ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ

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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Stan	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Stan	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Total Suspended Particulate	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0711	16-Jul-24	16-Jul-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Stack	Ammonia	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Ammonia	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Ammonia	Flue gas Analyzer	RYG_FS0711	16-Jul-24	16-Jul-25	12
Stack	Ammonia	Dry Gas	RYG_FS0317	10-Jan-25	10-Jul-25	6
Stack	Ammonia	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0457	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0551	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0461	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	BKK_FS1068	3-Jan-25	3-Jul-25	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	RYG_FS0456	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	RYG_FS0263	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	RYG_FS0460	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	RYG_FS0266	4-Jan-25	4-Jul-25	6
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0665	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0398	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0295	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0175	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0173	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0182	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0178	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NRH_FS0056	8-Mar-24	8-Sep-25	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0216	22-Oct-24	22-Oct-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0432	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0433	27-Jan-25	26-Jan-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0635	7-May-24	7-May-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0440	12-Feb-25	11-Feb-26	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0037	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0038	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0039	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0639	2-Oct-24	2-Oct-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0236	17-May-24	17-May-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0231	23-Dec-24	23-Dec-25	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	19-Jan-24	19-Jul-25	18
Rayong Lab	BOD	BOD meter with Sensor	RYG_EN0052	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	24-Sep-24	24-Sep-25	12
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	19-Mar-25	19-Mar-26	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0063	21-Mar-24	21-Sep-25	18
Rayong Lab	Temperature	pH meter	RYG_FS0596	1-Jul-24	1-Jul-25	12
Rayong Lab	Dissolved Oxygen	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Water Lab	Chloroform	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Bromoform	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Dibromochloromethane	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Bichlorobromomethane	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18

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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Water Lab	Total Trihalomethanes	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Rayong Lab	Dissolved Oxygen (on site)	DO Meter	RYG_FS0546	13-Aug-24	13-Aug-25	12
Water Lab	Copper	ICP-MS	BKK_EL0043	4-Oct-24	4-Apr-26	18
Water Lab	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Copper	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Iron	ICP-MS	BKK_EL0043	4-Oct-24	4-Apr-26	18
Water Lab	Iron	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Iron	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Calcium Hardness	Burette	BKK_EN0171	27-Feb-24	27-Aug-25	18
Rayong Lab	Total Alkalinity	pH meter	RYG_EN0183	19-Jan-24	19-Jul-25	18
Rayong Lab	Conductivity	Conductivity meter	RYG_EN0200	21-Mar-25	21-Sep-26	18
Rayong Lab	Total Hardness	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	Nitrate	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Silica	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Turbidity	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0168	11-Mar-24	11-Sep-25	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0183	19-Jan-24	19-Jul-25	18

Lot No. 2511749-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. **Location** : HRSGs 1
Date : 11 Mar 25 **Test Operator** : Saksit P.

O_2 ANALYZER
Model : TELEDYNE API 200EH **Serial No.** : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.15	0.05	0.40
Low-Level Gas	8.00	8.20	8.10	0.40
Span Gas	16.02	16.27	16.17	0.40

NO_x ANALYZER
Model : TELEDYNE API 200EH **Serial No.** : 774
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.30	0.15	0.08
Low-Level Gas	82.39	82.74	82.59	0.07
Span Gas	164.40	164.85	164.75	0.05

SO2 ANALYZER
Model : TELEDYNE API 100EH **Serial No.** : 437
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	-0.04	-0.02	0.01
Low-Level Gas	78.75	78.70	78.72	0.01
Span Gas	159.90	159.80	159.85	0.02

CO ANALYZER
Model : TELEDYNE API 300EM **Serial No.** : 451
Span (ppm) : 500

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	-0.05	-0.01	0.01
Low-Level Gas	79.48	79.43	79.47	0.01
Span Gas	407.40	407.35	407.39	0.01

Calibrated by

Saksit P

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

Lot No. 2511749-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. **Location** : HRSGs 1
Date : 11 Mar 25 **Test Operator** : Saksit P.

O_2 ANALYZER
Cylinder Conc. (%) : 16.02 **Span (%)** : 25

	O_2 Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.15	0.15	0.00	0.05	0.40	0.40
Upscale Gas	16.27	16.27	0.00	16.17	0.40	0.40

NO_x ANALYZER
Cylinder Conc. (ppm) : 164.40 **Span (ppm)** : 200

	NO_x Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.30	0.30	0.00	0.15	0.08	0.08
Upscale Gas	164.85	164.85	0.00	164.75	0.05	0.05

SO_2 ANALYZER
Cylinder Conc. (ppm) : 159.90 **Span (ppm)** : 200

	SO_2 Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.04	-0.04	0.00	-0.02	0.01	0.01
Upscale Gas	159.80	159.80	0.00	159.85	0.02	0.02

CO ANALYZER
Cylinder Conc. (ppm) : 407.40 **Span (ppm)** : 500

	CO Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.05	-0.05	0.00	-0.01	0.01	0.01
Upscale Gas	407.35	407.35	0.00	407.39	0.01	0.01

Calibrated by

Saksit P

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	1
Date	11 Mar 25	Location	HRSGs 1
Start Time	11:10	Test Operator	Saksit P.
SO_2 Analyzer Model	TELEDYNE API 100EH	Finish Time	11:30
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	437
CO/CO_2 Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	451

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:10	13.94	3.87	12.61	0.16	1.55	
11:11	13.95	3.87	12.73	0.16	1.55	
11:12	13.95	3.86	12.54	0.16	1.54	
11:13	13.95	3.86	12.07	0.15	1.58	
11:14	13.96	3.85	11.44	0.15	1.50	
11:15	13.95	3.86	10.90	0.15	1.55	
11:16	13.96	3.86	10.53	0.14	1.47	
11:17	13.95	3.85	10.26	0.14	1.47	
11:18	13.95	3.85	10.01	0.14	1.46	
11:19	13.95	3.85	9.89	0.15	1.48	
11:20	13.95	3.85	9.79	0.14	1.52	
11:21	13.95	3.86	9.78	0.14	1.49	
11:22	13.94	3.86	9.74	0.14	1.56	
11:23	13.94	3.86	9.72	0.15	1.53	
11:24	13.94	3.86	9.76	0.14	1.56	
11:25	13.95	3.86	9.79	0.14	1.46	
11:26	13.96	3.86	9.79	0.15	1.52	
11:27	13.96	3.86	9.75	0.14	1.48	
11:28	13.95	3.85	9.66	0.14	1.49	
11:29	13.96	3.85	9.62	0.14	1.46	
11:30	13.95	3.85	9.58	0.14	1.46	
Average	13.95	3.85	10.49	0.15	1.51	

Saksit P

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	2
Date	11 Mar 25	Location	HRSGs 1
Start Time	11:31	Test Operator	Saksit P.
SO_2 Analyzer Model	TELEDYNE API 100EH	Finish Time	11:51
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	437
CO/CO_2 Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	451

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:31	13.95	3.86	9.65	0.15	1.45	
11:32	13.95	3.86	9.63	0.14	1.48	
11:33	13.93	3.86	9.63	0.15	1.50	
11:34	13.94	3.86	9.58	0.15	1.56	
11:35	13.94	3.86	9.58	0.14	1.38	
11:36	13.95	3.86	9.59	0.15	1.48	
11:37	13.95	3.85	9.62	0.15	1.44	
11:38	13.95	3.85	9.63	0.15	1.46	
11:39	13.95	3.85	9.65	0.15	1.38	
11:40	13.96	3.85	9.58	0.15	1.43	
11:41	13.95	3.85	9.48	0.15	1.47	
11:42	13.93	3.86	9.45	0.15	1.49	
11:43	13.93	3.86	9.47	0.14	1.50	
11:44	13.95	3.86	9.48	0.15	1.59	
11:45	13.96	3.85	9.46	0.15	1.43	
11:46	13.95	3.85	9.48	0.15	1.59	
11:47	13.95	3.85	9.52	0.15	1.43	
11:48	13.95	3.86	9.51	0.15	1.45	
11:49	13.95	3.83	9.50	0.14	1.47	
11:50	13.94	3.86	9.51	0.15	1.45	
11:51	13.96	3.86	9.50	0.14	1.36	
Average	13.95	3.85	9.55	0.15	1.46	

Saksit P

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	11 Mar 25	Location	HRSGs 1
Start Time	11:52	Test Operator	Saksit P.
SO_2 Analyzer Model	TELEDYNE API 100EH	Finish Time	12:12
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	437
CO/CO_2 Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	451

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:52	13.95	3.86	9.45	0.15	1.50	
11:53	13.95	3.87	9.41	0.15	1.43	
11:54	13.93	3.88	9.44	0.15	1.54	
11:55	13.93	3.86	9.46	0.14	1.57	
11:56	13.95	3.86	9.46	0.15	1.56	
11:57	13.93	3.86	9.48	0.15	1.48	
11:58	13.92	3.85	9.51	0.15	1.46	
11:59	13.92	3.86	9.51	0.15	1.47	
12:00	13.95	3.85	9.45	0.16	1.52	
12:01	13.96	3.85	9.39	0.15	1.52	
12:02	13.96	3.85	9.34	0.16	1.49	
12:03	13.94	3.86	9.34	0.14	1.55	
12:04	13.94	3.86	9.39	0.15	1.48	
12:05	13.94	3.87	9.45	0.16	1.47	
12:06	13.94	3.86	9.54	0.15	1.50	
12:07	13.95	3.86	9.54	0.15	1.51	
12:08	13.96	3.85	9.49	0.15	1.42	
12:09	13.93	3.86	9.47	0.15	1.45	
12:10	13.94	3.86	9.55	0.14	1.43	
12:11	13.94	3.86	9.61	0.15	1.49	
12:12	13.96	3.86	9.61	0.15	1.49	
Average	13.95	3.85	9.47	0.15	1.49	

Saksit P

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

Airgas.
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	AIR LIQUIDE (THAILAND) LTD		
Part Number:	E04NI99E3HA0002	Reference Number:	160-402340013-1
Cylinder Number:	GN0027210	Cylinder Volume:	247.2 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2215 PSIG
PGVP Number:	A12022	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Feb 11, 2022

Expiration Date: Feb 11, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R 12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytica uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.39 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/
CARBON MONOXIDE	80.00 PPM	79.48 PPM	G1	+/- 0.6% NIST Traceable	02/04/2022
NITRIC OXIDE	80.00 PPM	82.38 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/
SULFUR DIOXIDE	80.00 PPM	78.75 PPM	G1	+/- 0.9% NIST Traceable	02/04/2022, 02/11/
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Dat
NTRM	09010212	KAL004777	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	200610-15	CC733106	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
NTRM	200610-04	CC708044	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889139	CC323707	4.097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010419	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Feb 03, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 10, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.5 Kg
Net Weight: 8.1 Kg

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E3HA0026	Reference Number:	82-401257890-1
Cylinder Number:	ND62877	Cylinder Volume:	247.2 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2215 PSIG
PGVP Number:	B52018	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Aug 07, 2018

Expiration Date: Aug 07, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	160.0 PPM	164.4 PPM	G1	+/- 1.1% NIST Traceable	07/30/2018, 08/07/2018
NITRIC OXIDE	160.0 PPM	164.4 PPM	G1	+/- 1.1% NIST Traceable	07/30/2018, 08/07/2018
SULFUR DIOXIDE	160.0 PPM	159.9 PPM	G1	+/- 1.1% NIST Traceable	07/30/2018, 08/07/2018
CARBON MONOXIDE	400.0 PPM	407.4 PPM	G1	+/- 1.1% NIST Traceable	07/30/2018
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	17060241	EB0079587	100.3 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	May 11, 2019
PRM	12368	5604119	29.86 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
GMIS	7042010104	CC503941	0.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NTRM	11010414	KAL004792	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023
NTRM	15060538	CC453507	491.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jan 08, 2021

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 CO	FTIR	Jul 19, 2018
Nicolet 6700 APW1100391 NO	FTIR	Jul 12, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 03, 2018
Nicolet 6700 APW1100391 SO2	FTIR	Aug 02, 2018

Triad Data Available Upon Request

NOTES:
Net weight: 8107 grams
Gross weight: 47690 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability P
Document EPA-600/R-12/531. All testing processes and measurements conform to the re
ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this ce
are certified to be NIST Traceable with total uncertainty as detailed under Analytical Unce
document shall not be reproduced in full without written approval of the issuer.

ACCREDITED
TESTING CERT No. 3082.05

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI92E3HA0000	Reference Number:	82-401018725-1
Cylinder Number:	ND60018	Cylinder Volume:	248.4 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2214 PSIG
PGVP Number:	B52017	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Oct 23, 2017

Expiration Date: Oct 23, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	8.003 %	G1	+/- 0.4% NIST Traceable	10/23/2017
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRMplus	09060208	CC262337	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Sep 28, 2017

Triad Data Available Upon Request

NOTES:
This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.

ACCREDITED
TESTING CERT No. 2000.02

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	AIR LIQUIDE (THAILAND) LTD		
Part Number:	E02NI84E3HA0001	Reference Number:	160-402340010-1
Cylinder Number:	GN0027197	Cylinder Volume:	249.8 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2214 PSIG
PGVP Number:	A12022	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Feb 02, 2022

Expiration Date: Feb 02, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	16.00 %	16.02 %	G1	+/- 0.4% NIST Traceable	02/02/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010230	K005228	23.20 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-WS-951 - O2	PARAMAGNETIC	Jan 27, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg
Net Weight: 8.2 Kg

Approved for Release

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date: 6-Feb-25
Next Cal. Date: 6-Aug-25

Barometric Pressure (mmHg): 752
Relative Humidity (%): 45.5
Temperature (°C): 31.5

Reference Dry Gas Meter Data
Reference Dry Gas Meter ID: BRK_FS11122
Serial No.: A2003240
Correction Factor (Y): 1.0000
Next Calibration Date: 25 Feb 26

Console Control Meter Data
Calibration No.: C-060225-RYG_FS0316
Dry Gas Meter ID: RYG_FS0316
Serial No.: 1706091
Model No.: XC-572-V

ΔH (mm.H2O)	θ Minutes	Reference Dry Gas Meter Calibration: Vr (Liters) Final	Vr (Liters) initial	Vr (Liters) Total	Tr (°C)	Console Control : Dry gas Meter: Vm (Liters) Final	Vm (Liters) initial	Vm (Liters) Total	Ti (°C)	To (°C)	Avg.Tm (°C)	Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor ΔHg
15	12.07	160.18	0.00	160.18	29.0	1164.4	1013.0	151.40	30.0	30.0	30.0	0.9908	44.6366
25	9.32	150.04	0.00	150.04	29.0	1380.6	1230.0	150.60	30.0	30.0	30.0	0.9971	44.4413
50	6.55	150.10	0.00	150.10	29.0	1550.8	1400.0	150.80	30.0	30.0	30.0	0.9938	43.8652
80	5.10	150.33	0.00	150.33	29.0	1720.6	1570.0	150.80	30.0	30.0	30.0	0.9924	42.4197
120	4.17	150.38	0.00	150.38	29.0	1900.9	1750.0	150.90	30.0	30.0	30.0	0.9863	42.5111
											Avg.	0.9931	43.5752

Y : Ratio of reading of reference to dry gas meter ; tolerance for individual values ± 0.02 from average.
ΔHg : Orifice pressure differential that equates to 21.24 lm of air @ 25 C and 760 mm of mercury , mmH2O ; tolerance for individual values ± 5.08 from average.
Procedure: 40 CFR 60,APP A,METH. SEC 5.3 & 7

Calibrated by: Saksit Phasiriphisut (Mr. Saksit Phasiriphisut) RYG Field Service Scientist(4)

Approved by: Nattapon Jangwareewong (Mr.Nattapon Jangwareewong) RYG Field Service Specialist(1)

