ภาคผนวก 7-1

สำเนา ใบสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์

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ISO 9001 CERTIFICATION ™ Intertek
UKAS MANAGEMENT SYSTEMS 014

PM10 Sampler Calibration

SITE

Project:High Volume Sampler Calibration
Location:Life & Environment Co.,Ltd
Date of calibration : Febuary 14,2024

DETAIL OF SAMPLER

Sampler Model:TE-6070 PM-10
Motor Model: TISCH
Motor Serail No,: 2184

CONDITIONS

Pressure of Ambient Air (Pa) (mm Hg):	760
Tempurerature of Ambient Air (Ta) (K):	305
Average Pressure (Ps) (mm Hg):	759
Average Temperature (Ts) (K):	302

CALIBRATION ORIFICE

Make : Tisch
Model : TE-5025A
Serial#: 5

Slope : 1.26202
Intercept: -0.01176

CALIBRATION

Plate or Test #	H_2O (in)	Qa (m^3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	11.40	1.704	54.0	34.21	Slope =	18.9651
2	9.60	1.565	48.0	30.41	Intercept =	1.0675
3	7.50	1.384	42.0	26.61	Corr. coeff.=	0.9951
4	4.70	1.098	34.0	21.54	SFR =	1.140
5	2.80	0.849	28.0	17.74	SSP =	37.75

# of Observations: 5

Calibrated by: [redacted]

Approved by : [redacted]
Industrial Hygiene Specialist

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PM10 Sampler Calibration

SITE

Project:High Volume Sampler Calibration
Location:Life & Environment Co.,Ltd
Date of calibration: Febuary 14,2024

DETAIL OF SAMPLER

Sampler Model:TE-6070 PM-10
Motor Model: TISCH
Motor Serail No,: 2095

CONDITIONS

Pressure of Ambient Air (Pa) (mm Hg):	760
Tempurerature of Ambient Air (Ta) (K):	305
Average Pressure (Ps) (mm Hg):	759
Average Temperature (Ts) (K):	302

CALIBRATION ORIFICE

Make : Tisch
Model : TE-5025A
Serial#: 5

Slope : 1.26202
Intercept: -0.01176

CALIBRATION

Plate or Test #	H_2O (in)	Qa (m^3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	11.50	1.712	58.0	36.74	Slope =	21.2408
2	9.50	1.556	52.0	32.94	Intercept =	0.2203
3	6.90	1.328	46.0	29.14	Corr. coeff.=	0.9957
4	4.80	1.109	36.0	22.81	SFR =	1.140
5	2.90	0.864	30.0	19.00	SSP =	37.75

# of Observations: 5

Calibrated by: [redacted]

Approved by : [redacted]
Industrial Hygiene Specialist

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PM10 Sampler Calibration

SITE

Project:High Volume Sampler Calibration
Location:Life & Environment Co.,Ltd
Date of calibration: Febuary 14,2024

DETAIL OF SAMPLER

Sampler Model:TE-6070 PM-10
Motor Model: TISCH
Motor Serail No,: 2094

CONDITIONS

Pressure of Ambient Air (Pa) (mm Hg):	760
Tempurerature of Ambient Air (Ta) (K):	305
Average Pressure (Ps) (mm Hg):	759
Average Temperature (Ts) (K):	302

CALIBRATION ORIFICE

Make : Tisch
Model : TE-5025A
Serial#: 5

Slope : 1.26202
Intercept: -0.01176

CALIBRATION

Plate or Test #	H_2O (in)	Qa (m^3/min)	I (chart)	IC (corrected)
1	11.50	1.712	52.0	32.94
2	9.20	1.532	46.0	29.14
3	7.20	1.356	40.0	25.34
4	4.60	1.086	31.0	19.64
5	2.80	0.849	22.0	13.94

LINEAR REGRESSION

Slope = 21.9130
Intercept = -4.4403
Corr. coeff.= 0.9997
SFR = 1.140
SSP = 37.75

# of Observations: 5

Calibrated by: [redacted]

Approved by : [redacted]
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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 038536 **Model :** 224-PC X R8

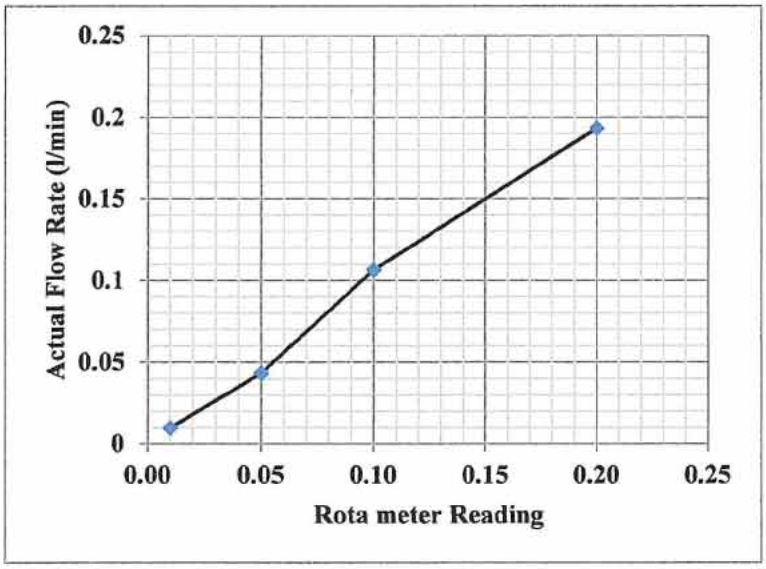
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-15

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.04	0.04	0.043	0.0058	±0.10	Pass
0.10	0.12	0.10	0.10	0.107	0.0115	±0.15	Pass
0.20	0.19	0.19	0.20	0.193	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 038556 **Model :** 224-PC X R8

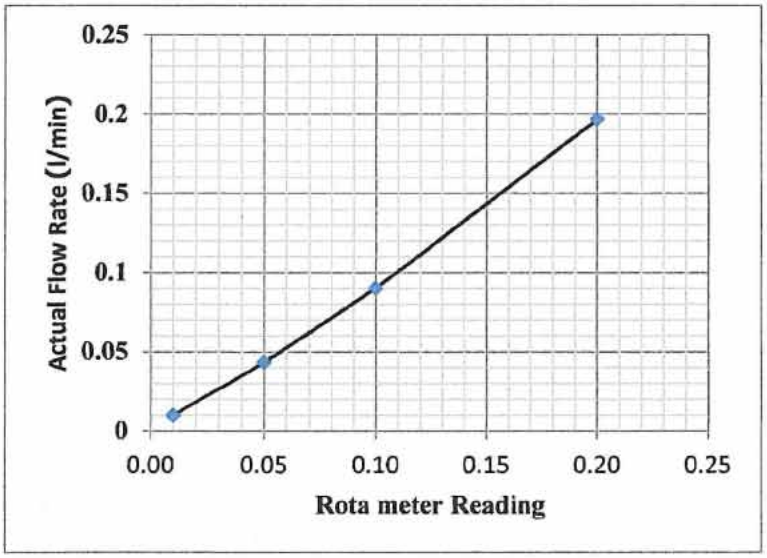
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-16

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.04	0.04	0.05	0.043	0.0058	±0.10	Pass
0.10	0.09	0.09	0.09	0.090	0.0000	±0.15	Pass
0.20	0.19	0.20	0.20	0.197	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 038545 **Model :** 224-PC X R8

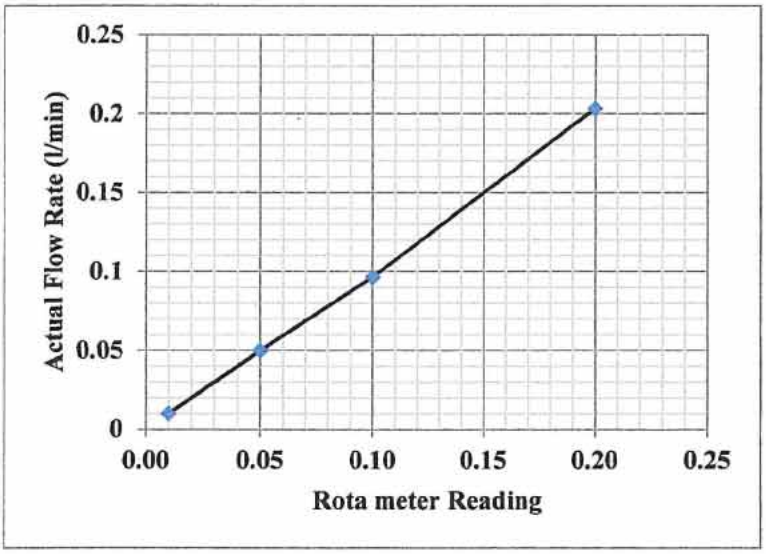
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-17

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.06	0.04	0.050	0.0100	±0.10	Pass
0.10	0.10	0.10	0.09	0.097	0.0058	±0.15	Pass
0.20	0.20	0.20	0.21	0.203	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 038566 **Model :** 224-PC X R8

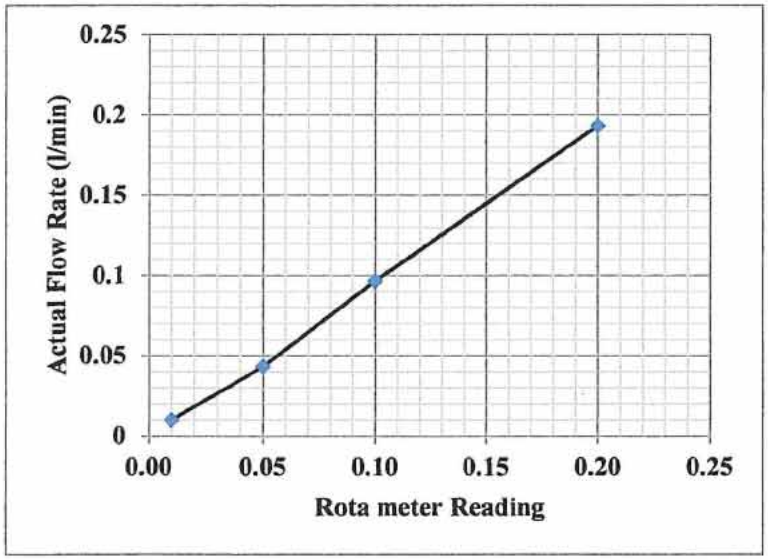
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-18

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.04	0.04	0.043	0.0058	±0.10	Pass
0.10	0.10	0.10	0.09	0.097	0.0058	±0.15	Pass
0.20	0.20	0.19	0.19	0.193	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** A122840 **Model :** 224-PC X R8

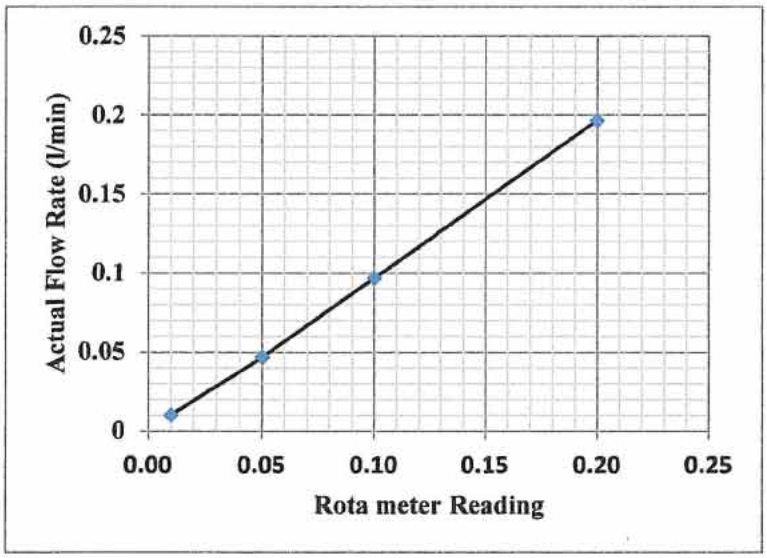
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-20

