25.00	14.94	22.30	Pass
31.50	14.19	21.50	Pass
40.00	13.73	20.20	Pass
50.00	12.67	18.80	Pass
63.00	11.65	17.80	Pass
80.00	11.33	16.60	Pass
100.00	10.46	15.60	Pass
125.00	9.87	15.70	Pass
160.00	9.05	15.50	Pass
200.00	8.69	15.20	Pass
250.00	8.31	15.20	Pass
315.00	8.29	15.20	Pass
400.00	8.36	15.70	Pass
500.00	8.54	16.00	Pass
630.00	9.01	16.60	Pass
800.00	9.58	17.30	Pass
1,000.00	10.24	18.10	Pass
1,250.00	10.97	18.90	Pass
1,600.00	11.71	19.80	Pass
2,000.00	12.57	20.80	Pass
2,500.00	13.44	21.70	Pass
3,150.00	14.42	22.80	Pass
4,000.00	15.46	23.50	Pass
5,000.00	16.46	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.28	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.29	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.32	30.40	Pass

-- End of measurement results --

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Page 7 of 8

2021-02-11 17:18

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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	26.60	36.00	Pass
C-weight Noise Floor	26.66	36.00	Pass
Z-weight Noise Floor	32.92	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	135.47	134.15	135.75	0.15	Pass
THD	-64.33	-68.00	-60.67	0.01 \pm	Pass
THD+N	-60.99	-68.00	-53.99	0.01 \pm	Pass

-- End of measurement results --

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Page 6 of 8

2021-02-11 17:18

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-- End of Report --

Signature: *Ren Harris*

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Page 8 of 8

2021-02-11 17:18

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Calibration Certificate

Certificate Number 2021000734

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

Model Number: LX72
Serial Number: 0005407
Test Results: Pass

Initial Condition: As Manufactured
Description: SoundTrack LX7 Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number: 00001.8378
Technician: Ron Harris
Calibration Date: 21 Jan 2021
Calibration Due: 23.47 °C ± 0.25 °C
Temperature: 52.8 %RH ± 2.0 %RH
Humidity: 86.25 kPa ± 0.13 kPa
Static Pressure:

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 073802 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/µPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure 00001.8384:

IEC 60661:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2006) Class 2

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 institutions, 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 LX7 Manual for SoundTrack LX7 & SoundExpert LX7: 1770.07 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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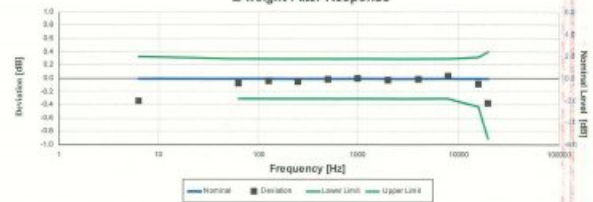
Page 1 of 8

2021-0-21T12:38:53

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Certificate Number 2021000734

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]	Uncertainty [dB]	Result
6.31	-0.34	-0.34	-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	-0.02	-0.30	0.30	0.15	Pass
1000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19852.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

— End of measurement results —

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Page 3 of 8

2021-0-21T12:38:53

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Certificate Number 2021000734

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

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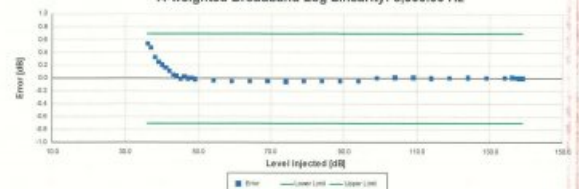
Page 2 of 8

2021-0-21T12:38:53

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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) 6.5, 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	0.54	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.28	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.04	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	0.05	-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	-0.01	-0.70	0.70	0.16	Pass
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.05	-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	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-0.70	0.70	0.16	Pass
57.00	-0.05	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.04	-0.70	0.70	0.16	Pass
61.00	0.00	-0.70	0.70	0.15	Pass
62.00	0.01	-0.70	0.70	0.15	Pass
63.00	0.01	-0.70	0.70	0.15	Pass
64.00	0.01	-0.70	0.70	0.15	Pass
65.00	0.01	-0.70	0.70	0.15	Pass
66.00	0.01	-0.70	0.70	0.15	Pass
67.00	0.01	-0.70	0.70	0.15	Pass
68.00	0.01	-0.70	0.70	0.15	Pass
69.00	0.01	-0.70	0.70	0.15	Pass
70.00	0.00	-0.70	0.70	0.15	Pass

— End of measurement results —

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Page 4 of 8

2021-0-21T12:38:53

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Certificate Number 2021000734

Peak Rise Time

Peak rise time performed according to IEC 60651-2001 8.4.4 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
136.95	40	Negative Pulse	134.80	133.33	135.33	Pass
		Positive Pulse	134.80	133.32	135.32	Pass
30		Negative Pulse	133.86	133.33	135.33	Pass
		Positive Pulse	133.86	133.32	135.32	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 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVLD	± 1.00	0.15 ±	Pass
		OVLD	± 1.00	0.15 ±	Pass
129.95	5	-0.12	± 1.00	0.15 ±	Pass
		-0.13	± 1.00	0.16 ±	Pass
119.95	3	-0.13	± 1.00	0.15 ±	Pass
		-0.13	± 1.00	0.15 ±	Pass
105.95	5	-0.12	± 1.00	0.15 ±	Pass
		-0.13	± 1.00	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 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVLD	± 1.00	0.15 ±	Pass
		OVLD	± 1.00	0.15 ±	Pass
129.95	5	-0.13	± 1.00	0.15 ±	Pass
		-0.12	± 1.00	0.15 ±	Pass
119.95	3	-0.13	± 1.00	0.15 ±	Pass
		-0.12	± 1.00	0.15 ±	Pass
105.95	5	-0.13	± 1.00	0.15 ±	Pass
		-0.11	± 1.00	0.15 ±	Pass

— End of measurement results—

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	0.10	Pass
0 dB Gain, Linearity	40.26	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.10	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

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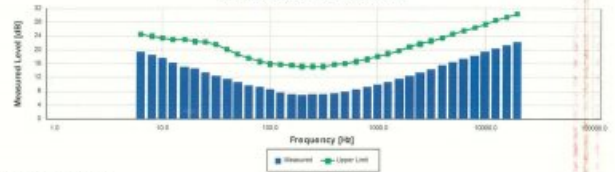
Page 5 of 8

D0001.8407 Doc E

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Certificate Number 2021000734

1/3-Octave Self-Generated Noise



The GLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	19.52	24.00	Pass
8.00	18.49	24.00	Pass
10.00	17.75	23.50	Pass
12.50	16.32	23.00	Pass
16.00	15.18	22.90	Pass
20.00	14.71	22.40	Pass
25.00	13.51	22.30	Pass
31.50	12.54	21.50	Pass
40.00	11.63	20.20	Pass
50.00	10.78	18.80	Pass
63.00	9.83	17.80	Pass
80.00	9.18	16.60	Pass
100.00	8.49	15.80	Pass
125.00	7.73	15.70	Pass
160.00	7.20	15.50	Pass
200.00	7.05	15.20	Pass
250.00	7.13	15.20	Pass
315.00	7.15	15.20	Pass
400.00	7.49	15.70	Pass
500.00	7.97	16.00	Pass
630.00	8.49	16.60	Pass
800.00	9.24	17.30	Pass
1,000.00	10.02	18.10	Pass
1,250.00	10.78	18.90	Pass
1,600.00	11.71	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.53	21.70	Pass
3,150.00	14.46	22.80	Pass
4,000.00	15.47	23.50	Pass
5,000.00	16.42	24.50	Pass
6,300.00	17.41	25.50	Pass
8,000.00	18.36	26.50	Pass
10,000.00	19.28	27.40	Pass
12,500.00	20.38	28.50	Pass
16,000.00	21.36	29.50	Pass
20,000.00	22.35	30.40	Pass

— End of measurement results—

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2021-1-21/13.38.53

Page 7 of 8

D0001.8407 Doc E

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Certificate Number 2021000734

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	28.88	38.00	Pass
C-weight Noise Floor	29.48	35.00	Pass
Z-weight Noise Floor	32.32	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	134.15	135.75	0.15	Pass
THD	-66.98	-68.00	-65.00	0.01 ±	Pass
THD+N	-62.82	-68.00	-58.00	0.01 ±	Pass

— End of measurement results—

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2021-1-21/13.38.53

Page 6 of 8

D0001.8407 Doc E

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— End of Report—

Signature: *Ren Haeris*

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2021-1-21/13.38.53

Page 8 of 8

D0001.8407 Doc E

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Calibration Certificate

Certificate Number 202100735

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Flora Khaoeng,
Bangkok, 10246, Thailand

Model Number LX72
Serial Number 0005408
Test Results Pass

Initial Condition As Manufactured
Description SoundTrack LX7 Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8376
Technician Ron Hanna
Calibration Date 21 Jan 2021
Calibration Due Temperature 23.46 °C ± 0.25 °C
Humidity 52.6 %RH ± 2.0 %RH
Static Pressure 95.25 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLX72C S/N 071534 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/µPa.

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

IEC 60951:2001 Type 2 ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2 ANSI S1.4 (R2006) Type 2
IEC 61252:2002 ANSI S1.25 (R2007)
IEC 61672:2013 Class 2 ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2 ANSI S1.11 (R2009) Class 2

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 uncertainty 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 (alpha = 0.05) 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 LX7 Manual for SoundTrack LX7 and SoundExpert LX7, 1770.01 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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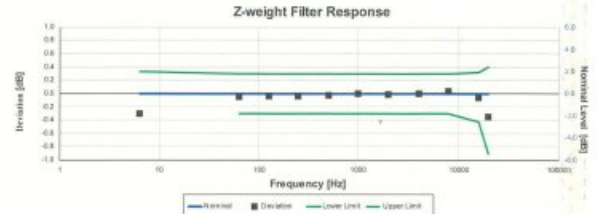
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Page 1 of 8

D0001.8387 Rev E

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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 5.6, IEC 60951:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4 (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)	Uncertainty (dB)	Result
6.31	-0.31	-0.31	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-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	-0.02	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,846.83	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results --

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2021-1-21T12:47:48

Page 3 of 8

D0001.8387 Rev E

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Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 3626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	999943
SRS DS360 Ultra-Low Disturbance Generator	2021-01-05	2022-01-05	907118

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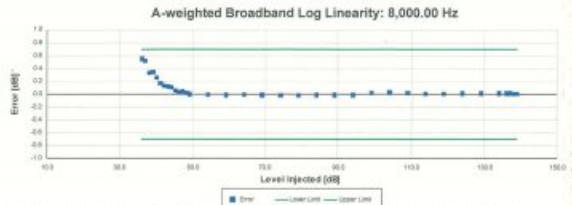
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Page 2 of 8

D0001.8387 Rev E

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Certificate Number 202100735



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 61252:2002 8, ANSI S1.4 (R2006) 5.5, 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
30.00	0.55	-0.70	0.70	0.16	Pass
37.00	0.52	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.34	-0.70	0.70	0.16	Pass
40.00	0.28	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.13	-0.70	0.70	0.16	Pass
43.00	0.12	-0.70	0.70	0.17	Pass
44.00	0.10	-0.70	0.70	0.17	Pass
45.00	0.06	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.05	-0.70	0.70	0.16	Pass
48.00	0.02	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	-0.01	-0.70	0.70	0.16	Pass
51.00	-0.01	-0.70	0.70	0.16	Pass
52.00	-0.01	-0.70	0.70	0.16	Pass
53.00	-0.01	-0.70	0.70	0.16	Pass
54.00	-0.01	-0.70	0.70	0.16	Pass
55.00	-0.01	-0.70	0.70	0.16	Pass
56.00	-0.01	-0.70	0.70	0.16	Pass
57.00	-0.01	-0.70	0.70	0.16	Pass
58.00	-0.01	-0.70	0.70	0.16	Pass
59.00	-0.01	-0.70	0.70	0.16	Pass
60.00	-0.01	-0.70	0.70	0.16	Pass
61.00	-0.01	-0.70	0.70	0.16	Pass
62.00	-0.01	-0.70	0.70	0.16	Pass
63.00	-0.01	-0.70	0.70	0.16	Pass
64.00	-0.01	-0.70	0.70	0.16	Pass
65.00	-0.01	-0.70	0.70	0.16	Pass
66.00	-0.01	-0.70	0.70	0.16	Pass
67.00	-0.01	-0.70	0.70	0.16	Pass
68.00	-0.01	-0.70	0.70	0.16	Pass
69.00	-0.01	-0.70	0.70	0.16	Pass
70.00	-0.01	-0.70	0.70	0.16	Pass
71.00	-0.01	-0.70	0.70	0.16	Pass
72.00	-0.01	-0.70	0.70	0.16	Pass
73.00	-0.01	-0.70	0.70	0.16	Pass
74.00	-0.01	-0.70	0.70	0.16	Pass
75.00	-0.01	-0.70	0.70	0.16	Pass
76.00	-0.01	-0.70	0.70	0.16	Pass
77.00	-0.01	-0.70	0.70	0.16	Pass
78.00	-0.01	-0.70	0.70	0.16	Pass
79.00	-0.01	-0.70	0.70	0.16	Pass
80.00	-0.01	-0.70	0.70	0.16	Pass
81.00	-0.01	-0.70	0.70	0.16	Pass
82.00	-0.01	-0.70	0.70	0.16	Pass
83.00	-0.01	-0.70	0.70	0.16	Pass
84.00	-0.01	-0.70	0.70	0.16	Pass
85.00	-0.01	-0.70	0.70	0.16	Pass
86.00	-0.01	-0.70	0.70	0.16	Pass
87.00	-0.01	-0.70	0.70	0.16	Pass
88.00	-0.01	-0.70	0.70	0.16	Pass
89.00	-0.01	-0.70	0.70	0.16	Pass
90.00	-0.01	-0.70	0.70	0.16	Pass
91.00	-0.01	-0.70	0.70	0.16	Pass
92.00	-0.01	-0.70	0.70	0.16	Pass
93.00	-0.01	-0.70	0.70	0.16	Pass
94.00	-0.01	-0.70	0.70	0.16	Pass
95.00	-0.01	-0.70	0.70	0.16	Pass
96.00	-0.01	-0.70	0.70	0.16	Pass
97.00	-0.01	-0.70	0.70	0.16	Pass
98.00	-0.01	-0.70	0.70	0.16	Pass
99.00	-0.01	-0.70	0.70	0.16	Pass
100.00	-0.01	-0.70	0.70	0.16	Pass
101.00	-0.01	-0.70	0.70	0.16	Pass
102.00	-0.01	-0.70	0.70	0.16	Pass
103.00	-0.01	-0.70	0.70	0.16	Pass
104.00	-0.01	-0.70	0.70	0.16	Pass
105.00	-0.01	-0.70	0.70	0.16	Pass
106.00	-0.01	-0.70	0.70	0.16	Pass
107.00	-0.01	-0.70	0.70	0.16	Pass
108.00	-0.01	-0.70	0.70	0.16	Pass
109.00	-0.01	-0.70	0.70	0.16	Pass
110.00	-0.01	-0.70	0.70	0.16	Pass
111.00	-0.01	-0.70	0.70	0.16	Pass
112.00	-0.01	-0.70	0.70	0.16	Pass
113.00	-0.01	-0.70	0.70	0.16	Pass
114.00	-0.01	-0.70	0.70	0.16	Pass
115.00	-0.01	-0.70	0.70	0.16	Pass
116.00	-0.01	-0.70	0.70	0.16	Pass
117.00	-0.01	-0.70	0.70	0.16	Pass
118.00	-0.01	-0.70	0.70	0.16	Pass
119.00	-0.01	-0.70	0.70	0.16	Pass
120.00	-0.01	-0.70	0.70	0.16	Pass
121.00	-0.01	-0.70	0.70	0.16	Pass
122.00	-0.01	-0.70	0.70	0.16	Pass
123.00	-0.01	-0.70	0.70	0.16	Pass
124.00	-0.01	-0.70	0.70	0.16	Pass
125.00	-0.01	-0.70	0.70	0.16	Pass
126.00	-0.01	-0.70	0.70	0.16	Pass
127.00	-0.01	-0.70	0.70	0.16	Pass
128.00	-0.01	-0.70	0.70	0.16	Pass
129.00	-0.01	-0.70	0.70	0.16	Pass
130.00	-0.01	-0.70	0.70	0.16	Pass

-- End of measurement results --

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2021-1-21T12:47:48

Page 4 of 8

D0001.8387 Rev E

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Peak Rise Time

Peak rise time performed according to IEC 60551:2001 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
136.95	40	Negative Pulse	134.62	133.04	135.04	Pass
		Positive Pulse	134.61	133.03	135.03	Pass
30	30	Negative Pulse	133.57	133.04	135.04	Pass
		Positive Pulse	133.58	133.03	135.03	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 60551:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limit [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.16 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	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 60551:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limit [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
105.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass

-- End of measurement results --

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	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.28	38.40	40.80	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 --

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2021-0212124748

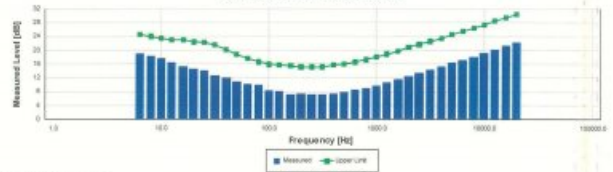
Page 5 of 8

D8001-9407 Rev. C

เอกสารไม่ควบคุม

Certificate Number 2021000735

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	18.99	24.60	Pass
8.00	18.35	24.00	Pass
10.00	17.55	23.50	Pass
12.50	16.37	23.00	Pass
16.00	15.28	22.50	Pass
20.00	14.72	22.40	Pass
25.00	14.08	22.30	Pass
31.50	12.80	21.50	Pass
40.00	12.16	20.20	Pass
50.00	10.99	18.80	Pass
63.00	10.11	17.60	Pass
80.00	9.87	16.80	Pass
100.00	8.44	16.00	Pass
125.00	8.10	15.70	Pass
160.00	7.30	15.50	Pass
200.00	7.36	15.20	Pass
250.00	7.24	15.20	Pass
315.00	7.19	15.20	Pass
400.00	7.44	15.70	Pass
500.00	7.92	16.00	Pass
630.00	8.49	16.50	Pass
800.00	9.12	17.30	Pass
1,000.00	9.85	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.54	19.80	Pass
2,000.00	12.45	20.80	Pass
2,500.00	13.35	21.70	Pass
3,150.00	14.31	22.60	Pass
4,000.00	15.36	23.50	Pass
5,000.00	16.40	24.50	Pass
6,300.00	17.24	25.50	Pass
8,000.00	18.19	26.50	Pass
10,000.00	19.30	27.40	Pass
12,500.00	20.20	28.50	Pass
16,000.00	21.24	29.50	Pass
20,000.00	22.23	30.40	Pass

-- End of measurement results --

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0801



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2021-0212124748

Page 7 of 8

D8001-9407 Rev. C

เอกสารไม่ควบคุม

Certificate Number 2021000735

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	26.78	36.00	Pass
C-weight Noise Floor	26.37	35.00	Pass
Z-weight Noise Floor	32.21	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	135.08	134.15	135.75	0.15	Pass
THD	-66.85	-68.00	-65.00	0.01 ±	Pass
THD+N	-62.67	-68.00	-58.00	0.01 ±	Pass

-- End of measurement results --

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2021-0212124748

Page 6 of 8

D8001-9407 Rev. C

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Certificate Number 2021000735

-- End of Report --

Signature: *Ron Harris*

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2021-0212124748

Page 8 of 8

D8001-9407 Rev. C

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 21-LXM-154
Request No : Req-2021-1418
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407008
Serial Number : A014995
Resolution : 1 lx
ID Number : UAE.FPM.018/2359

Range Calibration : 2000, 20000 lx
Instrument Status : Used

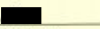
Calibration Environment and Details

Temperature : $25 \pm 2 \text{ }^{\circ}\text{C}$
Humidity : $60 \pm 20 \text{ \%RH}$
Received Date : 29 October, 2021
Calibrated Date : 12 November, 2021
Calibration Procedure : The measurement was done in accordance with CP-LXM-01
Reference Standard : Photometer and Illuminance Sensor, Serial No.: 306632, 385922, which was calibrated on 26 October 2021, Certificate No.: TP-1026-21

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of Metrology (Thailand)

Note

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

Approved By : 
Mr. Pait Mahavom
Calibration Engineer Supervisor
Issue Date : 12 November, 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
(PIM-708-LXM-01) Rev. 00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 21-ACT-191
Request No : Req-2021-0526

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6307
ID : UAE.FPM.049/2563

Class : 2
Range : 94, 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : $(23 \pm 2 \text{ }^{\circ}\text{C})$
Humidity : $(50 \pm 20 \text{ \%RH})$
Barometric Pressure : $(101.3 \pm 10.0 \text{ hPa})$
Received Date : 27 April 2021
Calibration Date : 28 May 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : 1x-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

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

Note

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

Calibrated By : 
Mr. Nopadol Laungant
Service Calibration Engineer
Approved By : 
Mr. Pait Mahavom
Calibration Engineer Supervisor
Issue Date : 28 May 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
(PIM-708-ACT-01) Rev. 00 Issue date 01/07/19

เอกสารไม่ควบคุม

Calibration Note
UUC Adjustment : Zero adjustment before use

Certificate No : 21-LXM-154
Request No : Req-2021-1418
Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (lx)
2000	0	0	0	0.34
	50	49	1	
	100	98	2	
	200	199	1	
	300	299	1	
	400	396	4	
	600	601	-1	
	800	799	1	
	1000	1000	-2	
	1200	1208	-8	
	1400	1402	-2	
	1600	1597	3	
	1800	1793	7	
	2000	1987	13	
20000	3000	2980	20	
	4000	3970	30	
	5000	4970	30	

End of Certificate

Calibrated By : 
Mr. Nopadol Laungant

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
(PIM-708-LXM-01) Rev. 00 Issue date 01/07/19

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Certificate No : 21-ACT-191
Request No : Req-2021-0526

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (\pm dB)	Acceptance Limit Class 2 (\pm dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.04	0.04	-	-	0.11	0.40
114 dB / 1000 Hz	114.16	0.16	-	-	0.11	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance Limit Class 2 (\pm %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.57	0.043	-	-	0.02	1.7
114 dB / 1000 Hz	999.56	0.044	-	-	0.02	1.7

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance Limit Class 2 (\pm %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.12		-		0.17	3.0
114 dB / 1000 Hz	0.22		-		0.17	3.0

Note :

- Acceptance limit was IEC 60942:2017 Class 1
- The calibration results include the calibrator pressure correction
- The calibration results include the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
(PIM-708-ACT-01) Rev. 00 Issue date 01/07/19

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunna, Bangplud Bangkok 10700 THAILAND.
Tel.0-2433-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21032
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00408979 / 189686 / 90424
ID No.:

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pitsupaisan

Approved by :

(Thanakul Petchurai)

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

QF-TS12-04-03-051060

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0009-20	03-Feb-21
Waveform Generator	33511B	MY53202742	EP-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL_BP_199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL_BP_200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL_BP_201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EP-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	17.7
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	-0.1	±1.0
8000	1.3	1.3	1.3	±5.0

เอกสารไม่ควบคุม

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

QF-TS12-04-03-051060

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21032
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.5	89.6		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirdhorn Rd.,Bangbunna, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com Http://www.sithiporn.com



Cert. No. : ACL21034
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Presumplier NH-24
Serial No.: 00409109 / 189688 / 90554
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

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

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

QP-TS12-04-03-051060

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.3
C - weight	17.3
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.1	1.1	1.1	±5.0

เอกสารไม่ควบคุม

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

QP-TS12-04-03-051060

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz.

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21034
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.5	89.6		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirdinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2433-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21035
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00609500 / 189689 / 01126
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKIANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thamakul Petchurai)

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0009-20	03-Feb-21
Waveform Generator	33511B	MY52303742	EP-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL_BP_199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL_BP_200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL_BP_201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EP-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.7

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

Frequency Weighting	Measured value (dB)
A - weight	13.6
C - weight	20.3
Flat	26.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	0.1	0.3	0.1	±1.0
8000	0.9	1.0	1.0	±5.0

QF-TS12-04-03-051060

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QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21036
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709651 / 188529 / 00801
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

Location : -
Ambient Temperature : (25.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Nathakorn Pisutpaisan)

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.7
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.0	0.0	0.0	±5.0

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21036
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirthom Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21037
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NIE-24
Serial No.: 00709655 / 188530 / 01206
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

1. National Institute of Metrology (Thailand).
2. Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.8
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	±1.5
1000	0.1	0.1	0.1	±1.0
8000	1.1	1.2	1.2	±5.0

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

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

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	135.9	-0.1	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	128.9	-0.1	± 1.1
124.0	123.9	-0.1	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21037
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	-0.1	±1.5
89.6	89.5		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirdinthom Rd.,Bangbunru, Bangkok 10700 THAILAND.
Tel:0-2433-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21038
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709656 / 189028 / 01207
ID No.:

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Natsakorn Pitsupisan

Approved by :
(Thanakul Petchurai)

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

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เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	23.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	±1.5
1000	0.1	0.1	0.1	±1.0
8000	1.1	1.2	1.2	±5.0

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21038
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirdinchor Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21039
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NIE-24
Serial No. : 00709670 / 188531 / 01221
ID No. : -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchumai)

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

QF-TS12-04-03-051069

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051069

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial.No.	Cert.No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL-BP, 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL-BP, 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL-BP, 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-03-051069

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.5	0.6	0.6	±5.0

QF-TS12-04-03-051069

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21040
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709682 / 187256 / 01233
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nuthakorn Pisutpaisan

Approved by :

(Nuthakorn Pisutpaisan)

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

QF-TS12-04-03-051060

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY53202742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KAL	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (91.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.5
Flat	22.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.8	0.9	0.9	± 5.0

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirintheorn Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21041
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01000182 / 187202 / 01844
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260 THAILAND.