FORM NO.: F-RY-024 REVISION NO.: 2 ISSUE DATE: 4th Jun 22

DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	2 Jun 25	Ambient Temperature (°C) :	31.5
Calibration sheet No. :	C-060225-RYG_FS0315	Relative Humidity (%) :	45.5
Digital Temperature ID :	RYG_FS0315	Reference Temperature ID :	RYG_FS0681
Serial No. :	1706091	Serial No. :	201090014918
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	13 May 25

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
Probe	100	102	2	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	101	1	±3	Pass
	120	120	0	±3	Pass
	140	141	1	±3	Pass
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	140	0	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมได้

Calibrated by : Saksit Phaisanphisut
(Mr. Saksit Phaisanphisut)
RYG Field Service Scientist (4)

Approved by : Natthapol Jiengwareewong
(Mr.Natthapol Jiengwareewong)
RYG Field Service Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 16/2/23

PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date :	6 Feb 25	Nozzle Set ID. :	RYG_FS0319
Calibration Sheet No. :	C-060225-RYG_FS0319	Vernier Caliper ID.:	BKK_FS1123

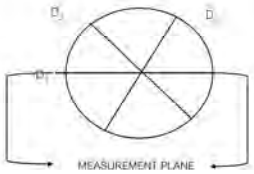
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D_1	D_2	D_3	ΔD	D_{avg}
1	0.298	0.300	0.305	0.007	0.301
2	0.465	0.475	0.465	0.010	0.468
3	0.605	0.605	0.605	0.000	0.605
4	0.540	0.540	0.540	0.000	0.540
5	0.770	0.760	0.765	0.010	0.765
6	0.930	0.928	0.930	0.002	0.929
7	1.082	1.080	1.085	0.005	1.082
8	1.240	1.230	1.235	0.010	1.235
9	1.594	1.558	1.551	0.043	1.568

Where :

D_1, D_2, D_3 = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

$D_{avg} = (D_1 + D_2 + D_3) / 3$

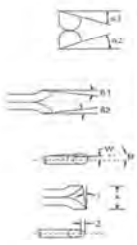


Calibrated by : Saksit Phaisanphisut
(Mr. Saksit Phaisanphisut)
RYG Field Service Scientist (4)

Approved by : Natthapol Jiengwareewong
(Mr.Natthapol Jiengwareewong)
RYG Field Service Specialist (1)

Type S Pitot Tube Calibration

Date Calibration	6-Feb-25	**Due Date**	9-Aug-25
Pitot ID	RYG_FS0321	**Inclinometer ID**	BKK_FS1131
Pitot SN	-	**Vernier ID**	RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	-1.4	-10° < α1 < +10°	OK
α2	-0.2	-10° < α2 < +10°	OK
β1	0.8	-5° < β1 < +5°	OK
β2	-0.4	-5° < β2 < +5°	OK
γ	0.8	-	-
θ	0.5	-	-
Z = A tan γ	0.013	Z ≤ 0.125"	OK
W = A tan θ	0.008	W ≤ 0.031"	OK
Dt	0.310	0.188" to 0.375"	OK
A/2Dt	1.484	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

Certify that pitot tube/porbe meets or exceeds all specifications, crieria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84 . See 40 CFR Pt. 60, App. A,EPA Method 2.

Calibrated by : Saksit Phaisanphisut
(Mr. Saksit Phaisanphisut)
RYG Field Services Scientist (4)

Approved By : Natthapol Jiengwareewong
(Mr.Natthapol Jiengwareewong)
RYG Field Services Specialist (1)

FORM NO.: F 06-124 REVISION NO.: 0 ISSUE DATE: 25/12/23

Calibration certificate Kalibrier-Zertifikat

5753561

Object Gegenstand	Control Unit t350	Measuring Box testo 350
Manufacturer Hersteller	TESTO SE & Co. KGaA	TESTO SE & Co. KGaA
Type description Typ	0632 3511	0632 3510
Serial no. Serien Nr.	64554897	64749498
Inventory no. Inventar Nr.	---	---
Test equipment no. Prüfmittel Nr.	---	---
Equipment no. Equipment Nr.	15862485	15861584
Location Standort	---	---
Customer Auftraggeber	ALS Laboratory Group (Thailand) Co., Ltd 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang TH Bangkok 10250 Thailand	
Customer ID no. Kunden Nr.	1031994	
Order no. Auftrags Nr.	12459724 / 0520 0055	
Date of calibration Datum der Kalibrierung	16.07.2024	
Date of the recommended re-calibration Datum der empfohlenen Rekalibrierung	16.07.2025	
Conformity statement Konformitätsaussage	Pass	

Hereby we confirm that the performing calibration laboratory is working with a management system according to ISO 9001:2015 and DIN EN ISO/IEC 17025:2018. Accreditation certificates can be found under www.testo/is.de. The measuring installations used for calibration are regularly calibrated and traceable to the national standards of the German Federal Physical Technical Institute (PTB) or other national standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement. The documents established for this procedure are available for viewing. All the necessary measured data can be found on this calibration certificate.

Hiermit bestätigen wir, dass das durchführende Kalibrierlabor ein Managementsystem nach ISO 9001:2015, sowie DIN EN ISO/IEC 17025:2018 eingeführt hat. Die Urkunden finden Sie auf www.testo/is.de. Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch Technischen Bundesanstalt (PTB) Deutschlands oder auf andere nationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln und Normen. Die für diesen Vorgang angefertigte Dokumentation kann eingesehen werden. Alle erforderlichen Messdaten sind in diesem Kalibrier-Zertifikat aufgelistet.

REVIEW BY Madison P.
APPROVED BY Nicha Oh
NEXT CAL. DATE 16/7/25

The expanded uncertainty of measurement was calculated according to EA-4/02 M:2022 with a coverage probability of about 95% and contains the uncertainty of the reference, the uncertainty of the method and the uncertainty of the test specimen. The conformity statement is made according to the decision rule "confidence level 50".
Die erweiterte Messunsicherheit wurde nach EA-4/02 M:2022 mit einer Überdeckungswahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid.
Dieser Kalibrierschein darf nur vollständig weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift und Stempel haben keine Gültigkeit.

Seal Stempel: KIRCHZARTEN testo TESTO INDUSTRIAL SERVICES
Supervisor Fachverantwortlicher: Martin Förderer
Technician Bearbeiter: S. Garcia — Samuel Garcia Zlodi

Testo Industrial Services GmbH
Gewerbestraße 3
79199 Kirchzarten
Tel +49 7661 90901-8000
Fax ---
www.testo/is.de
info@testo/is.de

testo

Calibration certificate Kalibrier-Zertifikat 5753561

Measuring equipment Messeinrichtungen

Index	Reference Referenz	Traceability Rückführung	Next cal. Rekal	Certificate-no. Zertifikat-Nr.	Eq.-no. Eq.-Nr.
a	Test gas medium 1 Prüfgas Medium 1	SCS-SCS0026 2024-02	2025-02	5514470	12898976
b	Test gas medium 3 Prüfgas Medium 3	SCS-SCS0026 2024-02	2025-02	5524390	12898987
c	Test gas medium 5 Prüfgas Medium 5	SCS-SCS0026 2024-02	2025-02	5501047	12898884
d	Test gas medium 8 Prüfgas Medium 8	SCS-SCS0026 2023-07	2024-07	5163030	12898887
e	Test gas medium 7 Prüfgas Medium 7	SCS-SCS0026 2024-02	2025-02	5514483	12898886
f	Test gas medium 11 Prüfgas Medium 11	SCS-SCS0026 2023-06	2024-06	5183035	14087964

Reference certificates are available at www.primasonline.com Referenzzertifikate sind auf www.primasonline.com abrufbar

Ambient conditions Umgebungsbedingungen

Temperature Temperatur (20...26) °C Humidity Feuchte (20...60) % RH % rF

Measuring procedure Messverfahren

The calibration was carried out by comparison measurement with calibrated test gases.
Die Kalibrierung erfolgte durch Vergleichsmessung mit kalibrierten Prüfgasen.

Measuring results Messergebnisse

Channel Kanal ---

Reference value Bezugswert		Indicated measured value probe Angezeigter Messwert Kalibriergegenstand		Deviation Abweichung		Allowed deviation[a] Zulässige Abweichung[a]		Measurement uncertainty (k=2) Messunsicherheit (k=2)		Confirmation Bewertung
ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	
CO										
100,6[e]	---	100	---	-0,6	---	± 11	---	3,3	---	pass
401,0[b]	---	403	---	2,0	---	± 21	---	8,4	---	pass
700,0[c]	---	702	---	2,0	---	± 36	---	14,4	---	pass
NO										
150,2[a]	---	151	---	0,8	---	± 9	---	4,0	---	pass
300[d]	---	302	---	2	---	± 16	---	6,9	---	pass
NO2										
100,4[e]	---	102,3	---	1,9	---	± 5,1	---	3,20	---	pass
SO2										
97,9[f]	---	96	---	-1,9	---	± 6	---	3,5	---	pass
O2										
---	0,00[a]	---	0,09	---	0,09	---	± 0,21	---	0,027	pass
---	2,52[c]	---	2,57	---	0,05	---	± 0,21	---	0,055	pass
---	5,01[b]	---	5,17	---	0,16	---	± 0,21	---	0,102	pass

[a] in accordance with the manufacturer gemäß Hersteller

Remarks Bemerkungen

SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

NSC-TISI-TIS 17025
CALIBRATION 0426

Calibration certificate

Calibration Certificate No. 25BKL0003

Object	Electronic non-automatic weighing instrument
Manufacturer	Sartorius
Type	MSU224S-100-DU
Serial | QM Ident. no.	31709552 | RYG_EN0003
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand
Order no	2230
Number of pages	4
Date of calibration	20 Feb 2025

This calibration certificate documents the traceability to national standards

Uncertainties of measurements are taken into account when only statements of compliance are made.

This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08

This certificate relate and apply this equipment only.

REVIEW BY Thanitak.

APPROVED BY D Amnuay

NEXT CAL DATE 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	Approval of the Calibration Certificate	Person in charge
06 Mar 2025	Mr. Chonchai Inthana	Kachen Lalee

Calibration object

Single range instrument

Model	MSU224S-100-DU
Serial Number	31709552
QM Ident. no | Inventory no.	RYG_EN0003 | ---
Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department | Cost center	Laboratory Department. | ---
Building | Floor	--- | 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M23081§7S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration | Temp. diff. $T_{weights} - T_{place}$	24.7 °C | 0.3 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 62.3 %RH

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g | 200 g		
	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0001 g
3	9.9999 g	200.0000 g
4	10.0000 g	200.0000 g
5	10.0000 g	200.0001 g
6	9.9999 g	200.0000 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0000 g
9	10.0000 g	200.0000 g
10	10.0000 g	200.0001 g
	s = 0.00004 g	s = 0.00005 g

Eccentricity

Test load (nominal):	100 g
Center	100.0000 g
Front left	100.0000 g
Back left	100.0001 g
Back right	99.9999 g
Front right	99.9999 g

Maximum deviation from centric loading indication
$|\Delta I_{ecc}|_{max}$ = 0.0001 g

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00018 g	0.00018 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00028 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %
Maximum error of indication		$\|E\|_{max}$ = 0.0001 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L. The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

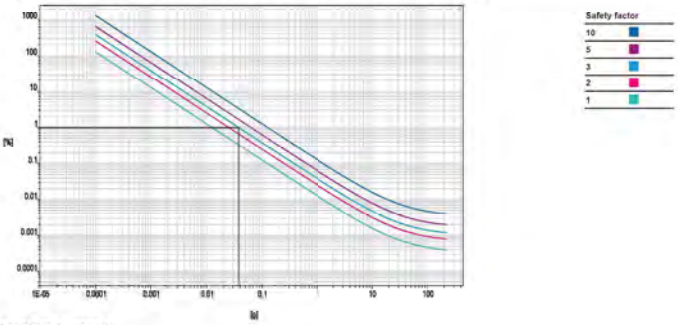
Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10⁻⁴/K

Uncertainty of the weighing result $U_{g}(W)$ $U_{g}(W) = 0.00013\ g + 3.42 \cdot 10^{-5} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading *R* into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication *R*	Uncertainty $U_{g}(W)$	Uncertainty relative $U_{g}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00032 g	0.00058 %
50 %	110.0000 g	0.00051 g	0.00046 %
75 %	165.0000 g	0.00069 g	0.00042 %
100 %	220.0000 g	0.00088 g	0.00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0380 g

DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date	10-Jan-25	Barometric Pressure (mm.Hg)	756.2
Next Calibration Date	10-Jul-25	Relative Humidity (%)	37.9
		Temperature (°C)	28.1
Dry Gas Meter Data		***Reference Dry Gas Meter Data***	
Calibration sheet No.	C-100125-RYG_FS0317	Reference Dry Gas Meter ID	BKK_FS1122
Dry Gas Meter ID	RYG_FS0317	Serial No.	A2003240
Serial No.	1706003	Correction Factor (Y)	1.0000
Model No.	XC-62-CV	Next Calibration Date	25-Feb-26

Reference Dry Gas Meter Calibration				Dry Gas Meter						Dry Gas Meter Correction
Vr (Liters)			Tr	Vm (Liters)			Ti	To	Avg. Tm	Factor
Final	Initial	Total	(°C)	Final	Initial	Total	(°C)	(°C)	(°C)	(Y)
30.00	0.00	30.00	24.0	30.02	0.00	30.02	25.0	25.0	25.0	1.0028
30.00	0.00	30.00	26.0	30.02	0.00	30.02	26.0	26.0	26.0	0.9993
60.00	0.00	60.00	27.0	60.02	0.00	60.02	27.0	27.0	27.0	0.9997
60.00	0.00	60.00	27.0	60.04	0.00	60.04	28.0	28.0	28.0	1.0026
90.00	0.00	90.00	28.0	90.02	0.00	90.02	28.0	28.0	28.0	0.9998
90.00	0.00	90.00	29.0	90.03	0.00	90.03	28.0	28.0	28.0	0.9963
									Avg.	1.0001

Y = Ratio of reading of reference dry gas meter to dry gas meter ; tolerance for individual ± 0.05 from average.