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.04	0.05	0.047	0.0058	±0.10	Pass
0.10	0.10	0.10	0.09	0.097	0.0058	±0.15	Pass
0.20	0.19	0.21	0.19	0.197	0.0115	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 20150601080 **Model :** BDX-II

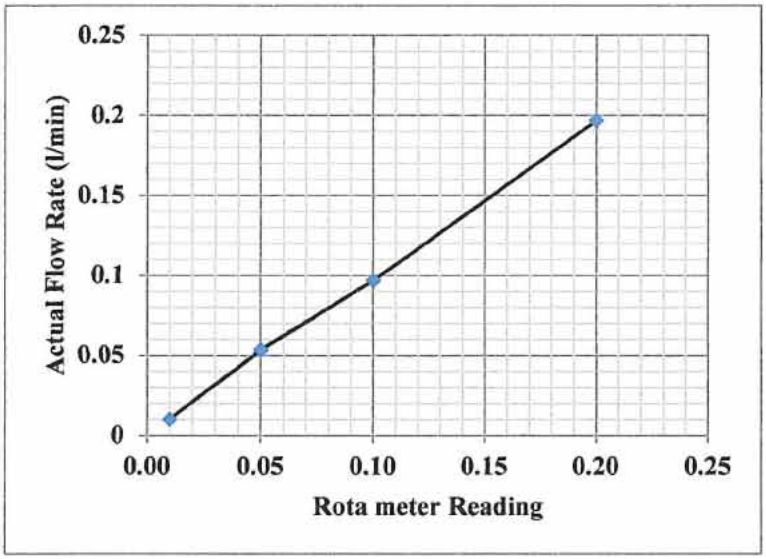
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-04

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.06	0.05	0.053	0.0058	±0.10	Pass
0.10	0.10	0.09	0.10	0.097	0.0058	±0.15	Pass
0.20	0.20	0.20	0.19	0.197	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 20170104055 **Model :** BDX-II

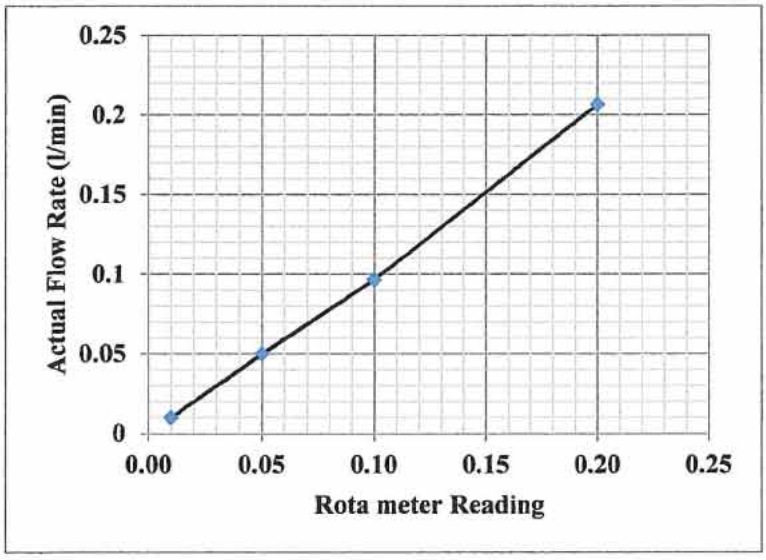
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-06

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.05	0.05	0.050	0.0000	±0.10	Pass
0.10	0.10	0.09	0.10	0.097	0.0058	±0.15	Pass
0.20	0.21	0.21	0.20	0.207	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 20170104061 **Model :** BDX-II

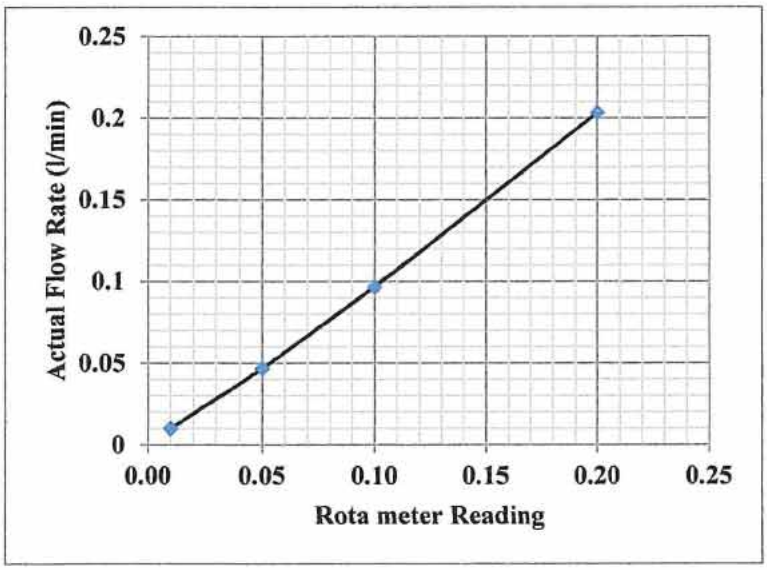
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-07

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.04	0.05	0.05	0.047	0.0058	±0.10	Pass
0.10	0.10	0.09	0.10	0.097	0.0058	±0.15	Pass
0.20	0.20	0.20	0.21	0.203	0.0058	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(Low Flow)** **Serial No.** 20170104062 **Model :** BDX-II

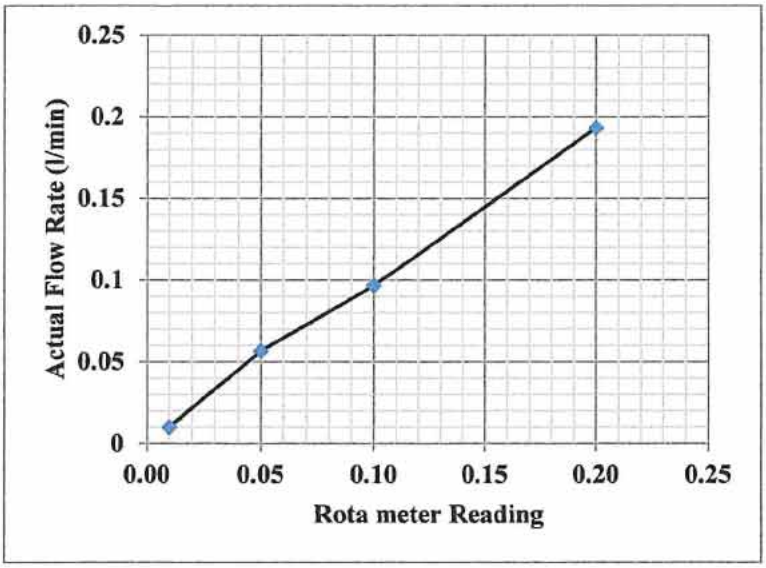
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-08

Next Time Calibration : MARCH 11, 2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.06	0.06	0.05	0.057	0.0058	±0.10	Pass
0.10	0.10	0.09	0.10	0.097	0.0058	±0.15	Pass
0.20	0.19	0.19	0.20	0.193	0.0058	±0.15	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 038536 **Model :** 224-PC X R8

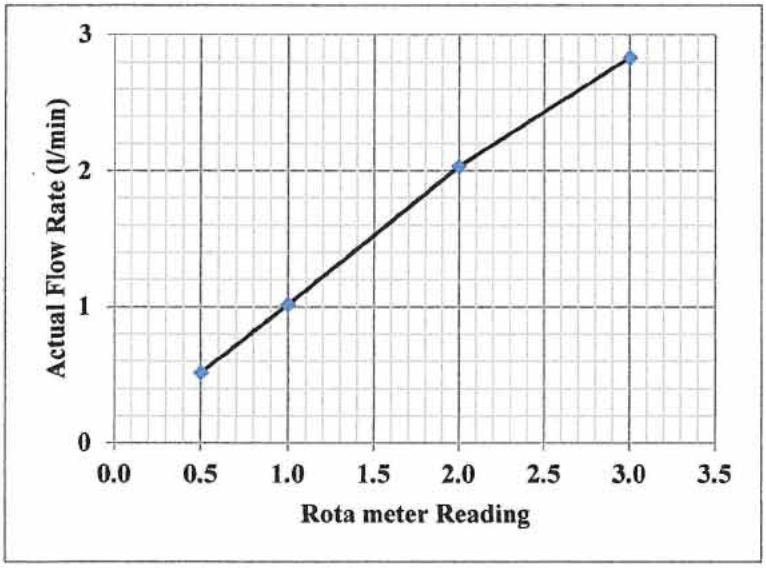
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-15

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.55	0.50	0.517	0.0289	±0.05	Pass
1.0	1.00	1.00	1.05	1.017	0.0289	±0.10	Pass
2.0	2.05	2.05	2.00	2.033	0.0289	±0.15	Pass
3.0	2.80	2.90	2.80	2.833	0.0577	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 038556 **Model :** 224-PC X R8

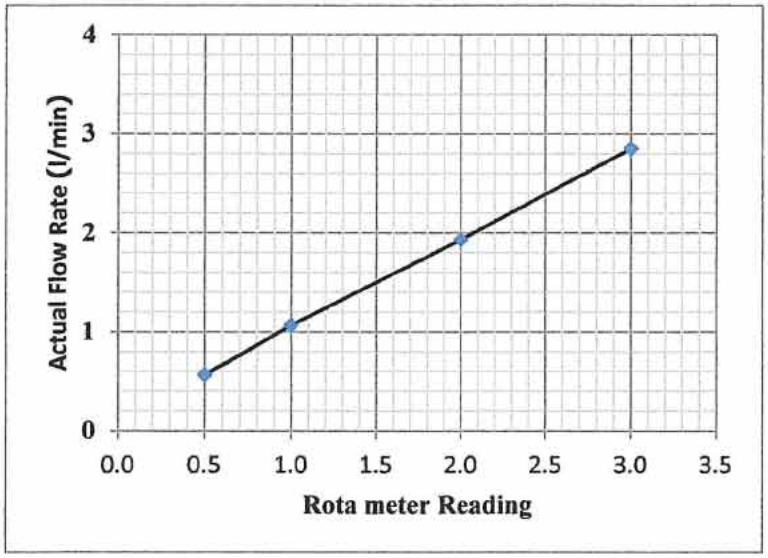
Manufacture : SKC (INC)

Date of Calibration : MARCH 11,2024 AM-16

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.55	0.60	0.567	0.0289	±0.05	Pass
1.0	1.05	1.05	1.10	1.067	0.0289	±0.10	Pass
2.0	1.95	1.95	1.90	1.933	0.0289	±0.15	Pass
3.0	2.80	2.85	2.90	2.850	0.0500	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