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisupaisan

Approved by :

(Nathakorn Pisupaisan)

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

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199-0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200-0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201-0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KA1	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.2
Flat	22.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	0.6	0.6	0.6	±5.0

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-03-051060

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	128.9	-0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-03-051060

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Continuation of Calibration Certificate

Cert. No. : ACL21041
Job No. : VC64AC0036
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-03-051060

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Calibration Certificate

Certificate Number 2021000495

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonwit 41, Sukhvit Road,
Bangkok, Phra Khanong,
Bangkok, 10266, Thailand

Model Number: LX72
Serial Number: 0025402
Test Results: Pass

Initial Condition: As Manufactured
Description: SoundTrack LX7 Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number: D0001.8378
Technician: Ron Harris
Calibration Date: 15 Jan 2021
Temperature: 22.94 °C ± 0.25 °C
Humidity: 54 %RH ± 2.0 %RH
Static Pressure: 87.56 kPa ± 0.13 kPa

Evaluation Method: Tested electrically using Larson Davis PPM/LX7C S/N 073808 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/µPa.

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

IEC 60851:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60854:2000 Type 2	ANSI S1.4 (R2000) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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 uncertainty 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 LX7 Manual for SoundTrack LX7 & SoundExpert LX7, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1002 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

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



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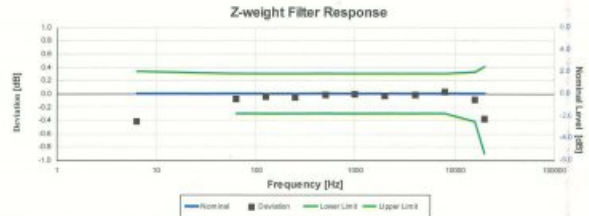
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Page 1 of 8

D0001.8407 Rev E

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Certificate Number 2021000495



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 5.6, IEC 60854:2000 5.1 and 5.2.2, IEC 60854:2000 5, ANSI S1.4 1063 (P2006) 5.1 and 5.2.1, 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	-0.41	-0.41	-1.11	0.33	0.15	Pass
8.31	-0.07	-0.07	-0.30	0.30	0.15	Pass
12.59	-0.04	-0.04	-0.30	0.30	0.15	Pass
25.11	-0.05	-0.05	-0.30	0.30	0.15	Pass
50.11	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,595.26	-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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Page 3 of 8

D0001.8407 Rev E

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Certificate Number 2021000495

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 3626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	606943
SRS DS360 Ultra Low Distance Gonioscope	2020-08-19	2021-08-19	007167

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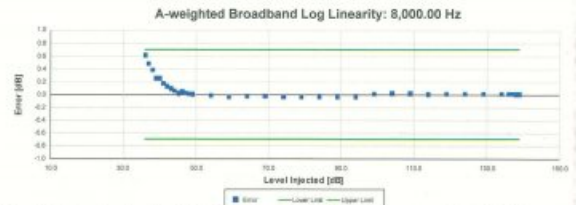
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Page 2 of 8

D0001.8407 Rev E

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Certificate Number 2021000495



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 60854:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (P2006) 6.9, ANSI S1.4-2014 Part 1: 5.5, ANSI S1.43 (P2007) 5.2

Level [dB]	Error [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.61	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.38	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.26	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.01	-0.70	0.70	0.16	Pass
46.00	0.00	-0.70	0.70	0.16	Pass
47.00	0.01	-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	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.03	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-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	0.00	-0.70	0.70	0.16	Pass
61.00	0.01	-0.70	0.70	0.16	Pass
62.00	0.01	-0.70	0.70	0.16	Pass
63.00	0.01	-0.70	0.70	0.16	Pass
64.00	0.01	-0.70	0.70	0.16	Pass
65.00	0.01	-0.70	0.70	0.16	Pass
66.00	0.01	-0.70	0.70	0.16	Pass
67.00	0.01	-0.70	0.70	0.16	Pass
68.00	0.01	-0.70	0.70	0.16	Pass
69.00	0.01	-0.70	0.70	0.16	Pass
70.00	0.01	-0.70	0.70	0.16	Pass
71.00	0.01	-0.70	0.70	0.16	Pass
72.00	0.01	-0.70	0.70	0.16	Pass
73.00	0.01	-0.70	0.70	0.16	Pass
74.00	0.01	-0.70	0.70	0.16	Pass
75.00	0.01	-0.70	0.70	0.16	Pass
76.00	0.01	-0.70	0.70	0.16	Pass
77.00	0.01	-0.70	0.70	0.16	Pass
78.00	0.01	-0.70	0.70	0.16	Pass
79.00	0.01	-0.70	0.70	0.16	Pass
80.00	0.01	-0.70	0.70	0.16	Pass
81.00	0.01	-0.70	0.70	0.16	Pass
82.00	0.01	-0.70	0.70	0.16	Pass
83.00	0.01	-0.70	0.70	0.16	Pass
84.00	0.01	-0.70	0.70	0.16	Pass
85.00	0.01	-0.70	0.70	0.16	Pass
86.00	0.01	-0.70	0.70	0.16	Pass
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88.00	0.01	-0.70	0.70	0.16	Pass
89.00	0.01	-0.70	0.70	0.16	Pass
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92.00	0.01	-0.70	0.70	0.16	Pass
93.00	0.01	-0.70	0.70	0.16	Pass
94.00	0.01	-0.70	0.70	0.16	Pass
95.00	0.01	-0.70	0.70	0.16	Pass
96.00	0.01	-0.70	0.70	0.16	Pass
97.00	0.01	-0.70	0.70	0.16	Pass
98.00	0.01	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.16	Pass
100.00	0.01	-0.70	0.70	0.16	Pass
101.00	0.01	-0.70	0.70	0.16	Pass
102.00	0.01	-0.70	0.70	0.16	Pass
103.00	0.01	-0.70	0.70	0.16	Pass
104.00	0.01	-0.70	0.70	0.16	Pass
105.00	0.01	-0.70	0.70	0.16	Pass
106.00	0.01	-0.70	0.70	0.16	Pass
107.00	0.01	-0.70	0.70	0.16	Pass
108.00	0.01	-0.70	0.70	0.16	Pass
109.00	0.01	-0.70	0.70	0.16	Pass
110.00	0.01	-0.70	0.70	0.16	Pass
111.00	0.01	-0.70	0.70	0.16	Pass
112.00	0.01	-0.70	0.70	0.16	Pass
113.00	0.01	-0.70	0.70	0.16	Pass
114.00	0.01	-0.70	0.70	0.16	Pass
115.00	0.01	-0.70	0.70	0.16	Pass
116.00	0.01	-0.70	0.70	0.16	Pass
117.00	0.01	-0.70	0.70	0.16	Pass
118.00	0.01	-0.70	0.70	0.16	Pass
119.00	0.01	-0.70	0.70	0.16	Pass
120.00	0.01	-0.70	0.70	0.16	Pass
121.00	0.01	-0.70	0.70	0.16	Pass
122.00	0.01	-0.70	0.70	0.16	Pass
123.00	0.01	-0.70	0.70	0.16	Pass
124.00	0.01	-0.70	0.70	0.16	Pass
125.00	0.01	-0.70	0.70	0.16	Pass
126.00	0.01	-0.70	0.70	0.16	Pass
127.00	0.01	-0.70	0.70	0.16	Pass
128.00	0.01	-0.70	0.70	0.16	Pass
129.00	0.01	-0.70	0.70	0.16	Pass
130.00	0.01	-0.70	0.70	0.16	Pass

-- End of measurement results --

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Page 4 of 8

D0001.8407 Rev E

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Certificate Number 2021000495

Peak Rise Time

Peak rise time performed according to IEC 60511:2001 5.4.4 and ANSI S1.4-1983 (R2006) 5.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
135.95	40	Negative Pulse 134.91	133.44	135.44	0.15	Pass
		Positive Pulse 134.90	133.43	135.43	0.15	Pass
30		Negative Pulse 133.96	133.44	135.44	0.15	Pass
		Positive Pulse 133.95	133.43	135.43	0.15	Pass

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 60511:2001 5.4.2 and ANSI S1.4-1983 (R2006) 5.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.16 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
105.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass

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 60511:2001 5.4.2 and ANSI S1.4-1983 (R2006) 5.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.12	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
105.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass

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	93.96	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.25	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

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716-684-0001

3021-1-07730-16-44



Page 5 of 8

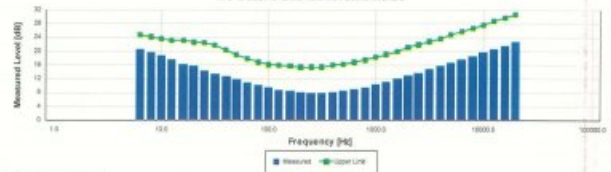
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00001-0407 Rev E

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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	20.44	24.60	Pass
8.00	19.59	24.00	Pass
10.00	18.63	23.50	Pass
12.50	17.52	23.00	Pass
16.00	15.23	22.90	Pass
20.00	15.53	22.40	Pass
25.00	14.27	22.30	Pass
31.50	13.26	21.50	Pass
40.00	12.60	20.20	Pass
50.00	11.67	19.80	Pass
63.00	10.88	17.60	Pass
80.00	9.97	16.60	Pass
100.00	9.19	16.90	Pass
125.00	8.50	16.70	Pass
160.00	8.26	15.50	Pass
200.00	7.87	15.20	Pass
250.00	7.69	15.20	Pass
315.00	7.58	15.20	Pass
400.00	8.01	15.70	Pass
500.00	8.30	16.00	Pass
630.00	8.81	16.60	Pass
800.00	9.40	17.30	Pass
1,000.00	10.16	18.10	Pass
1,250.00	11.00	18.90	Pass
1,600.00	11.80	19.80	Pass
2,000.00	12.71	20.80	Pass
2,500.00	13.57	21.70	Pass
3,150.00	14.57	22.60	Pass
4,000.00	15.54	23.50	Pass
5,000.00	16.48	24.50	Pass
6,300.00	17.43	25.40	Pass
8,000.00	18.43	26.50	Pass
10,000.00	19.48	27.40	Pass
12,500.00	20.43	28.50	Pass
16,000.00	21.40	29.50	Pass
20,000.00	22.41	30.40	Pass

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1681 West 820 North
Provo, UT 84601, United States
716-684-0001

3021-1-07730-16-44



Page 7 of 8

LARSON DAVIS
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00001-0407 Rev E

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Certificate Number 2021000495

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	35.00	Pass
C-weight Noise Floor	26.77	35.00	Pass
Z-weight Noise Floor	32.95	39.00	Pass

-- End of measurement results --

Total Harmonic Distortion

Measured using 1/3-Octave Filter

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.46	134.15	135.75	0.15	Pass
THD	-63.97	-58.00	-58.00	0.01 ±	Pass
THD+N	-60.84	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results --

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716-684-0001

3021-1-07730-16-44



Page 6 of 8

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00001-0407 Rev E

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-- End of Report --

Signature: *Ren Harris*

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3021-1-07730-16-44



Page 8 of 8

LARSON DAVIS
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00001-0407 Rev E

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Calibration Certificate

Certificate Number 2021000493

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi 1 Jomwong 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0005403
Test Results Pass

Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8379
Technician Ron Harris
Calibration Date 16 Jan 2021
Calibration Due
Temperature 23.25 °C ± 0.05 °C
Humidity 53.7 %RH ± 2.0 %RH
Static Pressure 87.56 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 073809 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/µPa.

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

IEC 60551:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2006) Class 2

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, 1770.01 Rev D Supporting Firmware Version 4.0.8, 2019-09-10

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

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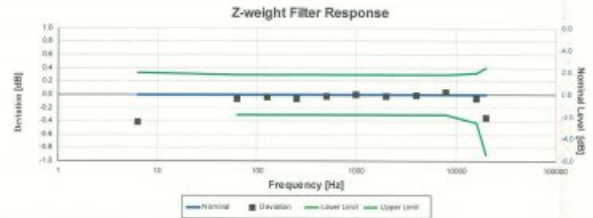
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Page 1 of 8

D0001.8377 Rev. E

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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 60551:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4-1983 (R2006) 6.1 and 9.2.1, ANSI S1.4-2014 Part 1, 5.6

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower Limit [dB]	Upper Limit [dB]	Uncertainty [dB]	Result
63.10	-0.41	-0.41	-1.11	0.33	0.15	Pass
83.10	-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	-0.06	-0.06	-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
1,996.26	-0.02	-0.02	-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
15,846.80	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

— End of measurement results —

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2021-1-17 10:02:27

Page 3 of 8

D0001.8377 Rev. E

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Description	Std Date	Std Ver	Std Standard
Han Scientific 2026-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS390 Ultra Low Distortion Generator	2021-01-05	2022-01-05	007118

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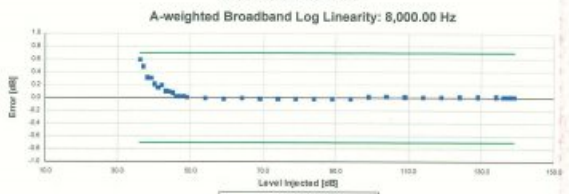
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Page 2 of 8

D0001.8377 Rev. E

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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 9, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 5.2

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	0.49	-0.70	0.70	0.16	Pass
38.00	0.31	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.15	-0.70	0.70	0.16	Pass
42.00	0.19	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.09	-0.70	0.70	0.16	Pass
45.00	0.07	-0.70	0.70	0.16	Pass
46.00	0.02	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.01	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	0.00	-0.70	0.70	0.16	Pass
51.00	-0.02	-0.70	0.70	0.16	Pass
52.00	-0.01	-0.70	0.70	0.16	Pass
53.00	-0.02	-0.70	0.70	0.16	Pass
54.00	-0.02	-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	-0.02	-0.70	0.70	0.16	Pass
58.00	-0.02	-0.70	0.70	0.16	Pass
59.00	-0.02	-0.70	0.70	0.16	Pass
60.00	-0.02	-0.70	0.70	0.16	Pass
61.00	-0.02	-0.70	0.70	0.16	Pass
62.00	-0.02	-0.70	0.70	0.16	Pass
63.00	-0.02	-0.70	0.70	0.16	Pass
64.00	-0.02	-0.70	0.70	0.16	Pass
65.00	-0.02	-0.70	0.70	0.16	Pass
66.00	-0.02	-0.70	0.70	0.16	Pass
67.00	-0.02	-0.70	0.70	0.16	Pass
68.00	-0.02	-0.70	0.70	0.16	Pass
69.00	-0.02	-0.70	0.70	0.16	Pass
70.00	-0.02	-0.70	0.70	0.16	Pass
71.00	-0.02	-0.70	0.70	0.16	Pass
72.00	-0.02	-0.70	0.70	0.16	Pass
73.00	-0.02	-0.70	0.70	0.16	Pass
74.00	-0.02	-0.70	0.70	0.16	Pass
75.00	-0.02	-0.70	0.70	0.16	Pass
76.00	-0.02	-0.70	0.70	0.16	Pass
77.00	-0.02	-0.70	0.70	0.16	Pass
78.00	-0.02	-0.70	0.70	0.16	Pass
79.00	-0.02	-0.70	0.70	0.16	Pass
80.00	-0.02	-0.70	0.70	0.16	Pass
81.00	-0.02	-0.70	0.70	0.16	Pass
82.00	-0.02	-0.70	0.70	0.16	Pass
83.00	-0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
85.00	-0.02	-0.70	0.70	0.16	Pass
86.00	-0.02	-0.70	0.70	0.16	Pass
87.00	-0.02	-0.70	0.70	0.16	Pass
88.00	-0.02	-0.70	0.70	0.16	Pass
89.00	-0.02	-0.70	0.70	0.16	Pass
90.00	-0.02	-0.70	0.70	0.16	Pass
91.00	-0.02	-0.70	0.70	0.16	Pass
92.00	-0.02	-0.70	0.70	0.16	Pass
93.00	-0.02	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.16	Pass
95.00	-0.02	-0.70	0.70	0.16	Pass
96.00	-0.02	-0.70	0.70	0.16	Pass
97.00	-0.02	-0.70	0.70	0.16	Pass
98.00	-0.02	-0.70	0.70	0.16	Pass
99.00	-0.02	-0.70	0.70	0.16	Pass
100.00	-0.02	-0.70	0.70	0.16	Pass
101.00	-0.02	-0.70	0.70	0.16	Pass
102.00	-0.02	-0.70	0.70	0.16	Pass
103.00	-0.02	-0.70	0.70	0.16	Pass
104.00	-0.02	-0.70	0.70	0.16	Pass
105.00	-0.02	-0.70	0.70	0.16	Pass
106.00	-0.02	-0.70	0.70	0.16	Pass
107.00	-0.02	-0.70	0.70	0.16	Pass
108.00	-0.02	-0.70	0.70	0.16	Pass
109.00	-0.02	-0.70	0.70	0.16	Pass
110.00	-0.02	-0.70	0.70	0.16	Pass
111.00	-0.02	-0.70	0.70	0.16	Pass
112.00	-0.02	-0.70	0.70	0.16	Pass
113.00	-0.02	-0.70	0.70	0.16	Pass
114.00	-0.02	-0.70	0.70	0.16	Pass
115.00	-0.02	-0.70	0.70	0.16	Pass
116.00	-0.02	-0.70	0.70	0.16	Pass
117.00	-0.02	-0.70	0.70	0.16	Pass
118.00	-0.02	-0.70	0.70	0.16	Pass
119.00	-0.02	-0.70	0.70	0.16	Pass
120.00	-0.02	-0.70	0.70	0.16	Pass
121.00	-0.02	-0.70	0.70	0.16	Pass
122.00	-0.02	-0.70	0.70	0.16	Pass
123.00	-0.02	-0.70	0.70	0.16	Pass
124.00	-0.02	-0.70	0.70	0.16	Pass
125.00	-0.02	-0.70	0.70	0.16	Pass
126.00	-0.02	-0.70	0.70	0.16	Pass
127.00	-0.02	-0.70	0.70	0.16	Pass
128.00	-0.02	-0.70	0.70	0.16	Pass
129.00	-0.02	-0.70	0.70	0.16	Pass

— End of measurement results —

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



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A PCB PIEZOTRONICS DIV.

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Page 4 of 8

D0001.8377 Rev. E

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Certificate Number 2021000493

Peak Rise Time

Peak rise time performed according to IEC 60661-2:2011 9.4.4 and ANSI S1.4-1983 (R2006) 9.4.4

Amplitude [dB]	Duration [μs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
135.95	40	Negative Pulse	134.73	133.25	0.15 ±	Pass
		Positive Pulse	134.73	133.24	0.15 ±	Pass
30	30	Negative Pulse	133.51	133.25	0.15 ±	Pass
		Positive Pulse	133.75	133.24	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 60661-2:2011 9.4.2 and ANSI S1.4-1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLID	± 1.00	0.15 ±	Pass
	5	OVLID	± 1.00	0.15 ±	Pass
125.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
115.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.15	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	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 60661-2:2011 9.4.2 and ANSI S1.4-1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLID	± 1.00	0.15 ±	Pass
	5	OVLID	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
115.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass

-- End of measurement results --

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	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.29	39.40	40.80	0.16	Pass
OSA Low Range	94.00	93.90	94.10	0.15	Pass
OSA Normal Range	94.00	93.30	94.80	0.15	Pass

-- End of measurement results --

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716-684-0901



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DO001.0407 Rev E

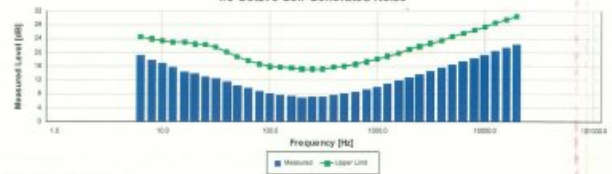
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Page 5 of 8

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Certificate Number 2021000493

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.29	24.60	Pass
8.00	17.93	24.00	Pass
10.00	16.87	23.50	Pass
12.50	15.86	23.00	Pass
16.00	14.44	22.50	Pass
20.00	13.94	22.40	Pass
25.00	12.98	22.30	Pass
31.50	12.42	21.90	Pass
40.00	11.54	20.20	Pass
50.00	10.41	18.80	Pass
63.00	9.67	17.60	Pass
80.00	8.79	16.60	Pass
100.00	8.14	15.80	Pass
125.00	7.76	15.70	Pass
160.00	7.47	15.50	Pass
200.00	7.03	15.20	Pass
250.00	7.10	15.20	Pass
315.00	7.20	15.20	Pass
400.00	7.56	15.70	Pass
500.00	8.07	16.00	Pass
630.00	8.97	16.60	Pass
800.00	9.35	17.30	Pass
1,000.00	9.98	18.10	Pass
1,250.00	11.01	18.90	Pass
1,600.00	11.90	19.80	Pass
2,000.00	12.71	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.95	22.60	Pass
4,000.00	15.50	23.50	Pass
5,000.00	16.44	24.50	Pass
6,300.00	17.41	25.50	Pass
8,000.00	18.39	26.50	Pass
10,000.00	19.32	27.40	Pass
12,500.00	20.34	28.50	Pass
16,000.00	21.28	29.50	Pass
20,000.00	22.26	30.40	Pass

-- End of measurement results --

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3020-1-073002.27

Page 7 of 8

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Certificate Number 2021000493

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	27.23	35.00	Pass
C-weight Noise Floor	28.45	35.00	Pass
Z-weight Noise Floor	32.10	39.00	Pass

-- End of measurement results --

Total Harmonic Distortion

Measured using 1/3-Octave filter

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.30	134.15	135.75	0.15	Pass
THD	-65.87	-68.00	-63.00	0.01 ±	Pass
THD+N	-62.06	-68.00	-56.00	0.01 ±	Pass

-- End of measurement results --

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DO001.0407 Rev E

3020-1-073002.27

Page 6 of 8

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Certificate Number 2021000493

-- End of Report --

Signature: Ron Harris

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DO001.0407 Rev E

3020-1-073002.27

Page 8 of 8

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhvit Road, Bangkok, Pratinang,
Bangkok 10260

Certificate No : 21-ACT-186
Request No : Req-2021-0523

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73246
ID : UAE.FPM.104/2561
Class : 1
Range : 94, 114 dB / 100 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 27 April 2021
Calibration Date : 28 May 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

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

Note

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

Calibrated By :

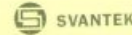
Mr. Noppadon Luangt
Service Calibration Engineer

Approved By :

Mr. P...
Calibration Engineer Supervisor

Issue Date : 28 May 2021

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
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ISO9001 certified

FACTORY CALIBRATION DATA OF THE SV 104 No. 97923
with microphone SV ANTEK type SV 27 No. 96494

1. CALIBRATION* (continued)

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
A	113.82	113.82	0.00
B	113.82	113.82	0.00
C	113.82	113.82	0.00

Calibration measured with the microphone SV ANTEK type SV 27 No. 96494 Calibration factor 1.0000

2. CALIBRATION* (continued)

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
Frequency	113.82	113.82	0.00
Reference	113.82	113.82	0.00

3. LINEARITY TEST* (continued)

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
Frequency	113.82	113.82	0.00
Reference	113.82	113.82	0.00

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
Frequency	113.82	113.82	0.00
Reference	113.82	113.82	0.00

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
Frequency	113.82	113.82	0.00
Reference	113.82	113.82	0.00

Characteristic	Factory value (dB)	Indication (dB)	Error (dB)
Frequency	113.82	113.82	0.00
Reference	113.82	113.82	0.00

4. TONE BURST RESPONSE*

Characteristic A, F₀ = 1000 Hz, Burden factor 25

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

Result	Duration (ms)	Amplitude (dB)	Frequency (Hz)	Reference (dB)	Error (dB)
MAN	1000	113.82	1000	113.82	0.00
SEI	1000	113.82	1000	113.82	0.00

Steady level measured result = 114 dB

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Certificate No : 21-ACT-186

Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)	Adjustment (dB)	Uncertainty	Acceptance Limit
	Measured	Error	Measured	Error
94 dB / 1000 Hz	93.88	-0.12	-	-
114 dB / 1000 Hz	113.84	-0.16	-	-

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty	Acceptance Limit
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)
94 dB / 1000 Hz	999.98	0.002	-	-
114 dB / 1000 Hz	999.98	0.002	-	-

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty	Acceptance limit
	Measured (%)	Measured (%)	(± %)	Class 1 (± %)
94 dB / 1000 Hz	0.09	-	0.17	2.5
114 dB / 1000 Hz	0.30	-	0.17	2.5

Note :

- Acceptance limit was IEC60842:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
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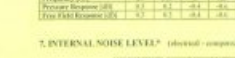
5. FREQUENCY RESPONSE* (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB



6. FREQUENCY RESPONSE* (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB



7. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

8. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

9. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

10. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

11. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

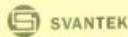
Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

12. INTERNAL NOISE LEVEL* (continued) - (continued)

Characteristic Z, Input A, 20 Hz, Steady state 114 dB

Characteristic	Indication (dB)	Reference (dB)	Error (dB)
Reference	114.00	114.00	0.00
Reference	114.00	114.00	0.00

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ISO9001 certified

FACTORY CALIBRATION DATA OF THE SV 104 No. 91924

with microphone SVANTER type SV27 No. 90400

1. CALIBRATION (continued)

Reference frequency: 1000 Hz, Standard Level: 114.0 dB

Characteristic	Current value [dB]	Indication [dB]	Error [dB]
A	113.5	113.5	0.0
B	113.0	113.0	0.0
C	112.5	112.5	0.0

Calibration measured with the microphone SVANTER type SV27 No. 90400, Calibration factor: 939.4 dB

2. CALIBRATION* (continued)

Characteristic: Z, Input: 7.5 mV, E_{ref} : 1000 Hz

Characteristic	Current value [dB]	Indication [dB]	Error [dB]
Indication	113.0	113.0	0.0
Output meter	113.0	113.0	0.0

3. LINEARITY TEST* (continued)

Characteristic: A, E_{ref} : 1000 Hz

Nominal result L(E) [dB]	100.0	101.0	102.0	103.0	104.0	105.0	106.0
Error [dB]	0.2	0.1	0.2	0.0	0.0	0.0	0.0

Certificate of Calibration

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

Certificate No.: 21-APM-052
Request No.: Req-2021-522

Unit Under Calibration Details

Measurement Item: Mass flow meter
Manufacturer: TSI
Model: 4148
Serial Number: 4146192007
ID: UAE-EFM-2232562
Location of Calibration: LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature: (23 ± 3) °C
Humidity: (55 ± 15) %RH
Barometric Pressure: (1010 ± 10) hPa
Received Date: 27 April 2021
Calibration Date: 8 June 2021
Calibration Procedure: In-house method CP-APM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Standard flow	21151012015	Sensidyne	21 April 2022
Air Flow Meter	Calibrator 3 High flow	18501012012	Sensidyne	21 April 2022

Traceability:

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

Note:

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

Calibration By: Mr. Noppran Luegan
Service Calibration Engineer

Approved By: Mr. Pait Nithanum
Calibration Engineer Supervisor
Issue Date: 8 June 2021

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

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Certificate of Calibration

Certificate No.: 21P1158
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: 111MS
Serial No.: -
ID No.: UAE-EMA2-1092552

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.