Calibrate by : Mr. Warawut Pubpa
RYG Field ServiceScientist (3)

Approved by : Mr.Natthapol Jiengwareewong
RYG Field ServiceSpecialist (1)

FORM NO.: F 06-023 REVISION NO.: 1 ISSUE DATE: 30/6/22

DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	10 Jan 25	Ambient Temperature (°C)	28.1
Calibration sheet No. :	C-100125-RYG_FS0317	Relative Humidity (%) :	37.9
Digital Temperature ID :	RYG_FS0317	Reference Temperature ID	RYG_FS0681
Serial No. :	1706003	Serial No. :	201090014918
Model :	XC-62-CV	Model :	Digicon-CC-VT-MS
		Next Calibrate :	13 May 25

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
	250	251	1	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
Probe	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	-	-	-	-	-
	-	-	-	-	-
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	1	1	±3	Pass
	25	26	1	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมได้

Calibrated by : (Mr. Warawut Pubpa)
RYG Field Services Scientist (3)

Approved by : Mr.Natthapol Jiengwareewong
RYG Field Services Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 16/2/23

DKSH

Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06230441
Model:	DR6000	Issued Date:	19 September 2023
Serial No. (or ID.):	1627845 (RYG_EN0037)	Job No.:	WO-00005382
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY N.Barwut
APPROVED BY D.
NEXT CAL. DATE 18/3/25

Environment Condition:

Temperature	23.9	°C	±	0.2	
Humidity	65.3	%RH	±	1.4	

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) (Wet Chemistry)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungrueang
Calibration Date: 18 September 2023
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sigma Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungrueang)
Person in charge

(Mr. Nitinun Srihawan)
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. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2633 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2630 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-th/en/

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Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.98	638.3	-0.32	0.13
746.48	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.3	1.886
391.44 +/- 0.11 nm	391.4	1.3	1.886

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4566	0.2760		
Absorbance (A)	0.413	0.300		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
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ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ) 18 Sep 2023 ปกติ	ตรวจสอบ (รับ) 18 Sep 2023 ไม่ปกติ	รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 18 Sep 2023 ปกติ	ตรวจสอบ (ส่ง) 18 Sep 2023 ไม่ปกติ	หมายเหตุ
		General			
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☑	☐	8. ความยาวคลื่น (Wavelength Check)	☑	☐	
☑	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☑	☐	9.2 Hours
☑	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☑	☐	741.5 Hours
☑	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☑	☐	
		pH Meter and Conductivity Meter			
☐	☐	12. อิเล็คโทรด (Electrode and Connection Cable)	☐	☐	
☐	☐	13. ระดับสารละลายใน Electroce (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็คโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องผ่านของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

เพิ่มเติม/ข้อแนะนำ : *656.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungrueang

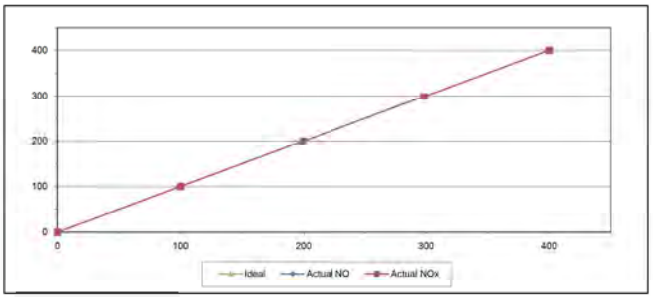
Service Engineer

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MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T278YRLL	Equipment ID	RYG_FS0457
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70	100.30	0.30	0.30
2	200.00	198.40	-1.60	-0.80	199.80	-0.20	-0.10
3	300.00	297.70	-2.30	-0.77	298.50	-1.50	-0.50
4	400.00	398.60	-1.40	-0.35	400.50	0.50	0.13
AVERAGE (%)				-0.70			-0.01



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

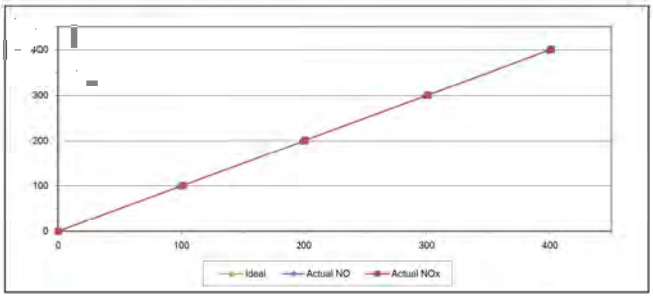
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	U8AOEAGK	Equipment ID	RYG_FS0551
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.30	1.30	1.30
2	200.00	198.70	-1.30	-0.65	201.30	1.30	0.65
3	300.00	298.40	-1.60	-0.53	301.20	1.20	0.40
4	400.00	398.50	-1.50	-0.38	401.30	1.30	0.33
AVERAGE (%)				-0.49			0.58



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

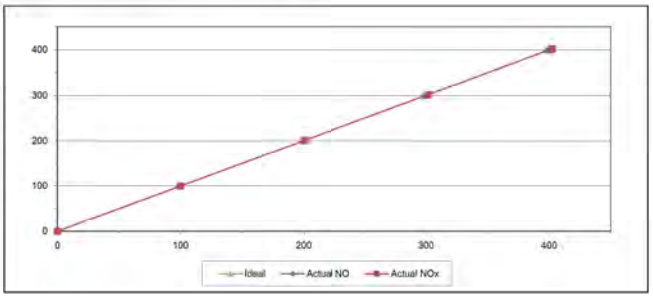
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T95HWM41	Equipment ID	RYG_FS0461
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.00	1.00	0.50
3	300.00	298.70	-1.30	-0.43	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	402.60	2.60	0.65
AVERAGE (%)				-0.31			0.41



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

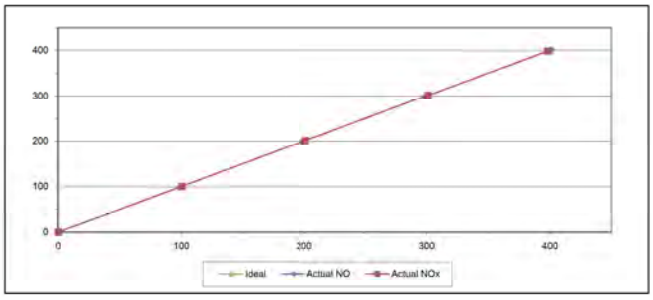
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	148EH0E0	Equipment ID	BKK_FS1064
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.70	0.70	0.70
2	200.00	199.30	-0.70	-0.35	201.40	1.40	0.70
3	300.00	298.50	-1.50	-0.50	301.30	1.30	0.43
4	400.00	401.30	1.30	0.33	398.30	-1.70	-0.42
AVERAGE (%)				-0.26			0.30



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

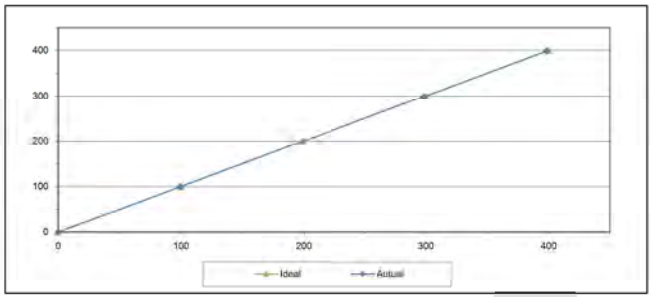
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	R0HWYDVW	Equipment ID	RYG_FS0456
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.50	-0.50	-0.25
3	300.00	298.50	-1.50	-0.50
4	400.00	398.80	-1.20	-0.30
AVERAGE (%)				-0.25



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

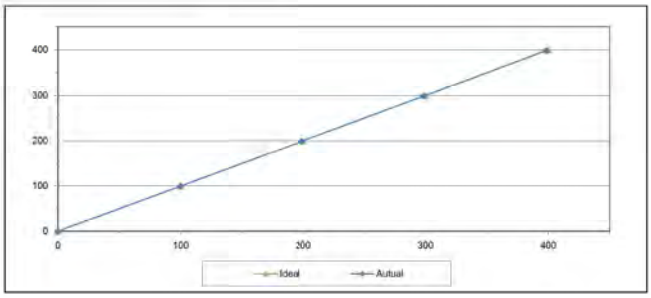
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	YPRXJJ20	Equipment ID	RYG_FS0263
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autua	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.40	-0.60	-0.30
3	300.00	298.20	-1.80	-0.60
4	400.00	398.10	-1.90	-0.47
AVERAGE (%)				-0.31



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

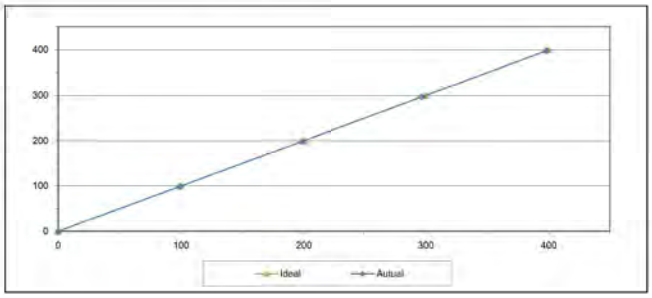
ALS Laboratory Group

FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	198.50	-1.50	-0.75
3	300.00	296.90	-3.10	-1.03
4	400.00	398.10	-1.90	-0.47
AVERAGE (%)				-0.69



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

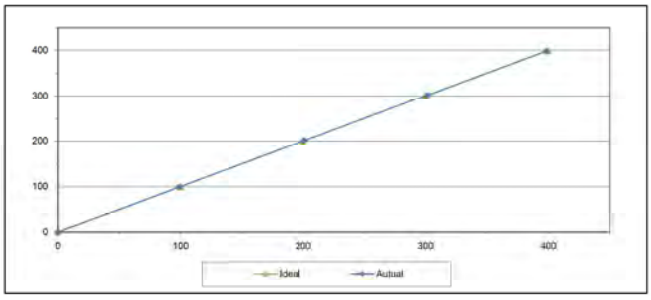
ALS Laboratory Group

FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	NM3M2D5M	Equipment ID	RYG_FS0266
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autua	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	201.10	1.10	0.55
3	300.00	302.30	2.30	0.77
4	400.00	398.20	-1.80	-0.45
AVERAGE (%)				-0.07



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

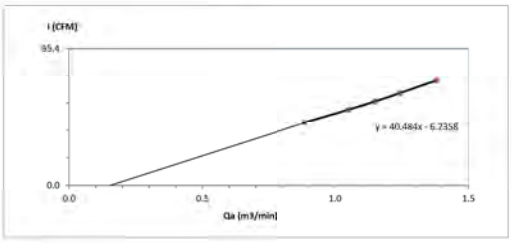
ALS Laboratory Group

FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	756.4
Calibrate Location :	วัดประชุมเมืองบ่าหุง	Temperature (°C) :	30.1
Calibrate Date :	9-Mar-25	High Volume ID :	RYG_FS0665
CalibrationSheet No.:	C-090325-RYG_FS0665	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	6264
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95561
Calibrator S/N :	1166	Calibrator Intercept :	-0.02266

Test No.	Delta H_2O (inch)	Qa (m^3/min)	I : Chart (CFM)	Linear Regression
1	1.7	0.886	30	Slope : 40.4845
2	2.4	1.049	36	Intercept : -6.2358
3	2.9	1.151	40	Correlation Coefficient : 0.9990
4	3.4	1.244	44	
5	4.2	1.380	50	



Calibrated by

(Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

Approved by :

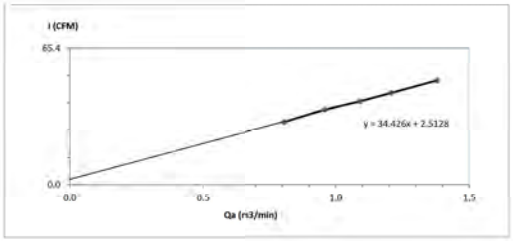
(Mr. Supot Salamteh)
RYG-Field Services Section Head

FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	บ้านสำนักหมอง	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0398
CalibrationSheet No.:	C-090325-RYG_FS0398	**High Volume Model :**	TE-5009X
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	5684
Calibrator Model :	TE-5028A	**Calibrator Slope :**	0.95561
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.02266

Test No.	Delta H_2O (inch)	Qa (m^3/min)	I : Chart (CFM)	Linear Regression
1	1.4	0.806	30	Slope : 34.4262
2	2.0	0.959	36	Intercept : 2.5128
3	2.6	1.091	40	Correlation Coefficient : 0.9994
4	3.2	1.208	44	
5	4.2	1.380	50	



Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

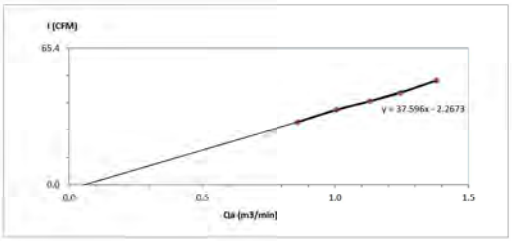
Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	โรงเรียนลุงหญ้า	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0399
CalibrationSheet No.:	C-090325-RYG_FS0399	**High Volume Model :**	TE-5009X
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	5683
Calibrator Model :	TE-5028A	**Calibrator Slope :**	0.95561
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.02266

Test No.	Delta H_2O (inch)	Qa (m^3/min)	I : Chart (CFM)	Linear Regression
1	1.6	0.861	30	Slope : 37.5963
2	2.2	1.005	36	Intercept : -2.2673
3	2.8	1.131	40	Correlation Coefficient : 0.9985
4	3.4	1.244	44	
5	4.2	1.380	50	



Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

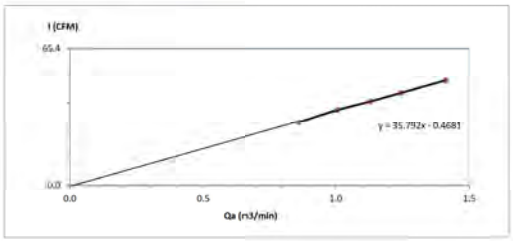
Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	โรงเรียนชุมแสง	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0295
CalibrationSheet No.:	C-090325-RYG_FS0295	**High Volume Model :**	TE-5009X
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	5502
Calibrator Model :	TE-5028A	**Calibrator Slope :**	0.95561
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.02266

Test No.	Delta H_2O (inch)	Qa (m^3/min)	I : Chart (CFM)	Linear Regression
1	1.6	0.861	30	Slope : 35.7925
2	2.2	1.005	36	Intercept : -0.4681
3	2.8	1.131	40	Correlation Coefficient : 0.9992
4	3.4	1.244	44	
5	4.4	1.412	50	



Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23

SARTORIUS

Accredited by
NSC-TISI-TIS 17025
Calibration 0426

NSC-TISI-TIS 17025
CALIBRATION 0426

Calibration certificate

Calibration Certificate No. 25BKL0001

Object	Electronic non-automatic weighing instrument
Manufacturer	Sartorius
Type	LA130S-F
Serial | QM Ident. no.	25409664 | RYG_EN0001
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.
Order no.	2230
Number of pages	4
Date of calibration	20 Feb 2025

This calibration certificate documents the traceability to national standards.

Uncertainties of measurements are taken into account when only statements of compliance are made.

This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.

This certificate relate and apply this equipment only.

REVIEW BY Thanitak.