IHAA
Industrial Health Association of Asia
สมาคมสุขศาสตร์อุตสาหกรรมแห่งเอเชีย

ISO 9001 CERTIFICATION Intertek ™ UKAS MANAGEMENT SYSTEMS 014

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 038545 **Model :** 224-PC X R8

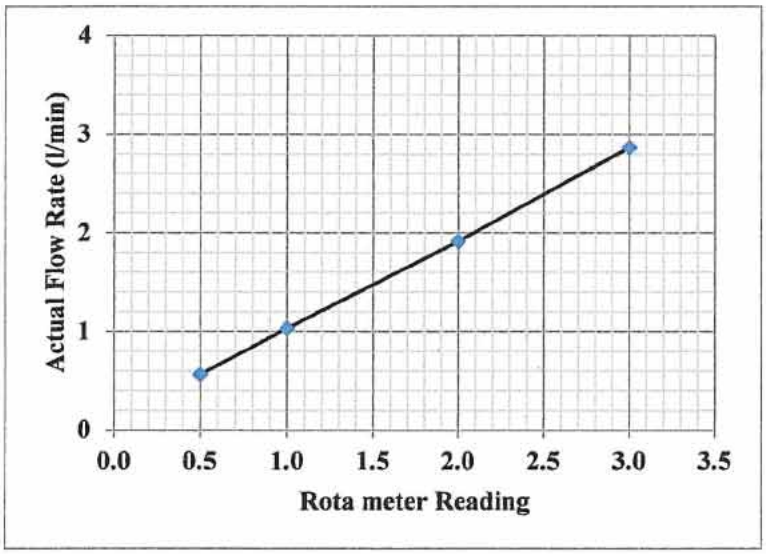
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-17

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.60	0.55	0.567	0.0289	±0.05	Pass
1.0	1.00	1.05	1.05	1.033	0.0289	±0.10	Pass
2.0	1.95	1.90	1.90	1.917	0.0289	±0.15	Pass
3.0	2.95	2.80	2.85	2.867	0.0764	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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ISO 9001 CERTIFICATION Intertek ™ UKAS MANAGEMENT SYSTEMS 014

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 038566 **Model :** 224-PC X R8

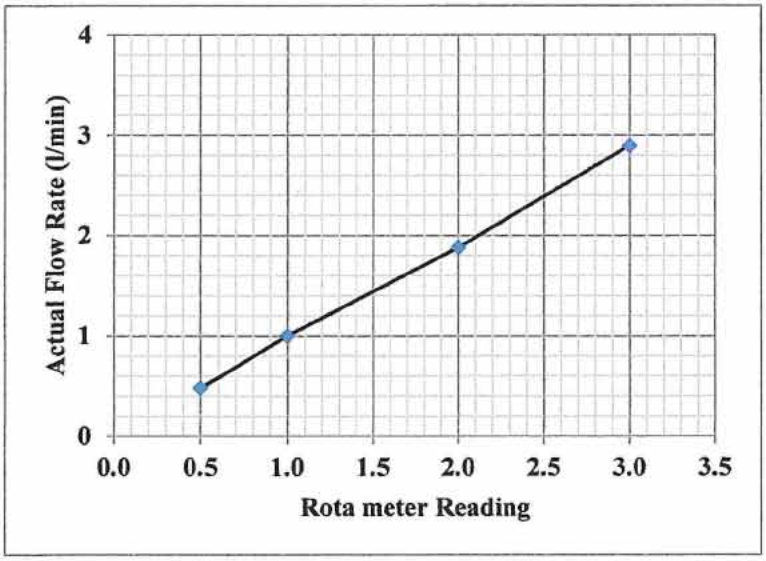
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-18

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.45	0.45	0.483	0.0577	±0.05	Pass
1.0	0.95	1.00	1.05	1.000	0.0500	±0.10	Pass
2.0	1.95	1.85	1.85	1.883	0.0577	±0.15	Pass
3.0	2.85	2.85	3.00	2.900	0.0866	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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ISO 9001 CERTIFICATION Intertek
UKAS MANAGEMENT SYSTEMS 014

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** A122840 **Model :** 224-PC X R8

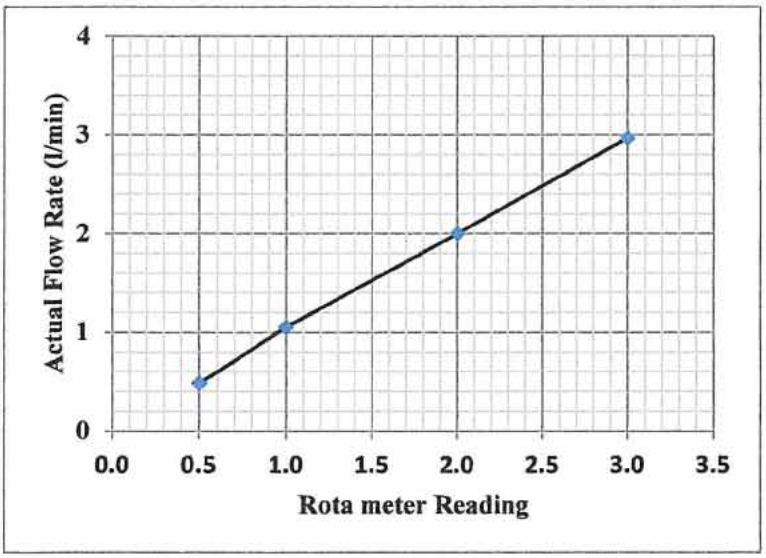
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024 AM-20

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.50	0.45	0.483	0.0289	±0.05	Pass
1.0	1.10	1.05	1.00	1.050	0.0500	±0.10	Pass
2.0	2.00	1.95	2.05	2.000	0.0500	±0.15	Pass
3.0	2.90	2.85	2.95	2.966	0.0500	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 20150601080 **Model :** BDX-II

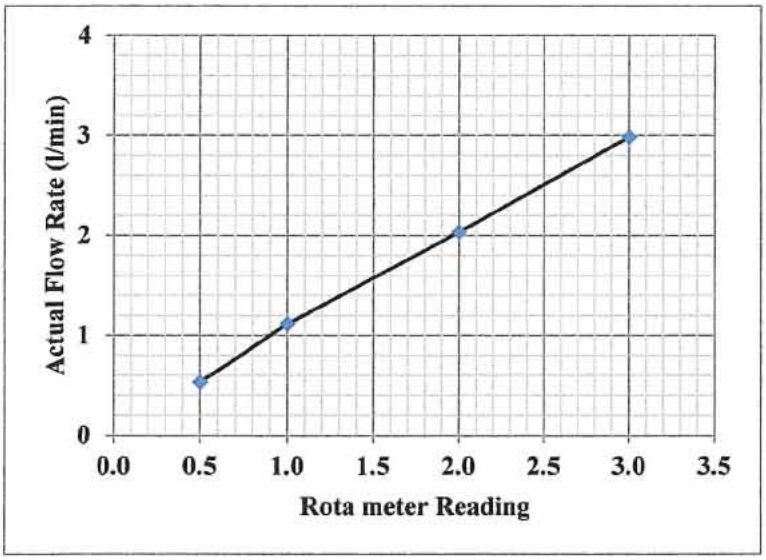
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-04

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003	Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.55	0.50	0.533	0.0289	±0.05	Pass
1.0	1.10	1.10	1.15	1.117	0.0289	±0.10	Pass
2.0	2.00	2.05	2.05	2.033	0.0289	±0.15	Pass
3.0	3.00	3.00	2.95	2.983	0.0289	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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ISO 9001 CERTIFICATION Intertek UKAS MANAGEMENT SYSTEMS 014

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 20170104055 **Model :** BDX-II

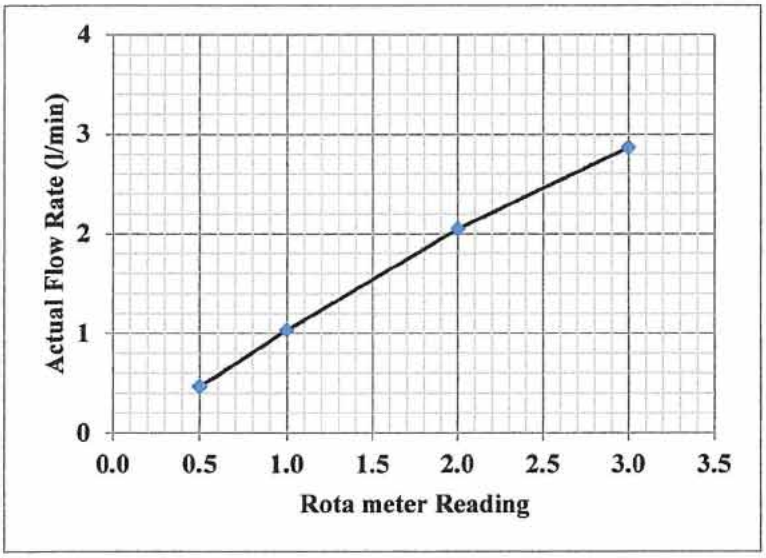
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-06

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.45	0.45	0.50	0.467	0.0289	±0.05	Pass
1.0	1.05	1.05	1.00	1.033	0.0289	±0.10	Pass
2.0	2.00	2.05	2.10	2.050	0.0500	±0.15	Pass
3.0	2.85	2.95	2.80	2.867	0.0764	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 20170104061 **Model :** BDX-II

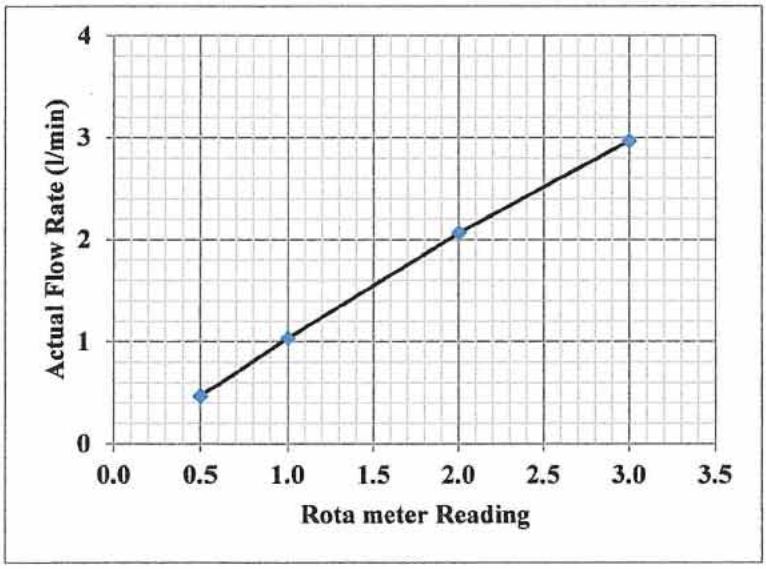
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-07

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.45	0.50	0.45	0.467	0.0289	±0.05	Pass
1.0	1.05	1.00	1.05	1.033	0.0289	±0.10	Pass
2.0	2.10	2.10	2.00	2.067	0.0577	±0.15	Pass
3.0	3.00	2.95	2.95	2.967	0.0289	±0.20	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

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ISO 9001 CERTIFICATION Intertek ™ UKAS MANAGEMENT SYSTEMS 014

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER **(High Flow)** **Serial No.** 20170104062 **Model :** BDX-II