Condition As-Received: Used Item
Received Date: 29 March 2021
Calibration Date: 31 March 2021

Reference: 2103-1188WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Prakanong, 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 guideline.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0053-20	05 Apr 2021

- This instrument was installed in vertical orientation and center of the dial was used as the reference level.
- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 7.50062 mmHg
- This instrument was used clean air as pressure media.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained at:-
National Institute of Metrology Thailand (NIMT)

Calibrated by: Suttan Khamkaew
Issue Date: 31 March 2021

Approved Signatory: [Signature]
[] Phatima Phrasomphol
[] Suna Suwanratel
[x] Atsapol Panurach

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B 0255508

Certificate No.: 21-APM-052
Request No.: Req-2021-522

Result of Calibration:

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
0.02	0.02005	0.019	0.00105	0.00065
0.05	0.05006	0.047	0.00306	0.00092
0.1	0.1013	0.098	0.0033	0.00119
0.2	0.2088	0.199	0.0096	0.0031
0.5	0.5085	0.503	-0.0055	0.008
1.0	1.002	0.996	-0.004	0.015
1.7	1.702	1.692	-0.010	0.025
2.0	2.003	1.991	-0.012	0.029

Note:

STD : Standard

UUC : Unit Under Calibration

End of Certificate

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Cert. No.: 21P1158
Page: 2 of 2

Result of calibration - Without adjustment Function: Absolute Pressure Measurement

Increasing Pressure	Applied Pressure (mmHg)	718.84	728.94	738.19	748.76	758.18	770.97
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	
Error (mmHg)	1.16	1.06	0.81	0.24	-0.18	-0.97	

Decreasing Pressure	Applied Pressure (mmHg)	770.93	758.94	748.49	738.89	728.63	718.81
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0	
Error (mmHg)	-0.93	-0.96	-0.51	-1.11	-1.37	-1.19	

The uncertainty of measurement was ± 0.24 mmHg

* 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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B 1046644



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES J. EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PHUTANAKARN ROAD BOX 16, SIANGKHAM, SIANGKHAM, BANGKOK 10359
TEL: 0-2117-5009-24 FAX: 0-2119-9498



Certificate of Calibration

Certificate No.: 21H804
Page: 1 of 2

Equipment: DSI Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE ANV.129/2550

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

Condition As-Received: Used Item
Received Date: 29 March 2021
Calibration Date: 31 March 2021
Reference: 2103-1189WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phrakhanong, 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 into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Exp. Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31883	18540	28 Jul 2021
2) Handheld Thermometer With Sensor	1521	ASA399	20968	10 Aug 2021

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. This Calibration is traceable to the International System of Unit maintained at:-
- National Institute of Standards and Technology (NIST), The United States of America
- National Institute of Metrology Thailand (NMT)

Calibrated by: Kaipap Onrat
Issue Date: 30 April 2021

Approved Signatory:

[✓] Chakrit Waiwongkaj
[] Pongthipha Tanwongkul
[] Pitak Srimongkol

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0258331

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7130 MOO 15, SOI SINTANAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0660-2116-5009-1 FAX: 0660-2116-7140



Certificate of Calibration

Certificate No.: 21-TPM-275
Request No.: Req-2021-1355
Page: 1/2

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

Unit Under Calibration Details

Calibration Parameter: Temperature
Manufacturer: JM
Model: QT-32
Serial Number: TP5030008
Resolution: 0.1 °C
ID Number: -
Range Calibration: 20°C to 60°C
Type of Sensor: RTD
Sensor Diameter (mm): 4.5
Calibration Position (mm): 67.5
Instrument Status: Used

Calibration Environment and Details

Temperature: 23 °C ± 1 °C
Humidity: 55 %RH ± 15 %RH
Received Date: 14 September 2021
Calibrated Date: 23 September 2021
Calibration Procedure: In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard: Digital Thermometer with Sensor, Manufacturer: GINO GINGGO, Model: GT11/RTD100, SN: 1200077, ID-AR-TPM Which was calibrated on 30 Mar 2021, Calibration Certificate No.: QR21-0719

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

Note

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

Approved By:

Mr. [Redacted]

Calibration Engineer Supervisor

Issue Date: 24 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date: 13/02/20

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Cert. No.: 21H804
Page: 2 of 2

Result of Calibration:

Without Adjustment				
Function: Humidity measurement.				
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	76	-4.0	1.9

Result of Calibration:

Without Adjustment				
Function:	Temperature measurement:			Uncertainty
	Standard	UUC*		of Measurement
	Temperature	Reading	Error	
	(°C)	(°C)	(°C)	(±°C)
	20.011	20.0	-0.011	0.72
	30.019	30.0	-0.019	0.72
	34.989	34.5	-0.489	0.72
	40.006	39.0	-1.006	0.72

UUC* : Unit Under Calibration

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

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1051238

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7130 MOO 15, SOI SINTANAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0660-2116-5009-1 FAX: 0660-2116-7140



Calibration Note
UUC Adjustment: Not Adjust

Certificate No.: 21-TPM-275
Request No.: Req-2021-1355
Page: 2/2

Result of Calibration:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.007	20.3	-0.3	0.14
	25.003	25.3	-0.3	0.14
	30.004	30.3	-0.3	0.14
	35.002	35.3	-0.3	0.14
	40.003	40.3	-0.3	0.14
	45.003	45.3	-0.3	0.14
DRY	20.007	20.3	-0.3	0.14
	25.006	25.3	-0.3	0.14
	30.007	30.3	-0.3	0.14
	35.006	35.3	-0.3	0.14
	40.007	40.3	-0.3	0.14
	45.007	45.3	-0.3	0.14
GLOBE	20.007	20.3	-0.3	0.14
	25.003	25.3	-0.3	0.14
	30.003	30.3	-0.3	0.14
	35.003	35.3	-0.3	0.14
	40.006	40.3	-0.3	0.14
	45.002	45.3	-0.3	0.14

End of Certificate

Calibrated By:

Mr. [Redacted]

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date: 13/02/20

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Certificate of Calibration

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

Certificate No : 21-TPM-276
Request No : Req-2021-1356
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT000015
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20°C to 60°C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 14 September 2021
Calibrated Date : 23 September 2021

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT1U/RTD100, SN: 12090077, ID: AR-TPM Which was calibrated on 30 Mar 2021, Calibration Certificate No.: QR21-0719

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

Note

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

Approved By :
Mr. Pichai Manakorn
Calibration Engineer Supervisor
Issue Date : 24 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No : 21-TPM-303
Request No : Req-2021-1405
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : JM
Model : QT-32
Serial Number : TPT000006
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 29 October 2021
Calibrated Date : 9 November 2021

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT1U/RTD100, SN: 12090077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QR21-0719

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

Note

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

Approved By :
Mr. Pichai Manakorn
Calibration Engineer Supervisor
Issue Date : 11 November 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date 13/02/20

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Certificate No : 21-TPM-276

Calibration Note
UUC Adjustment : Not Adjust
Request No : Req-2021-1356
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.002	20.0	0.0	0.14
	25.004	25.0	0.0	0.14
	30.007	30.0	0.0	0.14
	35.004	35.0	0.0	0.14
	40.005	40.0	0.0	0.14
	45.004	45.0	0.0	0.14
	50.005	50.0	0.0	0.14
	55.007	55.0	0.0	0.14
DRY	20.004	20.1	-0.1	0.14
	25.006	25.1	-0.1	0.14
	30.003	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.006	40.1	-0.1	0.14
	45.008	45.1	-0.1	0.14
	50.007	50.1	-0.1	0.14
	55.003	55.2	-0.2	0.14
GLOBE	20.005	20.0	0.0	0.14
	25.003	25.0	0.0	0.14
	30.003	30.0	0.0	0.14
	35.003	35.0	0.0	0.14
	40.005	40.0	0.0	0.14
	45.004	45.0	0.0	0.14
	50.004	50.0	0.0	0.14
	55.006	55.0	0.0	0.14

End of Certificate

Calibrated By :
Mr. Satchak Jongsakulakorn

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note
UUC Adjustment : Not Adjust
Request No : Req-2021-1405
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.003	20.1	-0.1	0.14
	25.004	25.1	-0.1	0.14
	30.003	30.1	-0.1	0.14
	35.003	35.1	-0.1	0.14
	40.007	40.1	-0.1	0.14
	45.005	45.1	-0.1	0.14
	50.007	50.2	-0.2	0.14
	55.007	55.2	-0.2	0.14
DRY	20.007	20.2	-0.2	0.14
	25.004	25.2	-0.2	0.14
	30.007	30.2	-0.2	0.14
	35.004	35.2	-0.2	0.14
	40.007	40.2	-0.2	0.14
	45.005	45.2	-0.2	0.14
	50.005	50.2	-0.2	0.14
	55.008	55.2	-0.2	0.14
GLOBE	20.005	20.1	-0.2	0.14
	25.004	25.2	-0.2	0.14
	30.007	30.2	-0.2	0.14
	35.004	35.2	-0.2	0.14
	40.005	40.2	-0.2	0.14
	45.004	45.2	-0.2	0.14
	50.005	50.2	-0.2	0.14
	55.008	55.2	-0.2	0.14

End of Certificate

Calibrated By :
Mr. Satchak Jongsakulakorn

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-708-TPM-01 Rev.01 Issue date 13/02/20

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Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 21-TPM-304
Request No : Req-2021-1403
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TPS000004
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.3
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 29 October 2021
Calibrated Date : 9 November 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: Q021-0719

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

Note

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

Approved By :
Mr. Paiti Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 November 2021

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Cert.No.: 21TW170
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE.EFM.066/2562 (ENV.DO.01/62)
Received Date : 04 August 2021
Test Date : 18 August 2021
Reference : 2108-0109WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd
3 Soi Udomsak 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 Sirthean

Approved by :
Approved Signatory

() Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 23 August 2021

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Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 21-TPM-304
Request No : Req-2021-1403
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.003	20.1	-0.1	0.14
	25.007	25.1	-0.1	0.14
	30.003	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.007	40.1	-0.1	0.14
	45.007	45.1	-0.1	0.14
	50.006	50.1	-0.1	0.14
	60.003	60.1	-0.1	0.14
DRY	20.004	20.1	-0.1	0.14
	25.004	25.1	-0.1	0.14
	30.003	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.007	40.1	-0.1	0.14
	45.007	45.1	-0.1	0.14
	50.006	50.1	-0.1	0.14
	60.003	60.1	-0.1	0.14
GLURE	20.004	20.1	-0.1	0.14
	25.007	25.1	-0.1	0.14
	30.007	30.1	-0.1	0.14
	35.005	35.1	-0.1	0.14
	40.006	40.1	-0.1	0.14
	45.007	45.1	-0.1	0.14
	50.004	50.1	-0.1	0.14
	60.003	60.1	-0.1	0.14

End of Certificate

Calibrated By :
Mr. Satchak Ingsakornkarn

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Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 18K100663

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.26	8.26	0.0055

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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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 27 FAX. 0 2719 9484



Cert. No.: 21TM1443
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE.EFM.066/2562 (ENV.DO.01/62)
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 : 4 August 2021
Calibrated Date : 20 August 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kht Ruttanaprapachai
Approved by :
() Pornthippa Tameyakul
() Mailee Butkruea
() Suwit Imjai
Issue Date : 25 August 2021

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.

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A 0027514



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 27 FAX. 0 2719 9484



Cert.No.: 21CH528
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE.EFM.006/2563(EFM.pH.05/63)
Condition As-Received: Used Item
Received Date : 19 April 2021
Calibration Date : 21 April 2021
Reference : 2104-0380WSC-5
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 Lemgagrakul
Approved by :
() Mailee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul
Issue Date : 26 April 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0027516



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2108 0109WSC-2

Cert. No.: 21TM1443
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
Digital Thermometer	1502A	A52847	201246	14 Oct 2021

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.: 18K100663

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.006	24.9	-0.106	0.16	2.00
30.0	100	30.004	29.9	-0.104	0.16	2.00
35.0	100	35.006	34.9	-0.106	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 0027515



Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
Document Process Calibrator	1385032	130RC022	20E4213	24 Nov 2021
Ref. Standard Thermometer	2188080	130RC044	20I1389	19 Nov 2021

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	705694	06 Sep 2022
pH 6.985	CPA chem	722285	19 Dec 2021
pH 10.012	CPA chem	722287	19 Dec 2021

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 (smV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

เอกสารไม่ควบคุม
A 1052055



Cert.No.: 21CH528
Page: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.19)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 999M0135	4.008	4.01	154.4	0.0085	2.05
	6.985	7.01	-18.0	0.011	2.00
	6.985	7.00	-17.8	0.0093	2.00
	10.012	10.01	-190.4	0.013	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 999M0135

Dimension of probe;

- Length : 90 mm.

- Diameter : 15 mm.

- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.001	25.0	-0.001	0.20	2.00
30.0	30.006	30.0	-0.006	0.20	2.00
35.0	35.001	35.0	-0.001	0.20	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 %.

-o-o-

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a 1052054

7890 GC Preventive Maintenance Checklist - Standard

System Information

Guidance

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

Instrument system name and ID	UAE TOX .021/2556 R-7890B
Instrument system site and location	UAE Instrument room 4th floor
List system component product numbers	List the serial numbers of each component
1. G4408	1. CN 13113001
2. G4419A	2. CN 1320018
3. G4514A	3. CN 13200169
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Preparation

- ☒ Discuss any specific issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform general inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware updates and verify with customers if they would like it 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.

Issued: 6-Sep-2018, Revision: A.01.12

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Page 2 of 7

Agilent Technologies

เอกสารไม่ควบคุม

7890 GC Preventive Maintenance Checklist - Standard

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies GC Support please visit our web site using the following URL:

<http://www.agilent.com/cs-us/products/gas-chromatography/gc-systems/7890lb-gc-support>

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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Only complete sections that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM Service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

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.

Issued: 6-Sep-2018, Revision: A.01.12

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Page 1 of 7

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เอกสารไม่ควบคุม

7890 GC Preventive Maintenance Checklist - Standard

Clean and Inspect GC

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

Inlet and detector consumable replacement

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

Zero Sensors and Leak test

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

ALS Maintenance

- ☒ Section NOT applicable
- ☒ 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 - clean if necessary
- ☒ Check for correct operation of syringe volume settings.

Issued: 6-Sep-2018, Revision: A.01.12

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Page 3 of 7

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7890 GC
Preventive Maintenance Checklist - Standard



Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Keyboard 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.

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.

Issued: 6-Sep-2018, Revision: A.01.12

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Page 4 of 7

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เอกสารไม่ควบคุม

7890 GC
Preventive Maintenance Checklist - Standard



7890 GC Parts List Table

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

Part Description	Part Number	Model# where used	Quantity Consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-3293	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-3295	7890A/B	N/A
FP Inlet PM kit	5188-6498	7890A/B	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VT)	5188-6495	7890A/B	N/A
MMI Cleaning Kit	G3510-60820	7890A/B	N/A
PTV Septumless Head Rebuild Kit	5182-0747	7890A/B	N/A
PTV Septumless Head Teflon Guide	5182-0748	7890A/B	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
FID Collector Replacement Kit	G1531-67001	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary FID base	G1531-80520	7890A/B	N/A
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	N/A
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	N/A

Issued: 6-Sep-2018, Revision: A.01.12

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Page 6 of 7

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เอกสารไม่ควบคุม

7890 GC
Preventive Maintenance Checklist - Standard



Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the PM service activity in the customer's instrument 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 Review Comments section below if there are additional comments
- ☒ Review the service and any test results with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.
- ☒ Please ask the customer if they would like to have Smart Alerts installed on their computer.

7890 GC Test Results Table

Detector Signal Outputs	Before PM service	After PM service
Front detector output	27.0	19.0
Back detector output	N/A	N/A
AUX detector output	N/A	N/A
Pressure decay test	Expected result	Actual result or N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	N/A

Issued: 6-Sep-2018, Revision: A.01.12

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Page 5 of 7

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เอกสารไม่ควบคุม

7890 GC
Preventive Maintenance Checklist - Standard



Service Engineer Comments (optional)

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 in this box.

Other Important Customer Web Links

- ☒ 7890 GC manual "Maintaining Your GC" - http://www.agilent.com/cs/library/usermanuals/public/G3430-9005220789001_Maintaining3200guide.pdf
- ☒ Need to know more? - <http://www.agilent.com/crosslink/university/>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number: 6006410510 Date service completed: 19 April 2021

Agilent signature: [Signature] Customer signature: [Signature]

Document part number: G3430-90004

Issued: 6-Sep-2018, Revision: A.01.12

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Page 7 of 7

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เอกสารไม่ควบคุม

Certificate of System Qualification

GC-QQ

System ID: CN13113001
 Organization Name: United Analyst and Engineering Consultan
 Organization Location: 3 Soi Udomsuk 41 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10200

Date: April 22, 2022 2:32:15 PM
 EQP Name: AgilentRecommended
 EQP Revision: GC.02.51
 Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
 Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
 Front SSL
 Setpoint Status: Pass
 Pressure: 25.0 psi
 Pressure Change: -5.1 psi /5 minutes
 Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
 Front SSL

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 1 / 21

เอกสารไม่ควบคุม

Setpoint Status: Pass
 Flow Type: Makeup
 Setpoint: 60.0 mL/min Measured Flow: 64.8 mL/min
 Purge Offset: 20 % setpoint
 Adjusted Setpoint: 72.00 mL/min
 Accuracy: 7.2 mL/min
 Agilent Recommended: <= 10.0 % setpoint (7.2 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
 Front FID
 Setpoint Status: Pass
 Flow Type: Fuel
 Setpoint: 30.0 mL/min Measured Flow: 30.2 mL/min
 Accuracy: 0.2 mL/min
 Agilent Recommended: <= 10.0 % setpoint (3.0 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
 Flow Type: Oxidizer
 Setpoint: 400.0 mL/min Measured Flow: 398.2 mL/min
 Accuracy: 1.8 mL/min
 Agilent Recommended: <= 10.0 % setpoint (40.0 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 3 / 21

เอกสารไม่ควบคุม

Setpoint Status: Pass
 Inlet Pressure: 25.0 psi Actual: 25.0 psi
 Accuracy: 0.0 psi
 Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
 Back FPD+
 Setpoint Status: Pass
 Flow Type: Fuel
 Setpoint: 60.0 mL/min Measured Flow: 60.2 mL/min
 Accuracy: 0.2 mL/min
 Agilent Recommended: <= 10.0 % setpoint (6.0 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
 Flow Type: Oxidizer
 Setpoint: 60.0 mL/min Measured Flow: 60.1 mL/min
 Accuracy: 0.1 mL/min
 Agilent Recommended: <= 10.0 % setpoint (6.0 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 2 / 21

เอกสารไม่ควบคุม

Setpoint Status: Pass
 Flow Type: Makeup
 Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min
 Accuracy: 0.1 mL/min
 Agilent Recommended: <= 10.0 % setpoint (2.5 mL/min)
 Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890
 Setpoint Status: Pass
 Zone: Oven
 Setpoint/Actual: 230.0 230.6 °C
 Temperature: 230.0 230.6 °C
 Accuracy: 0.6 °C
 Agilent Recommended: >= -1.0 % setpoint in K (-5.0 °C)
 <= 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass
 Zone: Oven
 Setpoint/Actual: 100.0 100.4 °C
 Temperature: 100.0 100.4 °C
 Accuracy: 0.4 °C
 Agilent Recommended: >= -1.0 % setpoint in K (-3.7 °C)
 <= 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 4 / 21

เอกสารไม่ควบคุม

Setpoint Status: **Pass**
 Setpoint(Average)
 Temperature: 100.0 100.4333 °C
 Stability: 0.1 °C
 Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Back FPD+
 Name: 7893A

Setpoint Status: **Completed**

Injection Volume on Column: 1.0 uL
 Mode: P-Mode

Overall Scouting Run Status
 Completed

Noise and Drift

Tested Combination1 Front SSL / Back FPD+
 Name: 7890

Setpoint Status: **Pass**
 Mode: P-Mode

Base Signal: 12.2 150 pA

ASTM Noise
 DU 1.58
 Drift: DU/Hr 0.52

Agilent Recommended: ≤ 2.00 ≤ 1.50
 Status: **Pass** **Pass**

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 5 / 21

เอกสารไม่ควบคุม

Setpoint Status: **Completed**
 Injection Volume on Column: 1.0 uL

Overall Scouting Run Status
 Completed

Noise and Drift

Tested Combination2 Front SSL / Front FID
 Name: 7890

Setpoint Status: **Pass**

Base Signal: 21.3 pA

ASTM Noise
 pA 0.07
 Drift: pA/Hr 0.85

Agilent Recommended: ≤ 0.10 ≤ 2.50
 Status: **Pass** **Pass**

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2 Front SSL / Front FID
 Name: 7893A

Setpoint Status: **Pass**

Injection Volume on Column: 1.0 uL

Area RSD: 0.44 % Retention Time RSD: 0.24 %
 Agilent Recommended: ≤ 3.00 ≤ 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 7 / 21

เอกสารไม่ควบคุม

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1 Front SSL / Back FPD+
 Name: 7893A

Setpoint Status: **Pass**

Injection Volume on Column: 1.0 uL
 Mode: P-Mode

Area RSD: 2.63 % Retention Time RSD: 0.02 %
 Agilent Recommended: ≤ 3.00 ≤ 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Back FPD+
 Name: 7890

Mode: P-Mode

Setpoint Status: **Pass**

Signal to Noise: 11529
 Agilent Recommended: ≥ 2400

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2 Front SSL / Front FID
 Name: 7893A