APPROVED BY

NEXT CAL DATE 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	Approval of the Calibration Certificate	Person in charge
06 Mar 2025	Mr. Chonchai Inthana	Kachen Lalee

Calibration object

Single range instrument

Model	LA130S-F
Serial Number	25409664
QM Ident. no | Inventory no.	RYG_EN0001 | ---

Maximum capacity (Max. load)	150.0000 g
Measured range	150.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department | Cost center	Laboratory Department. | ---
Building | Floor	--- | 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration | Temp. diff. $T_{weights} - T_{place}$	24.5 °C | 1.0 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 58.0 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g | 100 g		
	10 g	100 g
1	10.0000 g	100.0000 g
2	9.9999 g	100.0000 g
3	10.0000 g	99.9999 g
4	10.0000 g	100.0000 g
5	10.0000 g	99.9999 g
6	9.9999 g	99.9999 g
7	10.0000 g	100.0000 g
8	10.0000 g	100.0000 g
9	10.0000 g	100.0000 g
10	10.0000 g	100.0000 g
	s = 0.00004 g	s = 0.00005 g

Eccentricity

Test load (nominal):	50 g
Center	50.0000 g
Front left	50.0001 g
Back right	50.0000 g
Back right	49.9999 g
Front right	50.0001 g

Maximum deviation from centric loading indication
$|\Delta I_{ecc}|_{max}$ = 0.0001 g

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.0500 g	0.0500 g	0.0000 g	2.00	0.00013 g	0.25 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
2.0000 g	2.0000 g	0.0000 g	2.00	0.00013 g	0.0065 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00069 %
100.0000 g	100.0000 g	0.0000 g	2.00	0.00021 g	0.00021 %
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00028 g	0.00019 %
Maximum error of indication		$\|E\|_{max}$ = 0.0001 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L. The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

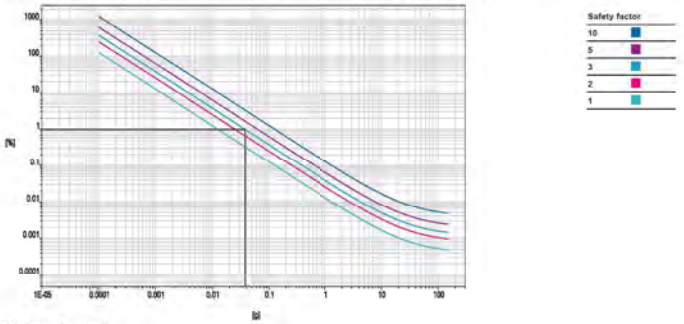
Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10^{-6}/K

Uncertainty of the weighing result $U_{gl}(W)$ $U_{gl}(W) = 0.00013\ g + 3.96 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	1.5000 g	0.00014 g	0.0091 %
25 %	37.5000 g	0.00028 g	0.00074 %
50 %	75.0000 g	0.00043 g	0.00057 %
75 %	112.5000 g	0.00058 g	0.00051 %
100 %	150.0000 g	0.00072 g	0.00048 %

Graphic realization of the relative uncertainty of measurement | process accuracy



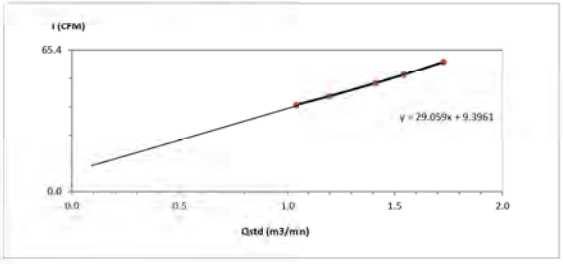
Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0380 g

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	วัดประชุมมิตรปารุง	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0175
CalibrationSheet No.:	C-090325-RYG_FS0175	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4801
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression	
1	2.4	1.0406	40		
2	3.2	1.1960	44	Slope :	29.0586
3	4.5	1.4115	50	Intercept :	9.3961
4	5.4	1.5428	54	Correlation Coefficient :	0.9989
5	6.8	1.7269	60		



Calibrated by _____ Approved by : _____

(Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

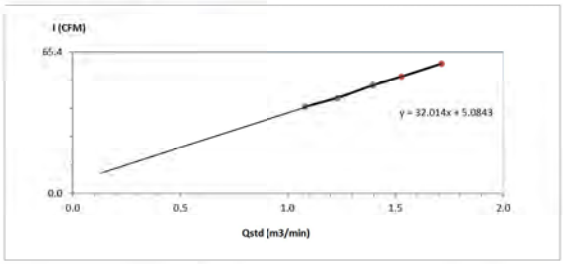
(Mr. Supot Salamteh)
RYG-Field Services Section Head

FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	บ้านสำนักมะม่วง	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0173
CalibrationSheet No.:	C-090325-RYG_FS0173	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4799
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0816	40	Slope : 32.0138
2	3.4	1.2317	44	Intercept : 5.0843
3	4.4	1.3962	50	Correlation Coefficient : 0.9992
4	5.3	1.5288	54	
5	6.7	1.7144	60	



Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

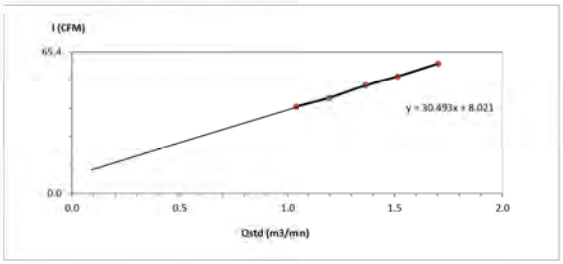
Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

RYG-Field Services Scientist(x)

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	วัดขากลูกหญ้า	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0182
CalibrationSheet No.:	C-090325-RYG_FS0182	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	5335
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.4	1.0406	40	Slope : 30.4926
2	3.2	1.1960	44	Intercept : 8.0210
3	4.2	1.3649	50	Correlation Coefficient : 0.9990
4	5.2	1.5146	54	
5	6.6	1.7018	60	



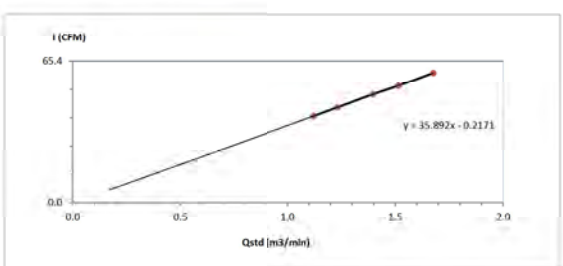
Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	**Barometric Pressure (mm Hg) :**	756.4
Calibrate Location :	วัดบางขุดล	**Temperature (°C) :**	30.1
Calibrate Date :	9-Mar-25	**High Volume ID :**	RYG_FS0178
CalibrationSheet No.:	C-090325-RYG_FS0178	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4804
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1211	40	Slope : 35.8919
2	3.4	1.2317	44	Intercept : -0.2171
3	4.4	1.3962	50	Correlation Coefficient : 0.9999
4	5.2	1.5146	54	
5	6.4	1.6764	60	



Calibrated by : (Mr.Saknarin Jaraskay)
RYG-Field Services Scientist(1)

Approved by : (Mr. Supot Salamteh)
RYG-Field Services Section Head

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Mobile: +6686329453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION0367

Air speed measurement laboratory
Calibration services department.

ilac-MRA
NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number
CWS-008-67

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM	: Cup anemometer
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-025 Data logger: 110-WS-25TR-N
SERIAL NUMBER	: Sensor: WSD-A5546 Data logger: A5546
ID NUMBER	: NKH_FS0056
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 23 Feb 2024
MEASUREMENT DATE	: 08 Mar 2024
ISSUE DATE	: 09 Mar 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area[1]	900	cm^2
Wind direction frontal area[2]	100	cm^2
Diameter of mounting pipe[3]	-	mm
Blockage ratio of test object[4]	0.111	[-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.1) °C, (42.3) %RH and (1012.0) hPa.

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Attraporn Lertsomphol

Approved signatory: Mr. Parinya Boonchuroen
Calibration Department Manager

Calibration procedure:
The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-03 and pitot tube with precision differential pressure meter model: DPM2500 in an close test section of Eiffel-type wind tunnel with 900 cm^2 cross test section area. The WI-CL-017 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0055-23

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

Remark:
[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

REVIEW BY Kanchana P.
APPROVED BY
NEXT CAL. DATE 8/9/25

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

Certificate Number
CWS-008-67

MEASUREMENT RESULTS [5]

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

v_{std} [4] (m/s)	Temp. wind Tunnel (°C)	Temp. room (°C)	v_{uuc} [7] (m/s)	Error (m/s)	U (k=2) (m/s)
1.016	24.06	24.10	0.8	-0.2	0.31
3.075	24.26	24.10	1.9	-0.2	0.31
5.014	23.86	24.10	2.8	-0.2	0.31
4.165	23.92	24.10	3.9	-0.3	0.31
4.97	23.52	24.10	4.9	0.0	0.31
5.97	24.06	24.10	6.0	0.0	0.31
6.99	23.90	24.10	7.0	0.1	0.31
7.93	23.84	24.10	8.0	0.1	0.31
8.94	23.50	24.10	9.0	0.1	0.31
9.93	23.46	24.10	10.0	0.1	0.31
10.94	23.78	24.10	11.0	0.1	0.31
11.94	23.60	24.10	12.1	0.1	0.31
12.94	23.78	24.10	13.1	0.2	0.31
13.94	23.50	24.10	14.1	0.1	0.31
14.88	23.66	24.10	15.1	0.2	0.32
15.87	23.60	24.10	16.1	0.2	0.40

Remark:

[5] Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

[4] Velocity of standard

[7] Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry

End of Certificate of Calibration

Jiranatee Associates Co., Ltd.

JIRANATEE ASSOCIATES CO.,LTD.

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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION0367

Wind direction measurement laboratory
Calibration services department.

NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number
CWD-008-67

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM	: Wind Direction Sensor
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-2SDL-N
SERIAL NUMBER	: Sensor: WSD-A5546 Data logger: A5546
ID NUMBER	: NIH_FS0056
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rr, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 23 Feb 2024
MEASUREMENT DATE	: 08 Mar 2024
ISSUE DATE	: 08 Mar 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PLACE OF CALIBRATION : Filet-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area[1]	900	cm^2
Wind direction frontal area[2]	129	cm^2
Diameter of mounting pipe[3]	-	mm
Blockage ratio of test object[4]	0.143	[-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.1)°C, (42.6) %RH and (1009.1) hPa

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

Calibration procedure:
The wind direction sensor was calibrated against Standard Rotary Encoder model AA40971-DM04-P3-5-U0 in an close test-section of Eiffel-type wind tunnel with 900 cm^2 cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: 0A-0036-23.

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

Remark:

[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

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

Certificate Number
CWD-008-67

MEASUREMENT RESULTS [5]

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D'_{std} Degree (°)	D'_{uuc} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.001	132	-3	0.80
	180.000	180	0	0.80
	225.000	228	3	0.80
	270.000	274	4	0.80
	315.000	320	5	0.80
	360.000	359	-1	0.80

Remark:

[5] Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

[4] Direction of standard

[7] Direction of Unit Under Calibration

End of Certificate of Calibration

Jiranatee Associates Co., Ltd.

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department.

NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-064-67

MEASUREMENT ITEM	: Data Logger with Temperature Sensor
MANUFACTURER	: Novalynx
MODEL/TYPE	: 110-WS-2SDL-N
SERIAL NUMBER	: A5546
ID NUMBER	: NIH_FS0056
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 23 Feb 2024
MEASUREMENT DATE	: 08 Mar 2024
ISSUE DATE	: 08 Mar 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibration procedure:
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

Reference Used During Calibration:
1.Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-05, Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

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

Calibrated by:
☐ Mr. Sorawit Thachalad
☑ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-064-67 Page 2 of 2 Pages

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: R3440766.
Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.058	19.8	-0.3	0.099
70	25.047	24.6	-0.4	0.14
70	30.034	29.7	-0.3	0.099
70	35.024	34.5	-0.5	0.14
70	40.008	39.5	-0.5	0.14

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

End of Certificate of Calibration

Jiranatee Associates Co.,Ltd.

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Jiranatee Associates Co.,Ltd
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-002-67 Page 1 of 2 Pages

MEASUREMENT ITEM	: Relative humidity with data logger
MANUFACTURER	: Nonsiyim
MODEL/TYPE	: Data Logger: 110-WS-2SDL-N Sensor: HMP60
SERIAL NUMBER	: Data Logger: A5546 Sensor: R3440766
ID NUMBER	: NKH_FS0056
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 23 Feb 2024
MEASUREMENT DATE	: 08 Mar 2024
ISSUE DATE	: 08 Mar 2024

Calibration procedure:
The Relative Humidity and Air Temperature calibration was done by in-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror Hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability:
The measurements are traceable to the International System of Units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-2079-23 and through Jiranatee Associates Co., Ltd. Certificate number: CDT-001-67.

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

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
☐ Mr. Soravit Thachalad
☑ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoonmit

Approved signatory: Mr. Parinya Boonchanom
Calibration Department Manager

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

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number: CDT-002-67 Page 2 of 2 Pages

Measurement Results:

The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity are reported in table below.
Calibration Range: 20%RH to 80%RH

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty +(%RH)
23.81	20.07	18.5	-1.5	0.40
23.61	51.38	48.6	-2.8	1.0
23.84	83.45	79.2	-4.2	1.6

UUC*: Unit Under Calibration

End of Certificate of Calibration

Jiranatee Associates Co.,Ltd.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplad, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

Cert. No. : ACC24055
Pages : 1 of 3

Calibration Certificate

Equipment :	SOUND CALIBRATOR
Manufacturer :	RION
Model :	NC-74
Serial No.:	34178124
ID No.:	RYG_FS0216
Condition As Found :	GOOD
Customer :	ALS LABORATORY GROUP (THAILAND) CO., LTD. 104 PHATTHANAKAN 40, PHATTHANAKAN ROAD, KHWAENG PHATTHANAKAN, KHET SUAN LUANG, BANGKOK, 10250 THAILAND.

REVIEW BY .....
APPROVED BY .....
NEXT CAL DATE 22-Oct-25

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

Received Date : 18 OCTOBER 2024
Calibration Date : 22 OCTOBER 2024
Date of Issue : 24 OCTOBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow on IEC-60942-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	09-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.19	0.19	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.82	0.10	3.0

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296515 / 179119 / 87526
ID No.: ILYG_FS0432

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

REVIEW BY .....
APPROVED BY.....
NEXT CAL DATE..... 26/ 01/ 2026

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

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.

SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25102
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	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	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

Cert. No. : ACL25102
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.3
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	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.2	0.2	0.2	±5.0

Cert. No. : ACL25102
Job No. : VC68AC0064
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Job No. : VC68AC0064
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	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	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Job No. : VC68AC0064
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8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.8	-0.2	±1.1

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
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

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Job No. : VC68AC0064
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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	130.0	130.0	0.0	±3.0
One	133.4	133.3	-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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-461/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphum.com

Cert. No. : ACL25103
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296516 / 180412 / 83182
ID No.: RYG_FS0433

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

REVIEW BY .....
APPROVED BY .....
NEXT CAL DATE..... 26/ 01/ 2026

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.

Cert. No. : ACL25103
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

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

Condition of this result of calibration :
1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25103
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	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	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Cert. No. : ACL25103
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Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.3
Flat	22.9

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	1.0	1.0	1.0	±5.0

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Cert. No. : ACL25103
Job No. : VC68AC0064
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	0.0	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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Cert. No. : ACL25103
Job No. : VC68AC0064
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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

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
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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

CERTIFICATE OF CALIBRATION

REVIEW BY Marotom P
APPROVED BY
NEXT CAL DATE 7/5/25

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **07 May 2024** CERTIFICATE NUMBER **213804**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2
Approved signatory
M.Berry
Electronically signed:
M.BERRY

Sound Calibrator : IEC 60942:2017

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:516
Serial number: 100249
Class: 2

Notes:

Test summary

Date of calibration: 07 May 2024

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2017 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The sound calibrator has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2017.