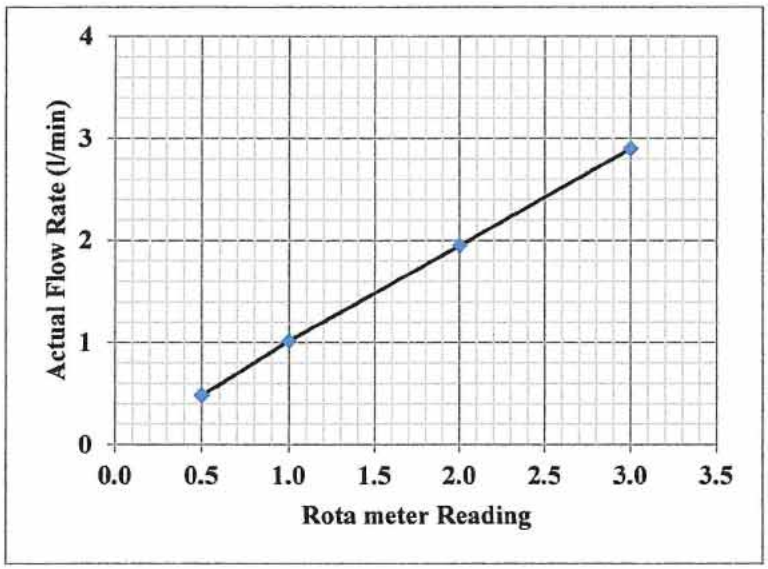
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024 GN-08

Next Time Calibration : MARCH 11,2025

Standard Criteria : Rota Meter	Ambient Condition
SKC Model1355EZ30 S/N 0107070345011/003	Temperature = 25.0 °C
	Pressure = 759 mmHg

Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.50	0.45	0.483	0.0289	±0.05	Pass
1.0	1.00	1.00	1.05	1.017	0.0289	±0.10	Pass
2.0	2.00	1.95	1.90	1.950	0.0500	±0.15	Pass
3.0	2.95	2.90	2.85	2.900	0.0500	±0.15	Pass



Calibrated by [redacted]

Approved by [redacted]

Industrial Hygiene Specialist

90,92,94 ซอยอ่อนนุช64 แขวงอ่อนนุช เขตสวนหลวง กรุงเทพฯ 10250 โทรศัพท์ (662)3200277-8

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24030129-1 Page : 1 of 3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	:	Rota Flow Meter			
Manufacturer	:	Brooks Instrument Division			
Model	:	1355EZ30			
Serial Number	:	0107070345011/003			
ID. Number	:	ROTA CAL.02			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 2 °C	Received Date	:	09 Mar 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	09 Mar 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	09 Mar 2025
Calibration Procedure	:	SP-CPM-04-13	Date of Issue	:	10 Mar 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Jirasak Pumbut
Calibration Officer

Approved by : [redacted]
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24030129-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard Flow Meter	520-H	200353	MW-0053-23	19 Aug 2024

Traceability

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

NIMT - The National Institute of Metrology, Thailand.

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สถาบันมาตรวิทยา.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

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Result of Calibration

Certificate No. : SPR24030129-1

Range : 0 to 5 L/Min

Function : Air Flow Measurement

Unit : L/Min

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
0.02	0.02	0.03432	-0.01432	1.716000	0.058
0.10	0.1	0.04881	0.05119	0.488100	0.058
1.00	1.0	0.9723	0.0277	0.972300	0.059
2.00	2.0	2.0044	-0.0044	1.002200	0.061
3.00	3.0	3.0270	-0.0270	1.009000	0.065

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2, providing a level of confidence approximately 95 %

- End of Certificate -

บริษัท พาราไซแอนติฟิค จำกัด
BARA SCIENTIFIC CO., LTD.

PREVENTIVE MAINTENANCE/ CALIBRATION

GC SYSTEM

GC-14B/C-R5A

ID NO.	:
REPORT NO.	:C-A3-TK-6611-0300
DATE OF REPORT	:15 November 2023
COMPLETION DATE	:15 November 2023
NEXT DUE DATE	:On November 2024

GAS CHROMATOGRAPHY

SERIAL NUMBER	C10733000756SA
CUSTOMER	LIFE AND ENVIRONMENT CO., LTD.
ADDRESS	90,92,94 SOI ON-NUCH 64, SRINAKARIN ROAD, ON-NUCH SUANLUANG, BANGKOK 10250.
ATTENTION	KHUN TUNYALUCK KREEPANICH
PHONE	02-320-0277-8 EXT.304,308
FAX	023200293
DONE BY	Mr.Thanawat Pumpaka
SERVICE REPORT NO.	TK-6611-0300

SIGNED FOR AND ON BEHALF OF
BARA SCIENTIFIC CO.,LTD.

[redacted]

อนุมัติใช้วันที่ 3 มีนาคม 2553

บริษัท พาราไซแอนติฟิค จำกัด
BARA SCIENTIFIC CO., LTD.

CERTIFICATE

THIS CERTIFIES THE PERFORMANCE OF SHIMADZU GAS CHROMATOGRAPHY AT

LIFE AND ENVIROMENT CO., LTD.ADDRESS : 90,92,94 SOI ON-NUCH 64, SRINAKARIN ROAD,SUANLUANG, BANGKOK 10250.

SYSTEM CONFIGURATION : GC-14B, C-R5A

DETECTOR TYPE : FLAME IONIZATION DETECTOR (FID)

METHOD : SENSITIVITY TEST OF FID BY SHIMADZU CORPORATION, JAPAN.

CHEMICAL : N-HEXADECANE(C_{16}) 100ng/uL (HEPTANE SOVENT)

SPECIFICATION OF FID :S(C/g)OF C16 IS MORE THAN 0.01(C/g)

RESULT : SENSITIVITY OF FID CH1 = **0.0163** C/g

REPRODUCIBILITY : Area Value CH1 CV $\leq$ 10.00 % = **1.566 %**

Retention Time CH1 CV $\leq$ 2.00 % = **0.348 %**

ISSUED ON : 15 November 2023

ISSUED AT : SERVICE SECTION, BARASCIENTIFIC CO.,LTD.

APPROVED BY :

[redacted]

SERVICE ENGINEER

PREVENTIVE MAINTENANCE/ CALIBRATION

GC SYSTEM

GC-14B/C-R5A

ID NO.	:-
REPORT NO.	:C-A3-TK-6711-0257
DATE OF REPORT	:13 November 2024
COMPLETION DATE	:13 November 2024
NEXT DUE DATE	:ON November 2025

GAS CHROMATOGRAPHY

SERIAL NUMBER	C10733000756SA
CUSTOMER	LIFE AND ENVIRONMENT CO., LTD.
ADDRESS	90,92,94 SOI ON-NUCH 64, SRINAKARIN ROAD, ON-NUCH SUANLUANG, BANGKOK 10250.
ATTENTION	KHUN TUNYALUCK KREEPANICH
PHONE	02-320-0277-8 EXT.304,308
FAX	023200293
DONE BY	Mr.Nattapon Ngamsang
SERVICE REPORT NO.	C-A3-TK-6711-0257

SIGNED FOR AND ON BEHALF OF
BARA SCIENTIFIC CO.,LTD.

[redacted]

อนุมัติใช้วันที่ 3 มีนาคม 2553

TOLTAL NUMBER OF PAGES: 28

บริษัท พาราไซแอนติฟิค จำกัด
BARA SCIENTIFIC CO., LTD.

CERTIFICATE

THIS CERTIFIES THE PERFORMANCE OF SHIMADZU GAS CHROMATOGRAPHY AT

LIFE AND ENVIROMENT CO., LTD.ADDRESS : 90,92,94 SOI ON-NUCH 64, SRINAKARIN ROAD,SUANLUANG, BANGKOK 10250.

SYSTEM CONFIGURATION : GC-14B, C-R5A

DETECTOR TYPE : FLAME IONIZATION DETECTOR (FID)

METHOD : SENSITIVITY TEST OF FID BY SHIMADZU CORPORATION, JAPAN.

CHEMICAL : N-HEXADECANE(C_{16}) 100ng/uL (HEPTANE SOVENT)

SPECIFICATION OF FID :S(C/g)OF C16 IS MORE THAN 0.01(C/g)

RESULT : SENSITIVITY OF FID CH1 = **0.0115** C/g

REPRODUCIBILITY : Area Value CH1 CV $\leq$ 10.00 % = **3.079 %**

Retention Time CH1 CV $\leq$ 2.00 % = **0.363 %**

ISSUED ON : 13 November 2024

ISSUED AT : SERVICE SECTION, BARASCIENTIFIC CO.,LTD.

APPROVED BY :

[redacted]

SERVICE ENGINEER

DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06230594
Model:	CE 1011	Issued Date:	14 December 2023
Serial No. (or ID.):	920-252	Job No.:	WO-00011851
Manufacturer:	CECIL	Page:	1 of 2
Condition:	In Condition		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Suanluang, Bangkok 10250 Thailand.

Environment Condition:

Temperature	24.7	°C	±	0.2	°C
Humidity	58.7	%RH	±	0.5	%RH

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Air Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Suanluang, Bangkok 10250 Thailand.

Calibration By: Miss.Kaewkan Suradech

Calibration Date: 13 December 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 Starna Scientific Limited.
The standard for Wavelength Certificate No. 105931 and 105898
The standard for Photometric Certificate No. 105940

[redacted]
Person in charge

[redacted]
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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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

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 8 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	421.0	-2.60	0.13
447.20	450.3	-3.10	0.13
459.30	459.5	-0.20	0.13
537.00	539.2	-2.20	0.13
638.00	641.1	-3.10	0.13
585.56	589.5	-3.94	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5890	0.590	-0.0010	0.0045
	0.7604	0.761	-0.0006	0.0045
	1.0241	1.032	-0.0079	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5782	0.574	0.0042	0.0045
	0.7430	0.738	0.0050	0.0045
	1.0016	1.000	0.0016	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5283	0.529	-0.0007	0.0045
	0.6854	0.686	-0.0006	0.0045
	0.9509	0.951	-0.0001	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5457	0.544	0.0017	0.0045
	0.6944	0.693	0.0014	0.0045
	0.9965	0.996	0.0005	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5837	0.578	0.0057	0.0045
	0.7223	0.715	0.0073	0.0045
	1.0935	1.084	0.0095	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5675	0.564	0.0035	0.0045
	0.6900	0.685	0.0050	0.0045
	1.0862	1.080	0.0062	0.0045

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

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01241067
Model:	LA130S-F	Issued Date:	22 March 2024
Serial No. (or ID.):	16908811 (EP-AB-01/47)	Job No.:	WO-00021722
Manufacturer:	Sartorius	Page:	1 of 2
Condition:	In condition		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature	26 °C	±	0.5 °C
Humidity	47 %RH	±	4.2 %RH

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Air (TSP/PM10) Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Polawad Ruamlrup

Calibration Date: 22 March 2024

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02240400

[redacted]
Person in charge

[redacted]
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).