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 8 / 21

เอกสารไม่ควบคุม

Tested Combination2 Front SSL / Front FID
 Name: 7890

Setpoint Status: **Pass**

Signal to Noise: 521845
 Agilent Recommended: ≥ 300000

Overall Signal to Noise Test Status

Pass

Date: April 22, 2022 2:32:15 PM
 System ID: CN13113001

Page 9 / 21

เอกสารไม่ควบคุม

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN13113001
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	Back
LTM Included?	No

Tested Combination2

Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	G4513A
Serial Number	CN13269018
Firmware Revision	A.10.08
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

Page 9 / 21

เอกสารไม่ควบคุม

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID+
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
Flow Filter Tested	P Mode

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

Page 11 / 21

เอกสารไม่ควบคุม

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7893A
Model Number	G4514A
Serial Number	CN13200169
Firmware Revision	A.10.16
Vial Heater	Not installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440B
Serial Number	CN13113001
Firmware Revision	B.02.03.2
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

Page 10 / 21

เอกสารไม่ควบคุม

Electronic Signature

Purpose

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Logged On User Name:	seenguthai.tanak@mon.agilent.com
Signature Creation Date:	April 22, 2022
Reason for Signature:	Executed protocol and published this original version of document

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Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

Page 12 / 21

เอกสารไม่ควบคุม

User Name: isangpradit.sank
Hardware: LAPTOP-CQ38K3M9V
System ID: CM13113001
Print Date: April 22, 2022 2:32:15 PM

CM13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 9:34:25 AM	Auth	SessionCreated	Session	None
April 22, 2022 9:34:25 AM	Start	Configuration	Session	None
April 22, 2022 9:34:29 AM	Auth	Enrollment	Licensing	User is Nonpaying and does not require an unlock code
April 22, 2022 9:34:51 AM	Auth	ExpLoaded	Session	EQP details for primary technique (SQ) File path: [Process\FedexGo\Configure\\sw\\00-02-81\\eqp\\EQP File Name: [00-02-81\\eqp\\EQP Name: [AgilentRecommended]
April 22, 2022 9:34:54 AM	End	Configuration	Session	None
April 22, 2022 9:35:00 AM	Start	Qualification	Session	OO
April 22, 2022 9:35:00 AM	Start	Execution	System Inspection and Basic Safety and Operation - 1800 - Qualitative Test - No septos associated	None
April 22, 2022 9:35:21 AM	End	Execution	System Inspection and Basic Safety and Operation - 1800 - Qualitative Test - No septos associated	Run Count: 1
April 22, 2022 9:35:24 AM	Start	Execution	Int Pressure Accuracy - Front SS - Pressure Controlled Int - S: 25.0 psi - L: <= 2.0 psi and <= 5.0 psi	None
April 22, 2022 9:35:32 AM	End	Execution	Int Pressure Accuracy - Front SS - Pressure Controlled Int - S: 25.0 psi - L: <= 2.0 psi and <= 5.0 psi	Run Count: 1
April 22, 2022 9:35:35 AM	Start	Execution	Int Pressure Accuracy - Front SS - Pressure Controlled Int - S: 25.0 psi - L: <= 2.0 psi and <= 5.0 psi	None

Page 1 / 5

Date: April 22, 2022 2:32:15 PM
System ID: CM13113001

เอกสารไม่ควบคุม

Page 13 / 21

User Name: isangpradit.sank
Hardware: LAPTOP-CQ38K3M9V
System ID: CM13113001
Print Date: April 22, 2022 2:32:15 PM

CM13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 9:37:33 AM	Auth	Data	Detector Flow Accuracy - Back FPD - Type: Makeup - S: 60.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 9:37:48 AM	End	Execution	Detector Flow Accuracy - Back FPD - Type: Makeup - S: 60.0 mL/min - L: <= 10.0% septant	Run Count: 1
April 22, 2022 9:44:35 AM	Start	Execution	Signal to Noise - Injection Tower, Front SS, Back FPD - Detector FPD - L: <= 2400	None
April 22, 2022 10:10:32 AM	Start	Execution	Signal to Noise - Injection Tower, Front SS, Back FPD - Detector FPD - L: <= 2400	None
April 22, 2022 10:10:37 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 10:10:48 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 10:10:59 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% septant	Run Count: 1
April 22, 2022 10:11:02 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Detector - S: 400.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 10:11:16 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Detector - S: 400.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 10:11:20 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Detector - S: 400.0 mL/min - L: <= 10.0% septant	Run Count: 1

Page 3 / 5

Date: April 22, 2022 2:32:15 PM
System ID: CM13113001

เอกสารไม่ควบคุม

Page 15 / 21

User Name: isangpradit.sank
Hardware: LAPTOP-CQ38K3M9V
System ID: CM13113001
Print Date: April 22, 2022 2:32:15 PM

CM13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 9:35:39 AM	End	Execution	Int Pressure Accuracy - Front SS - Pressure Controlled Int - S: 25.0 psi - L: <= 2.0 psi and <= 5.0 psi	Run Count: 1
April 22, 2022 9:35:42 AM	Start	Execution	Detector Flow Accuracy - Back FPD - Type: Fuel - S: 60.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 9:36:01 AM	Auth	Data	Detector Flow Accuracy - Back FPD - Type: Fuel - S: 60.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 9:36:08 AM	End	Execution	Detector Flow Accuracy - Back FPD - Type: Fuel - S: 60.0 mL/min - L: <= 10.0% septant	Run Count: 1
April 22, 2022 9:36:09 AM	Start	Execution	Detector Flow Accuracy - Back FPD - Type: Detector - S: 60.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 9:36:28 AM	Auth	Data	Detector Flow Accuracy - Back FPD - Type: Detector - S: 60.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 9:36:33 AM	End	Execution	Detector Flow Accuracy - Back FPD - Type: Detector - S: 60.0 mL/min - L: <= 10.0% septant	Run Count: 1
April 22, 2022 9:36:36 AM	Start	Execution	Detector Flow Accuracy - Back FPD - Type: Makeup - S: 60.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 9:37:09 AM	Start	Execution	Detector Flow Accuracy - Back FPD - Type: Makeup - S: 60.0 mL/min - L: <= 10.0% septant	None

Page 2 / 9

Date: April 22, 2022 2:32:15 PM
System ID: CM13113001

เอกสารไม่ควบคุม

Page 14 / 21

User Name: isangpradit.sank
Hardware: LAPTOP-CQ38K3M9V
System ID: CM13113001
Print Date: April 22, 2022 2:32:15 PM

CM13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 10:11:23 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% septant	None
April 22, 2022 10:11:40 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% septant	Manual Data Entry
April 22, 2022 10:11:49 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% septant	Run Count: 1
April 22, 2022 10:11:52 AM	Start	Execution	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	None
April 22, 2022 10:12:16 AM	Auth	Data	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	Manual Data Entry
April 22, 2022 10:12:16 AM	End	Execution	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	Run Count: 1
April 22, 2022 10:12:30 AM	Start	Execution	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	None
April 22, 2022 10:12:40 AM	Auth	Data	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	Manual Data Entry
April 22, 2022 10:12:46 AM	End	Execution	GC Oven Temperature Accuracy - 1800 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0% septant in K	Run Count: 1

Page 4 / 9

Date: April 22, 2022 2:32:15 PM
System ID: CM13113001

เอกสารไม่ควบคุม

Page 16 / 21

User Name: saengathai.sarak
Host Name: LAPTOP-CQ28KQWV
System ID: CN13113001
Print Date: April 22, 2022 2:32:15 PM

CN13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 18:12:49 AM	Start	Execution	GC Oven Temperature Stability	Note - 7880 - Temperature - Open - S: 180.0°C - L: $\pm 0.5^\circ\text{C}$
April 22, 2022 18:13:45 AM	End	Data	GC Oven Temperature Stability	Manual Data Entry - 7880 - Temperature - Open - S: 180.0°C - L: $\pm 0.5^\circ\text{C}$
April 22, 2022 10:13:48 AM	Start	Execution	GC Oven Temperature Stability	Run Count: 1 - 7880 - Temperature - Open - S: 180.0°C - L: $\pm 0.5^\circ\text{C}$
April 22, 2022 10:13:48 AM	Start	Execution	GC Scouting Run - Injection	None Tower: Front SSI, Back FPD - Part of System Preparation - No limits associated
April 22, 2022 10:16:11 AM	End	Data	GC Scouting Run - Injection	Data File Path: Tower: Front SSI, Back FPD - Part of System Preparation - No limits associated
April 22, 2022 10:16:51 AM	End	Execution	GC Scouting Run - Injection	Run Count: 1 Tower: Front SSI, Back FPD - Part of System Preparation - No limits associated
April 22, 2022 10:16:54 AM	Start	Execution	Noise and Drift - Back FPD -	None Detector: FPD - P-Make - L: (Noise) ± 2.00 150 pA - L (Drift) ± 1.50 150 pA/hour
April 22, 2022 10:15:07 AM	End	Data	Noise and Drift - Back FPD -	Data File Path: Detector: FPD - P-Make - L: (Noise) ± 2.00 150 pA - L (Drift) ± 1.50 150 pA/hour
April 22, 2022 10:15:18 AM	End	Execution	Noise and Drift - Back FPD -	Run Count: 1 Detector: FPD - P-Make - L: (Noise) ± 2.00 150 pA - L (Drift) ± 1.50 150 pA/hour

Page 5 / 8

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

เอกสารไม่ควบคุม

Page 17 / 21

User Name: saengathai.sarak
Host Name: LAPTOP-CQ28KQWV
System ID: CN13113001
Print Date: April 22, 2022 2:32:15 PM

CN13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 10:15:23 AM	Start	Execution	Injection Precision - Injection	Run Count: 1 Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:33 AM	Start	Execution	Signal to Noise - Injection	None Tower: Front SSI, Back FPD - Detector: FPD - L: ± 2400
April 22, 2022 10:16:45 AM	End	Data	Signal to Noise - Injection	Data File Path: Tower: Front SSI, Back FPD - Detector: FPD - L: ± 2400
April 22, 2022 10:15:51 AM	End	Execution	Signal to Noise - Injection	Run Count: 1 Tower: Front SSI, Back FPD - Detector: FPD - L: ± 2400
April 22, 2022 1:55:50 PM	Start	Execution	GC Scouting Run - Injection	None Tower: Front SSI, Front FID - Part of System Preparation - No limits associated
April 22, 2022 1:57:30 PM	End	Acquisition	Session	None
April 22, 2022 1:57:32 PM	End	Session	Session	None
April 22, 2022 1:57:37 PM	Start	Execution	GC Scouting Run - Injection	None Tower: Front SSI, Front FID - Part of System Preparation - No limits associated
April 22, 2022 1:57:37 PM	Start	Execution	GC Scouting Run - Injection	None Tower: Front SSI, Front FID - Part of System Preparation - No limits associated
April 22, 2022 1:58:32 PM	End	Data	GC Scouting Run - Injection	Data File Path: Tower: Front SSI, Front FID - Part of System Preparation - No limits associated
April 22, 2022 1:58:50 PM	End	Execution	GC Scouting Run - Injection	Run Count: 1 Tower: Front SSI, Front FID - Part of System Preparation - No limits associated

Page 7 / 8

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

เอกสารไม่ควบคุม

Page 19 / 21

User Name: saengathai.sarak
Host Name: LAPTOP-CQ28KQWV
System ID: CN13113001
Print Date: April 22, 2022 2:32:15 PM

CN13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 10:15:23 AM	Start	Execution	Injection Precision - Injection	None Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:15:43 AM	Start	Execution	Injection Precision - Injection	None Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 10:16:06 AM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Back FPD - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$

Page 8 / 9

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

เอกสารไม่ควบคุม

Page 18 / 21

User Name: saengathai.sarak
Host Name: LAPTOP-CQ28KQWV
System ID: CN13113001
Print Date: April 22, 2022 2:32:15 PM

CN13113001 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 22, 2022 1:55:53 PM	Start	Execution	Noise and Drift - Front FID -	None Detector: FID - L (Noise) ± 0.10 pA - L (Drift) ± 2.50 pA/hour
April 22, 2022 1:56:46 PM	End	Data	Noise and Drift - Front FID -	Data File Path: Detector: FID - L (Noise) ± 0.10 pA - L (Drift) ± 2.50 pA/hour
April 22, 2022 1:59:51 PM	End	Execution	Noise and Drift - Front FID -	Run Count: 1 Detector: FID - L (Noise) ± 0.10 pA - L (Drift) ± 2.50 pA/hour
April 22, 2022 1:59:55 PM	Start	Execution	Injection Precision - Injection	None Tower: Front SSI, Front FID - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 2:00:18 PM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Front FID - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 2:00:18 PM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Front FID - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 2:00:18 PM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Front FID - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$
April 22, 2022 2:00:18 PM	End	Data	Injection Precision - Injection	Data File Path: Tower: Front SSI, Front FID - GC - L (Noise) $\pm 3.00\%$ - L (Rel. Time) $\pm 1.00\%$

Page 8 / 9

Date: April 22, 2022 2:32:15 PM
System ID: CN13113001

เอกสารไม่ควบคุม

Page 20 / 21



Highly Regulated Transactions		Highly Controlled Compliance Review	
Subject	Area Type	Material	603 10,000
		Energy Related	200 10,000
		Subject/Non-Subject	20,000 10,000
Measurements and Results			
Test	Flow		
1000	24.0	1.0	10,000
Actual Measurement	100 10.0	10 subject	1 23 10,000 1
Let's demonstrate a subject on 1.0, actually, actually a subject			
Subject Status	Flow		10,000 1
Control Director Flow Accuracy Test Status			
Flow: _____			

[illegible][illegible][illegible]

Chromatogram showing a single sharp peak at 20.29 minutes. The y-axis is labeled 'Abundance' and ranges from 0 to 1,000,000. The x-axis is labeled 'Time (min)' and ranges from 0 to 24. A small peak is visible at approximately 1.5 minutes. The main peak is labeled with its retention time: 20.29 (20.29, 20.29, 20.29).

[illegible][illegible][illegible][illegible]

GC Oven Temperature

GC Oven Temperature Stability

Purpose

Stability data is obtained after Method 1 is selected. The stability of the oven temperature. Stability is measured as the difference between the highest and lowest oven temperature.

Configuration Details

Sample	Temp
Sample 1	150.0 °C
Sample 2	150.0 °C
Sample 3	150.0 °C
Sample 4	150.0 °C
Sample 5	150.0 °C
Sample 6	150.0 °C
Sample 7	150.0 °C
Sample 8	150.0 °C
Sample 9	150.0 °C
Sample 10	150.0 °C
Sample 11	150.0 °C
Sample 12	150.0 °C
Sample 13	150.0 °C
Sample 14	150.0 °C
Sample 15	150.0 °C
Sample 16	150.0 °C
Sample 17	150.0 °C
Sample 18	150.0 °C
Sample 19	150.0 °C
Sample 20	150.0 °C
Sample 21	150.0 °C
Sample 22	150.0 °C
Sample 23	150.0 °C
Sample 24	150.0 °C
Sample 25	150.0 °C
Sample 26	150.0 °C
Sample 27	150.0 °C
Sample 28	150.0 °C
Sample 29	150.0 °C
Sample 30	150.0 °C
Sample 31	150.0 °C
Sample 32	150.0 °C
Sample 33	150.0 °C
Sample 34	150.0 °C
Sample 35	150.0 °C
Sample 36	150.0 °C
Sample 37	150.0 °C
Sample 38	150.0 °C
Sample 39	150.0 °C
Sample 40	150.0 °C
Sample 41	150.0 °C
Sample 42	150.0 °C
Sample 43	150.0 °C
Sample 44	150.0 °C
Sample 45	150.0 °C
Sample 46	150.0 °C
Sample 47	150.0 °C
Sample 48	150.0 °C
Sample 49	150.0 °C
Sample 50	150.0 °C
Sample 51	150.0 °C
Sample 52	150.0 °C
Sample 53	150.0 °C
Sample 54	150.0 °C
Sample 55	150.0 °C
Sample 56	150.0 °C
Sample 57	150.0 °C
Sample 58	150.0 °C
Sample 59	150.0 °C
Sample 60	150.0 °C
Sample 61	150.0 °C
Sample 62	150.0 °C
Sample 63	150.0 °C
Sample 64	150.0 °C
Sample 65	150.0 °C
Sample 66	150.0 °C
Sample 67	150.0 °C
Sample 68	150.0 °C
Sample 69	150.0 °C
Sample 70	150.0 °C
Sample 71	150.0 °C
Sample 72	150.0 °C
Sample 73	150.0 °C
Sample 74	150.0 °C
Sample 75	150.0 °C
Sample 76	150.0 °C
Sample 77	150.0 °C
Sample 78	150.0 °C
Sample 79	150.0 °C
Sample 80	150.0 °C
Sample 81	150.0 °C
Sample 82	150.0 °C
Sample 83	150.0 °C
Sample 84	150.0 °C
Sample 85	150.0 °C
Sample 86	150.0 °C
Sample 87	150.0 °C
Sample 88	150.0 °C
Sample 89	150.0 °C
Sample 90	150.0 °C
Sample 91	150.0 °C
Sample 92	150.0 °C
Sample 93	150.0 °C
Sample 94	150.0 °C
Sample 95	150.0 °C
Sample 96	150.0 °C
Sample 97	150.0 °C
Sample 98	150.0 °C
Sample 99	150.0 °C
Sample 100	150.0 °C

Stability Data

Time	Temperature	Average	Stdev
1	150.0	150.0	0.00
2	150.0	150.0	0.00
3	150.0	150.0	0.00
4	150.0	150.0	0.00
5	150.0	150.0	0.00
6	150.0	150.0	0.00
7	150.0	150.0	0.00
8	150.0	150.0	0.00
9	150.0	150.0	0.00
10	150.0	150.0	0.00
11	150.0	150.0	0.00
12	150.0	150.0	0.00
13	150.0	150.0	0.00
14	150.0	150.0	0.00
15	150.0	150.0	0.00
16	150.0	150.0	0.00
17	150.0	150.0	0.00
18	150.0	150.0	0.00
19	150.0	150.0	0.00
20			

Table 1. Input Characteristics

Variable	Value	Relative Error	Relative Error
Age (yr)	1020.00	0.0%	Relative Error
HT (cm)	162.0000	0.0%	Relative Error
Weight (kg)	75.00	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error

Figure 1. Results

Figure 1 consists of two scatter plots. The top plot shows the relationship between Age (yr) and HT (cm). The x-axis is labeled 'Age (yr)' and ranges from 0 to 100. The y-axis is labeled 'HT (cm)' and ranges from 150 to 180. The plot shows a positive correlation with a regression line. The bottom plot shows the relationship between Age (yr) and Weight (kg). The x-axis is labeled 'Age (yr)' and ranges from 0 to 100. The y-axis is labeled 'Weight (kg)' and ranges from 50 to 100. The plot shows a negative correlation with a regression line. Both plots include data points and a legend indicating the regression line and the data points.

Table 2. Input Characteristics

Variable	Value	Relative Error	Relative Error
Age (yr)	1020.00	0.0%	Relative Error
HT (cm)	162.0000	0.0%	Relative Error
Weight (kg)	75.00	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error
Relative Error	0.0000	0.0%	Relative Error

Figure 2. Results

Figure 2 consists of two scatter plots. The top plot shows the relationship between Age (yr) and HT (cm). The x-axis is labeled 'Age (yr)' and ranges from 0 to 100. The y-axis is labeled 'HT (cm)' and ranges from 150 to 180. The plot shows a positive correlation with a regression line. The bottom plot shows the relationship between Age (yr) and Weight (kg). The x-axis is labeled 'Age (yr)' and ranges from 0 to 100. The y-axis is labeled 'Weight (kg)' and ranges from 50 to 100. The plot shows a negative correlation with a regression line. Both plots include data points and a legend indicating the regression line and the data points.

[illegible][illegible][illegible]

Acquisition method: **SingleShot_TMS**
 Acquisition method: **MSD_PDA_01**
 Data file: **MSD_PDA01_00001.D**
 Acquisition date: **2014-06-26 17:46:55**

Acquisition parameters:
 Acquisition method: **MSD_PDA_01**
 Data file: **MSD_PDA01_00001.D**
 Acquisition date: **2014-06-26 17:46:55**

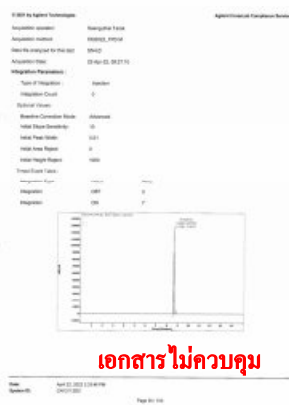
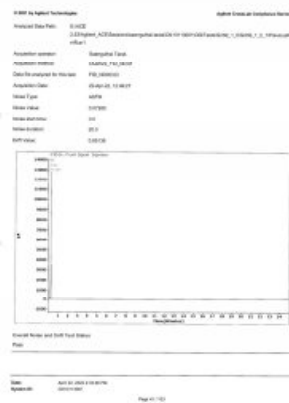
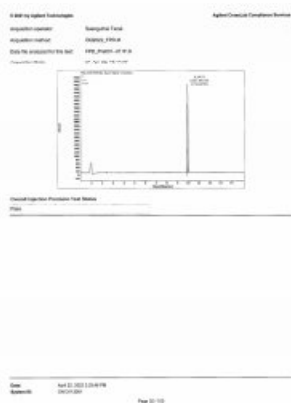
Chromatogram showing a single sharp peak at 1.000 minutes. The y-axis is labeled 'AU' (Absorbance Units) and ranges from 0 to 1000. The x-axis is labeled 'minutes' and ranges from 0 to 2. The peak is labeled '1.000 min' and '1.000 min'.

Agilent 1100 Agilent Technologies
 Agilent model: 1100B, PDA
 Agilent version: 11.00.00.00
 Acquisition Date: 21-Apr-05 16:08:00

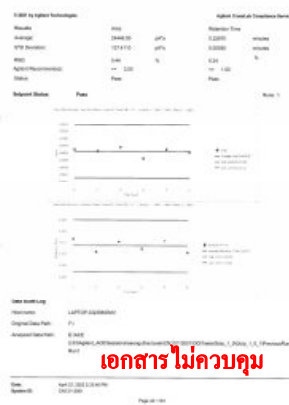
Chromatogram showing a single sharp peak at 16.080 minutes. The y-axis is labeled 'AU' (Absorbance Units) and ranges from 0 to 2. The x-axis is labeled 'Time (min)' and ranges from 0 to 20. The peak is labeled '16.080 min' and '100.00%'. The baseline is stable at approximately 0.1 AU.

Acquisition name: Sample17a.T
 Acquisition method: FID1012_PDA.D
 Data file name: Sample17a.D
 Acquisition Date: 21-Apr-05 16:08:00

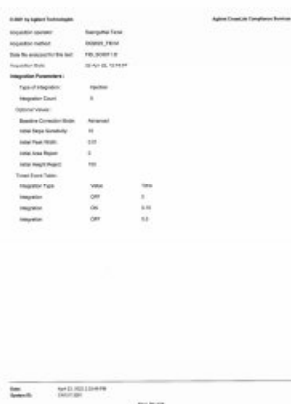
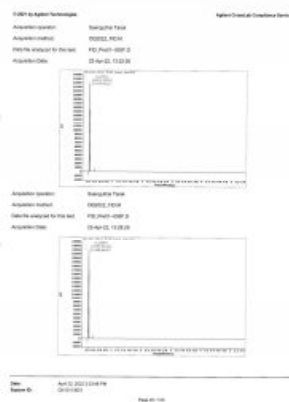
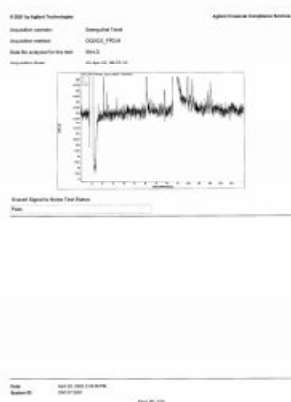
Chromatogram showing a single sharp peak at 16.080 minutes. The y-axis is labeled 'AU' (Absorbance Units) and ranges from 0 to 2. The x-axis is labeled 'Time (min)' and ranges from 0 to 20. The peak is labeled '16.080 min' and '100.00%'. The baseline is stable at approximately 0.1 AU.