Notes:

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number: **213804**
Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 101.76 kPa
Temperature: 21.7 °C
Humidity: 45.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0839263
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Acceptance limit	Uncertainty
Level (dB)	94.00	93.98	93.98	94.00	**93.99**	-0.01	±0.40	0.11 dB
Distortion (%)	< 4.00	0.24	0.35	0.64	**0.41**	0.41	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.0	1000.6	999.8	**1000.1**	0.1	±1.7	0.1 Hz
Level (dB)	114.00	113.89	113.90	113.90	**113.90**	-0.10	±0.40	0.11 dB
Distortion (%)	< 4.00	1.01	1.01	0.94	**0.98**	0.98	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	**1000.3**	0.3	±1.7	0.1 Hz

End of results

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**

DATE OF ISSUE **13 February 2025** CERTIFICATE NUMBER **232798**

Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
R.Thomas
Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc **Notes:**
Model: RC:110A
Serial number: 89107
Class: 2

Test summary

Date of calibration: 12 February 2025

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

Notes:

REVIEW BY Supt S.
APPROVED BY
NEXT CAL DATE 11/ 02/ 2026

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number: 232798

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 101.41 kPa Temperature: 24.9 °C Humidity: 32.4 %
After Pressure: 101.42 kPa Temperature: 25.0 °C Humidity: 32.7 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1063074
Environmental Monitor	Comet	T7510	21962628

Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.00	114.01	114.00	**114.00**	0.00	±0.75	0.11 dB
Distortion (%)	< 4.00	0.98	0.70	0.72	**0.80**	0.80	+4.00	0.13 %
Frequency (Hz)	1000.0	1002.2	1002.2	1002.2	**1002.2**	2.2	±20.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

End of results

JNAC
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY Nirakorn P.
APPROVED BY
NEXT CAL. DATE 14/9/25

Calibration report Number
CDM-108-67

CALIBRATION REPORT

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YF476
ID NUMBER	: RYG_FS0037
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 16 Sep 2024
MEASUREMENT DATE	: 17 Sep 2024
ISSUE DATE	: 18 Sep 2024

Calibration procedure:
The Noise dosimeter (Unit Under Calibration) was calibrated against Standard doseBadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the International system of units (SI) through Cirrus research plc via Certificate number: 218610

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:
Instrument name: doseBadge Reader **Manufacturer:** Cirrus Research plc. **Model:** RC:110A **Serial number:** 81051
Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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

JNAC
JIRANATEE ASSOCIATES CO.,LTD.
Jiranatee Associates Co.,Ltd
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Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY Nirakorn P.
APPROVED BY
NEXT CAL. DATE 14/9/25

Calibration report Number
CDM-109-67

CALIBRATION REPORT

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YF477
ID NUMBER	: RYG_FS0038
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 16 Sep 2024
MEASUREMENT DATE	: 17 Sep 2024
ISSUE DATE	: 18 Sep 2024

Calibration procedure:
The Noise dosimeter (Unit Under Calibration) was calibrated against Standard doseBadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the International system of units (SI) through Cirrus research plc via Certificate number: 218610

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PRECONDITIONING The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:
Instrument name: doseBadge Reader **Manufacturer:** Cirrus Research plc. **Model:** RC:110A **Serial number:** 81051
Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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

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Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY Monakorn P.
APPROVED BY
NEXT CAL. DATE 14/9/25

Calibration report Number
CDM-110-67

CALIBRATION REPORT

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A/S
SERIAL NUMBER	: YF478
ID NUMBER	: RYG_FS0039
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 16 Sep 2024
MEASUREMENT DATE	: 17 Sep 2024
ISSUE DATE	: 18 Sep 2024

Calibration procedure:
The Noise dosimeter (Unit Under Calibration) was calibrated against Standard doseBadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Traceability:
This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through Cirrus research plc via Certificate number: 218610

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PRECONDITIONING The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:
Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051
Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration

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

JIRANATEE ASSOCIATES CO.,LTD.

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NSC-TISI-TIS 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY Monakorn P.
APPROVED BY
NEXT CAL. DATE 2/10/25

Calibration report Number
CDM-177-67

CALIBRATION REPORT

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:120A
SERIAL NUMBER	: MK502818
ID NUMBER	: RYG_FS0639
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 01 Oct 2024
MEASUREMENT DATE	: 02 Oct 2024
ISSUE DATE	: 04 Oct 2024

Calibration procedure:
The Noise dosimeter (Unit Under Calibration) was calibrated against Standard doseBadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Traceability:
This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through Cirrus research plc via Certificate number: 218610

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010± 10	hPa

PRECONDITIONING The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:
Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: CR:110 Serial number: 70818
Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

Approved signatory: Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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

JIRANATEE ASSOCIATES CO.,LTD.

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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department.

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NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-085-67

MEASUREMENT ITEM	: Heat Stress Monitor
MANUFACTURER	: Delta OHM
MODEL/TYPE	: HD32.2
SERIAL NUMBER	: 15030244
ID NUMBER	: RYG_FS0236
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 15 May 2024
MEASUREMENT DATE	: 17 May 2024
ISSUE DATE	: 21 May 2024

Calibration procedure:
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:
The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: MT-0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09, Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

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

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Monakorn P.
APPROVED BY
14/7/25

Calibrated by:
☐ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol
☑ Miss Ruangrumpai Phoommit

Approved signatory: Mr. Parinya Booncharoen
Calibration Department Manager

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

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-085-67

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 20030506.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.058	20.1	0.0	0.099
80	25.047	25.1	0.1	0.099
80	30.042	30.1	0.1	0.099
80	35.035	35.1	0.1	0.099
80	40.025	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 17009684.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.0	-0.1	0.099
110	25.047	25.0	0.0	0.099
110	30.042	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.025	40.0	-0.1	0.16

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15033223.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.059	20.1	0.0	0.099
75	25.047	25.0	0.0	0.099
75	30.043	29.8	-0.2	0.099
75	35.035	34.7	-0.3	0.099
75	40.024	39.6	-0.4	0.099

UUC*: Unit Under Calibration
Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.21 providing a level of confidence of approximately 95%.

End of Certificate of Calibration

Jiranatee Associates Co.,Ltd.

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department

NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-221-67 **Page 1 of 2 Pages**

MEASUREMENT ITEM	: Heat Stress Monitor
MANUFACTURER	: Delta OHM
MODEL/TYPE	: HD32.2
SERIAL NUMBER	: 15020735
ID NUMBER	: RYG_FS0231
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand
RECEIVED DATE	: 11 Dec 2024
MEASUREMENT DATE	: 23 Dec 2024
ISSUE DATE	: 23 Dec 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH

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

TABULATION OF RESULTS:
The table on next page give the measured values.

REVIEW BY ..... Sipt S

APPROVED BY .....

NEXT CAL DATE..... 23/ 12 /25

Calibration procedure:
The temperature calibration was done by In-House calibration method no. WI-CT-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0113-24

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09, Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 21 Oct 2025

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

J NAC JIRANATEE ASSOCIATES CO.,LTD.

Approved signatory: .....
Mr. Parinya Booncharoen
Calibration Department Manager

Calibrated by:
☐ Mr. Sopon Thachalad
☐ Miss. Jittraporn Lertsamphai
☑ Miss. Kaangrumasi Phoonnitl

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FFOM THE LABORATORY

Jiranatee Associates Co.,Ltd.

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-221-67 Page 2 of 2 Pages

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 15035050. Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.064	20.1	0.0	0.099
80	25.063	25.1	0.0	0.099
80	30.047	30.1	0.1	0.099
80	35.037	35.0	0.0	0.099
80	40.024	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 17023218. Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.1	0.0	0.099
110	25.063	25.1	0.0	0.099
110	30.047	30.1	0.1	0.099
110	35.037	35.1	0.1	0.099
110	40.024	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15033221. Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.064	20.1	0.0	0.099
75	25.063	25.0	-0.1	0.099
75	30.047	30.0	0.0	0.099
75	35.037	35.0	0.0	0.099
75	40.024	40.0	0.0	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration

J NAC JIRANATEE ASSOCIATES CO.,LTD.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
57/64 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0 2717 3000-29 FAX. 0 2719 9384

NSC-TISI-TIS17025 CALIBRATION 0066

Cert.No.: 24CH96
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenCompact S220
Serial No. :	C104059460
ID No. :	RYG_EN0183
Condition As-Received :	Used Item
Received Date :	18 January 2024
Calibration Date :	19 January 2024
Reference :	2401-0579DSC-2
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand
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 thempecature standard
Calibrated by :	Warakorn Lemgagtrakul
Approved by :	Approved Signatory

REVIEW BY N.Barkit
APPROVED BY
NEXT CAL DATE 19/04/25

(√) Saithip Meangmai
( ) Warakorn Lemgagtrakul
( ) Ponpan Palpim

Issue Date : 24 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0062854

Cert.No.: 24CH96
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC110	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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	940102	27 Nov 2026
pH 6.988	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.000	177.48	177.4	4.000	0.058	2.00
S/N.: C104059460	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

Saithip

a 1198287

Cert.No.: 24CH96
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.01,7.00,10.01)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.013	176.0	0.0054	2.07
S/N.: 3225367	6.986	6.983	2.2	0.0084	2.00
	9.997	9.996	-174.1	0.0065	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225367

Dimension of probe

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor *k*
25.0	25.001	25.2	0.199	0.13	2.00

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

-o0o-

a 1198288

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

NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Certificate No. : 24E289
Page : 1 of 2

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Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenCompact S220
Serial No.: C104059460
ID No.: RYG_EN0183
Condition As-Received: Used Item
Received Date: 18 January 2024
Calibration Date: 23 January 2024
Reference: 2401-0579DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	E2U2300035	29 May 2024

2.This result of calibration was made on requested at the point specified by customer.
3.The certificate is valid only to the item calibrated on date and place of calibration.
4.This Certification is traceable to the International System of Unit maintained through:-
-NA Caltechnologies Co.,Ltd., ANAB Accredited No. Calibration AC-2658

Calibrated by : Wutchareeporn Wongchutikrane
Issue Date : 24 January 2024
Approved Signatory :
[ ] Phalinee Prabpaipal
[✓] Nuntawat Khamchai
[ ] Pongsagorn Boonyaporn

B 0333296

Cert. No.: 24E289
Page.: 2 of 2

Result of calibration :- (*) Without adjustment ( ) After adjustment

Function: DC voltage measurement **Range:** 2000 mV

Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty (± µV)
-200.0000	-200.0	0.0	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	99.9	-0.1	63
150.0000	149.9	-0.1	65
200.0000	199.9	-0.1	68

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 %

UUC* = Unit Under Calibration.

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a 1198963

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert. No.: 25LM10
Page.: 1 of 2

REVIEW BY Photchana S.
APPROVED BY
NEXT CAL DATE 20/07/26

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 17 January 2025
Calibrated Date : 20 January 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lerngagtrakul
Approved by :
Approved Signatory

( ) Chakrit Waewwanjua
(✓) Suwit Imjai
( ) Kunchit Promprat

Issue Date : 23 January 2025

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.

Equipment : DO Meter with Sensor **Cert. No.:** 25LM10
Condition As-Received : Used Item **Page.:** 2 of 2
Reference : 2501-0600DSC-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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	24I1022	TPA	17 Sep 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 15E100464

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor *k*
20.00	60	20.002	19.81	-0.192	0.15	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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Certificate of Testing

Cert.No.: 25TW15
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115/
Serial No. : 15E102786
ID No. : RYG_EN0032
Received Date : 17 January 2025
Test Date : 20 January 2025
Reference : 2501-0600DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by : Saithip
Approved Signatory

( ) Pornthippa Tameyakul
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 January 2025

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	142338821	110RC001	24MM131	04 July 2025

2. Standard Material :-

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

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**
Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0084

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

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ilac-MRA
MSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert. No.: 24TM1663
Page : 1 of 3

Equipment : Low Temp Incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : V818.0084
ID No. : RYG_EN0154

REVIEW BY Thanitak.
APPROVED BY
NEXT CAL DATE 01/05/26

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng,
Rayong 21140, Thailand
Location : BOD Room

Received Order : 01 November 2024
Calibration Date : 01 November 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by : Kunchit
Approved Signatory

( ) Ponpan Paipim
( ) Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1

Cert. No.: 24TM1663
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

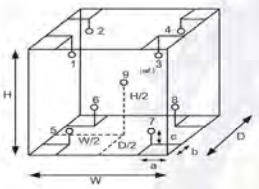
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	24	25
REL.Humid. (%)	55	53
AC Supply (Volt)	220	221



Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09

Probe Installation Details :

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

Dimension of Chamber :

D =	0.60	m
W =	1.0	m
H =	1.2	m
Capacity =	0.72	m³

Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1

Cert. No.: 24TM1663
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)	Coverage Factor *k*
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point	Measured Temperature (°C) Position								Uncertainty
(°C)	1	2	3	4	5	6	7	8	9 (ref.)	(±°C)
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	0.30

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was incluced 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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NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert.No.: 24CG3711
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng
Rayong 21140, Thailand

REVIEW BY ..... Tharitak.
APPROVED BY ..... D.Thanaboon
NEXT CAL DATE..... 24/09/25

Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 756 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-ngeunkam Wongsa

Approved by :
Approved Signatory

(✓) Srisuda Khamtha
( ) Ponpan Paipim
( ) Unnopphol Harachai

Issue Date : 24 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	*k* Factor
10	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	2.00

Remark mL = cm^3

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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SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

NSC-TISI-TIS 17025
CALIBRATION 0426

Calibration certificate

Calibration Certificate No. 25BKL0004

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial | QM Ident. no.	26207038 | RYG_EN0002	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY Thanitak.
APPROVED BY
NEXT CAL DATE 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date 06 Mar 2025 | Approval of the Calibration Certificate: Mr. Chonchai Inthana | Person in charge: Kachen Lalee

Calibration object

Single range instrument

Model	MSE224S-100-DU
Serial Number	26207038
QM Ident. no | Inventory no.	RYG_EN0002 | ---

Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department | Cost center	Laboratory Department. | ---
Building | Floor	--- | 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration | Temp. diff $T_{weights} - T_{place}$	24.4 °C | 0.6 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 50.2 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g | 200 g		
	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0001 g
3	10.0001 g	200.0001 g
4	10.0000 g	200.0000 g
5	10.0001 g	200.0000 g
6	10.0001 g	200.0001 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0001 g
9	10.0001 g	200.0000 g
10	10.0000 g	200.0000 g
	s = 0.00005 g	s = 0.00005 g

Eccentricity

Test load (nominal):	100 g
Center	100.0000 g
Front left	99.9998 g
Back left	100.0000 g
Back right	100.0000 g
Front right	100.0000 g
Maximum deviation from centric loading indication |ΔEecc| max = 0.0002 g	

Error of indication

Test load L	Indication I	Error E	Expansion factor k	Uncertainty $U(E)$	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.027 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00014 g	0.0027 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00014 g	0.0014 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00072 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00016 g	0.00032 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00021 g	0.00021 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00034 g	0.00017 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00039 g	0.00018 %
Maximum error of indication		$\|E\|_{max}$ = 0.0001 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L. The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use order: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate.

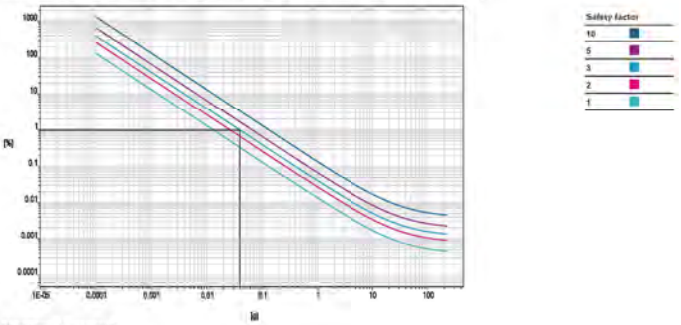
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}$/K
Uncertainty of the weighing result $U_{gl}(W)$	$U_{gl}(W) = 0.00013\ g + 3.95 \cdot 10^{-4} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00035 g	0.00063 %
50 %	110.0000 g	0.00056 g	0.00051 %
75 %	165.0000 g	0.00078 g	0.00047 %
100 %	220.0000 g	0.00100 g	0.00045 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0395 g

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Certificate of Calibration

Cert. No.: 24TM632
Page : 1 of 3

Equipment :	Hot Air Oven
Manufacturer :	Memmert
Model :	UFE 500
Serial No. :	G511.1572
ID No. :	RYG_EN0010

REVIEW BY ThanitaK.
APPROVED BY
NEXT CAL DATE 21/09/25

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140 Thailand

Location : Oven Room

Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

( ) Pornthippa Tameyakul
( ) Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Procedure Used :-

Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

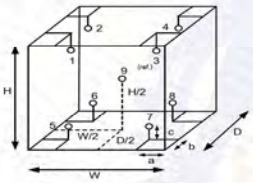
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	59
AC Supply (Volt)	222	224



Probe Installation Details :

a =	5.0	cm
b =	5.0	cm
c =	5.0	cm

Dimension of Chamber :

D =	0.40	m
W =	0.56	m
H =	0.48	m
Capacity =	0.11	m³

Position :	Ref. Std. ID No.: @ Calibration Point (180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor *k*
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point	Measured Temperature (°C)									Uncertainty
	Position									
(°C)	1	2	3	4	5	6	7	8	9 (ref.)	(±°C)
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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Certificate of Calibration