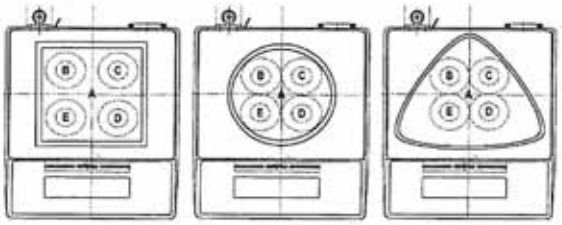
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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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

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 5 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0000	0.0001	0.0000	-0.0001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
1	0.00005
10	0.00009

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00014	2.11
2	2.00002	2.0000	0.0000	0.00014	2.11
3	3.00003	2.9999	-0.0001	0.00015	2.11
4	4.00003	4.0000	0.0000	0.00015	2.10
5	5.00002	5.0001	0.0001	0.00014	2.11
6	6.00003	6.0000	0.0000	0.00015	2.10
7	7.00004	6.9999	-0.0001	0.00015	2.10
8	8.00005	8.0000	0.0000	0.00015	2.08
9	9.00005	9.0000	0.0000	0.00015	2.08
10	10.00001	10.0001	0.0001	0.00015	2.11

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
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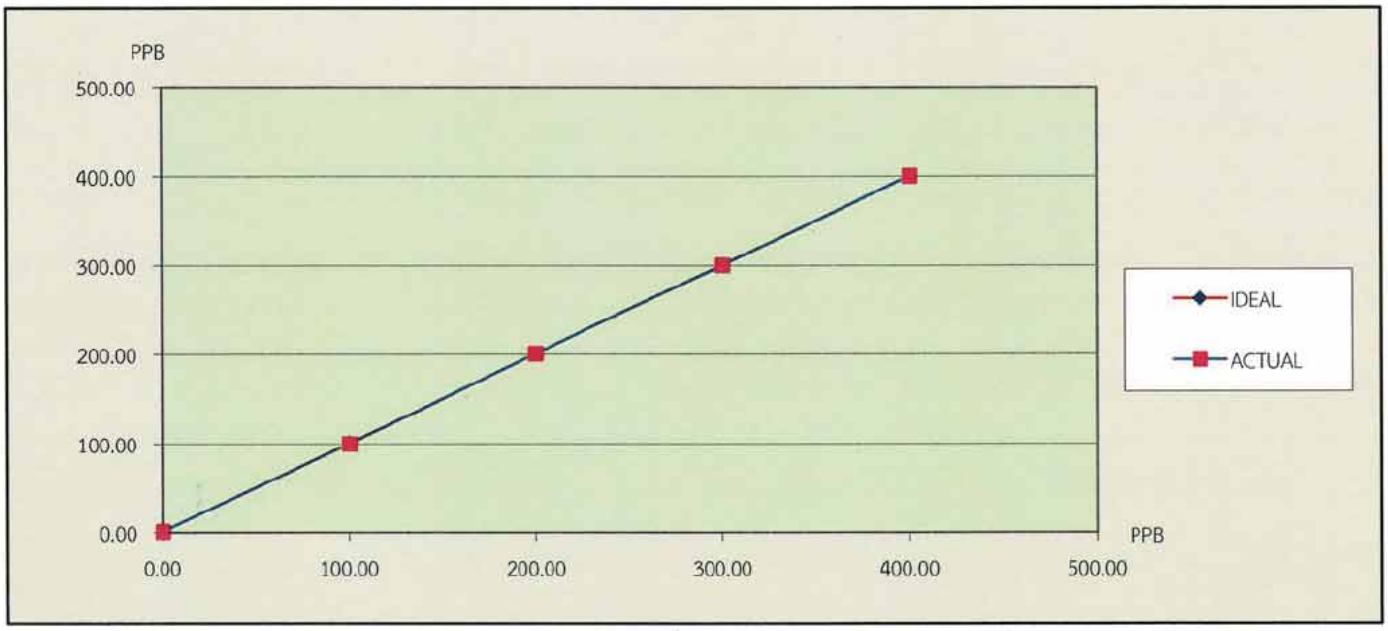
JIRANATEE ASSOCIATES CO.,LTD.

TEST REPORT

CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]				
EQRIPMENT NAME	: SO_2 Analyzer				
MANUFACTURER	: HORIBA	MODEL :	APSA-370	SERIAL NO	: 4AXYPEYX
STANDARD GAS CONCENTRATION (PPM)	: 53.29 PPM			CYLINDER NO	: CC734373
CYLINDER PRESSURE (PSI)	: 1,400 PSI			CERTIFIED DATE	: 12/05/2020
CERTIFIED BY	: AIRGAS			EXPIRED DATE	: 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS			
	IDEAL	ACTUAL	ERROR	%ERROR
ZERO	0.00	0.10	0.10	-
1	100.00	99.40	-0.6	-0.60
2	200.00	200.00	0.0	0.00
3	300.00	299.50	-0.5	-0.17
4	400.00	399.70	-0.3	-0.08
AVERAGE (%)				0.21



CALIBRATED BY :..... [redacted] ..... DATE : 15/2/24

CHECKED BY :..... [redacted] ..... DATE : 15/2/24

JIRANATEE ASSOCIATES CO.,LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ถนน ซอยเพชรเกษม 7,7/1 เพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

CHECK LIST

CUSTOMER NAME : All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQUIPMENT NAME : SO_2 Analyzer		
MANUFACTURER : HORIBA	MODEL : APSA-370	SERIAL NO. : 4AXYPEYX

TEST VALUES				
NO.	Ambient SO_2 Monitor	UNIT	BEFORE	AFTER
1	SIGNAL	mV (Voltage of the measured SO_2 Value)	19.10	4.20
2	LAMP	mV (200mV to 1200 mV)	297.30	297.30
3	CELL	°C (Ambient tembient temperature +(5°C to 15°C))	34.00	34.00
4	PUMP	kPa (65 kPa or less)	43.60	43.60
5	AMBIENT	kPa	101.40	101.40
6	SAMPLE	L/min (0.6 L/min to 1.0 L/min)	-	-
7	DC 24 V	V (24 V ± 0.5 V)	23.90	23.90
8	DC 5 V	V (5 V ± 0.5 V)	4.90	4.90
9	SAMPLE SO2 Reading	PPB	3.80	0.80
10	Zero	PPB	3.10	0.10
11	Span	PPB	258.70	399.70

Remark : Reference EX-EN-019-56 , Ambient SO2 Monitor APSA-370 Operetion Manual Page #78
(Ambeint temperature = 5°C to 40°C)

อาการที่ตรวจพบ

-

รายละเอียดการดำเนินการ

- ทำ Calibration Zero/Span , Multipoint , เช็ค Dianostics

ผลการดำเนินการ

- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : [redacted] DATE : 15/2/24

CHECKED BY : [redacted] DATE : 15/2/24

JNAC JIRANATEE ASSOCIATES CO.,LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15 , 67/35-36 ซอยเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร : 02-868-0812-13 โทรสาร : 02-868-1889

SITHIPORN associates

Test Report Calibration

Ecotech EC9850 Sulphur Dioxide Analyzer

Issued By	Sithiporn Associates Company Limited	Calibration Date	22-Jan-2024
Owner Name	Life & Environment Co.,Ltd.	Product Brand	Ecotech
Certificate Number	34303	Type Systematic	Analyzer Ambient Monitoring

Model :	EC9850	Serial Number :	02-0314

Calibration Standard equipment : Std. Gas Mixture Cylinder Number EB0140749 Expired Date 10-Mar-2024

Brand : Airgas

Components	Concentration
Carbon Monoxide (CO)	4498 PPM
Nitric Oxide (NO)	45.69 PPM
Sulfur Dioxide (SO_2)	45.54 PPM
Nitrogen (N_2)	Balance

Calibration Setting

Span Instrument Gain 25.833 Start Time 11:00

Reading (Before Adj.)			
Span Set Point	Expected Concentration (PPB)	Analyzer Response (PPB)	Error %
Zero	0	0	-
Span	400	400	0.00

Span Instrument Gain 26.634 Finish Time 11:35

Signature [redacted] Approved [redacted]

บริษัท สิทธิพรแอสโซซิเอส จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

451-451/1 ถนนสิรินธร แขวงบางบำหรุ เขตบางพลัด กรุงเทพฯ 10700
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok 10700, Thailand
Email : center@sithiphorn.com
Tel. +66 2433 8331 www.sithiphorn.com

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A00V3	Reference Number:	160-402036564-1
Cylinder Number:	EB0140749	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Mar 10, 2021

Expiration Date: Mar 10, 2024

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
NOX	45.00 PPM	45.70 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
NITRIC OXIDE	45.00 PPM	45.69 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
SULFUR DIOXIDE	45.00 PPM	45.54 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
CARBON MONOXIDE	4500 PPM	4498 PPM	G1	+/- 0.6% NIST Traceable	03/04/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200611-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

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
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Feb 26, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Feb 22, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Feb 18, 2021

Triad Data Available Upon Request

NOTES:
Gross Weight: 28.4 Kg
Net Weight: 4.6 Kg
PO# 5221000722

[redacted]
Approved for Release

ACCREDITED
CERT 3082.05

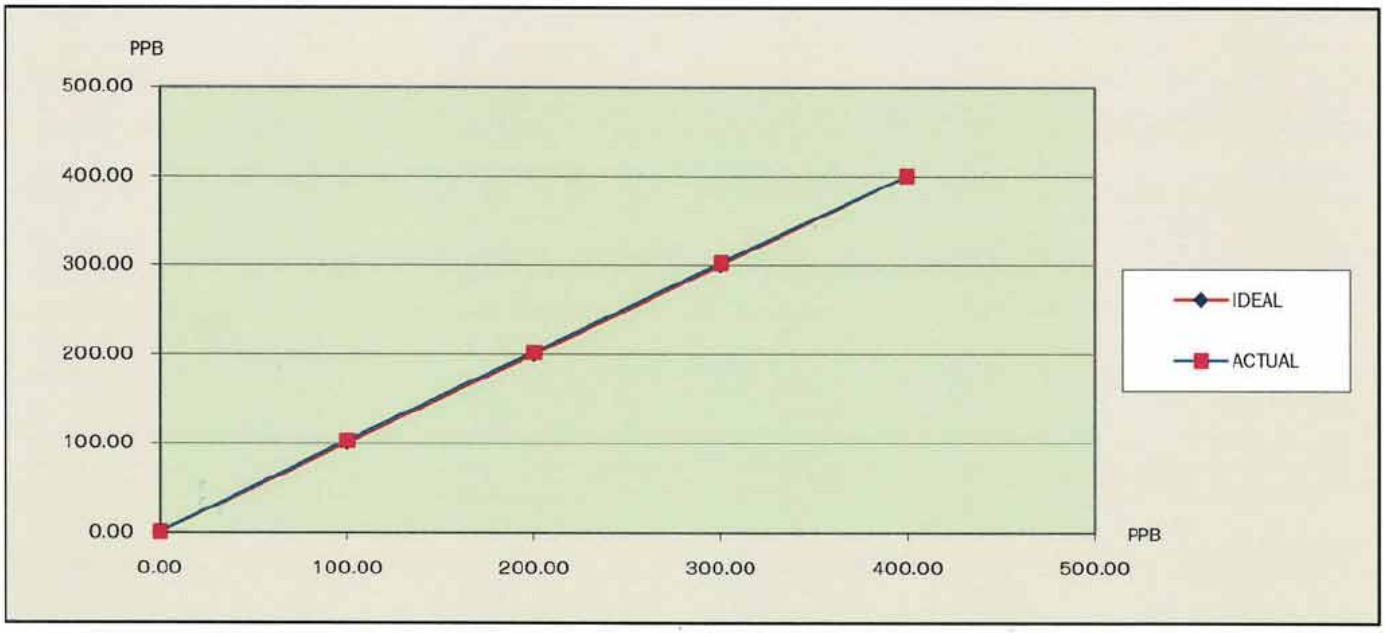
JNAC
JIRANATEE ASSOCIATES CO.,LTD

TEST REPORT

CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQRIPMENT NAME	: SO_2 Analyzer		
MANUFACTURER : HORIBA	MODEL : APSA-370	SERIAL NO	: YAW9F92K
STANDARD GAS CONCENTRATION (PPM) : 53.29 PPM		CYLINDER NO	: CC734373
CYLINDER PRESSURE (PSI) : 1,400 PSI		CERTIFIED DATE	: 12/05/2020
CERTIFIED BY : AIRGAS		EXPIRED DATE	: 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS			
	IDEAL	ACTUAL	ERROR	%ERROR
ZERO	0.00	0.10	0.10	-
1	100.00	102.00	2.0	2.00
2	200.00	201.90	1.9	0.95
3	300.00	301.70	1.7	0.57
4	400.00	399.90	-0.1	-0.03
AVERAGE (%)				0.87