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Math & Computer Technology
 Acquisition System: **Emergent Tests**
 Acquisition Method: **ASSET, RASSET**
 Acquisition Path for the Test: **FE_250-2-02.d**
 Acquisition Date: **09/09/01 1:44:34**

Integration Parameters:
 Type of Integration: **Function**
 Integration Cycle: **0**
 Control Value: **Advanced**
 Boolean Condition (Include Only Rows Satisfying): **0**
 Initial Feed Rate: **0.03**
 Initial Delay Rate: **0**
 Average Rate Report: **NO**
 Final Feed Rate: **0**
 Integration Type: **Value**
 Integration: **MIN**
 Integration: **MAX**
 Integration: **MIN**
 Integration: **MAX**
 Integration: **MIN**
 Integration: **MAX**

0 10
 Value
 Integration
 0 10

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[illegible]

Tutoring Activities		English Content and Assessment Results	
Attachments Tutoring materials used: The following online resources and all appropriate guides have been incorporated into the English I Qualification Report (2018). Learning skills resources available on the website include a complete listing for "Study Skills", "Student Communication Skills" (2018), "Writing Skills" (2018), "Information Literacy Skills" (2018), and "Research Skills" (2018). The "Student Communication Skills" (2018) and "Writing Skills" (2018) resources are available on the English I Qualification Report website. The "Student Communication Skills" (2018) and "Writing Skills" (2018) resources are available on the English I Qualification Report website.			
Activity	Resource Name	Page	
ESR	Writing	Writing Skills Qualification Portfolio	10
ESR	Reading	Reading Skills Qualification Portfolio	12
ESR	Reading	Student's Reading Portfolio and Qualification	13
ESR	Reading	Student's Reading Portfolio and Qualification	14
ESR	Reading	Student's Reading Portfolio and Qualification	15
ESR	Reading	Student's Reading Portfolio and Qualification	16
ESR	Test	Confidence of Calculation Qualification	17
ESR	Test	Confidence of Calculation Qualification	18
ESR	Test	Confidence of Calculation Qualification	19
ESR	Test	Confidence of Calculation Qualification	20
ESR	Test	Confidence of Calculation Qualification	21
ESR	Test	Confidence of Calculation Qualification	22
ESR	Test	Confidence of Calculation Qualification	23
ESR	Test	Confidence of Calculation Qualification	24
ESR	Test	Confidence of Calculation Qualification	25
ESR	Test	Confidence of Calculation Qualification	26
ESR	Test	Confidence of Calculation Qualification	27
ESR	Test	Confidence of Calculation Qualification	28
ESR	Test	Confidence of Calculation Qualification	29
ESR	Test	Confidence of Calculation Qualification	30
ESR	Test	Confidence of Calculation Qualification	31

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© 2017 by Ashraf Habibullah *Calibration of Calibration Tools (Worksheet)* Applied Structural Engineers

Worksheet Name: _____ Certificate of Calibration (see Worksheet)

Trescal

— Certificate of Calibration —




INTERNATIONAL CERTIFICATION OF ACCURACY (NIST-TRACEABLE)
 Test Method: **ASCE 101**
 Test Item: **Calibration**

Item: **Calibration**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by: **ASCE 101**

Calibration Date: **10/1/2017**

Calibration Due Date: **10/1/2018**

Reference: **ASCE 101**

Parameter	Unit	Value
Temperature	°C	20.0
Humidity	%	50

Serial/Component: **101-000-000**

Lot: **101-000-000**

Calibrated by:

Document Title: Technical Specification of Trescal Product

Document Date: 15/05/2015

Document Author: นาย ธีรพงศ์ (Mr. Theerapong)

Document Version: 1.0

Document Status: Draft

Document Content Summary: The document describes the Trescal product, which is a high-performance, low-cost, and easy-to-use solution for various applications. It highlights the product's features, benefits, and usage instructions. The document is signed by Mr. Theerapong on 15/05/2015.

Document Footer: 15/05/2015

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

[illegible][illegible]

Applied Chemical Technology

Course: Applied Chemical Technology
 Discipline: Chemistry
 Qualification: Certificate of Qualification / Technician

CERTIFICATE OF CALIBRATION

No. _____
 Date of Issue: 30th Aug 2021

Equipment: _____
Serial No: 604040401

Calibration: _____
Due Date: 30th Sep 2021
Calibrated by: _____
Checked by: _____

Measurement: _____
Measurement uncertainty: _____

Measurement results: _____

Calibration results: _____

Calibration results table:

Parameter	Measured Value	Accepted Value	Uncertainty	Remarks
Length	10.00	10.00	±0.01	OK
Mass	10.00	10.00	±0.01	OK
Volume	10.00	10.00	±0.01	OK
Temperature	10.00	10.00	±0.01	OK
Pressure	10.00	10.00	±0.01	OK
Humidity	10.00	10.00	±0.01	OK
Concentration	10.00	10.00	±0.01	OK
Viscosity	10.00	10.00	±0.01	OK
Refractive Index	10.00	10.00	±0.01	OK
Surface Tension	10.00	10.00	±0.01	OK
Electrical Resistance	10.00	10.00	±0.01	OK
Electrical Conductivity	10.00	10.00	±0.01	OK
Electrical Capacitance	10.00	10.00	±0.01	OK
Electrical Inductance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admittance	10.00	10.00	±0.01	OK
Electrical Impedance	10.00	10.00	±0.01	OK
Electrical Reactance	10.00	10.00	±0.01	OK
Electrical Susceptance	10.00	10.00	±0.01	OK
Electrical Admitt				

Document Name: Calibration of Calibration Thermocouple

Author: [Blank]

Date: [Blank]

Page 13 / 13

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Highest Grade on Transduction Probe

Student Name _____

Certification of Calibration Transduction Probe

CERTIFICATE OF CALIBRATION

Case No. 1234567
Date of Issue: 07 June 2023

Case Name: Transduction Probe
Type: Calibration Certificate

Customer Name: _____
Customer Address: _____
Customer Phone: _____

Issue Date: 07 June 2023
Valid Until: 07 June 2024

The following table contains the calibration data for the transduction probe. The accuracy of the calibration is guaranteed for the duration of the validity period. The calibration data is valid for the duration of the validity period.

Calibration Data (mV)		Temperature (°C)		Resistance (kΩ)		Voltage (V)	
Probe	Value	Probe	Value	Probe	Value	Probe	Value
1	100.0	2	20.0	3	10.0	4	5.0
5	2.5	6	1.25	7	0.625	8	0.3125
9	0.15625	10	0.078125	11	0.0390625	12	0.01953125

The calibration data is valid for the duration of the validity period. The calibration data is valid for the duration of the validity period.

Notes:

- The calibration data is valid for the duration of the validity period.
- The calibration data is valid for the duration of the validity period.

Signature of the Calibration Engineer

Date of Issue

1-800-875-5428 for Support Technologies
 Applied Control and Construction Products
 Document Name: Certification of Calibration: Transomate Plus

 Date: April 22, 2002 12:00 PM
 Station ID: 2001010101
 Page 1 of 1

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[illegible]

Document Name	Continuation of Calibration Temperature Process	Adapt Clinical Use Instructions Process
		
		<i>Legal Property</i> © 2012

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The screenshot shows a document titled "Exhibit B of Analysis" with a subtitle "200-000, Sample". The document is dated "2000-000" and is labeled "Page 1 of 10". The document is a "Table of Contents" and lists the following sections:

- 1. Introduction
- 2. Methodology
- 3. Results
- 4. Discussion
- 5. Conclusion
- 6. References
- 7. Appendix

The document is a "Table of Contents" and lists the following sections:

- 1. Introduction
- 2. Methodology
- 3. Results
- 4. Discussion
- 5. Conclusion
- 6. References
- 7. Appendix

The document is a "Table of Contents" and lists the following sections:

- 1. Introduction
- 2. Methodology
- 3. Results
- 4. Discussion
- 5. Conclusion
- 6. References
- 7. Appendix

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10.01 The Agilest Technologies <i>Exercise</i>		Agilest Compliance Integration Framework	
Exercise Name:		Classification of System Classification:	
<div>  Agilest Technologies Agilest Compliance Engine Self Qualification Version: 1.0.0.0 (2023-01-01) </div>			
Product Name:		Product Version:	
Agilest		1.0.0.0	
Product Type:		Product Category:	
Compliance		Compliance	
Product Description:		Product Features:	
Agilest Compliance Engine (ACE) is a self-qualifying compliance engine that provides a comprehensive set of tools and services for organizations to manage their compliance requirements.		- Self-qualifying compliance engine - Comprehensive set of tools and services - Agilest Compliance Engine (ACE)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:		Product Version History:	
1.0.0.0 (2023-01-01)		1.0.0.0 (2023-01-01)	
Product Version History:			

เอกสารไม่ควบคุม

© 2004 by Springer-Verlag Berlin Heidelberg				Mathematical Control and Optimization Series	
ISBN 3-540-23492-5 ISBN 0-387-02349-2				Springer-Verlag Berlin Heidelberg New York (2004) 234 pages, 120 illustrations	
AMS 2000 Classification: 35P30, 35B45, 35B65, 35B99, 35D30, 35D40, 35D55, 35D60, 35D65, 35D70, 35D80, 35D90, 35D95, 35F00, 35F10, 35F15, 35F20, 35F25, 35F30, 35F35, 35F40, 35F45, 35F50, 35F55, 35F60, 35F65, 35F70, 35F75, 35F80, 35F85, 35F90, 35F95, 35G00, 35G05, 35G10, 35G15, 35G20, 35G25, 35G30, 35G35, 35G40, 35G45, 35G50, 35G55, 35G60, 35G65, 35G70, 35G75, 35G80, 35G85, 35G90, 35G95, 35H00, 35H05, 35H10, 35H15, 35H20, 35H25, 35H30, 35H35, 35H40, 35H45, 35H50, 35H55, 35H60, 35H65, 35H70, 35H75, 35H80, 35H85, 35H90, 35H95, 35J00, 35J05, 35J10, 35J15, 35J20, 35J25, 35J30, 35J35, 35J40, 35J45, 35J50, 35J55, 35J60, 35J65, 35J70, 35J75, 35J80, 35J85, 35J90, 35J95, 35K00, 35K05, 35K10, 35K15, 35K20, 35K25, 35K30, 35K35, 35K40, 35K45, 35K50, 35K55, 35K60, 35K65, 35K70, 35K75, 35K80, 35K85, 35K90, 35K95, 35L00, 35L05, 35L10, 35L15, 35L20, 35L25, 35L30, 35L35, 35L40, 35L45, 35L50, 35L55, 35L60, 35L65, 35L70, 35L75, 35L80, 35L85, 35L90, 35L95, 35M00, 35M05, 35M10, 35M15, 35M20, 35M25, 35M30, 35M35, 35M40, 35M45, 35M50, 35M55, 35M60, 35M65, 35M70, 35M75, 35M80, 35M85, 35M90, 35M95, 35N00, 35N05, 35N10, 35N15, 35N20, 35N25, 35N30, 35N35, 35N40, 35N45, 35N50, 35N55, 35N60, 35N65, 35N70, 35N75, 35N80, 35N85, 35N90, 35N95, 35O00, 35O05, 35O10, 35O15, 35O20, 35O25, 35O30, 35O35, 35O40, 35O45, 35O50, 35O55, 35O60, 35O65, 35O70, 35O75, 35O80, 35O85, 35O90, 35O95, 35P00, 35P05, 35P10, 35P15, 35P20, 35P25, 35P30, 35P35, 35P40, 35P45, 35P50, 35P55, 35P60, 35P65, 35P70, 35P75, 35P80, 35P85, 35P90, 35P95, 35Q00, 35Q05, 35Q10, 35Q15, 35Q20, 35Q25, 35Q30, 35Q35, 35Q40, 35Q45, 35Q50, 35Q55, 35Q60, 35Q65, 35Q70, 35Q75, 35Q80, 35Q85, 35Q90, 35Q95, 35R00, 35R05, 35R10, 35R15, 35R20, 35R25, 35R30, 35R35, 35R40, 35R45, 35R50, 35R55, 35R60, 35R65, 35R70, 35R75, 35R80, 35R85, 35R90, 35R95, 35S00, 35S05, 35S10, 35S15, 35S20, 35S25, 35S30, 35S35, 35S40, 35S45, 35S50, 35S55, 35S60, 35S65, 35S70, 35S75, 35S80, 35S85, 35S90, 35S95, 35T00, 35T05, 35T10, 35T15, 35T20, 35T25, 35T30, 35T35, 35T40, 35T45, 35T50, 35T55, 35T60, 35T65, 35T70, 35T75, 35T80, 35T85, 35T90, 35T95, 35U00, 35U05, 35U10, 35U15, 35U20, 35U25, 35U30, 35U35, 35U40, 35U45, 35U50, 35U55, 35U60, 35U65, 35U70, 35U75, 35U80, 35U85, 35U90, 35U95, 35V00, 35V05, 35V10, 35V15, 35V20, 35V25, 35V30, 35V35, 35V40, 35V45, 35V50, 35V55, 35V60, 35V65, 35V70, 35V75, 35V80, 35V85, 35V90, 35V95, 35W00, 35W05, 35W10, 35W15, 35W20, 35W25, 35W30, 35W35, 35W40, 35W45, 35W50, 35W55, 35W60, 35W65, 35W70, 35W75, 35W80, 35W85, 35W90, 35W95, 35X00, 35X05, 35X10, 35X15, 35X20, 35X25, 35X30, 35X35, 35X40, 35X45, 35X50, 35X55, 35X60, 35X65, 35X70, 35X75, 35X80, 35X85, 35X90, 35X95, 35Y00, 35Y05, 35Y10, 35Y15, 35Y20, 35Y25, 35Y30, 35Y35, 35Y40, 35Y45, 35Y50, 35Y55, 35Y60, 35Y65, 35Y70, 35Y75, 35Y80, 35Y85, 35Y90, 35Y95, 35Z00, 35Z05, 35Z10, 35Z15, 35Z20, 35Z25, 35Z30, 35Z35, 35Z40, 35Z45, 35Z50, 35Z55, 35Z60, 35Z65, 35Z70, 35Z75, 35Z80, 35Z85, 35Z90, 35Z95, 35A00, 35A05, 35A10, 35A15, 35A20, 35A25, 35A30, 35A35, 35A40, 35A45, 35A50, 35A55, 35A60, 35A65, 35A70, 35A75, 35A80, 35A85, 35A90, 35A95, 35B00, 35B05, 35B10, 35B15, 35B20, 35B25, 35B30, 35B35, 35B40, 35B45, 35B50, 35B55, 35B60, 35B65, 35B70, 35B75, 35B80, 35B85, 35B90, 35B95, 35C00, 35C05, 35C10, 35C15, 35C20, 35C25, 35C30, 35C35, 35C40, 35C45, 35C50, 35C55, 35C60, 35C65, 35C70, 35C75, 35C80, 35C85, 35C90, 35C95, 35D00, 35D05, 35D10, 35D15, 35D20, 35D25, 35D30, 35D35, 35D40, 35D45, 35D50, 35D55, 35D60, 35D65, 35D70, 35D75, 35D80, 35D85, 35D90, 35D95, 35E00, 35E05, 35E10, 35E15, 35E20, 35E25, 35E30, 35E35, 35E40, 35E45, 35E50, 35E55, 35E60, 35E65, 35E70, 35E75, 35E80, 35E85, 35E90, 35E95, 35F00, 35F05, 35F10, 35F15, 35F20, 35F25, 35F30, 35F35, 35F40, 35F45, 35F50, 35F55, 35F60, 35F65, 35F70, 35F75, 35F80, 35F85, 35F90, 35F95, 35G00, 35G05, 35G10, 35G15, 35G20, 35G25, 35G30, 35G35, 35G40, 35G45, 35G50, 35G55, 35					

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NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1

NFI Calibration Certificate					
No.	Equipment	Model	Serial No.	Calibration Date	Calibration Interval
1	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
2	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
3	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
4	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
5	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
6	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
7	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
8	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
9	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months
10	Electronic Balance	AB204-S	1128312528	2021-11-24	12 Months

Date: 2021-11-24 10:00 AM
Page 1 of 1



Calibration Certificate

Certificate No.: 2200704-001-01
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: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S

Serial No.: 1128312528

ID No.: UAE.AIR.019/2550

Order No.: 2200704

Operation No.: 2200704-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by: Mr. Wrasop Sooktong
Scientist

Approved by: [Signature]
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 30 November 2021

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 reissued other than in full, except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2200704-001-01
Equipment: Electronic Balance
Model: AB204-S
Serial No.: 1128312528
Capacity: 200 g
Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE.AIR.019/2550

Date of Calibration: 24 November 2021

Page 2 of 5

Environment Condition: Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 40 ± 2.5 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	830064054	TCS	PQ010975	12 January 2022
Standard Weight Class E2	1-500g	8300640128	TCS	PQ010985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-hydro Meter	11A1	now ul. 87H 003/55	Quality Reborn	QK21-0207	15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
10	0.00000
20	0.00000

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9999	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

Calibration Report

Certificate No.: 2200704-001-01

Equipment:

Model: A8204-S

Serial No.: 1128312528

Capacity: 200 g

Manufacturer: Mettler Toledo

Resolution: 0.0001 g

ID No.: UAE-AR-019/2550

Date of Calibration: 24 November 2021

Page 3 of 5

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Test Weight by filter pan)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.0000	0.0000	0.0000	0.000042	2.00
0.1	0.1000	0.1010	0.0009	0.000042	2.00
0.5	0.5000	0.5000	0.0000	0.000042	2.00
1	1.0000	1.0000	0.0000	0.000042	2.00
5	5.0000	5.0000	0.0000	0.000043	2.00
10	10.0000	10.0000	0.0000	0.000043	2.00
20	20.0000	20.0000	0.0000	0.000043	2.00
50	50.0000	50.0000	0.0000	0.000044	2.00
100	100.0000	100.0000	0.0000	0.000045	2.00
150	150.0000	150.0000	0.0000	0.000046	2.00
200	200.0000	200.0000	0.0000	0.000049	2.00

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200704-001-01

Equipment:

Model: A8204-S

Serial No.: 1128312528

Capacity: 200 g

Manufacturer: Mettler Toledo

Resolution: 0.0001 g

ID No.: UAE-AR-019/2550

Date of Calibration: 24 November 2021

Page 5 of 5

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.0000	0.0000	0.0000	0.000042	2.00
0.1	0.1000	0.1000	0.0000	0.000042	2.00
0.5	0.5000	0.5000	0.0000	0.000042	2.00
1	1.0000	1.0000	0.0000	0.000043	2.00
5	5.0000	5.0000	0.0000	0.000044	2.00
10	10.0000	10.0000	0.0000	0.000045	2.00
20	20.0000	20.0000	0.0000	0.000046	2.00
50	50.0000	50.0000	0.0000	0.000047	2.00
100	100.0000	100.0000	0.0000	0.000048	2.00
150	150.0000	150.0000	0.0000	0.000049	2.00
200	200.0000	200.0000	0.0000	0.000052	2.00

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

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200704-001-01

Equipment:

Model: A8204-S

Serial No.: 1128312528

Capacity: 200 g

Manufacturer: Mettler Toledo

Resolution: 0.0001 g

ID No.: UAE-AR-019/2550

Date of Calibration: 24 November 2021

Page 4 of 5

Environment Condition: Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 43 ± 2.5 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1-50mg 859008154 TCS M21010975 12 January 2022

Standard Weight Class E2 1-500g 859008128 TCS M21010985 13 January 2022

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hugo Meter 11A1 aem.kil BTH 853/55 Quality Network QK21-0207 15 February 2022

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

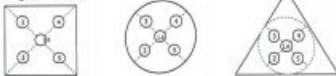
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.00003
200	0.00003

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9990	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2200708-001-01

Client name:

Address:

2200708-001-01

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

3 Soi Udomsuk 41, Sukhumvit Road,

Bangchack, Prakhonong, Bangkok 10260

Equipment:

Electronic Balance

Manufacturer:

METTLER TOLEDO

Model:

AX 105 DR

Serial No.:

1122100406

ID No.:

UAE.WAO.004/2546

Order No.:

2200708

Operation No.:

2200708-001

Date of Receipt:

24 November 2021

Date of Calibration:

24 November 2021

Calibrated by Mr. Worapob Sookkong

Scientist

Approved by

(Mr. Worapob Sookkong)

Manager, Division of Calibration Laboratory

Date of Issue: 30 November 2021

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 reissued other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2200706-001-01

Equipment: Electronic Balance
Model: XP205
Serial No.: 874805497
Capacity: 220 gManufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE/CA/004/2361

Date of Calibration: 24 November 2021

Page 2 of 3

Environment Condition: Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %
Place of Calibration: 306 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-000mg	830800554	TCS	P02019975	12 January 2022
Standard Weight Class E2	1-500g	8308005128	TCS	P02019985	12 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PORTE 400	NFI.BTH 001/17	Quality Relation	Q021-0209	15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
190	0.00003
200	0.00004

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9996	49.9999	49.9998	49.9999	49.9999	49.9999	0.0001

F-C5-012 Revision: 00 Date: 14-12-61



Calibration Report

Certificate No.: 2200706-001-01

Equipment: Electronic Balance
Model: XP205
Serial No.: 874805497
Capacity: 220 gManufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE/CA/004/2361

Date of Calibration: 24 November 2021

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor F
Unloaded	0.0000	0.0000	0.0000	0.000009	2.08
0.001	0.0010	0.0010	0.0000	0.000009	2.08
0.01	0.0100	0.0100	0.0000	0.000009	2.08
0.1	0.1000	0.1000	0.0000	0.000009	2.08
1	0.9999	1.0000	0.0001	0.000009	2.08
10	9.9999	10.0000	0.0001	0.000009	2.08
20	19.9999	19.9999	0.0001	0.000009	2.08
40	39.9999	39.9999	0.0001	0.000011	2.08
50	49.9999	49.9999	0.0001	0.000012	2.08
70	69.9999	69.9997	0.0002	0.000014	2.08
90	89.9999	89.9999	0.0000	0.000016	2.08
100	100.0000	100.0000	0.0000	0.000017	2.08
120	109.9999	110.0000	0.0001	0.000018	2.08
140	119.9999	119.9999	0.0001	0.000019	2.08
150	149.9999	149.9999	-0.0001	0.000020	2.08
170	169.9999	170.0000	-0.0001	0.000020	2.08
200	200.0000	199.9997	0.0003	0.000020	2.08

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

----- End -----

F-C5-012 Revision: 00 Date: 14-12-61

55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

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

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

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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only complete/printout 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 a "X" or tick mark "✓" in the checkbox. Add hand written "additional details" if required.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM Service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Issued: 29-Jun-2016

Revision: 8.0

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Page 1 of 10

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55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard

System Information

Instrument System Name/ID:	Instrument Location:
AA-240E	UAE
Record the list of system component product numbers below.	List the serial numbers of the components present in the system below.
1. 81451A	1. 81451000
2. 81451A	2. 81451000
3. 81451A	3. 81451000
4. 81451A	4. 81451000
5. 81451A	5. 81451000
6. 81451A	6. 81451000
7. 81451A	7. 81451000
8. 81451A	8. 81451000
9. 81451A	9. 81451000
10. 81451A	10. 81451000

Guidance:

- Check box if instrument configuration report is attached instead of completing the table above.

Preparation, Safe operation and Initial performance checks

- Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).
- NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Check for required firmware updates and verify with customers if they would like it installed.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- Discuss any specific issues with the customer prior to starting.
- Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- Perform a Basic Cu ABS test - "As found test_2"
- Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Page 2 of 10

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FLAME SYSTEM section

☒ Section NOT Applicable

Electronic components

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

Mechanical components

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

Optics components

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

Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.

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FURNACE SYSTEM section

☐ Section NOT Applicable

Electronic components

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

Mechanical components

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

Optic components

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

Gas handling, water system and workhead component checks

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

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- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bang releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

เอกสารไม่ควบคุม



Analytical performance for Furnace systems

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

PSD autosampler accessory for Furnace systems

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

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☒ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☒ Adjust each roller so that it rotates freely.
- ☒ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☒ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☒ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☒ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☒ Check clips securing the diluents holder and replace if necessary.
- ☒ Disconnect, clean T-piece, and reassemble the tubing using the following steps.
 - ☒ Remove the T-pieces by disconnecting the pump tubes, the pump bands and all other tubing.
 - ☒ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
 - ☒ Wash the T-piece under a tap with a strong flow of water.
 - ☒ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
 - ☒ Reassemble.

Sample preparation system (SPS 4) accessory

- ☒ Section NOT Applicable
- The Agilent SPS 4 autosampler is designed to need minimal maintenance. The following maintenance requirements are suggested to maintain the performance of the autosampler.
- ☒ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.