Cert. No.: 24TM634
Page : 1 of 3

Equipment :	Hot Air Oven
Manufacturer :	Memmert
Model :	UF 110
Serial No. :	B423.0853
ID No. :	RYG_EN0213

REVIEW BY ThanitaK.
APPROVED BY
NEXT CAL DATE 21/03/25

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140 Thailand

Location : Oven Room

Received Order : 21 March 2024
Calibration Date : 21 - 22 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

( ) Pornthippa Tameyakul
( ) Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : Hot Air Oven **Cert. No.:** 24TM634
Condition As-Received : Used Item **Page :** 2 of 3
Reference : 2403-0563OC-3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

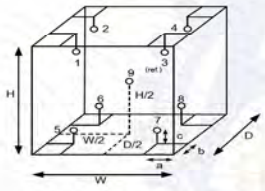
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	59
AC Supply (Volt)	224	223



Position :	Ref. Std. ID No.: @ Calibration Point (180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

Probe Installation Details :

a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
			Capacity =	0.11	m³

Dimension of Chamber :

Equipment : Hot Air Oven **Cert. No.:** 24TM634
Condition As-Received : Used Item **Page :** 3 of 3
Reference : 2403-0563OC-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)	Coverage Factor k
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C) Position 1	2	3	4	5	6	7	8	9 (ref.)	Uncertainty (±°C)
104.0	104.169	103.506	103.898	103.712	103.772	103.730	104.289	103.805	103.798	0.42
180.0	180.701	179.239	179.935	179.999	180.127	180.138	180.895	179.313	180.211	1.1

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

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

UUC* : Unit Under Calibration

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

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

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SCG

Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454 **Page 1 of 3**

Certificate of Calibration

Equipment : **Chamber (Oven)**
Manufacturer : **MEMMERT**
Model : **UF 110**
Serial No. : **B423.0853**
Customer Code : **RYG_EN0213**
ID No. : **T5884A5**
Customer : **ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)**
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140
Customer Location : **ENVIRONMENT LABORATORY**
Date of Receipt : **12 March 2025**
Calibrated By : **Sujjar Naknakred (Site Calibration Manager)**
Approved By : **Boonchai Suriyawong (Site Calibration Manager)**
Date of Issue : 21 MAR 2025

REVIEW BY Thanitta
APPROVED BY
NEXT CAL. DATE 19/03/26

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

SCG

Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454 **Page 2 of 3**

Calibration Report

Equipment : **Chamber (Oven)**
Date of Calibration : **19 March 2025**
Environment : **Temperature : 26.5-26.9 °C**
Line Voltage : 223.9-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986).
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 1 Hour 44 Minute At 104 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☒ Close
   ☐ Not Available
5. Adjustment :
   ( ) without adjustment (X) after adjustment

Approved By.

SCG

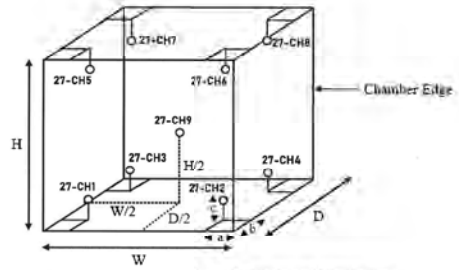
Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm , H (Height) = 46 cm and D (Depth) = 40 cm
Size of Installed Standard sensor number 27-CH1 to number 27-CH9 : a = 5 cm, b = 5 cm and c = 5 cm
Size of Installed Standard sensor number 27-CH5 : W/2 = 56 cm/2 , H/2 = 46 cm./2 and D/2 = 40cm./2

Measurement Results

	Average Standard Reading at each position (°C)								
Calibration Point	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9
104	103.84	104.10	104.10	104.48	103.73	104.14	103.95	103.57	104.22
180	179.41	179.92	180.80	181.37	179.54	179.52	179.82	179.41	180.31

Chamber (Oven)			Temperature Distribution				
Setting °C	Reading (°C) Min , Max	Reading (°C) Average	Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	103.9 , 104.1	104.0	104.01	0.08	0.65	0.42	2.00
180.0	-	180.0	180.01	0.17	1.26	0.49	2.00

* The quoted uncertainty exclude "uniformity"
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, provicing a level of confidence of approximately 95 % .

End of Certificate.

Approved By.

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

ilac-MRA

NSC-TISI-TIS17025 CALIBRATION 0039

Certificate of Calibration

Cert. No.: 24TM635

REVIEW BY Thanitak.
APPROVED BY
NEXT CAL DATE 21/09/25

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WNB22
Serial No. :	L513.0648
ID No. :	RYG_EN0061
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5, T. Maenam Khu, A. Pluakdaeng, Rayong 21140, Thailand
Location :	Wet Chemistry Lab
Received Order :	21 March 2024
Calibration Date :	21 March 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Man Pattanapongpaiboon
Approved by :	Approved Signatory

( ) Pornthippa Tameyakul
( ) Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Procedure Used :-

Cert. No.: 24TM635

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

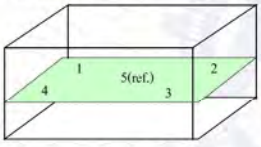
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM635

Calibration point	UUC* Setting	UUC* Reading	Average* Standard Reading (°C) Position					Uncertainty
(°C)	(°C)	(°C)	1	2	3	4	5 (ref.)	(± °C)
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point	Uniformity	Stability	Coverage Factor
(°C)	(°C)	(± °C)	*k*
85.0	0.19	0.11	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-oOo-

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

Certificate of Calibration

Cert.No.: 24CH774
Page.: 1 of 2

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	Seven2Go S2
Serial No. :	C221115514
ID No. :	RYG_FS0596
Condition As-Received:	Used Item
Received Date :	28 June 2024
Calibration Date :	01 July 2024
Reference :	2406-0969DSC-6
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)

REVIEW BY Pitthaya T.
APPROVED BY
NEXT CAL DATE 01/07/25

Calibrated by : Warakorn Lerngagtrakul

Approved by :
Approved Signatory

( ) Unnopphol Harachai
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

- This Certification is traceable to SI Throught Technology Promotion Association (Thailand - Japan)

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	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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 Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(±mV)	*k*
pH Meter	4.00	177.48	178	4.00	0.58	2.00
S/N.: C221115514	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reacing	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.01	180	0.0079	2.00
S/N.: 3293232	6.986	6.99	5	0.011	2.00
	9.997	10.00	-172	0.0092	2.00

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

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

Certificate of Calibration

Cert. No.: 24LM108
Page.: 1 of 2

Equipment :	pH Meter with Sensor
Manufacturer :	Mettler Toledo
Model :	Seven2Go S2
Serial No. :	C221115514
ID No. :	RYG_FS0596
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location :	TPA On Site Calibration Laboratory
Received Order :	28 June 2024
Calibrated Date :	01 July 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
AC Line Voltage :	(220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :
Approved Signatory

( ) Ponpan Paipim
(✓) Suwit Imjai
( ) Kunchit Promprat

Issue Date : 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2406-0969DSC-7

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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	23I1216	TPA	11 Oct 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 3293232

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor *k*
25.0	100	25.003	25.1	0.097	0.16	2.00
30.0	100	30.002	30.2	0.198	0.16	2.00
40.0	100	40.003	40.2	0.197	0.16	2.00
50.0	100	50.002	50.2	0.198	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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Metrology
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate of Calibration

Equipment	:	Chamber (Cold Room)
Manufacturer	:	MODULAR
Model	:	IREVCOHCOO
Serial No.	:	C00351459
Customer Code	:	RYG_EN0184
ID No.	:	T1939A5
Customer	:	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
		616/10 Moo 5 T.Maenam Khu,
		A.Pluakdaeng, Rayong 21140
Customer Location	:	Laboratory
Date of Receipt	:	5 June 2024
Calibrated By	:	Sujjar Naknakred (Site Calibration Manager)
Approved By	:	Preecha Phisassutthikul (Temperature Calibration Manager)
Date of Issue	:	12 JUN 2024

REVIEW BY Thanitall.
APPROVED BY
NEXT CAL. DATE 11/12/25

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Metrology
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Calibration Report

Equipment	:	Chamber (Cold Room)
Date of Calibration	:	11 June 2024
Environment	:	Temperature : 23.1-24.1 °C
		Line Voltage : 222.3-226.3 V
		Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

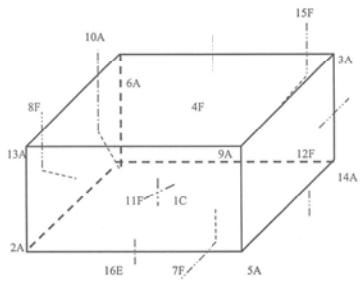
Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T240713	19 April 2025
TC	TYPE T	TN171-TN180	T240713	19 April 2025
DATA LOGGER	34970A	T149	T240713	19 April 2025

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 3 Hour 30 Minute At 3 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☐ Close
   ☒ Not Available
5. Adjustment :
   ( ) without adjustment (X) after adjustment

Approved By.

Metrology
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170

11F	=	TN171
12F	=	TN172
13A	=	TN173
14A	=	TN174
15F	=	TN175
16E	=	TN176

Approved By.

Metrology
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Calibration Report

Measurement Results:

	Average Standard Reading at each position (°C)									
Calibration Point	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.73	2.70	2.77	2.78	2.99	2.35	3.09	3.21	3.08	2.90
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.39	3.01	2.92	2.81	3.42	3.42				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor *k*
	Min , Max	Average					
3.0	2.9 , 4.4	3.7	2.97	1.32	1.13	2.02	2.00

* The quoted uncertainty exclude " uniformity "
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

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REVIEW BY Nat Sor
APPROVED BY LL AT
NEXT CAL. DATE 13-Jun-25

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	GM-7
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Paithanakarn 40, Paithanakarn Rd., Khwang Suan Luang, Khet Suan Luang, Bangkok.
Date:	December 13, 2023 3:32:46 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.50, GCMS.02.50
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 Accuracy

Name: 7890

Front SSL

Setpoint Status: **Pass**

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.0	psi

Accuracy: 0.0 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

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Setpoint Status: **Pass**

Zone: Oven

Setpoint/Actual

Temperature:	230.0	232.3	°C	
Accuracy:		2.3	°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

Temperature:	100.0	100.7	°C	
Accuracy:		0.7	°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

Setpoint Status: **Pass**

Setpoint/Average

Temperature:	100.0	100.4	°C
Stability:		0.0	°C
Agilent Recommended:	<=	0.5	

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1 Front SSL / External SQ

Name: 5977A

Setpoint Status: **Pass**

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Overall Log Amp Test Status

Pass

RFPA

Tested Combination1 Front SSL / External SQ

Name: 5977A

Setpoint Status: **Pass**

Amu:	1050	m/z	Drift After Five Minutes:				RFPA Voltage:	
			Z	mV			504	mV
Agilent Recommended:			>= -100		and	<= 100	<= 1100	

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1 Front SSL / External SQ

Name: 5977A

Setpoint Status: **Pass**

Filament: 1

Setpoint Status: **Pass**

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1 Front SSL / External SQ

Name: 5977A

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Source: EI - Extractor Filament: 1

Setpoint Status: **Pass**

Signal to Noise:		11318
Agilent Recommended:	>=	1200

Source: EI - Extractor Filament: 2

Setpoint Status: **Pass**

Signal to Noise:		16558
Agilent Recommended:	>=	1200

Overall Signal to Noise EI Test Status

Pass

NOTE: This test's 0 comment(s) and 6 deviation(s) are available in the Attachments section.

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System :

System ID	GM-7
Manufacturer	Agilent Technologies
Name	7890

Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (uL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN14133181
Firmware Revision	B.02.03
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	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977A
Serial Number	US1415M299
Firmware Revision	5977 6.00.21
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	December 13, 2023
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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Report Generated by Hostname: ASBKKWX492

System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:22:24 AM	Audit	SessionCreated	Session	None
December 13, 2023 10:22:24 AM	Start	Configuration	Session	None
December 13, 2023 10:22:24 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
December 13, 2023 10:23:53 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp]. EQP File Name: [Gc.02.50.eqp]. EQP Name: [AgilentRecommended]. Protocol Revision: [Gc.02.50]. EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp]. EQP File Name: [GcMs.02.50.eqp]. EQP Name: [AgilentRecommended].
December 13, 2023 10:23:56 AM	End	Configuration	Session	None
December 13, 2023 10:23:59 AM	Start	Qualification	Session	OQ
December 13, 2023 10:23:59 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None

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User Name: supasak.nimsongtham

System Id: GM-7

Report Generated by Hostname: ASBKKWX492

Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:24:10 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1
December 13, 2023 10:24:11 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
December 13, 2023 10:24:15 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
December 13, 2023 10:24:17 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 13, 2023 10:32:09 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
December 13, 2023 10:32:11 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
December 13, 2023 10:32:12 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 13, 2023 10:34:58 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
December 13, 2023 10:44:09 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1



User Name: supasak.nimsongtham

System Id: GM-7

Report Generated by Hostname: ASBKKWX492

Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:55:00 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 13, 2023 10:55:07 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 10:55:09 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 13, 2023 10:55:10 AM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
December 13, 2023 10:55:12 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
December 13, 2023 10:55:13 AM	Start	Execution	Log Amp - 5977A SQ - Source: EI - Extractor	None
December 13, 2023 10:56:42 AM	End	Execution	Log Amp - 5977A SQ - Source: EI - Extractor	Run Count : 1
December 13, 2023 10:56:43 AM	Start	Execution	RFPA - 5977A SQ - Source: EI - Extractor	None
December 13, 2023 11:04:44 AM	End	Execution	RFPA - 5977A SQ - Source: EI - Extractor	Run Count : 1
December 13, 2023 11:04:45 AM	Start	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
December 13, 2023 11:32:36 AM	End	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1

User Name: supasak.nimsongtham

System Id: GM-7

Report Generated by Hostname: ASBKKWX492

Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 11:32:38 AM	Start	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:33:09 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 11:48:39 AM	Start	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:48:42 AM	End	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
December 13, 2023 11:48:43 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 11:49:48 AM	Audit	AseClosed	Session	None
December 13, 2023 12:36:06 PM	Audit	AseReverted	Session	None
December 13, 2023 12:36:40 PM	Audit	SessionHeader	Session	Error
December 13, 2023 12:36:42 PM	Start	Qualification	Session	OQ
December 13, 2023 12:36:42 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	None

User Name: supasak.nimsongtham

System Id: GM-7

Report Generated by Hostname: ASBKKWX492

Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 12:37:32 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data\OQ2023\S2N_F1.D
December 13, 2023 12:38:18 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
December 13, 2023 12:38:51 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 1
December 13, 2023 12:38:51 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 12:40:15 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data\OQ2023\S2N_F1.D
December 13, 2023 12:40:00 PM	Edit	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 2
December 13, 2023 12:42:06 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 12:42:47 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data\OQ2023\S2N_F2.D

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System Id: GM-7
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GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 12:13:54 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
December 13, 2023 1:54:41 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 0
December 13, 2023 1:54:41 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 1:54:50 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\Data \OQ2023\S2N_F1.D
December 13, 2023 1:56:32 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
December 13, 2023 1:56:50 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 0
December 13, 2023 1:56:50 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 2:14:02 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\Data \OQ2023\S2N_F1.D

Date: December 13, 2023 3:32:48 PM
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System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 2:19:40 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 4
December 13, 2023 2:26:07 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 1
December 13, 2023 2:26:07 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:26:20 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\Data \OQ2023\S2N_F2.D
December 13, 2023 2:26:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2
December 13, 2023 2:26:51 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 2
December 13, 2023 2:26:51 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:27:01 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\Data \OQ2023\S2N_F2.D

Date: December 13, 2023 3:32:48 PM
System ID: GM-7

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Report Generated by Hostname: ASBKKWX492