CALIBRATED BY :..... DATE : 15/2/24

CHECKED BY :..... DATE : 15/2/24

JNAC JIRANATEE ASSOCIATES CO.,LTD

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ถนน ซอยเพชรเกษม 7,7/1 เพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

CHECK LIST

CUSTOMER NAME : All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQUIPMENT NAME : SO_2 Analyzer		
MANUFACTURER : HORIBA	MODEL : APSA-370	SERIAL NO. : YAW9F92K

TEST VALUES

NO.	Ambient SO_2 Monitor	UNIT	BEFORE	AFTER
1	SIGNAL	mV (Voltage of the measured SO_2 Value)	7.20	2.10
2	LAMP	mV (200mV to 1200 mV)	294.70	294.70
3	CELL	°C (Ambient tembient temperature +(5°C to 15°C))	35.80	35.80
4	PUMP	kPa (65 kPa or less)	41.80	41.80
5	AMBIENT	kPa	101.20	101.20
6	SAMPLE	L/min (0.6 L/min to 1.0 L/min)	-	-
7	DC 24 V	V (24 V ± 0.5 V)	23.90	23.90
8	DC 5 V	V (5 V ± 0.5 V)	5.00	5.00
9	SAMPLE SO2 Reading	PPB	1.90	0.50
10	Zero	PPB	1.90	0.10
11	Span	PPB	432.60	399.90

Remark : Reference EX-EN-019-56 , Ambient SO2 Monitor APSA-370 Operetion Manual Page #78
(Ambeint temperature = 5°C to 40°C)

อาการที่ตรวจพบ

-

รายละเอียดการดำเนินการ

- ทำ Calibration Zero/Span , Multipoint , เช็ค Dianostics

ผลการดำเนินการ

- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : [redacted] *DATE :* 15/2/24

CHECKED BY : [redacted] *DATE :* 15/2/24

JNAC JIRANATEE ASSOCIATES CO.,LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

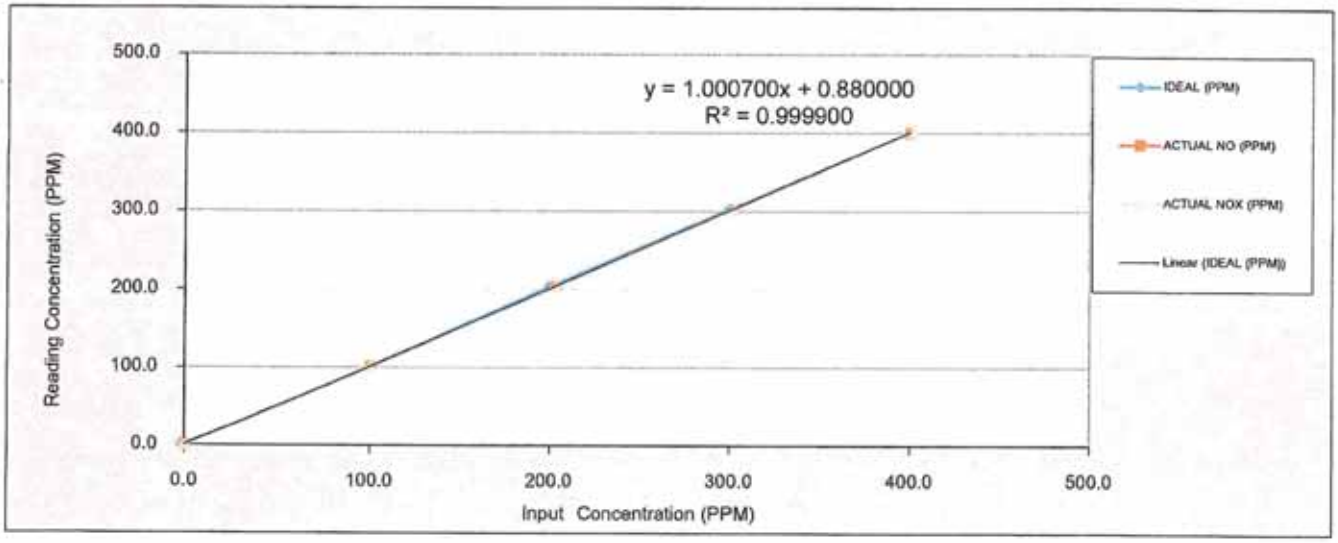
เลขที่ 63/14-15 , 67/35-36 ซอยเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร : 02-868-0812-13 โทรสาร : 02-868-1889

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : บริษัท ชีวิตและสิ่งแวดล้อม จำกัด		
EQUIPMENT NAME : NO_x Analyzer		
MANUFACTURER : Teledyne API	MODEL : 200EH	SERIAL NUMBER : 2288
STANDARD GAS CONCENTRATION (PPM) : 53.40		CYLINDER NO : CC745169
CYLINDER PRESSURE (PSIG) : 2015		CERTIFIED DATE : Mar 10, 2021
CERTIFIED BY : AIRGAS SPECIALTY GASES		EXPIRED DATE : Mar 10, 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS						
	IDEAL (PPM)	ACTUAL NO (PPM)	ERROR NO (PPM)	% ERROR NO	ACTUAL NO_x (PPM	ERROR NO_x (PPM)	% ERROR NO_x
ZERO	0.00	0.00	0.00	-	0.00	0.00	-
1	100.00	100.30	0.30	0.30	100.30	0.30	0.30
2	200.00	203.30	3.30	1.65	203.30	3.30	1.65
3	300.00	302.00	2.00	0.67	302.00	2.00	0.67
4	400.00	399.50	-0.50	-0.13	401.50	1.50	0.38
AVERAGE (%)				0.68			0.75



CALIBRATED BY : คุณธนาคม มหาอาจ	DATE : 22 กุมภาพันธ์ 2567

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

KINETICS

บริษัท ไคเนติคส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : บริษัท ชีวิตและสิ่งแวดล้อม จำกัด

วันที่ : 22 กุมภาพันธ์ 2567

รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : 200E

หมายเลขอุปกรณ์ / เครื่องมือ : 2288

TEST VALUES				
	API MODEL 200E		BEFORE	AFTER
1	RANGE	50 - 20,000 PPM	500.0	500
2	STABILITY	≤ 1 PPM	0.4	0.1
3	SAMPLE FLOW	500 ± 10% cc/min	489	488
4	OZONE FLOW	80 ± 10% cc/min	80	80
5	PMT	mV	53.2	62
6	NORM PMT	mV	3.9	23.3
7	A ZERO	-20 To 150 mV	58	49.2
8	HPVS	400 - 900 V	762	750
9	RX CELL TEMP	50 ± 1 °C	49.9	50.0
10	BOX TEMP	AMBIENT ± 5 °C	29.3	32.4
11	PMT TEMP	7 ± 2 °C	6.9	6.9
12	MOLY TEMP	315 ± 5 °C	314	314
13	RX CELL PRESSURE	< 10 in - Hg-A	5.1	5.0
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	29.6	29.5
15	NOX SLOPE	1.0 ± 0.3	1.245	1.131
16	NOX OFFSET	-50 To 150	24.2	14.2
17	NO SLOPE	1.0 ± 0.3	1.117	1.024
18	NO OFFSET	-50 To 150	1.3	1.1
19	NO SAMPLE READING	PPM	1.6	0.6
20	NO2 SAMPLE READING	PPM	7.0	6.5
21	NOX SAMPLE READING	PPM	8.6	7.1
22	OPTIC TEST	2000 ± 1000 mV	1972	1980
23	ELECTRICAL TEST	2000 ± 1000 mV	2153	2150
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.21 / 12.23 / 15.69 / -15.14	5.21 / 12.17 / 15.99 / -15.11
25	ZERO GAS NO / NOx	0.00 / 0.00 PPM	0.1 / -5.2	0.0 / 0.0
26	SPAN GAS NO / NOx	400.00 / 400.00 PPM	418 / 430	399.5 / 401.5

หมายเหตุ

- ทำการเปลี่ยน OZONE GENERATOR นำเอาของเครื่อง Nox Sn.2287 มาใส่แทน เนื่องจากตัวเก่าของเครื่องใช้งานไม่ได้
- Calibrate Multi-point

[redacted]

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณธนาคม มหาอาจ โทรศัพท์ : 0-2515-8937

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทรเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

SITHIPORN associates

Test Report Calibration

Ecotech EC9841 Nitrogen Oxides Analyzer

Issued By	Sithiporn Associates Company Limited	Calibration Date	22-Jan-2024
Owner Name	Life & Environment Co.,Ltd.	Product Brand	Ecotech
Certificate Number	34303	Type Systematic	Analyzer Ambient Monitoring

Model :	EC9841	Serial Number :	02-0409

Calibration Standard equipment : Std. Gas Mixture Cylinder Number EB0140749 Expired Date 10-Mar-2024

Brand : Airgas

Components	Concentration
Carbon Monoxide (CO)	4498 PPM
Nitric Oxide (NO)	45.69 PPM
Sulfur Dioxide (SO_2)	45.54 PPM
Nitrogen (N_2)	Balance

Calibration Setting

Span Instrument Gain 13.546 Start Time 11:00

Reading (After Adj.)			
Span Set Point	Expected Concentration (PPB)	Analyzer Response (PPB)	Error %
Zero NO	0	0	-
Zero NO_x	0	1	-
Span NO	400	399	-0.25
Span NO_x	400	400	0.00

Span Instrument Gain 10.764 Finish Time 11:35

Signature [redacted] Approved [redacted]

บริษัท สิทธิพรแอสโซซิเอส จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

451-451/1 ถนนสิรินธร แขวงบางบำหรุ เขตบางพลัด กรุงเทพฯ 10700
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok 10700, Thailand
Email : center@sithiphorn.com
Tel. +66 2433 8331 www.sithiphorn.com

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A00V3	Reference Number:	160-402036564-1
Cylinder Number:	EB0140749	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Mar 10, 2021

Expiration Date: Mar 10, 2024

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
NOX	45.00 PPM	45.70 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
NITRIC OXIDE	45.00 PPM	45.69 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
SULFUR DIOXIDE	45.00 PPM	45.54 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
CARBON MONOXIDE	4500 PPM	4498 PPM	G1	+/- 0.6% NIST Traceable	03/04/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200611-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

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
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Feb 26, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Feb 22, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Feb 18, 2021