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55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard

- Cleaning the autosampler cover panels with domestic window cleaner.
- Checking the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

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

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

Sample preparation system (SPS 3) accessory☒ Section NOT Applicable

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

Vapor generation accessory VGA (hydride generator)☒ Section NOT Applicable

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

UltrAA lamp accessory (external)☒ Section NOT Applicable

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

เอกสารไม่ควบคุม

55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard**AA consumable and parts list table**

Part Description	Part Number	Product/Manufacturer	PM supplied or consumable
Test Solution - Cu Spgem solution	6610030100	50 55 140 240 280	PM supplied
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*
Kit: MB 7 O-rings, aqueous, complete set	9910063400	50 55 140 240 280	PM supplied
Organic Kit	9910063500	50 55 140 240 280	PM supplied
Wire Nebulizer Cleaning	9910034700	50 55 140 240 280	consumable
Tubing-Capillary Std Nets	8910024800	50 55 140 240 280	consumable
Capillary Tube Filter: Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable
Glass impact beads (5/µ)	8910025700	50 55 140 240 280	consumable
Teflon impact beads (5/µ): (organics only)	9910063300	50 55 140 240 280	consumable
Burner cleaning strip (100/µ)	9910063800	50 55 140 240 280	consumable
Window UV silica - round (right side)	2010082600	50 55 140 240 280	PM supplied
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied
Pad adhesive window - round	4910012700	50 55 140 240 280	PM supplied
Pad adhesive window - rectangular	4910012800	50 55 140 240 280	PM supplied
Electrode kit (1 pr) (D2)	6510003400	GTA120	PM supplied
Shroud (D2)	6510003100	GTA120	PM supplied
Zeeman electrode kit (1 pr)	6510003500	GTA120	PM supplied
Zeeman shroud	6510003600	GTA120	PM supplied
O-ring: PSD rinse bottle	6610025000	PSD120	PM supplied

NOTE:

Items classified as PM supplied in the above table are included in the standard PM. Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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

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55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard**Restore system**

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

Guidance:

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

Service Review

- Attach available reports/printouts of all tests to this documentation.
- Record the PM service activity in the customer's instrument 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 Review Comments section below if there are additional comments.
- Review the service and any test results with the customer.
- If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

AA PM Performance test results and measurements table

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	< 55 %	—
Flame performance test with 5 ppm copper sample		
Air/acetylene, mixing paddle removed	Abs value > 0.5	—
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	—
Furnace optics PMT Gain test		
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	< 55 %	45
Furnace performance test with 25 ppb copper sample		
Precision %RSD	≤ 4.0	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample		
Precision %RSD	≤ 4.0	1.5
Abs value	≥ 0.15	0.145 0.109 0.103

เอกสารไม่ควบคุม

55 240 280 Series Atomic Adsorption Spectroscopy
System Preventive Maintenance Checklist - Standard**Service Engineer Comments****Other Important Customer Web Links**

How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
Need to know more? - www.agilent.com/chem/education
Need technical support? - www.agilent.com/chem/techsupport
Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service Request no. [REDACTED]

Agilent Signature: [REDACTED]

Total no. of pages for this document: 10

เอกสารไม่ควบคุม

SVD Results Report



Report ID: 1 Diagnostic Start Time: 9/15/2021 9:42:05 AM Diagnostic End Time: 9/15/2021 10:29:49 AM
Customer: UAE Service Engineer: Khunghol
Address: BKK Contact Details: 02-6376363

Instrument Configuration

Configuration:

Serial Number: MY18130003 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: False Mono Type: Automatic
Furnace Instrument: True Gasbox Type: No Gas Box
Zeeman Present: True Auto Burner Adjuster: False
Internal Zeeman: True Mains Frequency: 50
Internal UltraAA: True Firmware Version: 2.12
Optics Type: Single Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: False PWB Version: 181
Boot Block Version: 2.02

EEPROM Data:

Instrument Run Hours: 12971.967 D2 Run Hours: 0.000
Zero Wavelength Offset: D2 Serial Number: not set 1
Mono Correction: D2 Install Date: 1/1/1970
Flame Hours: 0.000 D2 Original Intensity: 1.000
D2 Last Intensity: 1.000

Frequency:

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

Result: **Passed**

Report Generated At: 9/15/2021 10:30:14 AM

1

SVD Results Report SVD
เอกสารไม่ควบคุม

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.10	13.20	Passed
-12.00 V Rail	-13.20	-11.80	-10.80	Passed
5.00 V Rail	4.50	5.00	5.50	Passed
310.00 V Rail	279.00	318.00	341.00	Passed

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2

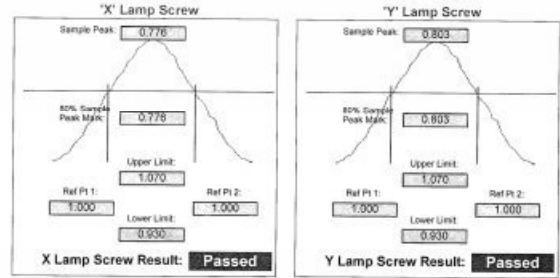
SVD Results Report SVD
เอกสารไม่ควบคุม

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.66	325.15	Passed
Second Order	649.23	649.66	649.97	Passed

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3

SVD Results Report SVD
เอกสารไม่ควบคุม

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: **Performed**

Lower Limit(nm)	324.604	324.724	Upper Limit(nm)
(Approach from Zero Order)			
Sample 1:	324.664		Sample 2: 324.660
Sample 3:	324.660		Sample 4: 324.660
Sample 5:	324.664		Sample 6: 324.660
Sample 7:	324.660		Sample 8: 324.664
Sample 9:	324.664		Sample 10: 324.664

Mean: 324.662

Standard Deviation: 0.002

Result: **Passed**

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4

SVD Results Report SVD
เอกสารไม่ควบคุม

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	199	297	Passed
S1	158	168	191	Passed
S2	271	299	332	Passed
S3	474	514	579	Passed
S4	825	930	1006	Passed
S5	1435	1548	1754	Passed
S6	2498	2795	3053	Passed
S7	4347	4753	5313	Passed

Interlocks:

Burner Fitted:	Untested	Flame Detect:	Untested
N2O Burner Fitted:	Untested	GCU Active:	Untested
Flame Shield Closed:	Untested	Oxidant Pressure:	Untested
Gas Control Fitted:	Untested	Oxidant Changeover:	Untested
Pressure Release Bung Fitted:	Untested	Ignition:	Untested
Liquid Trap Fitted:	Untested		

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5

SVD Results Report

เอกสารไม่ควบคุม

SpectraAA Report.

4:58 PM 10/1/2021

Page 1 of 2

Analyst:
Date Started: 2:12 PM 10/1/2021 GMT: 7:12 AM 10/1/2021
Worksheet: Test Cu (2)
Comment:
Methods: Cu Pb
Computer name: DESKTOP-LUNGLIE
Serial Number: MY-18135653

Method: Cu (Zeeman)

Element - Matrix: Cu - Zeeman
Instrument Type: ug/L
Conc. Units: ug/L
Instrument Mode: Absorbance
Sampling Mode: Autosomal
Calibration Mode: Concentration
Measurement Mode: Peak Height
Replicates Standard: 2
Replicates Sample: 2

Separation Factor: 1.0
Minimum Reading: Disabled
Smoothing: 7 point
Conc. Dec. Places: 2

Wavelength: 327.4 nm
Slit Width: 0.5 nm
Gain: 58 %
Lamp Current: 4.0 mA
Lamp Position: 1
Background Correction: IBC On

STANDARD 1: 15.00 ug/L
STANDARD 2: 30.00 ug/L
STANDARD 3: 45.00 ug/L
Restlope Rate: 10
Restlope Standard No.: 2
Restlope Lower Limit: 75.0 %
Restlope Upper Limit: 125.0 %
Recalibration Rate: 20
Calibration Algorithm: Linear
Cal. Lower Limit: 25.0 %
Cal. Upper Limit: 150.0 %

Workhead Height: 0.0 mm
Total Volume: 15 uL
Sample Volume: 10 uL
Vol. Reduction Factor: 2
Bulk Conc.: 30.00 ug/L
Bulk Vial No.: 49
Makeup Vial No.: 50
Sample No. of Injections: 1
Sample Last Dry Step: 1

Step	Temp (C)	Time (s)	Flow (L/min)	Gas Type	Read	Signal Storage
1	85	5.0	0.3	Normal	No	No
2	95	40.0	0.3	Normal	No	No
3	120	10.0	0.3	Normal	No	No

เอกสารไม่ควบคุม
1-0015-0021

Auto Lamp Recognition:

Lamp 1: 70 - Sodium/Potassium (Na/K)	Lamp 5: Not Supported
Lamp 2: 3 - Arsenic (As)	Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu)	Lamp 7: Not Supported
Lamp 4: 21 - Gold (Au)	Lamp 8: Not Supported

Result: Passed

GTA Temperature Monitoring:

Performed

Notes:

PM

Signatures:

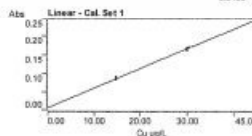
UAE _____ Date _____
Khunphol _____ Date _____

SpectraAA Report.

4:58 PM 10/1/2021

Page 2 of 2

Sample ID	Conc. ug/L	%RSD	SD	Mean Abs	80 Abs
CAL ZERO	0.00	16.3	0.0009	0.0057	0.0050
STANDARD 1	15.00	7.6	0.0065	0.0853	0.0862
STANDARD 2	30.00	4.2	0.0092	0.1634	0.0845
STANDARD 3	45.00	1.9	0.0048	0.2463	0.0942
	0.2430				
	0.2465				



Curve Fit: Linear
Characteristic Conc: -0.15 ug/L
r: 0.9999
Calculated Conc: 0.09 15.00 29.67 45.21
Residuals: -0.09 -0.03 0.33 -0.21

Abs = 0.0053 x C + 0.00518

Sample 001	30.67	2.5	0.0042	0.1687	0.0837
	Readings				
	0.1657		0.1717		

เอกสารไม่ควบคุม
1-0015-0021

Report Generated At: 9/15/2021 10:30:14 AM

6

SVD Results Report

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP-OES 5100 v01
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 8115A	1. MY 11150221
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass other
Torch	Radial Dual View other
Injector Diameter	2.4mm 0.8mm 1.4mm 0.8mm other
Injector Material	Quartz Ceramic other

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

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

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- Discuss any specific questions or issues with the customer prior to starting.
- Review the instrument logbook.
- Perform general external inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware/software updates and verify with customers if they would like it installed.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the 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.
- Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- Section 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 Polyclear Plus cooling fluid.
- Clean the cooling system Air filter and the condenser.

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

- ☒ Section 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 rack 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

- ☒ Section 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

AVS 4, 6, 7

- ☒ Section 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

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and 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 and record the result in the Instrument Test Results Table
 - ☒ Subsystem Communications Test
 - ☒ Air Flow

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Page 4 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

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	115.113 VAC	196.510 VAC
Mains Current	8.119 A	3.131 A
Instrument Temperature	13.4 °C	13.5 °C
RF Air Flow (sensor speed)	16.8 Hz	19.8 Hz
Plasma Exhaust Temperature	No measurement	55.0 °C
Water Flow Oscillator	No measurement	1.43 L/min
Water Flow Detector	8.80 L/min	1.33 L/min
Water Inlet Temperature	19.1 °C	13.8 °C
Polychromator Temperature	35.8 °C	35.0 °C
CCD Temperature	16.9 °C	-39.3 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	614.15 kPa	619.53 kPa
Purge Gas Supply Pressure*1	61.134 kPa	616.13 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	9.40 L/min
Nebulizer Back Pressure	No measurement	165.85 kPa
Plasma Gas Flow	No measurement	15.80 L/min
Auxiliary Gas Flow	No measurement	1.28 L/min
RF Power	No measurement	1201.1 W
RF Supply Current	No measurement	3.23 A
RF Supply Voltage	No measurement	196.510 V

*1 If option installed

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Page 6 of 8

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เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

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	4.013.3	1.151.1	4.191.3	1.118.3
Mn 257.610 nm SRBR	11.415.1	31.194.3	11.991.6	31.412.1
Al 396.152 nm SBR	3.3	15.3	4.3	13.3
K 766.491 nm SBR	5.3	31.9	5.3	99.3

* 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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Page 5 of 8

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เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A, G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	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-T port valve for AVS6/7	G8404-60002	G8404A, G8405	—
Rotor seal for 4 port valve for AVS4	G8403-60002	G8403A	—
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 engineers 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	—

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

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

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

Issued: 4 March 2021, Revision: A.01

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Page 7 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist



- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

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.

Other Important Customer Web Links

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes-literature>
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 800453115 Date service completed 04/12/21

Agilent signature Nukoon L. Customer signature Aphorn Onkong

Document part number: G8014-90075

Issued: 4 March 2021, Revision: A.01

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Page 8 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	6.23	
C (193.027 nm)	≤ 11.50	8.28	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.158 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.568 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.06	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (614.171 nm)	≤ 42.00	24.99	
Ar (676.263 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

Page 2 of 4

เอกสารไม่ควบคุม

Page 1 of 4

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY1803001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/8/2021 9:14:59 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	Pass
Precision Test	Pass

Page 1 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4	
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2	
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6	
Pb (220.353 nm)	≥ 48.0	SRBR	191.1	2682.8	172.6	
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8	
Al (306.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5	
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17096.5	
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0	
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2	
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7	
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9	
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4	
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	956.2	
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4	
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1	
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374903.6	7249.0	
Al (306.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4	
Ba (493.408 nm)	≥ 60.0	SBR	209.7	1089956.6	51728.3	
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	1.21	
Zn (213.857 nm)	≤ 1.50	0.39	
Pb (220.353 nm)	≤ 2.60	0.41	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.41	
Ba (493.408 nm)	≤ 1.50	0.51	
K (766.491 nm)	≤ 1.50	0.36	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.51	
Se (196.026 nm)	≤ 1.50	0.73	
Zn (213.857 nm)	≤ 1.50	0.30	
Zn (213.857 nm)	≤ 1.50	0.37	
Cd (214.439 nm)	≤ 1.50	0.36	
Pb (220.353 nm)	≤ 1.50	0.28	
Mn (257.610 nm)	≤ 1.50	0.63	
Cr (287.716 nm)	≤ 1.50	0.30	
Cu (324.754 nm)	≤ 1.50	0.54	
Al (396.152 nm)	≤ 1.50	0.45	
Ba (493.408 nm)	≤ 1.50	0.64	
K (766.491 nm)	≤ 1.50	0.56	

Page 4 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.22	
As (188.980 nm)	≤ 8.20	6.15	
G (193.027 nm)	≤ 11.50	8.22	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.158 nm)	≤ 13.40	9.21	
Zn (213.857 nm)	≤ 8.70	6.87	
Pb (220.353 nm)	≤ 9.50	7.02	
Cd (228.616 nm)	≤ 17.20	11.81	
Ba (230.424 nm)	≤ 9.40	7.46	
Mn (257.610 nm)	≤ 13.30	9.49	
Mn (260.568 nm)	≤ 20.30	14.19	
Cr (287.716 nm)	≤ 11.00	7.90	
Cu (324.754 nm)	≤ 25.00	18.92	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.29	
Ba (455.403 nm)	≤ 44.00	33.66	
Sr (480.733 nm)	≤ 36.00	17.64	
Ba (493.408 nm)	≤ 36.00	25.56	
Ba (514.171 nm)	≤ 42.00	24.75	
Ar (675.283 nm)	≤ 74.00	59.18	
K (766.491 nm)	≤ 80.00	65.19	

Page 2 of 4

เอกสารไม่ควบคุม

Post PI

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	Nukoon L.	
Test Completed On	12/9/2021 12:55:49 PM	
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	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Optics Test		
	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

Page 1 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5	
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9	
Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3	
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9	
Mn (257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	6662.9	
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2	
K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4	
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5	
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3	
Zn (213.857 nm)	≥ 1743.0	SRBR	8620.7	200915.6	504.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4	
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	564.0	
Mn (257.610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5	
Cr (267.716 nm)	≥ 1048.0	SRBR	5018.6	196000.6	1532.6	
Cu (324.754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6	
Al (396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4	
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5	
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.80	1.38	
Se (196.026 nm)	≤ 2.60	0.91	
Zn (213.857 nm)	≤ 1.50	0.38	
Pb (220.353 nm)	≤ 2.60	0.44	
Mn (257.610 nm)	≤ 1.50	0.43	
Al (396.152 nm)	≤ 1.50	0.38	
Ba (493.408 nm)	≤ 1.50	0.66	
K (766.491 nm)	≤ 1.50	0.36	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.81	
Se (196.026 nm)	≤ 1.50	0.52	
Zn (208.200 nm)	≤ 1.50	0.36	
Zn (213.857 nm)	≤ 1.50	0.33	
Cd (214.439 nm)	≤ 1.50	0.41	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.74	
Cr (267.716 nm)	≤ 1.50	0.25	
Cu (324.754 nm)	≤ 1.50	0.71	
Al (396.152 nm)	≤ 1.50	0.44	
Ba (493.408 nm)	≤ 1.50	0.73	
K (766.491 nm)	≤ 1.50	0.97	

Page 4 of 4

เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		141.475			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.874			
Work Coil Current (A)		45.931			
RF Power Supply Current (A)		2.000			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.261	Passed		
Dark Current Test	6000	0.734	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

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	Nukoon L.	
Test Completed On	12/8/2021 1:34:10 PM	
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)	
15.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

Page 1 of 2

เอกสารไม่ควบคุม



Certificate of Calibration

DX-120 : Anion (ID#042)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

DX-120 S/N : 03010223

for

บริษัท อาริยาเคมีคอล จำกัด
เลขที่ ๑๐๐/๑๐๐ ถนนสุขุมวิท กรุงเทพฯ ๑๐๑

Operator Signature : [Redacted] Date : Dec 08, 2021
(Mr.Channarong Khiao-un)
Test Engineer

เอกสารไม่ควบคุม

Qualification Report

PM Check list ,CM_OQ and PQ
DX-120 : Anion (ID#042)
For
UAE
(2nd Contract)



Preventive Maintenance Checklist

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
UAE (2 nd Contract)	Khun Suwan
Engineer Name	Date
Mr.Channarong Khiao-un	8-Dec-2021

Instrument Detail

Instrument Model	Application
DX-120 (ID#042)	Anion
Instrument components	Serial Number
DX-120	03010223

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	ASRS 300	-	-

Remark:

Perform By
Archonics Lab Co.,Ltd

And

Date

Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Preventive Maintenance Check List



Preventive Maintenance Checklist

General Inspection Checklist

Item	Description	Result		Action Taken	N.A.
		Pass	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
4	Barbed fitting and tee fitting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
6	Rheodyne Valve for Leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Clean	<input type="checkbox"/>
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port face	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bott	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and female	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
13	Cell for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
17	Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
19	Inspect air for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
20	Phalon seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
21	Back up seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
23	Front panel test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
26	Conductivity electronic test 160±1 uS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005uS)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
28	Check column	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
29	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Clean	<input type="checkbox"/>
30	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
32	Check leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
35	Detector background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Chromeleon Operational Qualification (CM_OQ)

Seq: USER-139D97B086_Local_ArchemicalService Contract20212nd Con 8-Dec-2021CM_OQ 8-Dec-2021CM_OQ Page 2 of 15
Smp: Parabenes Runtime: 12/8/2021 10:02:07 AM



Chromeleon Operational Qualification, Part 1 Verification of Selected Results

Calibration Type: LOI
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Report Variable	Peak Name	Status
Offset (c0)	n.a.	ok
	n.a.	ok
	n.a.	ok
Slope (c1)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Correlation Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Std. Deviation	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Rel. Std. Dev.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Chromeleon (c) DIONEX 2008
Version 6.80 SR12 Build 3578 (207169)

CM_OQ / Report Formula_Part_1
Printed: 12/8/2021 11:01 AM

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Seq: USER-139D97B086_Local_ArchemicalService Contract20212nd Con 8-Dec-2021CM_OQ 8-Dec-2021CM_OQ Page 1 of 15
Smp: Parabenes Runtime: 12/8/2021 10:02:07 AM



Chromeleon Operational Qualification

General Information

Computer Name (Server): LAB-IC
Computer Name (Client): LAB-IC
Version Number: 6.80 SR12 Build 3578 (207169)
Operator: Mr.Channarong Khiao-Un

General System Suitability Test: Test passed

Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: (The parameters are marked with *.)	Max. Deviation:	0.02 s



Reviewer's Signature / Date

Operator's Signature / Date

Chromeleon (c) DIONEX 2008
Version 6.80 SR12 Build 3578 (207169)

CM_OQ / General Information
Printed: 12/8/2021 11:01 AM

เอกสารไม่ควบคุม

Seq: USER-139D97B086_Local_ArchemicalService Contract20212nd Con 8-Dec-2021CM_OQ 8-Dec-2021CM_OQ Page 3 of 15
Smp: Parabenes Runtime: 12/8/2021 10:02:07 AM



Chromeleon Operational Qualification, Part 1 Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EPI/USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Chromeleon (c) DIONEX 2008
Version 6.80 SR12 Build 3578 (207169)

CM_OQ / Report Formula_Part_1
Printed: 12/8/2021 11:01 AM

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result: Passed



Reviewer's Signature / Date

Operator's Signature / Date

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev (abs)	Methylparabene	ok
	Ret.Dev (abs)	Ethylparabene	ok
	Ret.Dev (abs)	Propylparabene	ok
	Ret.Dev (rel)	Methylparabene	ok
	Ret.Dev (rel)	Ethylparabene	ok
	Ret.Dev (rel)	Propylparabene	ok
Area	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
Rel.Area (Total)	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
Height	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
Rel.Height (Total)	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
Amount	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
Concentration	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Concentration	Propylparabene	ok
Rel.Amount	Rel.Amount	Methylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
Peak Width (0%)	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
Peak Width (5%)	Peak Width (5%)	Methylparabene	ok
	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
Peak Width (10%)	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
	Peak Width (10%)	Propylparabene	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type: LOF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj. Vol.		ok
	Dil. Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
	Quantification Method		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Signal Dimension		ok
	Noise 2.1-2.3		ok
Peak Results	No.	Methylparabene	ok
	No.	Ethylparabene	ok
	No.	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Peak Name	Propylparabene	ok
	Ret. Time	Methylparabene	ok
	Ret. Time	Ethylparabene	ok
	Ret. Time	Propylparabene	ok
	Ret. Time	Propylparabene	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
Left Width (0%)	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
Right Width (0%)	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
Peak Start	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
Peak Stop	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
Peak Start Value	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
Peak Stop Value	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
	Peak Stop Value	Propylparabene	ok
BL-Value Peak Start	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
BL-Value Peak Stop	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
Type	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
Resolution(EP)	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(EP)	Propylparabene	ok
Resolution(USP)	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Resolution(USP)	Propylparabene	ok
Asymmetry(EP)	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Ethylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
Peak Calibration	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
Peak Table	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amount	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	Deviation
	RSD Match	Ethylparabene	Deviation
	RSD Match	Propylparabene	Deviation
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result: Failed



Reviewer's Signature / Date

Operator's Signature / Date

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Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Calibration Type: LOFF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
EXT230NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
EXT290NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
Smooth Data:			
UV_VIS_1_MA_005_001	Noise (1.9-2.4 min)		ok
UV_VIS_1_OL_051_001	Noise (1.9-2.4 min)		ok
EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok

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Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOFF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed



Reviewer's Signature / Date

Operator's Signature / Date

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Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result: Passed



Reviewer's Signature / Date

Operator's Signature / Date

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Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOFF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
	No. of Peaks	ok
Tube Report	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

Test Result: Passed



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Operator's Signature / Date

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Limits:

Test	Customized Limits	Dionex Recommended Limits
DX120 Conductivity Noise (nS)	2	2
DX120 Conductivity Drift (nS/hr)	20	20
Injector Precision (Area %RSD)	1.0	1.0
Injector Carry Over (Area %)	0.1	0.1
DX120 Detector Linearity (Corr.)	0.999	0.999
DX120 Detector Linearity (%RSD)	5	5

Performance Qualification (PQ)

Additional Information:

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Period between Qualifications:	6 months
		Next Qualification:	Jun-2022

Customer Signature

Qualification Executor

Date: 8-Dec-21

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Performance Qualification

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00
Chromleon	6.80 SR12 Build 3578 (202169)	Dionex	33308	n.a.

Accessories:

Name	Description	Lot / Serial Number	Expire Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	210719	Jul-2022
Sample 2	Nitrate, 10 ppm	210719	Jul-2022
Sample 3	Nitrate, 25 ppm	210719	Jul-2022
Sample 4	Nitrate, 50 ppm	210719	Jul-2022
Sample 5	Nitrate, 100 ppm	210719	Jul-2022
Sample 6	Nitrate, 1000 ppm	210719	Jul-2022
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.