System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 2:27:42 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 3
December 13, 2023 2:29:14 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 3
December 13, 2023 2:29:14 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:34:02 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:41:28 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:42:42 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\Data \OQ2023\S2N_F2_001.D
December 13, 2023 2:44:22 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 4
December 13, 2023 2:44:56 PM	End	Qualification	Session	OQ
December 13, 2023 2:44:56 PM	Start	Reporting	Session	None

Date: December 13, 2023 3:32:48 PM
System ID: GM-7

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Report Generated by Hostname: ASBKKWX492

System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 3:01:22 PM	Audit	AceClosed	Session	None
December 13, 2023 3:29:10 PM	Audit	AceRestarted	Session	None
December 13, 2023 3:29:10 PM	Audit	SessionReopened	Session	None
December 13, 2023 3:29:13 PM	Start	Qualification	Session	OQ
December 13, 2023 3:31:33 PM	Audit	Reporting	Session	Report Generated : Certificate
December 13, 2023 3:32:16 PM	Audit	Reporting	Session	Report Generated : Report

Date: December 13, 2023 3:32:48 PM
System ID: GM-7

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 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 24TW170
Page.: 1 of 2

REVIEW BY Pitthaya T.
APPROVED BY S.T.S
NEXT CAL DATE 13/08/25

Equipment :	DO Meter
Manufacturer :	Mettler Toledo
Model :	Seven2Go S9
Serial No. :	C131262002
ID No. :	RYG_FS0546
Received Date :	09 August 2024
Test Date :	13 August 2024
Reference :	2408-0344DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean
Approved by :	Saithip Approved Signatory

( ) Unnopphol Harachai
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 14 August 2024

Cert.No.: 24TW170
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	1308U10	23CG1172	22 Mar 2025
2. Balance	N03679	140RC001	23MM537	14 Sep 2024

2. Standard Material :-

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

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**
Dissolved Oxygen Probe No.: 829633

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.21	0.0045

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

-o0o-

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TEL.0-2717-3000-29 FAX.0-2719-9484

ilac-MRA
NSC-TEH-T0137025 CALIBRATION 0036

Certificate of Calibration

Cert. No.: 24LM132
Page.: 1 of 2

Equipment :	DO Meter with Sensor
Manufacturer :	Mettler Toledo
Model :	Seven2Go S9
Serial No. :	C131262002
ID No. :	RYG_FS0546
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location :	TPA On Site Calibration Laboratory
Received Order :	09 August 2024
Calibrated Date :	13 August 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
AC Line Voltage :	(220 ± 22) V
Calibrated by :	Warakorn Lerngagtrakul
Approved by :	Approved Signatory

( ) Ponpan Paipim
(✓) Suwit Imjai
( ) Kunchit Promprat

Issue Date : 16 August 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2408-0344DSC-2

Cert. No.: 24LM132
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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	23I1216	TPA	11 Oct 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
   Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function : Temperature measurement
This instrument was connected with temperature sensor, S/N.: 829633

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	90	20.002	20.1	0.098	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 %.

-o0o-

Agilent Technologies

Agilent Technologies (Thailand) Limited
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Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

SERVICE REPORT

Customer Contact:
ALS Laboratory Group (Thailand) Co Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
charattagarn.imchom@alsglobal.com
227158780

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006676060	Service Confirmation: 6905905441

Invoice To:
ALS Laboratory Group (Thailand) Co Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

REVIEW BY Tattaporn C.
APPROVED BY Sanita N.
NEXT CAL. DATE 7/4/2024

Delivery Site:
ALS Laboratory Group (Thailand) Co Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:
Room
Bldg
Lab
Dept

Direct Inquiries to:
Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
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Contact Fax: +662 632 4334

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Agilent Technologies (Thailand) Limited / Head Office
U Chu Liang Bldg. 22/F Unit A,D
968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542058216

Citibank N.A. Bangkok Branch
398 Interchange 21 Building, Sukhumvit Road, Klongtoey Nua
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No. 012-4492-007 ,
THB Krung Thai Bank PCL
Siam Square Br. 419/1-2 Rama I Rd. Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6905905441
Service Confirmation Date: 08.10.2024

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6106T Chiller	2U15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	04.10.2024	04.10.2024
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

Additional Information:

Service Confirmation Number: 6905905441
Service Confirmation Date: 08.10.2024

Service Information:

Problem Description: *WU-EOQ-IM-7900-5001253655		
Service Provided: Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability. I calibrate the instrument No BKK_EL0043 test all pass.		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 7.0	**Travel Hours:** 2.0	
Customer Field Service Representative Name: Panthep Kurasathain	**Customer Field Service Representative Signature:**	**Date:** 08 Oct 2024
Customer Name: Supakwan Mak	**Customer Signature:** Supakwan M	**Date:** 08 Oct 2024
Additional Comments:		

SCG

Metrological Center

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676 Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : T5306A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 13 September 2023
Calibrated By : Sanee Musikawan (Site Calibration Manager)
Approved By : / Sujjar Naknakred (Site Calibration Manager)
Date of Issue : 26 SEP 2023

REVIEW BY Tattaporn C.
APPROVED BY Sanita N.
NEXT CAL. DATE 22/03/25

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Metrological Center
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
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Calibration Report

Equipment : **HEATING BLOCK**
Date of Calibration : **22 September 2023**
Environment : **Temperature : 21.8-23.1 °C**
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

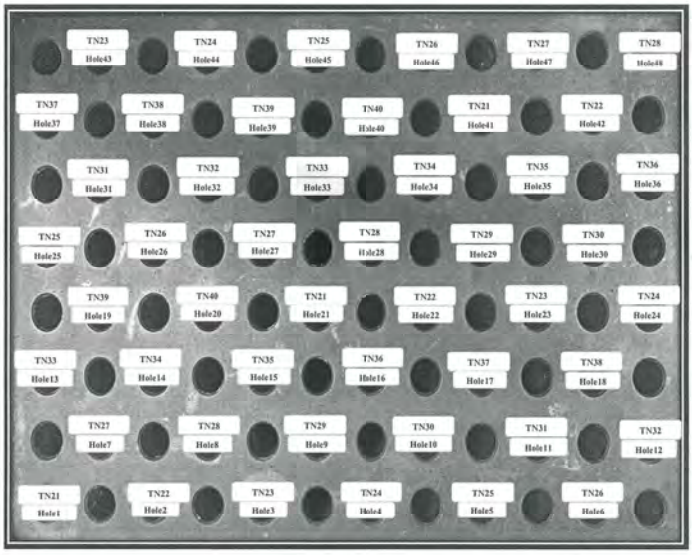
Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 2 Hour 20 Minute At 95 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☐ Close
   ☒ Not Available
5. Adjustment :
   ( ) without adjustment (X) after adjustment

Approved By._____

Metrological Center
SCI ECO Services Company Limited
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Calibration Report



FRONT CONTROL

Approved By._____

FM-L13 I08/30-05-57

Metrological Center
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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
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Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51	95.17
95	Min	94.57	93.95	94.75	94.92	94.00	94.72
	Average	94.79	94.18	94.98	95.17	94.26	94.95
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35	94.97
	Min	94.94	94.95	94.72	94.71	94.90	94.57
	Average	95.15	95.19	94.96	94.94	95.13	94.77
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33	95.31
	Min	94.99	95.09	94.78	94.82	94.88	94.96
	Average	95.18	95.30	95.00	95.02	95.11	95.13
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63	94.67
	Min	95.21	94.06	94.13	93.88	94.28	94.27
	Average	95.40	94.24	94.33	94.06	94.45	94.47
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14	95.03
	Min	94.83	95.03	92.56	94.95	94.79	94.70
	Average	95.01	95.20	92.75	95.12	94.96	94.87
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24	93.87
	Min	94.24	94.55	94.44	93.98	93.92	93.56
	Average	94.43	94.72	94.60	94.14	94.08	93.71
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89	95.35
	Min	93.95	94.05	93.67	93.48	94.39	94.90
	Average	94.13	94.24	93.86	93.65	94.64	95.12
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45	94.87
	Min	95.57	95.15	94.82	94.84	94.99	94.48
	Average	95.78	95.39	95.05	95.07	95.22	94.68

Approved By._____

FM-L13 I08/30-05-57

Metrological Center
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Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.27
105	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.00	104.92	104.97
	Average	105.20	105.02	105.07	105.11	105.02	105.06
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69	105.19
	Min	105.17	105.37	104.75	104.59	104.50	105.00
	Average	105.27	105.50	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	106.41	104.71	105.63	105.82
	Min	105.08	104.22	106.15	104.41	105.37	105.56
	Average	105.19	104.32	106.28	104.56	105.50	105.69
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	103.34	105.78	105.59	105.87
	Min	104.67	105.96	103.08	105.56	105.36	105.68
	Average	104.81	106.11	103.21	105.67	105.48	105.77
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.75	104.86	104.80	105.20	104.50	104.39
	Min	104.54	104.63	104.59	105.00	104.32	104.18
	Average	104.65	104.75	104.69	105.10	104.41	104.28
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.88	104.85
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.61	105.42	105.19
	Min	105.45	105.61	105.14	105.27	105.18	104.94
	Average	105.58	105.73	105.27	105.44	105.30	105.07

Approved By._____

FM-L13 I08/30-05-57

Metrological Center
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Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min , Max	Average		
100.0	100.3 , 100.5	100.4	0.26	0.81
107.0	107.0 , 107.1	107.1	0.19	0.78

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By._____

Metrological Center
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : T5306A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 26 February 2025
Calibrated By : Atiphong Rongrat (Technician)
Approved By : _____ / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 27 MAR 2025

REVIEW BY Tattaporn C.
APPROVED BY Suriya N.
NEXT CAL DATE 04/09/26 (~~04/09/25~~)
Suriya N 27/3/25 P.M.

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Metrological Center
SCI ECO Services Company Limited
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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Calibration Report

Equipment : **HEATING BLOCK**
Date of Calibration : **4 March 2025**
Environment : **Temperature : 24.4-24.9 °C**
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

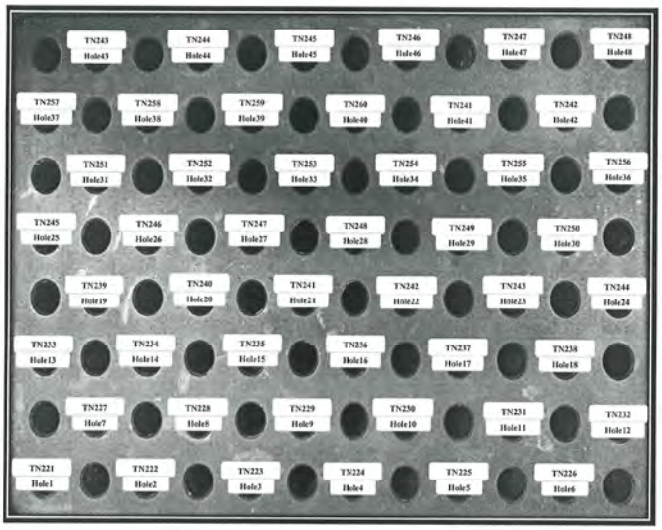
Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

3. This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
4. Condition of calibrated item : good
Equipment Description :
Time Constant 2 Hour 40 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
5. Adjustment :
( ) without adjustment (X) after adjustment

Approved By._____

Metrological Center
SCI ECO Services Company Limited
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Calibration Report



FRONT CONTROL

Approved By._____

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Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	94.85	95.37	95.03	95.25	95.52	94.75
95	Min	94.17	94.66	94.38	94.63	94.87	94.12
	Average	94.51	95.02	94.70	94.94	95.20	94.43
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.71	94.56	94.79	95.32	95.44	95.06
	Min	94.05	93.88	94.10	94.65	94.90	94.65
	Average	94.38	94.22	94.44	94.99	95.17	94.85
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.26	95.43	95.40	95.71	95.41	95.06
	Min	94.54	94.64	94.71	95.10	94.86	94.43
	Average	94.90	95.03	95.06	95.41	95.13	94.74
R4 Hole19-Hole24		TN239	TN240	TN241	TN242	TN243	TN244
	Max	95.13	95.06	95.68	96.10	95.35	95.80
	Min	94.39	94.43	94.86	95.51	94.88	95.12
	Average	94.76	94.75	95.27	95.83	95.12	95.46
R5 Hole25-Hole30		TN245	TN246	TN247	TN248	TN249	TN250
	Max	94.95	95.81	95.39	95.82	95.66	95.66
	Min	94.47	95.03	94.67	94.99	94.84	94.87
	Average	94.71	95.42	95.03	95.41	95.25	95.27
R6 Hole31-Hole36		TN251	TN252	TN253	TN254	TN255	TN256
	Max	96.07	95.34	96.38	95.39	94.95	95.12
	Min	95.28	94.55	95.51	94.62	94.13	94.35
	Average	95.67	94.95	95.90	95.00	94.54	94.73
R7 Hole37-Hole42		TN257	TN258	TN259	TN260	TN241	TN242
	Max	95.15	95.63	96.11	95.09	95.34	95.51
	Min	94.38	94.88	95.32	94.28	94.54	94.72
	Average	94.76	95.25	95.71	94.69	94.94	95.11
R8 Hole43-Hole48		TN243	TN244	TN245	TN246	TN247	TN248
	Max	95.84	95.87	95.44	95.72	95.65	95.75
	Min	95.06	95.10	94.60	94.95	94.87	94.98
	Average	95.45	95.48	95.02	95.34	95.26	95.36

Approved By,

Metrological Center
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Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.48	104.40	104.60	105.27	105.24	105.19
105	Min	104.15	104.02	104.25	104.94	104.91	104.93
	Average	104.32	104.21	104.42	105.10	105.08	105.06
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.20	105.45	105.58	105.96	105.81	106.03
	Min	104.92	105.14	105.29	105.64	105.53	105.79
	Average	105.06	105.29	105.43	105.80	105.67	105.91
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	106.09	106.14	105.83	106.25	105.97	105.88
	Min	105.80	105.89	105.57	106.00	105.69	105.65
	Average	105.94	106.01	105.70	106.13	105.83	105.77
R4 Hole19-Hole24		TN239	TN240	TN241	TN242	TN243	TN244
	Max	105.87	105.75	105.30	105.07	105.22	105.66
	Min	105.62	105.52	105.13	104.90	105.05	105.49
	Average	105.74	105.63	105.21	104.98	105.14	105.57
R5 Hole25-Hole30		TN245	TN246	TN247	TN248	TN249	TN250
	Max	105.62	105.54	105.52	105.75	105.97	105.60
	Min	105.45	105.35	105.31	105.57	105.81	105.49
	Average	105.53	105.44	105.41	105.66	105.89	105.59
R6 Hole31-Hole36		TN251	TN252	TN253	TN254	TN255	TN256
	Max	106.19	106.34	106.47	105.96	105.76	105.35
	Min	106.02	106.15	106.31	105.77	105.58	105.18
	Average	106.10	106.24	106.39	105.87	105.67	105.27
R7 Hole37-Hole42		TN257	TN258	TN259	TN260	TN241	TN242
	Max	106.21	105.59	105.45	105.36	106.08	106.09
	Min	106.04	105.42	105.28	105.20	105.90	105.92
	Average	106.12	105.51	105.37	105.28	105.99	106.00
R8 Hole43-Hole48		TN243	TN244	TN245	TN246	TN247	TN248
	Max	106.54	106.33	105.78	105.38	105.42	105.69
	Min	106.38	106.16	105.60	105.20	105.25	105.52
	Average	106.46	106.25	105.69	105.29	105.33	105.61

Approved By,

Metrological Center
SCI ECO Services Company Limited
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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min , Max	Average		
102.0	-	102.0	0.43	0.83
107.0	-	107.0	0.20	0.70

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k, which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By,

Metrology
SCI ECO Services Company Limited
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Website : www.scieco.co.th E-Mail : calibrate@scg.com

Certificate of Calibration

Equipment	:	Chamber (Cooling Room)
Manufacturer	:	KOLDTECH
Model	:	KM 320
Serial No.	:	TBN-1012061/05
Customer Code	:	BKK_EN0167
ID No.	:	T2463A3
Customer	:	ALS Laboratory Group (Thailand) Co.,Ltd.
		104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
		Khet Suan Luang, Bangkok 10250
Customer Location	:	Laboratory
Date of Receipt	:	29 November 2023
Calibrated By	:	Atiphong Rongrat (Technician)
Approved By	:	/ Boorchai Suriyawong (Site Calibration Manager)
Date of Issue	:	09 JAN 2024

REVIEW BY
APPROVED BY
NEXT CAL. DATE 06/06/25

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T232160 Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. Thisequipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

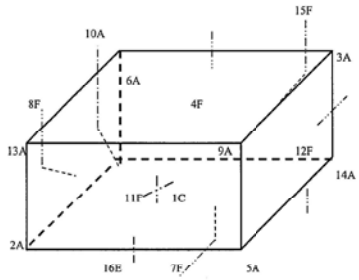
3. This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
5. Adjustment :
(X) without adjustment ( ) after adjustment

Approved By.