Triad Data Available Upon Request

NOTES:
Gross Weight: 28.4 Kg
Net Weight: 4.6 Kg
PO# 5221000722

[redacted]
Approved for Release

ACCREDITED
CERT 3082.05

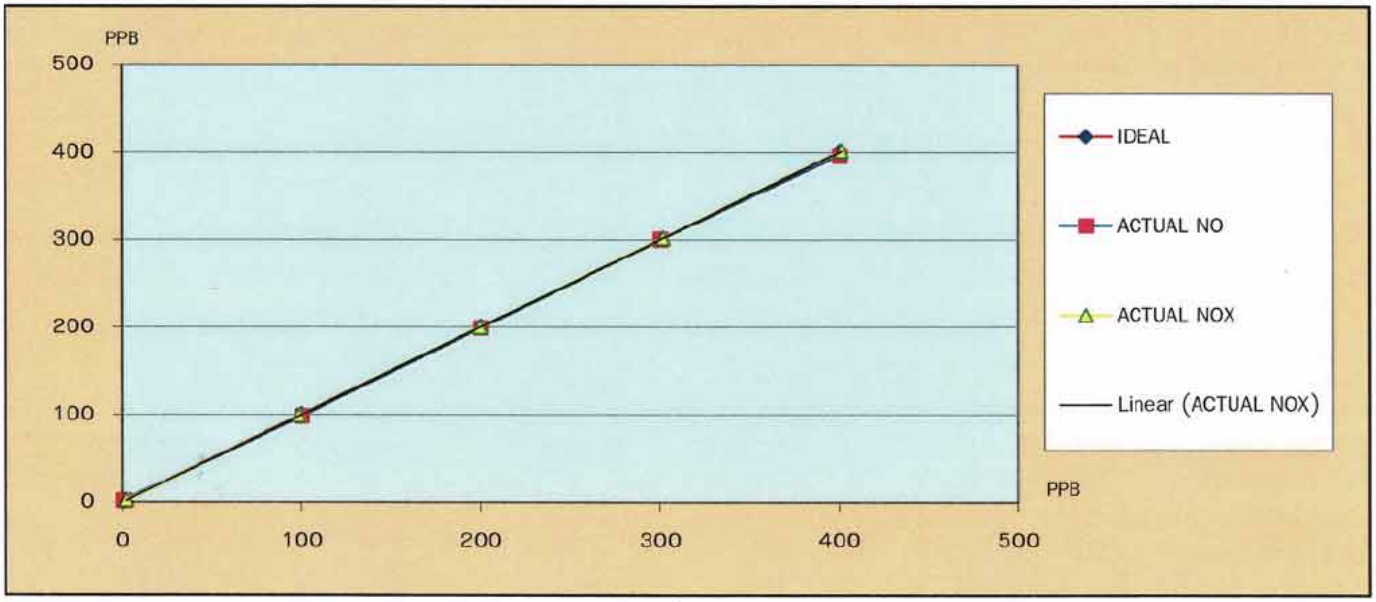
JNAC
JIRANATEE ASSOCIATES CO.,LTD.

TEST REPORT

CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]				
EQRIPMENT NAME	: NO_x Analyzer				
MANUFACTURER	: HORIBA	MODEL :	APNA-370	SERIAL NO	: J0V032W3
STANDARD GAS CONCENTRATION (PPM)	: 53.15 PPM			CYLINDER NO	: CC734373
CYLINDER PRESSURE (PSI)	: 1,400 PSI			CERTIFIED DATE	: 12/05/2020
CERTIFIED BY	: AIRGAS			EXPIRED DATE	: 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS						
	IDEAL	ACTUAL NO	ERROR NO	%ERROR NO	ACTUAL NO_x	ERROR NO_x	%ERROR NO_x
ZERO	0.00	0.40	0.40	-	0.00	0.00	-
1	100.00	101.00	1.00	1.00	100.30	0.30	0.30
2	200.00	200.80	0.80	0.40	200.50	0.50	0.25
3	300.00	301.40	1.40	0.47	300.20	0.20	0.07
4	400.00	399.60	-0.40	-0.10	399.70	-0.30	-0.08
AVERAGE (%)				0.44			0.14



CALIBRATED BY : [redacted] DATE : 16/2/24

CHECKED BY : ..... DATE : 16/2/24

JNAC JIRANATEE ASSOCIATES CO.,LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15,16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ซอยนเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

CHECK LIST

CUSTOMER NAME : All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQUIPMENT NAME : NO_X Analyzer		
MANUFACTURER : HORIBA	MODEL : APNA-370	SERIAL NO. : J0V032W3

TEST VALUES

NO.	NO_X Analyzer (APNA-370)	UNIT	BEFORE	AFTER
1	Signal (NO)	mV	1.60	1.30
2	Signal (NO_X)	mV	6.00	12.60
3	Detector	Temp °C , Standard Value : Ambient temp+(5°Cto15°C)	42.10	40.10
		Pressure kPa , Standard Value : (Ambient/1013x100-20)±4kPa	75.80	77.90
4	AMBIENT	kPa	101.60	101.70
5	SAMPLE	L/min (1.1 L/min ± 0.3 L/min)	-	-
6	DC 24 V	V (24 V ± 0.5 V)	23.60	23.60
7	DC 5 V	V (5 V ± 0.5 V)	5.00	5.00
8	Samping NO Reading	PPB	1.40	2.20
9	Samping NO_2 Reading	PPB	5.20	19.40
10	Samping NO_X Reading	PPB	6.70	21.80
11	Zero (NO)	PPB	1.40	0.40
12	Span(NO)	PPB	389.00	399.60
13	Zero (NO_X)	PPB	1.40	0.00
14	Span (NO_X)	PPB	390.10	399.70

Remark : Reference EX-EN-022-56 , "Ambient NO_X Monitor APNA-370 Operetion Manual " Page #48

(Ambient temperature = 5°C to 40°C)

อาการที่ตรวจพบ

- Touch Screen ไม่ได้

รายละเอียดการดำเนินการ

- เปลี่ยน Touch Screen ทำ Calibration Zero/Span , Multipoint , เช็ค Dianostics

ผลการดำเนินการ

- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY :..... [redacted] ..... *DATE :* 16/2/24

CHECKED BY :..... ..... *DATE :* 16/2/24

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ซอยเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

SITHIPORN associates

Maintenance and Calibration Report

Wind Speed Sensor

Met One Instrument	Model: 034B	S/N. : Y1846
Date 7 February 2024		Start Time 13:30
Calibrator : Metone	Model: 053-220	S/N.: W15225
Data Logger : Metone	Model: 466A	S/N.: Y1191

Customer : Life & Environment Co.,Ltd.

Maintenance

Replace Front Bearing	☐ Yes	☑ No
Replace Back Bearing	☐ Yes	☑ No
Replace Shaft Coupler	☐ Yes	☑ No
Replace Hub	☐ Yes	☑ No

Testing Result

Generate Speed	Reading		% Error
RPM	Expect (MPS)	Logger	
0	0.30	0.30	0.0
100	2.94	3.10	-5.4
200	5.61	5.50	2.0
300	8.27	8.30	-0.4
400	10.93	11.10	-1.6
500	13.60	13.50	0.7

Comment : Set the offset of WS is 0.3 m/s.

Test by force to rotate the WS sensor from 0 - 500 round per second.

Data Logger Metone Model 466A, S/N. Y1191

Engineer Name : [redacted]

SITHIPORN associates

Maintenance and Calibration Report

Wind Direction Sensor

Met One Instrument	Model: 034B	S/N. : Y1846
Date 7 February 2024		Start Time 13:30
Data Logger : Metone	Model: 466A	S/N.: Y1191

Customer : Life & Environment Co.,Ltd.

Maintenance

Replace Front Bearing	☐ Yes	☑ No
Replace Back Bearing	☐ Yes	☑ No
Replace Potentiometer	☐ Yes	☑ No

Calibration Result

Reading			Analog Output (Volt)	
Expected	Logger	% Error	Expected	Measured
360,0	0.1	0.1	2.500	2.499
90	90.1	0.1	0.625	0.625
180	180.0	0.0	1.250	1.249
270	270.0	0.0	1.875	1.874

Comment : Check the rotation of WD (potentiometer) is change as characteristic.

Performed rotate the WD increase 90 degee per 1 step from 0,360 , 90, 180 and 270 degree.

Data Logger Metone Model 466A, S/N. Y1191

Engineer Name : ... [redacted] .....

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Certificate of Calibration

Certificate Number : SPR24020474-8 Page : 1 of 3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	:	Sound Level Meter			
Manufacturer	:	Pulsar			
Model	:	45			
Serial Number	:	PN2449			
ID. Number	:	N/A			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 3 °C	Received Date	:	29 Feb 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	01 Mar 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	01 Mar 2025
Calibration Procedure	:	SP-CPE-04-01	Date of Issue	:	02 Mar 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul
Calibration Officer

Approved by : [redacted]
Authorized Signatory

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24020474-8

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24020474-8

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24020474-9

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	:	Sound Level Meter			
Manufacturer	:	Pulsar			
Model	:	45			
Serial Number	:	PN2450			
ID. Number	:	N/A			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 3 °C	Received Date	:	29 Feb 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	01 Mar 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	01 Mar 2025
Calibration Procedure	:	SP-CPE-04-01	Date of Issue	:	02 Mar 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24020474-9

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Result of Calibration

Certificate No. : SPR24020474-9

Range : 94 to 114 dB Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Select Z Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Certificate of Calibration

Certificate Number : SPR24020474-10 Page : 1 of 3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang,
Bangkok 10250

Equipment Name	:	Sound Level Meter			
Manufacturer	:	Pulsar			
Model	:	45			
Serial Number	:	PN2451			
ID. Number	:	N/A			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 3 °C	Received Date	:	29 Feb 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	01 Mar 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	01 Mar 2025
Calibration Procedure	:	SP-CPE-04-01	Date of Issue	:	02 Mar 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul
Calibration Officer

Approved by : [redacted]
Authorized Signatory

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24020474-10

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24020474-10

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.7	93.7	-0.3	-0.3	0.15
114	113.6	113.6	-0.4	-0.4	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24050563-1

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	:	Sound Level Meter			
Manufacturer	:	ACO			
Model	:	6236			
Serial Number	:	222219			
ID. Number	:	SLM-NO.8			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 3 °C	Received Date	:	31 May 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	05 Jun 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	05 Jun 2025
Calibration Procedure	:	SP-CPE-04-01	Date of Issue	:	06 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
( )
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24050563-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Result of Calibration

Certificate No. : SPR24050563-1 Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	93.9	0.0	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Certificate of Calibration

Certificate Number : SPR24050563-2 Page : 1 of 3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222220

ID. Number : SLM-NO.9

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 31 May 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 05 Jun 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 05 Jun 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 06 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

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Calibration Report

Certificate Number : SPR24050563-2

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24050563-2

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	93.9	0.0	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

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Certificate of Calibration

Certificate Number : SPR24050563-3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222222

ID. Number : SLM-NO.11

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 31 May 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 05 Jun 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 05 Jun 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 06 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24050563-3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

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METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Result of Calibration

Certificate No. : SPR24050563-3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

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Certificate of Calibration

Certificate Number : SPR24090384-1

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222241

ID. Number : SLM-NO.12

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 20 Sep 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 20 Sep 2024
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 21 Sep 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24090384-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

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Result of Calibration

Certificate Number : SPR24090384-1

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24090384-2

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222242

ID. Number : SLM-NO.13

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 20 Sep 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 20 Sep 2024
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 21 Sep 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference prccedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24090384-2