Customer Signature

Qualification Executor

Date: 8-Dec-21

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Performance Qualification

Detector Noise and Drift

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
DX120 Conductivity Noise (nS)	PASS
DX120 Conductivity Drift (nS/hr)	PASS

Customer Signature

Qualification Executor

Date: 8-Dec-21

เอกสารไม่ควบคุม

Data for detector noise

Segment number	Noise, nS
1	2.596
2	2.231
3	1.111
4	2.130
5	2.284
6	0.960
7	2.415
8	2.031
9	2.138
10	2.622
11	0.719
12	1.270
13	1.671
14	1.444
15	1.699
16	2.892
17	1.850
18	1.950
19	1.379
20	2.205
Average, nS	1.885
Limit, nS	2
Result	PASS

Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.427	1.280	20.000	PASS

Customer Signature

Qualification Executor

Date: 8-Dec-21

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Performance Qualification

Injector Precision

Instruments:

Instrument Name	Model	Supplier	Serial Number	Module/Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. Inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS

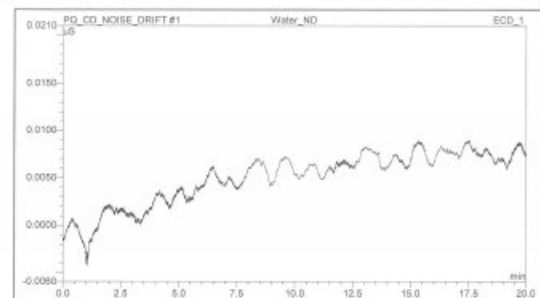
Customer Signature

Qualification Executor

Date: 8-Dec-21

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Chromatogram of Detector Noise and Drift



Customer Signature

Qualification Executor

Date: 8-Dec-21

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Data for Injector Precision test

Name	Area uS*min Nitrate ECD_1
Inj Precision_1	1.665
Inj Precision_2	1.688
Inj Precision_3	1.691
Inj Precision_4	1.688
Inj Precision_5	1.699
Inj Precision_6	1.699
Inj Precision_7	1.689
Inj Precision_8	1.711
Inj Precision_9	1.711
Inj Precision_10	1.700
Average:	1.695
Std. Dev:	0.013
% RSD:	0.783 %
Limit:	1.0 %
Result:	PASS

Customer Signature

Qualification Executor

Date: 8-Dec-21

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Performance Qualification

Injector Carry Over

Instruments:

Instrument Name	Model	Supplier	Serial Number	Module/ware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 6	Nitrate, 1000 ppm
Blank	Water
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
Injector Carry Over (Area %)	PASS

Customer Signature: [Signature] Qualification Executor: [Signature] Date: 8-Dec-21

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Performance Qualification

Detector Linearity

Instruments:

Instrument Name	Model	Supplier	Serial Number	Module/ware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 1	Nitrate, 5 ppm
Sample 2	Nitrate, 10 ppm
Sample 3	Nitrate, 25 ppm
Sample 4	Nitrate, 50 ppm
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

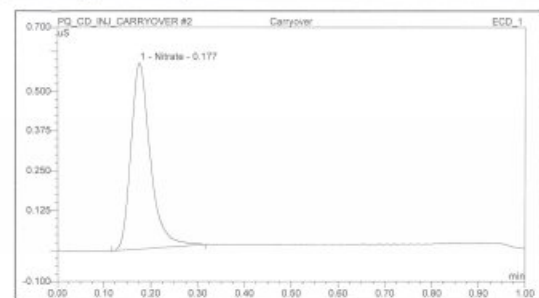
Test Results Summary

Test	Result
DX120 Detector Linearity (Corr.)	PASS
DX120 Detector Linearity (%RSD)	PASS

Customer Signature: [Signature] Qualification Executor: [Signature] Date: 8-Dec-21

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Chromatogram for Carry Over test



Data for Carry Over test

Name	Ret.Time (detected) min	Area uS*min
	Nitrate ECD_1	Nitrate ECD_1
High Level	0.18	30.991
Carryover	0.18	0.028
Water	0.18	0.022
Carry over:		0.070 %
Limit:		0.1 %
Result:		PASS

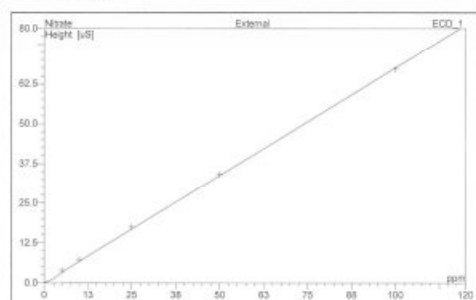
Customer Signature: [Signature] Qualification Executor: [Signature] Date: 8-Dec-21

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Data for Detector Linearity

Name	Amount ppm	Height uS
	Nitrate ECD_1	Nitrate ECD_1
Detector linearity_1	5.000	3.962
Detector linearity_2	10.000	7.384
Detector linearity_3	25.000	17.462
Detector linearity_4	50.000	34.143
Detector linearity_5	100.000	67.127

Linearity Plot



Calibration Type	Number of Points	Offset	Slope
Lin	5	0.000	0.678
	Correlation Coefficient	% RSD	
Linearity:	1.000	2.260	
Limit:	0.999	5	
Result:	PASS	PASS	

Customer Signature: [Signature] Qualification Executor: [Signature] Date: 8-Dec-21

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CERTIFICATE

Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254

Certificate of Analysis

Lot Number 210719

Expiration of Certification
July 2022

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.07 \pm 0.03
2	9.95 \pm 0.07
3	24.49 \pm 0.10
4	49.16 \pm 0.13
5	99.0 \pm 1
6	993 \pm 4

The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 070890-01

28-Dec-2011

thermo.com/scientific.com/vit/dionex

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0001149-EN-021003 001118-10

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Channarong Khiao-Un

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SPC Calibration Center

SERT
Part of DKSH Group



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab955
Serial No. (or ID.): 16300356
Manufacturer: SI Analytics
Electrode Serial No.: 16070067
Condition: In Condition

Certificate No.: C24210091
Issued Date: 29 March 2021
Job No.: KSPR2104894
Page: 1 of 2
Model: LF413T
Brand: SI Analytics

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C \pm 2 °C
Humidity 50 %RH \pm 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsohit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakhonong, Bangkok 10260 Thailand

Calibration By: Mr. Imron Ama
Calibration Date: 29 March 2021
The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the CRM maintained by DAKS/DKD calibration laboratory through Radometer Analytical Co., Ltd. Certificate No. 1561, 1515, 1377

(Mr. Imron Ama)

Person in charge

SERT

บริษัท เอสอาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Dureung Boonsopon)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories. The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. This report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

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SPC RT Co., Ltd.
1194 Soi Wachirathamsohit 57, Sukhumvit 101/1 Rd., Bangkok, Prakanong, Bangkok 10260 Thailand
Tel: 0 205 4333-5 (Ext. 3333-3336) Fax: 0 205 4333-4 (Ext. 4333-4334) Email: info@spcrt.com Website: www.spcrt.com

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SPCC-FAC24-06: 23 Nov 2020

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration		Coverage Factor	
Conductivity Solution	Reading	Correction	(k)	Uncertainty (±)
24.97 $\mu\text{S/cm}$	26.7 $\mu\text{S/cm}$	-1.73 $\mu\text{S/cm}$	2.00	0.52 $\mu\text{S/cm}$
1408.3 $\mu\text{S/cm}$	1439 $\mu\text{S/cm}$	-30.7 $\mu\text{S/cm}$	2.00	7.8 $\mu\text{S/cm}$
111.31 mS/cm	112.4 mS/cm	-1.09 mS/cm	2.00	0.58 mS/cm

After Adjustment : at 1408.3 $\mu\text{S/cm}$

Standard	Unit Under Calibration	Coverage Factor	Uncertainty (±)	
Conductivity Solution	Reading	(k)		
24.97 µS/cm	25.8 µS/cm	-0.83 µS/cm	2.00	0.52 µS/cm
1408.3 µS/cm	1410 µS/cm	-1.7 µS/cm	2.00	7.8 µS/cm
111.31 mS/cm	110.1 mS/cm	1.21 mS/cm	2.00	0.58 mS/cm

The End of Certificate

0020 00003 094 4000000000 37 00000000 0001 00000000 00000000 00000000 00000000 00000000
 00000 000003 094 501 0000000000 51 00000000 0001 00000000 00000000 00000000 00000000 00000000
 T 0 205 4330 000 0000-3000 Fax 0 205 4420 E-mail: info.aap@vsnl.com Website: www.aap-t.com

เอกสารไม่ควบคุม

National Food Institute, Ministry of Industry, Thailand



Calibration Report

Certificate No.: 2101019-01-01																																														
Equipment:	<p> Manufacturer: METTLER TOLEDO Model: SeiveCompact 5226 Serial No.: 1113432421 Type: Bench top ID No.: UAE-WAT-005264 </p>																																													
	<p> Resolution: 0.01 g / 0.1 ml Mode: SeiveCompact 5226 Type: Bench top </p>																																													
<p> Date of Calibration: 14 June 2021 Page 2 of 2 </p>																																														
<p> Location: Chemical Calibration Laboratory, National Feed Institute Environment Condition: Ambient Temperature: (23.7 ± 1.5) °C Relative Humidity: (63.6 ± 3) % Condition of Equipment: Good Condition </p>																																														
<p>Condition of this Results of Calibration</p>																																														
<p>1. Calibration Method</p> <p>In house method: ISO-G002 based on direct measurement by using standard volume calibrator and certified reference material (CRM).</p>																																														
<p>2. Reference Standards / Certified Reference Material</p> <table border="1"> <thead> <tr> <th>Instruments</th> <th>Serial/ Cr. No.</th> <th>Manufacturer</th> <th>Certificate No.</th> <th>Due Date</th> </tr> </thead> <tbody> <tr> <td>2.1 DC Voltage Calibrator</td> <td>2101019</td> <td>Puke</td> <td>SGL-207-0662</td> <td>17 June 2021</td> </tr> <tr> <td>2.2 Digital Thermometer</td> <td>2101017</td> <td>Puke</td> <td>CGC 03005-01</td> <td>30 October 2021</td> </tr> <tr> <td>2.3 Thermo-Hygro Meter</td> <td>NP1-8163117</td> <td>PCANPC</td> <td>GR25-1578</td> <td>21 September 2021</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Certified Reference Material</th> <th>Lot No.</th> <th>Manufacturer</th> <th>Ref. No.</th> <th>Expiry Date</th> </tr> </thead> <tbody> <tr> <td>2.4 0.1 µl buffer 4.000 (Primary µl buffer Solution)</td> <td>1710043</td> <td>CP-Chem</td> <td>PA216 L5</td> <td>2 October 2022</td> </tr> <tr> <td>2.5 0.0 µl buffer 8.880 (Primary µl buffer Solution)</td> <td>1710043</td> <td>CP-Chem</td> <td>PA217 L5</td> <td>2 October 2022</td> </tr> <tr> <td>2.6 0.1 µl buffer 10.31 (Primary µl buffer Solution)</td> <td>1710050</td> <td>CP-Chem</td> <td>PA225 L6</td> <td>2 October 2021</td> </tr> <tr> <td>2.7 0.1 µl buffer 7.30 (Standard µl buffer Solution)</td> <td>710051</td> <td>CP-Chem</td> <td>PA110 L5</td> <td>2 October 2021</td> </tr> </tbody> </table>		Instruments	Serial/ Cr. No.	Manufacturer	Certificate No.	Due Date	2.1 DC Voltage Calibrator	2101019	Puke	SGL-207-0662	17 June 2021	2.2 Digital Thermometer	2101017	Puke	CGC 03005-01	30 October 2021	2.3 Thermo-Hygro Meter	NP1-8163117	PCANPC	GR25-1578	21 September 2021	Certified Reference Material	Lot No.	Manufacturer	Ref. No.	Expiry Date	2.4 0.1 µl buffer 4.000 (Primary µl buffer Solution)	1710043	CP-Chem	PA216 L5	2 October 2022	2.5 0.0 µl buffer 8.880 (Primary µl buffer Solution)	1710043	CP-Chem	PA217 L5	2 October 2022	2.6 0.1 µl buffer 10.31 (Primary µl buffer Solution)	1710050	CP-Chem	PA225 L6	2 October 2021	2.7 0.1 µl buffer 7.30 (Standard µl buffer Solution)	710051	CP-Chem	PA110 L5	2 October 2021
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<p>3.5 Certified Reference Material No. 2.7</p> <p>traceable to</p> <p>SI-M Ref H-4 L-066 No. 34-2020, SI-M Ref H-10 L-066 No. 29-2020, SI-M Ref H-4 L-066 No. 35-04-2020, SI-M Ref H-10 L-066 No. 29-05-2020, The Standard Solution preparation and certified by CP-Chem; Lot is accredited to ISO 17025 and ISO/IEC 17025</p>																																														
<p>4. This certificate was certified only for the Instruments we calibrated.</p>																																														
<p>5. The result of calibration was found accurate as shown on date and place of calibration only.</p>																																														

F-CB-012 Revision: 00 Date: 14-12-61

เอกสารแนบควบคุม

 National Food Institute, Ministry of Industry, Thailand
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2005-2010, 20, Anu Aham Road, Bang Yi Khan Subdistrict, Bang Phat District, Bangkok 10720, Thailand.
Tel.: +66 10 414-8190, Fax: +66 10 414-8191, E-mail: nfi@nfi.go.th, nfi@nfi.go.th, nfi@nfi.go.th

Calibration Certificate

Certificate No.: 2103189-031-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment:	pH Meter
Manufacturer:	METTLER TOLEDO
Model:	SevenCompact 8220
Serial No.:	C113432421
ID No.:	UAE.WAT.300/2564
Order No.:	2193189
Operation No.:	2193189-001
Date of Receipt:	9 June 2021
Date of Calibration:	14 June 2021

Approved by _____
(Mr Pish _____)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 68%.

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-CIS-004 Revision: 00 Date: 14-12-63

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:	2103169-001-01	Resolution:	0.01 pH	0.1 pH	
Equipment:	<p>Model: gH Meter</p> <p>Manufacturer: METTLER TOLEDO</p> <p>Serial No.: C110432421</p> <p>ID No.: UAE.WAT.35/2564</p>	<p>Model: SevenCompact 8320</p> <p>Type: Seven top</p>			
Date of Calibration:	16 June 2021	Page 3 of 8			
Calibration Results:					
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)					
Nominal pH	DC Voltage Standard (mV)	Intermediate Indicator Reading		Uncertainty (ENW) (mV)	Coverage Factor (k)
		mV	pH		
9.00	416.158	414.1	0.00	0.005	2.00
2.00	200.811	205.8	2.00	0.003	2.00
4.00	177.481	177.4	4.00	0.005	2.00
5.00	55.160	50.2	6.00	0.008	2.00
7.00	0.005	0.0	7.00	0.003	2.00
8.00	-69.158	-66.1	8.00	0.008	2.00
10.00	-177.401	-177.4	10.00	0.003	2.00
12.00	-299.812	-295.8	12.00	0.005	2.00
14.00	-416.158	-416.1	14.00	0.008	2.00
2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)					
Equipment:	gH Electrode	Type:	Combined Electrode		
Manufacturer:	METTLER TOLEDO	Model:	pH-8 Expert Pro-ISM		
Serial No.:	1115910	ID No.:	NA		

F-CIS-012 Revision: 00 Date: 14-12-81

เอกสารแนบควบคุม

Calibration Report

Certificate No.: 2103189-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenCompact 5220
Serial No.: C113432421 ID No.: UAE.WAT.0092504
Manufacturer: METTLER TOLEDO
Date of Calibration: 14 June 2021 Page 4 of 9

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition:
Ambient Temperature 24 °C ± 1 °C
Relative Humidity 54 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method:
 - In house method: W-TD-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	1521	A85907	TE 640339-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	306	809001			

Support Equipment: - Low Temperature Bath (SOCAL-6), Model: Europa-6 Plus Basic, S/N: 3418832

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

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2103189-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Order No.: 2103189
Operation No.: 2103189-002
Date of Receipt: 9 June 2021
Date of Calibration: 14 June 2021

Calibrated by: Mr. Manee Somsak Expert
Approved by: [Signature]
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 June 2021

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-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103189-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenCompact 5220
Serial No.: C113432421 ID No.: UAE.WAT.0092504
Manufacturer: METTLER TOLEDO
Date of Calibration: 14 June 2021 Page 5 of 8

Calibration point: 16.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: HiLab Expert Pro-BM S/N: 1110812
- Dimension of probe: Diameter 12 mm, Length 120 mm,
- Sheath material: Plastic (PEEK)

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
14.9	16.001	0.1	0.13
24.8	24.999	0.1	0.13
35.0	34.996	0.0	0.13

Note

- UUC* : Unit Under Calibration

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103189-003-01
Equipment: pH Meter
Resolution: 0.01 pH ± 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Date of Calibration: 14 June 2021 Page 2 of 8

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.7 ± 1.5) °C Relative Humidity: (53 ± 4) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration:

1. Calibration Method: In house method: W-CC-082 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material

Reference Standards	Serial ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2793007	Ptaka	SCL-297-0802	17 June 2021
2.2 Digital Thermometer	2793007	Ptaka	CC 83809-01	30 October 2021
2.3 Thermo-Hygrometer	NF187403317	Ptaka	GR20-1578	21 September 2021

Certified Reference Material	Lot No.	Manufacturer	Ref No.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710549	CPAchem	PH016.L3	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710549	CPAchem	PH017.L3	2 October 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	710590	CPAchem	PH020.L3	2 October 2021
2.7 pH buffer 7.00 (Standard pH buffer Solution)	710551	CPAchem	PH017.L3	2 October 2021

3. The certification is traceable to The International System of Unit (SI Unit):
 - 3.1 Instruments No.2.1 through NIS-TIS-TIS-17020 Laboratory Accreditation of Calibration No.0078
 - 3.2 Instruments No.2.2 through NIS-TIS-TIS-17020 Laboratory Accreditation of Calibration No.0091
 - 3.3 Instruments No.2.3 through NIS-TIS-TIS-17020 Laboratory Accreditation of Calibration No.0202
 - 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Homed cell using calibrated thermometer, barometer, and manometer. 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 BM Refs No.7 Luth 20.04.2020; BM Refs No.8 Luth 28.05.2020; BM Refs No.9 Luth 20.04.2020; BM Refs No.10 Luth 28.05.2020. 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-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand

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Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 8505 Website : www.nfi.go.th E-mail : nfi@nfi.go.th



Calibration Report

Certificate No.: 2103189-002-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 123118210
Type: Bench top
ID No.: UAE-WAT-010288

Date of Calibration: 14 June 2021 Page 3 of 5

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		
0.00	414.118	414	0.08	0.58	2.00
2.00	295.911	296	2.00	0.58	2.00
4.00	177.401	176	4.00	0.58	2.00
6.00	59.180	59	6.00	0.58	2.00
7.00	0.800	0	7.00	0.58	2.00
8.00	-89.100	-89	8.00	0.58	2.00
10.00	-177.401	-177	10.00	0.58	2.00
12.00	-295.612	-296	12.00	0.58	2.00
14.00	-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
Manufacturer: METTLER TOLEDO
Serial No.: 115882
Type: Combined Electrode
Model: InLab Solids
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.000	4.01	180	98.8	0.0071	2.00
6.880	6.87	16		0.0075	2.00
6.880	6.87	16		0.0075	2.00
10.000	10.01	-166	98.8	0.0080	2.00
6.880	6.89	8		0.0080	2.00

F-CS-012 Revision: 00 Date: 14-12-61

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Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 8505 Website : www.nfi.go.th E-mail : nfi@nfi.go.th



Calibration Report

Certificate No.: 2103189-002-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 123118210
ID No.: UAE-WAT-010288
Manufacturer: METTLER TOLEDO

Date of Calibration: 14 June 2021 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 25 mm.
- Description of probe, model: InLab Solids SN: 115882
- Dimension of probe: Diameter 6 mm, Length 25 mm.
- Sheath material: Glass

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.18
25.1	24.999	-0.1	0.12
35.1	34.999	-0.1	0.12

Note:
- UUC: Unit Under Calibration

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

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand

2028 Soi 26, Anul Anam Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 8505 Website : www.nfi.go.th E-mail : nfi@nfi.go.th



Calibration Report

Certificate No.: 2103189-002-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 123118210
ID No.: UAE-WAT-010288
Manufacturer: METTLER TOLEDO

Date of Calibration: 14 June 2021 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 24 °C ± 1 °C
Relative Humidity: 94 % ± 2 %

Condition of this result of Calibration:

- Calibration Method:
 - In house method: WTE-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	1321	A85067	TS 64028-01	12-Oct-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	285	00691			

Support Equipment: - Low Temperature Bath (BOCAL-6), Model: Bump-6 Plus Basic, SN: 0419002

- 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
- Result of Calibration: ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
504 PATTANAKARN ROAD 501 TH. 50 ANULANG SUANLIANG BANGKOK 10250
TEL: 0-2717-8000-21 FAX: 0-2719-0484



Certificate of Calibration

Cert. No.: 21TM1405
Page: 1 of 3

Equipment: BOD Incubator
Manufacturer: Arco
Model: UCA-1320
Serial No.: -
ID No.: UAE.WAO.002/2550
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: 17 August 2021
Calibration Date: 17 August 2021
Ambient Temperature: (25 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Khit Rutanaprapachai
Approved by:
() Pornthipps Tameyskul
() Masee Bulkruea
() Suwit Imjai
Issue Date: 1 September 2021

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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0031567



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2108-0364OC-1
Procedure Used :-

Cert. No.: 21TM1405
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	34970A	MY41021843	21LM2	18 Feb 2022

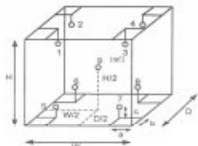
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 = 10 cm D = 0.53 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.78 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL.Humid. (%)	52	55
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม
a 1069646



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
230/1 PATTANAKARN ROAD 3RD FL. BANGKOK 10260 THAILAND
TEL. 0-2517-8800-27 FAX. 0-2519-9484



Cert. No.: 21TM1406
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : -

ID No. : UAE.WAO.018/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 17 August 2021

Calibration Date : 17 August 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Rutanaprapachai

Approved by :

App. Laboratory

() Pornthipps Tameysakul
(/) Malee Buksuea
() Suwit Imjai

Issue Date : 1 September 2021

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 0031569



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2108-0364OC-1
Result of Calibration :- (*) Without Adjustment

Cert. No.: 21TM1405
Page.: 3 of 3

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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	19.5	19.3	0.46	0.45	1.0	0.78	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position 1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.018	20.137	20.086	19.942	20.157	20.093	19.968	19.860	20.048

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 1069645



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2108-0364OC-2
Procedure Used :-

Cert. No.: 21TM1408
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	34970A	MY41021843	21LM2	18 Feb 2022

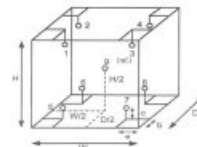
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 = 10 cm D = 0.53 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.78 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	52	55
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	21-04RTD-11
2	21-04RTD-12
3	21-04RTD-13
4	21-04RTD-14
5	21-04RTD-15
6	21-04RTD-16
7	21-04RTD-17
8	21-04RTD-18
9 (ref.)	21-04RTD-19

เอกสารไม่ควบคุม
a 0031569



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2106-0364OC-2
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 21TM1406
 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	19.8	19.7	0.37	0.50	1.1	0.62	2

Calibration Point (°C) : 20.0
 Measured Temperature (°C) : 19.742, 19.762, 19.784, 19.819, 19.764, 19.797, 19.787
 Position : 1, 2, 3, 4, 5, 6, 7, 8, 9 (ref.)
 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



National Food Institute, Ministry of Industry, Thailand
 2009 Soi 36, Anurak Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
 Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 0550 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Report

Certificate No.: 2200708-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Resolution: 0.0001 g / 0.0001 g

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Capacity: 110 g

Date of Calibration: 24 November 2021

Page 2 of 4

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 38 ± 1 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method 01-PA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2011905	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M2011905	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	400.401.87H.803/55	Quality Return	Q421-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
15	0.000007
30	0.0000084
50	0.000053
100	0.000048

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	50.0000	49.9999	50.0000	49.9999	49.9999	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

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National Food Institute, Ministry of Industry, Thailand
 2009 Soi 36, Anurak Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
 Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 0550 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Certificate

Certificate No.: 2200708-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr. Worapong Seoktong
 Scientist

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

Date of Issue: 30 November 2021

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 reissued other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

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National Food Institute, Ministry of Industry, Thailand
 2009 Soi 36, Anurak Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
 Tel : +66 (0) 2422 8500 Fax : +66 (0) 2422 0550 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Report

Certificate No.: 2200708-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Resolution: 0.0001 g / 0.0001 g

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Capacity: 110 g

Date of Calibration: 24 November 2021

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0-30 g; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.0000009	2.58
0.01	0.009998	0.01000	0.00000	0.000011	2.58
0.02	0.019997	0.02000	0.00000	0.000012	2.58
0.05	0.050001	0.05000	0.00000	0.000011	2.58
0.1	0.100002	0.10000	0.00000	0.000012	2.58
0.2	0.200004	0.20000	0.00000	0.000013	2.58
0.5	0.500004	0.50000	-0.00001	0.000014	2.58
1	0.999996	1.00000	-0.00001	0.000016	2.58
2	1.999997	1.99999	0.00001	0.000019	2.58
5	4.999997	4.99999	0.00001	0.000022	2.58
10	10.000026	9.99994	0.00009	0.000024	2.58
20	20.000037	19.99991	0.00013	0.000099	2.58
30	30.000043	29.99990	0.00014	0.00012	2.58

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand
12008 Soi 36, Anan Aranyas Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand.
Tel : +66 (0) 2402 8500 Fax : +66 (0) 2402 8505 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122109406
Capacity: 110 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.004/2346

Date of Calibration: 24 November 2021

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 30 - 100 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor k
40	40.0000	39.9999	0.0001	0.00014	2.30
45	44.9998	44.9999	0.0001	0.00015	2.30
50	49.9999	49.9999	0.0001	0.00016	2.30
55	54.9997	54.9998	0.0001	0.00016	2.30
60	60.0002	60.0000	0.0001	0.00018	2.30
65	65.0000	64.9999	0.0001	0.00018	2.30
70	70.0003	70.0000	0.0001	0.00019	2.30
75	75.0001	74.9999	0.0001	0.00020	2.30
80	80.0000	79.9998	0.0001	0.00021	2.30
85	85.0003	84.9998	0.0001	0.00022	2.30
90	89.9999	89.9998	0.0001	0.00021	2.30
100	99.9997	99.9998	0.0001	0.00020	2.30

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

----- End -----

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701OC-1

Cert. No.: 21TM1876
Page: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-QT02 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	34970A	MY44067817	21LM10	20 Jul 2022

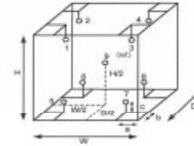
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.33 m
b = 5.0 cm W = 0.40 m
c = 5.0 cm H = 0.40 m
Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	230	230

Ref. Std. ID No.: @ Calibration Point		
Position	(140, 180) °C	(104) °C
1	21-1STC-01	15RTD2/11
2	21-1STC-02	15RTD2/12
3	21-1STC-03	15RTD2/13
4	21-1STC-04	15RTD2/14
5	21-1STC-05	15RTD2/15
6	21-1STC-06	15RTD2/20
7	21-1STC-07	15RTD2/17
8	21-1STC-08	15RTD2/18
9 (ref.)	21-1STC-09	15RTD2/19

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
2344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-37 FAX: 0-2719-9888



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
2344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-37 FAX: 0-2719-9888

Certificate of Calibration

Cert. No.: 21TM1876
Page: 1 of 3

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UF 55

Serial No.: B216.1666

ID No.: UAE.WAO.027/2559

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: 29 October 2021

Calibration Date: 29 October 2021

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Kunchit Promrat

Approved by:

(/) Ponthippa Tameyakul
(/) Malee Butkuea
(/) Suwit Imjai

Issue Date: 4 November 2021

The Uncertainties are for a confidence probability of approximately 95 %

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เอกสารไม่ควบคุม



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701OC-1

Cert. No.: 21TM1876
Page: 3 of 3

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)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.18	0.87	1.2	1.1	2

Measured Temperature (°C)								
Calibration Point (°C)	1	2	3	4	5	6	7	8
104.0	103.852	103.978	104.362	104.323	103.776	104.015	104.312	104.196
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.895
180.0	180.598	180.339	180.758	180.619	179.716	179.829	180.204	180.365

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



Hanna Instruments (Thailand) Ltd.
 410/67-68 Soi Rachadapisek 24, Rachadapisek Rd., Samen-eok,
 Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No.: HIT-2132-0756
 Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 **Serial No. :** 1147807

Manufacturer : Hanna Instruments

Made in : Romania

Condition As-Received : Used Product

Reference : RE211097

Customer name : United Analyst and Engineering Consultant Co., Ltd.
 3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
 Phrakhanong, Bangkok 10260

Received date : 29 July 2021

Calibrate date : 2 August 2021

Issue date : 5 August 2021

Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)% RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by : 

Mr. Athakorn Samphan
Calibration Engineer

Approved by : 


Mr. Anan Sewachaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.
 This result of calibration was found accurate on date and place of calibration only.