FM-L15 I18/18-08-66

Certificate No. T232160 Page 3 of 4

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C	= TN161	12F	= TN172
2A	= TN162	13A	= TN173
3A	= TN163	14A	= TN174
4F	= TN164	15F	= TN175
5A	= TN165	16E	= TN176
6A	= TN166		
7F	= TN167		
8F	= TN168		
9A	= TN169		
10A	= TN170		
11F	= TN171		

Approved By.

FM-L15 I18/18-08-66

Certificate No. T232160 Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor *k*
	Min , Max	Average					
3.0	2.8 , 4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

FM-L15 I18/18-08-66

SCG Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tublkwang, Kaeng Kho, Saraburi, Thailand 18260
Bangkok Tel : +668 9205 6851 , +669 81924 0059
Saraburi Tel : +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250873 Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : KOLDTECH
Model : KM 320
Serial No. : TBN-101206I/05
Customer Code : BKK_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Laboratory Room
Date of Receipt : 28 May 2025
Calibrated By : Atiphong Rongrat (Technician)
Approved By : / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 19 JUN 2025

REVIEW BY Sinda K.
APPROVED BY Siriluk P.
NEXT CAL DATE 04/12/26

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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

SCG
Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260
NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250873

Calibration Report

Equipment : **Chamber (Cooling Room)**
Date of Calibration : **4 June 2025**
Environment : **Temperature : 23.4-24.9 °C**
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 10 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	T121	T242036	3 December 2025

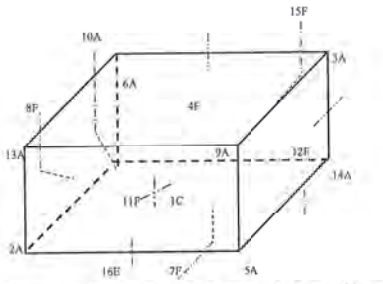
3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 2 Hour 20 Minute At 3 °C
   Fresh Air Damper [ ] Open [ ] Min [ ] Medium [ ] Max
   [ ] Close
   [X] Not Available
5. Adjustment :
   (X) without adjustment ( ) after adjustment

Approved By.

SCG
Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260
NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250873

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C	= TN91	12F	= TN102
2A	= TN92	13A	= TN103
3A	= TN93	14A	= TN104
4F	= TN94	15F	= TN105
5A	= TN95	16E	= TN106
6A	= TN96		
7F	= TN97		
8F	= TN98		
9A	= TN99		
10A	= TN100		
11F	= TN101		

Approved By.

SCG
Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260
NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250873

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101	TN102
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44	3.13
	TN103	TN104	TN105	TN106								
	3.19	3.06	3.46	2.92								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min , Max	Average					
3.0	2.8 , 3.9	3.4	3.14	1.20	1.30	1.90	2.04

The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484
ilac-MRA
NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert.No.: 24CG952
Page.: 1 of 2

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	BKK_EN0171
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	760 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Natcha Chayyingcheiw
Approved by :	Approved Signatory

REVIEW BY Sirilak P.
APPROVED BY
NEXT CAL DATE 27/08/25

( ) Unnopphol Harachai
(✓) Srisuda Khamtha
( ) Sa-ngeunkam Wongsa

Issue Date : 27 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Equipment : Burette
Received Date : 23 February 2024
Condition As-Received : New Item
Calibration Date : 27 February 2024
Reference : 2402-0757DSC-1

Cert.No.: 24CG952

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205DR	1126143764	140RC004	23MM538	TPA	15 Sep 2024
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer	-	0834181	140EC005	23I948	TPA	10 Aug 2024

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	*k* Factor
50	50.0032	0.010	2.00

Remark mL = cm^3

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

-o0o-

DKSH

Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Orion STAR A215
Serial No. (or ID.): X58821 (RYG-EN0200)
Manufacturer: Thermo Scientific
Electrode Serial No. YQ1-11982 Model : ORION 013005MD Brand : Thermo Scientific
Condition: In Condition

Certificate No.: C24250077
Issued Date: 21 March 2025
Job No.: WO-00064803

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY Phatchanan S.
APPROVED BY
NEXT CAL. DATE 21/3/26

Environment Condition: Temperature 23.5 °C ± 0.8 °C
Humidity 52.4 %RH ± 1.3 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemisty Lab) 616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Pongpisut Suebchantha
Calibration Date: 21 March 2025
The Method used: In house method, CAL-WI-49 base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 1066606, 1066607, 1066608, 1066609

(Mr. Pongpisut Suebchantha)
Person in charge

(Miss Kaewkan Suradech)
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. The report shall not be reproduced except in full without approval of DKSH Technology Limited.
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนงเหนือ เขตวัฒนา กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Prakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Calibration Results:

Before Adjustment

Standard Conductivity Solution		Unit Under Calibration Reading		Correction		Coverage Factor (k)	Uncertainty (±)	
25.000	µS/cm	27.43	µS/cm	-2.430	µS/cm	2.00	0.28	µS/cm
84.003	µS/cm	90.76	µS/cm	-6.757	µS/cm	2.00	0.68	µS/cm
1413.1	µS/cm	1464	µS/cm	-50.9	µS/cm	2.00	11	µS/cm
12.881	mS/cm	13.41	mS/cm	-0.529	mS/cm	2.00	0.098	mS/cm

After Adjustment ; at 25 µS/cm, 84 µS/cm, 1413 µS/cm, 12.88 mS/cm

Standard Conductivity Solution		Unit Under Calibration Reading		Correction		Coverage Factor (k)	Uncertainty (±)	
25.000	µS/cm	25.63	µS/cm	-0.630	µS/cm	2.00	0.28	µS/cm
84.003	µS/cm	84.53	µS/cm	-0.527	µS/cm	2.00	0.68	µS/cm
1413.1	µS/cm	1415	µS/cm	-1.9	µS/cm	2.00	11	µS/cm
12.881	mS/cm	12.92	mS/cm	-0.039	mS/cm	2.00	0.098	mS/cm

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนงเหนือ เขตวัฒนา กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Prakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

DKSH

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064803

ชนิดเครื่องมือ: CONDUCTIVITY METER รุ่น: Orion STAR A215 หมายเลขเครื่อง: X58821

ตรวจสอบ (ก่อน) 21 Mar 2025		รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 21 Mar 2025		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ของใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☐	☐	8. ความยาวคลื่น (Wavelength Check)	☐	☐	
☐	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☐	☐	
☐	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☐	☐	
☐	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☐	☐	
		pH Meter and Conductivity Meter			
☑	☐	12. อิเล็คโทรด (Electrode and Connection Cable)	☑	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☑	☐	15. ขาจับอิเล็คโทรด (Stand)	☑	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

ข้อแนะนำ :

Mr. Pongpisut Suebchantha
Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนงเหนือ เขตวัฒนา กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Prakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

DKSH

Certificate of Calibration

Equipment : Digital Thermometer with Proba
Model : Orion STAR A215
Serial No. : X58821
Manufacturer : Thermo Scientific
ID No. : RYG-EN0200

Certificate No. : C15250430
Issued Date : 21 March 2025
Job No. : WO-00064803
Page : 1 of 2
Condition : In Condition

Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY Photchanan S.
APPROVED BY
NEXT CAL. DATE 21/3/26

Environment Condition : Temperature: 30 °C ± 10 °C
Humidity: 55 %RH ± 25 %RH
Voltage: 220 VAC ± 10 %

Calibration Place : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab) 616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By : Mr. Piyapat Saidoung
Calibration Date : 21 March 2025
The Method used : In house method, CAL-WI-69, by comparison with standard thermometer
Traceability : This certificate is traceable to the International System of Unit maintained by:
Quality Reborn Co.,Ltd. (QR)

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Tweewong Thaithiang)
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. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-2043	21 August 2024	21 August 2025

Calibration Results:

Without Adjustment

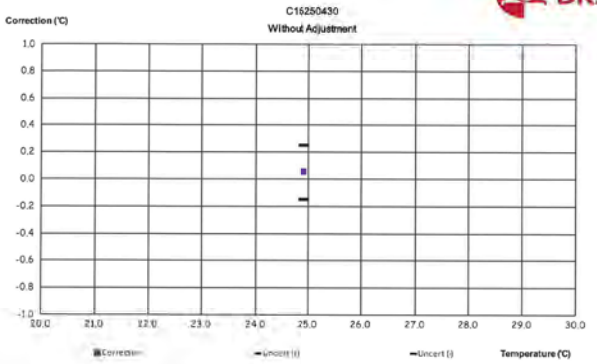
Sensor Type: RTD Electrode Serial No. CS1-11923 Channel: -
Diameter (mm): 15 Length (mm): 120 Immersion (mm): 110

Calibrate Point.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
25.0	24.954	24.9	0.054	0.20

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

DKSH



DKSH

ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment : Digital Thermometer with Probe
Serial No. : X58821

Certificate No. : C15250430
Model : Orion STAR A215

ตรวจสอบ (รับ) 21-Mar-2025 ปกติ	ตรวจสอบ (รับ) 21-Mar-2025 ไม่ปกติ	รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 21-Mar-2025 ปกติ	ตรวจสอบ (ส่ง) 21-Mar-2025 ไม่ปกติ	หมายเหตุ
		General			
☑	☐	1. สายไฟ	☑	☐	
☑	☐	2. Adapter / Power supply 220 / 110 VAC	☑	☐	
☑	☐	3. การทำงาน Main Switch	☑	☐	
☑	☐	4. การทำงาน Selector Key	☑	☐	
☑	☐	5. การแสดงผล Display	☑	☐	
☐	☐	6. Battery	☐	☐	ไม่มี
☑	☐	7. สภาพตัวเครื่อง	☑	☐	
☑	☐	8. สภาพ Sensor (In / Ex)	☑	☐	

ข้อแนะนำ : _____

_____

_____

Mr. Piyapat Saidoung
Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

DKSH

Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06250108
Model:	DR6000	Issued Date:	18 March 2025
Serial No. (or ID.):	1627845 (RYG_EN0037)	Job No.:	WO-00064379
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Photchannas
APPROVED BY
NEXT CAL. DATE 18/09/26

Environment Condition: Temperature 24.4 °C ± 0.3 °C
Humidity 60.8 %RH ± 3.5 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Preecha Phooarsai)
Person in charge

(Miss Keewkan Suradech)
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. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	638.3	-0.32	0.13
748.48	748.8	-0.32	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2667	0.265	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.948	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

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Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.7	1.770
391.44 +/- 0.11 nm	391.4	1.4	1.854

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4566	0.2780		
UUC: Absorbance (A)	0.413	0.299		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

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DKSH

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ) 18 Mar 2025 ปกติ	ตรวจสอบ (รับ) 18 Mar 2025 ไม่ปกติ	รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 18 Mar 2025 ปกติ	ตรวจสอบ (ส่ง) 18 Mar 2025 ไม่ปกติ	หมายเหตุ
		General			
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☑	☐	8. ความยาวคลื่น (Wavelength Check)	☑	☐	*
☑	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☑	☐	13.5 Hours
☑	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☑	☐	893.0 Hours
☑	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☑	☐	
		pH Meter and Conductivity Meter			
☐	☐	12. อิเล็คโทรด (Electrode and Connection Cable)	☐	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็คโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

เพิ่มเติม/ข้อแนะนำ : * 656.1nm = 656.1nm
* 486.0nm = 485.7nm

Mr.Preecha Phooarsai
Service Engineer

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Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

Equipment:	Block Digestion Unit	Certificate No.:	C29240011
Model:	KT-20s	Issued Date:	22 March 2024
Serial No. (or ID.):	5720210009/5770200073	Job No.:	WO-00020429
Manufacturer:	Gerhardt	Page:	1 of 4
Condition:	In Condition	Digestion Block:	20 holes.

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition:

Temperature:	25 °C	±	0.7 °C
Humidity:	54 %RH	±	4.1 %RH
Voltage:	225 VAC	±	1.7 VAC

REVIEW BY N.Bamrit
APPROVED BY D.Sri
NEXT CAL. DATE 11/09/25

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Thanathorn Phunook

Calibration Date: *11 March 2024*

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL) Certificate No.: TC22/0080

(Mr. Thanathorn Phunook)
Person in charge

(Mr. Udon Srichana)
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 conditons. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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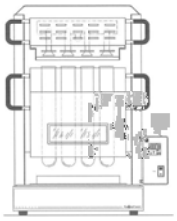
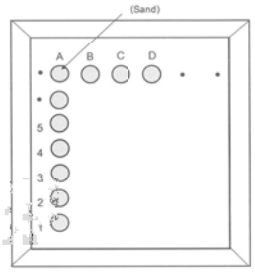


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

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Calibration Results:

Pre Calibrtion

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	380	380	380	401.5	21.5	1.5
A2				401.2	21.2	1.5
A3				399.1	19.1	1.5
A4				397.8	17.8	1.5
A5				395.1	15.1	1.5
B1				396.6	16.6	1.5
B2				396.1	16.1	1.5
B3				392.9	12.9	1.5
B4				391.6	11.6	1.5
B5				390.7	10.7	1.5
C1				395.3	15.3	1.5
C2				395.6	15.6	1.5
C3				392.8	12.8	1.5
C4				391.7	11.7	1.5
C5				390.3	10.3	1.5
D1				397.6	17.6	1.5
D2				396.6	16.6	1.5
D3				395.0	15.0	1.5
D4				394.2	14.2	1.5
D5				393.6	13.6	1.5

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Calibration Results:

Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	380	365	365	382.5	17.5	1.5
A2				382.4	17.4	1.5
A3				382.1	17.1	1.5
A4				379.7	14.7	1.5
A5				378.3	13.3	1.5
B1				380.1	15.1	1.5
B2				380.1	15.1	1.5
B3				378.5	13.5	1.5
B4				378.3	13.3	1.5
B5				379.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.9	13.9	1.5
C4				378.2	13.2	1.5
C5				377.3	12.3	1.5
D1				380.5	15.5	1.5
D2				380.6	15.6	1.5
D3				378.1	13.1	1.5
D4				378.7	13.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

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ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
11 Mar 2024			11 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1. สายไฟ	☑	☐	
☑	☐	2. การทำงาน Main Switch	☑	☐	
☑	☐	3. การทำงาน Selector Key	☑	☐	
☑	☐	4. การแสดงผล Display	☑	☐	
☑	☐	5. สภาพ Hole	☑	☐	
☐	☐	6. สภาพฝาปิด	☐	☐	ไม่มี
☑	☐	7. สภาพตัวเครื่อง	☑	☐	
☑	☐	8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☑	☐	

ข้อแนะนำ :

Mr. Thanathorn Phunook

Service Engineer

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