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

เอกสารไม่ควบคุม



Hanna Instruments (Thailand) Ltd.
 410/67-68 Soi Rachadapisek 24, Rachadapisek Rd., Samen-eok,
 Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No.: HIT-2132-0756
 Page : 3 of 3

Result of Calibration :


Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	150.3 (°C)	150.0 (°C)	2.4 (°C)	± 0.59 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	1	2	3	4	5
150.0	148.9	149.5	150.1	150.4	149.7
	6	7	8	9	10
	149.9	151.1	151.5	150.5	150.3
	11	12	13	14	15
	149.4	149.6	150.4	150.3	150.2
	16	17	18	19	20
	149.5	149.9	150.4	150.1	150.3
	21	22	23	24	25
	149.1	149.1	149.6	149.8	150.1

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

** End of certificate **

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Hanna Instruments (Thailand) Ltd.
 410/67-68 Soi Rachadapisek 24, Rachadapisek Rd., Samen-eok,
 Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No.: HIT-2132-0756
 Page : 2 of 3

Condition of this result of calibration

Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935005	03250060101	21T167	Technology Promotion Association (Thailand-Japan)


Reference / Procedure :

This equipment was calibrated by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90


All data shown below were as-received values without adjustment.

SITE CALIBRATION



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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard


Agilent Technologies

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

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

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

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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only complete/printout 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 a "X" or tick mark "✓" in the checkbox. Add hand written 'additional details' if required.
- Complete Not Applicable check boxes to indicate services not delivered, as needed
- Complete the PM Service in the order of the tasks listed.
- Complete the Service Review section together with the customer

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 Page 1 of 10

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System Information

Instrument System Name/LD:	Instrument Location:
AA-240B	UAE
Record the list of system component product numbers below.	List the serial numbers of the components present in the system below.
1. 01456A	1. 01456000
2. 01456A	2. 01456000
3. 01456A	3. 01456000
4. 01456A	4. 01456000
5. 01456A	5. 01456000
6. 01456A	6. 01456000
7. 01456A	7. 01456000
8. 01456A	8. 01456000
9. 01456A	9. 01456000
10. 01456A	10. 01456000

Guidance:

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

Preparation, Safe operation and Initial performance checks

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

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

- ☒ Review the instrument logbook.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Check for required firmware updates and verify with customers if they would like it installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☒ Discuss any specific issues with the customer prior to starting.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Gas handling components and safety interlocks

- ☐ Change the burner o-ring.
- ☐ Clean the nebulizer, spray chamber and liquid trap.
- ☐ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☐ Check that the pressure relief bung releases readily.
- ☐ Change o-rings on the fuel and oxidant delivery barbs
- ☐ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☐ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☐ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.

Gas handling components and safety interlocks

- ☐ Check and clean the igniter electrode
- ☐ Pressure test for leaks
- ☐ Leak test gasbox internal components and connections
- ☐ Check safety interlock status and operation using the SVD interlock monitoring diagnostic.

Analytical performance for Flame systems

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

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FLAME SYSTEM section

- ☒ Section NOT Applicable

Electronic components

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

Mechanical components

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

Optics components

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

Sample Introduction and Atomization

- ☐ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☐ Clean the burner slot with a clean white card.
- ☐ Check the uniformity of the slot width.
- ☐ Clean the burner if required.

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FURNACE SYSTEM section

- ☐ Section NOT Applicable

Electronic components

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

Mechanical components

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

Optic components

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

Gas handling, water system and workhead component checks

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

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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard



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Analytical performance for Furnace systems

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

PSD autosampler accessory for Furnace systems

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

Sample introduction pump system (SIPS) accessory

- Section NOT Applicable
- Re-torque screws securing the hubs, presser arms and pump rotors.
- Adjust each roller so that it rotates freely.
- Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- Re-torque the nuts that fasten the motor mounting plate to the chassis.
- Check clips securing the diluents holder and replace if necessary.
- Disconnect, clean T-piece, and reassemble the tubing using the following steps:
 - Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
 - Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
 - Wash the T-piece under a tap with a strong flow of water.
 - Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
 - Reassemble.

Sample preparation system (SPS 4) accessory

- Section NOT Applicable
- The Agilent SPS 4 autosampler is designed to need minimal maintenance. The following maintenance requirements are suggested to maintain the performance of the autosampler.
- Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.

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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard



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Restore system

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

Guidance:

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

Service Review

- Attach available reports/printouts of all tests to this documentation.
- Record the PM service activity in the customer's instrument 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 Review Comments section below if there are additional comments
- Review the service and any test results with the customer.
- If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

AA PM Performance test results and measurements table

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	< 55 %	—
Flame performance test with 5 ppm copper sample		
Air/acetylene, mixing paddle removed	Abs value > 0.5	—
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	—
Furnace optics PMT Gain test		
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	< 55 %	45
Furnace performance test with 25 ppb copper sample		
Precision %RSD	≤ 4.0	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample		
Precision %RSD	≤ 4.0	9.9
Abs value	≥ 0.15	0.145 0.149 0.147 0.148 0.146 0.147 0.147 0.147 0.147 0.147

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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard



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- Cleaning the autosampler cover panels with domestic window cleaner.
- Checking the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- Check the X-axis, Theta-axis and Z-axis PFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

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

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

Sample preparation system (SPS 3) accessory

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

Vapor generation accessory VGA (hydride generator)

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

UltraAA lamp accessory (external)

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

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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard



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AA consumable and parts list table

Part Description	Part Number	Part Name	Part Description
Test Solution - Cu Spec solution	6610030100	50 55 140 240 280	PM supplied
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied
Organic kit	9910093500	50 55 140 240 280	PM supplied
Wire Nebulizer Cleaning	9910034700	50 55 140 240 280	consumable
Tubing-Capillary Std Nets	9910024800	50 55 140 240 280	consumable
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable
Teflon impact beads (5/pk) (organics only)	9910063300	50 55 140 240 280	consumable
Burner cleaning strip (100/pk)	9910063900	50 55 140 240 280	consumable
Window UV silica - round (right side)	3010082600	50 55 140 240 280	PM supplied
Window UV silica - rectangular (left side)	2010082600	50 55 140 240 280	PM supplied
Pad adhesive window - round	4910013700	50 55 140 240 280	PM supplied
Pad adhesive window - rectangular	4910012800	50 55 140 240 280	PM supplied
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied
Shroud (D2)	6310003100	GTA120	PM supplied
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied
Zeeman shroud	6310003600	GTA120	PM supplied
O-ring, PSD rinse bottle	6610025600	PSD120	PM supplied

NOTE:

Items classified as PM supplied in the above table are included in the standard PM. Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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

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55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard



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Service Engineer Comments

Other Important Customer Web Links

How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
Need to know more? - www.agilent.com/chem/education
Need technical support? - www.agilent.com/chem/techsupport
Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service Request n: [REDACTED] Date service completed: [REDACTED]

Agilent Signature: [REDACTED] Customer Signature: [REDACTED]

Total no. of pages for this document: 10

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Page 10 of 10

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Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00V Rail	10.80	12.10	13.20	Passed
-12.00V Rail	-13.20	-11.80	-10.80	Passed
5.00V Rail	4.50	5.00	5.50	Passed
310.00V Rail	279.00	318.00	341.00	Passed

Report Generated At: 9/15/2021 10:30:14 AM

2

SVD Results Report SVD

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SVD Results Report



Report ID: 1 Diagnostic Start Time: 9/15/2021 9:42:05 AM Diagnostic End Time: 9/15/2021 10:29:49 AM
Customer: UAE Service Engineer: Khunphol
Address: BKK Contact Details: 02-6376363

Instrument Configuration

Configuration:

Serial Number: MY18130003 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: False Mono Type: Automatic
Furnace Instrument: True Gasbox Type: No Gas Box
Zeeman Present: True Auto Burner Adjuster: False
Internal Zeeman: True Mains Frequency: 50
Internal UltraAA: True Firmware Version: 2.12
Optics Type: Single Beam Photomultiplier Type: Normal(90nm)
D2 BG Correction Fitted: False PWB Version: 181
Boot Block Version: 2.02

EEPROM Data:

Instrument Run Hours: 12971.967 D2 Run Hours: 0.000
Zero Wavelength Offset: D2 Serial Number: not set 1
Mono Correction: D2 Install Date: 1/1/1970
Flame Hours: 0.000 D2 Original Intensity: 1.000
D2 Last Intensity: 1.000

Frequency:

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

Result: Passed

Report Generated At: 9/15/2021 10:30:14 AM

1

SVD Results Report SVD

เอกสารไม่ควบคุม

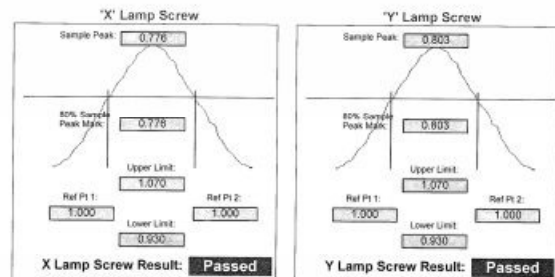
Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80

Lamp Alignment: Performed



Grating Squareness:

Lamp Element(s): Copper

Lamp Turret Position: 3

Lamp Current(mA): 4.00

Slit Width(nm): 0.5

1st Order Wavelength(nm): 324.80

Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.66	325.15	Passed
Second Order	649.23	649.66	649.97	Passed

Report Generated At: 9/15/2021 10:30:14 AM

3

SVD Results Report SVD

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Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3

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

Lamp Alignment: **Performed**

Lower Limit(nm) 324.604
(Approach from Zero Order)
Sample 1: 324.664
Sample 3: 324.660
Sample 5: 324.664
Sample 7: 324.660
Sample 9: 324.664

324.724 Upper Limit(nm)
(Approach from end)
Sample 2: 324.660
Sample 4: 324.660
Sample 6: 324.660
Sample 8: 324.664
Sample 10: 324.664

Mean: 324.662
Standard Deviation: 0.002

Result: **Passed**

Auto Lamp Recognition:

Lamp 1: 70 - Sodium/Potassium (Na/K)
Lamp 2: 3 - Arsenic (As)
Lamp 3: 14 - Copper (Cu)
Lamp 4: 21 - Gold (Au)

Lamp 5: Not Supported
Lamp 6: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Performed

Notes:

PM

Signatures:

UAE

Date

Khunphol

Date

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4

SVD Results Report

เอกสารไม่ควบคุม

Report Generated At: 9/15/2021 10:30:14 AM

6

SVD Results Report

เอกสารไม่ควบคุม

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	199	297	Passed
S1	156	166	191	Passed
S2	271	299	332	Passed
S3	474	514	579	Passed
S4	825	930	1006	Passed
S5	1435	1548	1754	Passed
S6	2496	2785	3053	Passed
S7	4347	4753	5313	Passed

Interlocks:

Burner Fitted: **Untested**
N2O Burner Fitted: **Untested**
Flame Shield Closed: **Untested**
Gas Control Fitted: **Untested**
Pressure Release Bung Fitted: **Untested**
Liquid Trap Fitted: **Untested**

Flame Detect: **Untested**
GCU Active: **Untested**
Oxidant Pressure: **Untested**
Oxidant Changeover: **Untested**
Ignition: **Untested**

Report Generated At: 9/15/2021 10:30:14 AM

5

SVD Results Report

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SpectraAA Report:

4:58 PM 10/1/2021

Page 1 of 2

Analyst:
Date Started: 2:12 PM 10/1/2021 GMT: 7:12 AM 10/1/2021
Worksheet: Test Cu Pb
Comment:
Method: Cu Pb
Computer name: DESKTOP-LUNGLIE
Serial Number: MY18130003

Method: Cu (Zeeman)

Element - Matrix: Cu -
Instrument Type: Zeeman
Conc. Units: ug/L
Instrument Mode: Absorbance
Sampling Mode: Autocontrol
Calibration Mode: Concentration
Measurement Mode: Peak Height
Replicates Standard: 2
Replicates Sample: 2

Separation Factor: 1.0
Minimum Reading: Disabled
Smoothing: 7 point
Conc. Dec. Places: 2

Wavelength: 327.4 nm
Slit Width: 0.5 nm
Gain: 50 %
Lamp Current: 4.0 mA
Lamp Position: 1
Background Correction: RC On

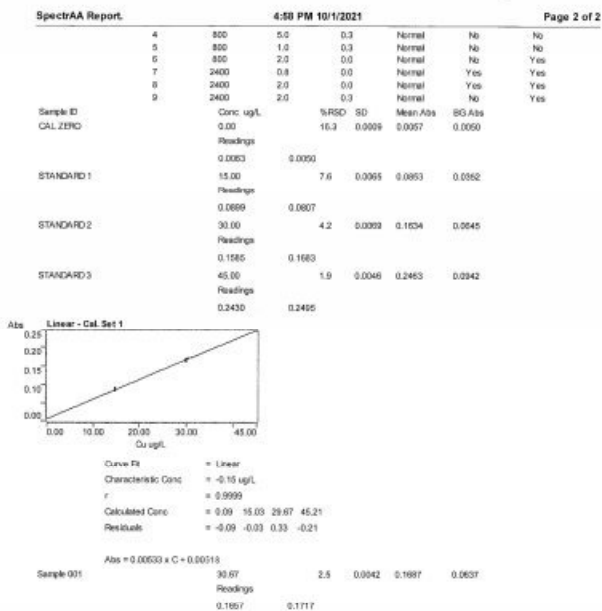
STANDARD 1: 15.00 ug/L
STANDARD 2: 30.00 ug/L
STANDARD 3: 45.00 ug/L
Restope Rate: 10
Restope Standard No.: 2
Restope Lower Limit: 75.0 %
Restope Upper Limit: 125.0 %
Recalibration Rate: 20
Calibration Algorithm: Linear
Cal. Lower Limit: 20.0 %
Cal. Upper Limit: 150.0 %

Workhead Height: 0.0 mm
Total Volume: 15 uL
Sample Volume: 10 uL
Vial Reduction Factor: 2
Bulk Conc.: 30.00 ug/L
Bulk Vial No.: 49
Makeup Vial No.: 50
Sample No. of Injections: 1
Sample Last Dry Step: 1

Step	Temp (C)	Time (s)	Flow (uL/min)	Gas Type	Read	Signal Storage
1	65	5.0	0.3	Normal	No	No
2	95	40.0	0.3	Normal	No	No
3	120	10.0	0.3	Normal	No	No

SVD Results Report

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

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

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

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Page 1 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP-OES 5110 VDV
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 811158	1. MY 195 50021
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass other
Torch	Radial Dual View other
Injector Diameter	2.4mm 5.8mm 1.4mm 0.8mm other
Injector Material	Quartz Ceramic other

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Page 2 of 8

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- ✓ Discuss any specific questions or issues with the customer prior to starting.
- ✓ Review the instrument logbook.
- ✓ Perform general external inspection of system for cleanliness.
- ✓ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ✓ Check for required firmware/software updates and verify with customers if they would like it installed.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *not*
- ✓ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the 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 SYDV 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. *not*
- ✓ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- Section 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 Polyclear Plus cooling fluid.
- ✓ Clean the cooling system Air filter and the condenser.

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Page 3 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ✓ Water Flow
- ✓ Gas Flows
- ✓ RF Generator
- ✓ Camera Test
- ✓ Optics Test
- ✓ Nebulizer Test

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	4.013.3	1.351.1	4.141.4	3.618.3
Mn 257.610 nm SRBR	11415.1	31494.3	11441.6	34412.4
Al 396.152 nm SBR	3.3	15.3	4.3	13.3
R 795.691 nm SBR	5.3	13.3	5.3	14.3

* 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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Page 5 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

- Section 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 rucks 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

- Section 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

AVS 4, 6, 7

- Section 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

Instrument Adjustment

- ✓ Check position of Zn peak, adjust if required.
- ✓ Check Argon Ratio, adjust to specified value if required.
- ✓ Perform Detector Calibration.
- ✓ Perform Instrument Calibration.
- ✓ Run Instrument Performance Test and 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 and record the result in the Instrument Test Results Table
 - ✓ Subsystem Communications Test
 - ✓ Air Flow

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Page 4 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

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	115.113 VAC	144.510 VAC
Mains Current	8.114 A	3.213 A
Instrument Temperature	13.4 °C	13.5 °C
RF Air Flow (sensor speed)	16.8 Hz	19.8 Hz
Plasma Exhaust Temperature	No measurement	15.8 °C
Water Flow Oscillator	No measurement	1.33 L/min
Water Flow Detector	8.88 L/min	1.13 L/min
Water Inlet Temperature	14.1 °C	13.1 °C
Polychromator Temperature	15.8 °C	15.0 °C
OCD Temperature	16.4 °C	-14.3 °C
Thermal Stabiliser	15.8 °C	15.8 °C
Argon Supply Pressure	144.15 kPa	144.15 kPa
Purge Gas Supply Pressure*1	141.14 kPa	144.15 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	8.10 L/min
Nebulizer Back Pressure	No measurement	141.65 kPa
Plasma Gas Flow	No measurement	15.80 L/min
Auxiliary Gas Flow	No measurement	1.28 L/min
RF Power	No measurement	1201.3 W
RF Supply Current	No measurement	8.13 A
RF Supply Voltage	No measurement	144.510 V

*1 If option installed

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Page 6 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist



ICP-OES Parts List Table

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A, G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8005-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	—
Rotor seal for 6-7 port valve for AV80/7	G8404-60002	G8494A/G8495	—
Rotor seal for 4 port valve for AV84	G8403-60002	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 engineers 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	—

Restore system

For ICP applications, ask the customer to reinstall their sample introduction system.

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

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

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Page 7 of 8

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เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY1803001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:58 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	Pass
Precision Test	Pass

Page 1 of 4

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist



- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

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.

Other Important Customer Web Links

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes/literature>
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number: 500453313 Date service completed: 04/12/21

Agilent signature: [Signature] Customer signature: [Signature]

Document part number: G8014-60075

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Page 8 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Resolution Test	Specification	Width	Pass
Element Wavelength			
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	6.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.156 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.568 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.06	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (614.171 nm)	≤ 42.00	24.99	
Ar (676.263 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test		Pass				
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4	
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2	
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6	
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6	
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8	
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5	
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17096.5	
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0	
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2	
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7	
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9	
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4	
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2	
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314644.0	1807.4	
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1	
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374903.6	7249.0	
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4	
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3	
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6	

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	Nukoon L.	
Test Completed On	12/9/2021 12:55:49 PM	
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	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Optics Test		
	Pass	
	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	1.21
Zn (213.857 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 2.60	0.41
Mn (257.610 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.51
K (766.491 nm)	≤ 1.50	0.36
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.73
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.26
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.54
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.64
K (766.491 nm)	≤ 1.50	0.56

เอกสารไม่ควบคุม

Resolution Test		Pass	
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.22	
As (188.980 nm)	≤ 8.20	6.15	
C (193.027 nm)	≤ 11.50	8.22	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.158 nm)	≤ 13.40	9.21	
Zn (213.857 nm)	≤ 8.70	6.87	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.81	
Ba (230.424 nm)	≤ 9.40	7.46	
Mn (257.610 nm)	≤ 13.30	9.49	
Mn (260.568 nm)	≤ 20.30	14.19	
Cr (267.716 nm)	≤ 11.00	7.90	
Cu (324.754 nm)	≤ 25.00	18.92	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.29	
Ba (455.403 nm)	≤ 44.00	33.66	
Sr (480.733 nm)	≤ 36.00	17.64	
Ba (493.408 nm)	≤ 36.00	25.56	
Ba (614.171 nm)	≤ 42.00	24.75	
Ar (675.283 nm)	≤ 74.00	59.18	
K (766.491 nm)	≤ 80.00	65.19	

เอกสารไม่ควบคุม

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9
Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9
Mn (257.610 nm)	≥ 3518.0	SRBR	11093.6	281210.1	547.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	296.5
Zn (206.200 nm)	≥ 234.0	SRBR	1306.9	16162.3	150.3
Zn (213.857 nm)	≥ 1743.0	SRBR	8620.7	200915.6	504.7
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn (257.610 nm)	≥ 10625.0	SRBR	34490.9	1493092.8	1872.5
Cr (267.716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6
Cu (324.754 nm)	≥ 19.0	SBR	57.5	423983.7	7248.6
Al (396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9

Page 3 of 4

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030801	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Nukoon L.	
Test Completed On	12/9/2021 1:34:10 PM	
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)	
15.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

Page 1 of 2

เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.38
Se (196.026 nm)	≤ 2.60	0.91
Zn (213.857 nm)	≤ 1.50	0.38
Pb (220.353 nm)	≤ 2.60	0.44
Mn (257.610 nm)	≤ 1.50	0.43
Al (396.152 nm)	≤ 1.50	0.38
Ba (493.408 nm)	≤ 1.50	0.66
K (766.491 nm)	≤ 1.50	0.36
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.61
Se (196.026 nm)	≤ 1.50	0.52
Zn (206.200 nm)	≤ 1.50	0.36
Zn (213.857 nm)	≤ 1.50	0.33
Cd (214.439 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 1.50	0.36
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.25
Cu (324.754 nm)	≤ 1.50	0.71
Al (396.152 nm)	≤ 1.50	0.44
Ba (493.408 nm)	≤ 1.50	0.73
K (766.491 nm)	≤ 1.50	0.97

Page 4 of 4

เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	141.475				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.874				
Work Coil Current (A)	45.931				
RF Power Supply Current (A)	2.000				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.261	Passed		
Dark Current Test	6000	0.734	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

เอกสารไม่ควบคุม