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

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METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

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Result of Calibration

Certificate Number : SPR24090384-2

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24040397-1

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	:	Sound Level Meter			
Manufacturer	:	Quest Technologies			
Model	:	1900			
Serial Number	:	CC5020002			
ID. Number	:	SLM-NO.1			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 3 °C	Received Date	:	30 Apr 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	04 May 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	04 May 2025
Calibration Procedure	:	SP-CPE-04-01	Date of Issue	:	05 May 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24040397-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24040397-1

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24060488-15

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	: Noise Dose Meter		
Manufacturer	: SOUNDTEK		
Model	: ST-130		
Serial Number	: 220100105		
ID. Number	: NT-07		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 28 Jun 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 28 Jun 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 28 Jun 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 29 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24060488-15

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate Number : SPR24060488-15

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24060488-14

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	: Noise Dose Meter		
Manufacturer	: SOUNDTEK		
Model	: ST-130		
Serial Number	: 220100103		
ID. Number	: NT-06		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 28 Jun 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 28 Jun 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 28 Jun 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 29 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24060488-14

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Result of Calibration

Certificate Number : SPR24060488-14

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.4	93.4	-0.6	-0.6	0.15
114	113.3	113.3	-0.7	-0.7	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.3	93.3	-0.7	-0.7	0.15
114	113.2	113.2	-0.8	-0.8	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24060488-16

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	: Noise Dose Meter		
Manufacturer	: SOUNDTEK		
Model	: ST-130		
Serial Number	: 220300020		
ID. Number	: NT-09		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 28 Jun 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 28 Jun 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 28 Jun 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 29 Jun 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24060488-16

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Result of Calibration

Certificate Number : SPR24060488-16

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24040397-3

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	: Noise Dose Meter		
Manufacturer	: SOUNDTEK		
Model	: ST-130		
Serial Number	: 170800296		
ID. Number	: NT-02		

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 30 Apr 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 04 May 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 04 May 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 05 May 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

Calibration Report

Certificate Number : SPR24040397-3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24040397-3

Range : 94 to 114 dB Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

SP METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24040397-5

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name	: Noise Dose Meter		
Manufacturer	: SOUNDTEK		
Model	: ST-130		
Serial Number	: 190500072		
ID. Number	: NT-05		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 30 Apr 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 04 May 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 04 May 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 05 May 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Calibration Officer

Approved by : [redacted]

Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24040397-5

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24040397-5

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24040397-4

Customer : Life and Environment Co., Ltd.
90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., On-Nuch, Suanluang, Bangkok 10250

Equipment Name : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 190500065

ID. Number : NT-03

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 30 Apr 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 04 May 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 04 May 2025
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 05 May 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit
Calibration Officer

Approved by : [redacted]
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

Calibration Report

Certificate Number : SPR24040397-4

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

ID LINE : IEC17025

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate No. : SPR24040397-4

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204 **MTC No.** EEL. BP. 117/0167

CALIBRATION CERTIFICATE

Submitted by : Life and Environment Co.,Ltd.

Address : 90, 92, 94 Soi On-Nuch 64, Srinakarin Rd., Suanluang, Bangkok, 10250.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre. Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Quest Technologies

Model : QC-20

Serial No. : QOF110014

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 12 Jan. 2024

Date of Calibration : 23 Jan. 2024

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204 **MTC No.** EEL. BP. 117/0167

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa , Corrected to Reference Conditions : 101.325 kPa , 23.0°C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.96	-0.04	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.3	-0.7	± 1.5	±1.0%

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.65	± 0.60	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 23 Jan. 2024

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204 **MTC No.** EEL. BP. 117/0167

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa , Corrected to Reference Conditions : 101.325 kPa , 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	113.95	-0.05	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.3	-0.7	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.35	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by : [redacted]

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Jan. 2024

Date of Issue : 24 Jan. 2024

Ref : 20112670112001680O1

End of Certificate

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha. Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

NSC-TISI-TIS 17025
CALIBRATION 0426

Calibration certificate

Calibration Certificate No. 23BCI0349

Object	Electronic non-automatic weighing instrument
Manufacturer	Sartorius
Type	MSE125P-100-DU
Serial | QM Ident. no.	0028606077 | N/A
Customer	Life and Environment Co., Ltd. 90, 92, 94 Soi On-Nuch 64,Srinakarin Road, On-Nuch, Suanluang, Bangkok 10250. Thailand.
Order no.	218684
Number of pages	4
Date of calibration	15 Sep 2023

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.

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
15 Sep 2023	[redacted]	[redacted]

Calibration object

Multi interval instrument

Model	MSE125P-100-DU	
Serial Number	0028606077	
QM Ident. no | Inventory no.	N/A | ---	
Range	1	2
Maximum capacity (Max. load)	60.00000 g	120.0000 g
Measured range	60.00000 g	120.0000 g
Scale interval	0.00001 g	0.0001 g

Place of calibration

Address	According to page 1
Department | Cost center	Laboratory Testing. | ---
Building | Floor	--- | 1st Floor.
Room	Air(TSP/PM10) Testing Laboratory.
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	MHB382-SD Cer No.C19231845,(Traceable to SI unit through DKSH)	23 Aug 2024
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2026

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	15 Sep 2023
Temperature at place of calibration | Temp. diff. $T_{weights}$ - T_{place}	25.8 °C | 0.2 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 40.0 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 50 g | 100 g

	50 g	100 g
1	50.00002 g	100.0000 g
2	50.00001 g	100.0000 g
3	50.00001 g	100.0000 g
4	50.00001 g	100.0000 g
5	50.00001 g	100.0000 g
6	50.00002 g	100.0000 g
7	50.00002 g	99.9999 g
8	50.00002 g	100.0000 g
9	50.00001 g	100.0000 g
10	50.00002 g	100.0000 g
	s = 0.000005 g	s = 0.00003 g

Eccentricity

Test load (nominal):	**50 g**
Center	50.00002 g
Front left	50.00001 g
Back left	50.00004 g
Back right	50.00004 g
Front right	50.00001 g

Maximum deviation from centric loading indication

$|\Delta I_{ecc}|_{max}$ = 0.00002 g

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty $U(E)$	Uncertainty relative $U_{rel}(E)$
0.01000 g	0.01000 g	0.00000 g	2.00	0.000024 g	0.24 %
0.10000 g	0.10000 g	0.00000 g	2.00	0.000037 g	0.037 %
1.00000 g	1.00000 g	0.00000 g	2.00	0.000037 g	0.0037 %
10.00002 g	10.00002 g	0.00000 g	2.00	0.000069 g	0.00069 %
20.00002 g	20.00002 g	0.00000 g	2.00	0.000069 g	0.00034 %
55.00004 g	55.00003 g	-0.00001 g	2.00	0.00017 g	0.00031 %
70.0000 g	70.0000 g	0.0000 g	2.00	0.00017 g	0.00024 %
80.0001 g	80.0001 g	0.0000 g	2.00	0.00018 g	0.00023 %
100.0000 g	100.0000 g	0.0000 g	2.00	0.00017 g	0.00017 %
110.0000 g	110.0000 g	0.0000 g	2.00	0.00028 g	0.00025 %
120.0000 g	120.0000 g	0.0000 g	2.00	0.00028 g	0.00023 %
Maximum error of indication		$\|E\|_{max}$ = 0.00001 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	$1 \cdot 10^{-6}$/K

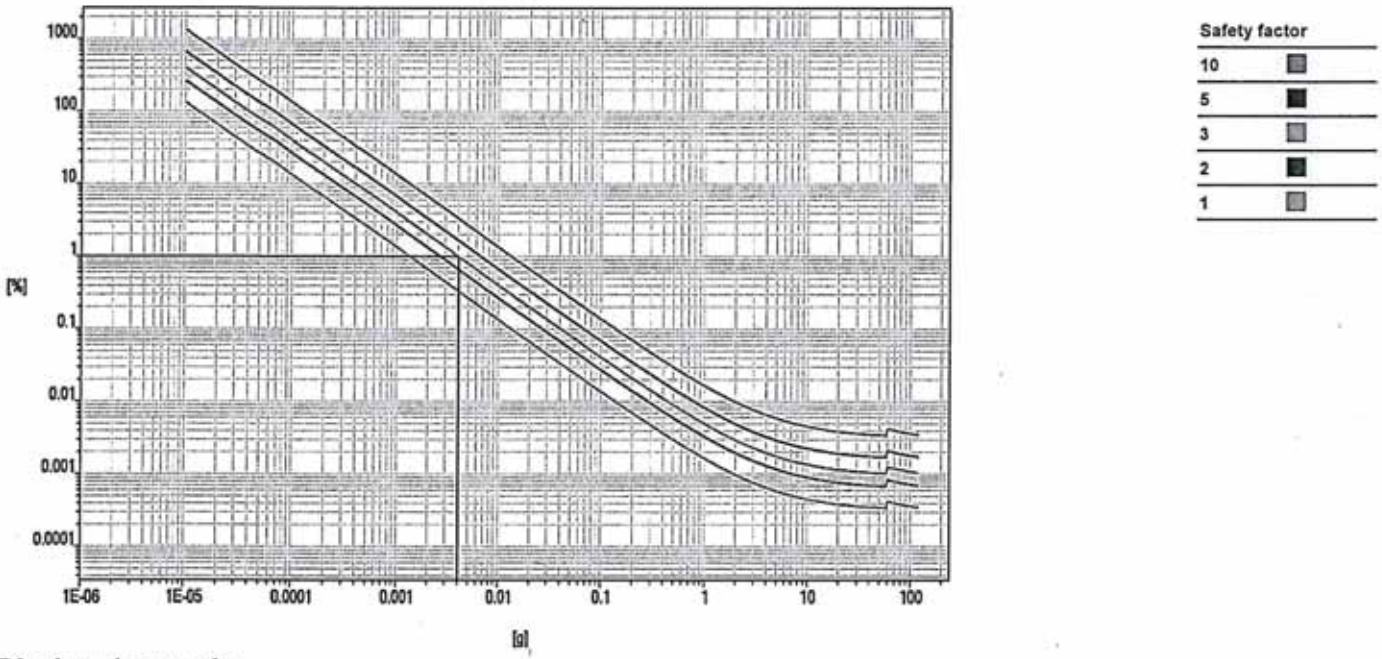
Uncertainty of the weighing result $U_{gl}(W)$

Partial weighing range 1 | 0.00000 g...60.00000 g	$U_{gl}(W) = 0.000013\ g + 3.20 \cdot 10^{-6} \cdot R$
Partial weighing range 2 | 60.00000 g...120.0000 g	$U_{gl}(W) = 0.000086\ g + 2.77 \cdot 10^{-6} \cdot R$

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 Max1	Net indication *R*	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	0.60000 g	0.000015 g	0.0025 %
25 %	15.00000 g	0.000061 g	0.00041 %
50 %	30.00000 g	0.00011 g	0.00036 %
75 %	45.00000 g	0.00016 g	0.00035 %
100 %	60.00000 g	0.00021 g	0.00034 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.00400 g

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Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #:	XC-572
Serial #:	605186
DGM Model #:	SK25EX
DGM Serial #:	0005288

Calibration Conditions

Bar. Pressure (mm Hg):	756.0
Ambient Temperature (°C):	25.7
Relative Humidity (%):	65
Altitude (m):	1.50
Bar. Pressure Corr. (mm Hg):	755.9

Calibration Reference

Work No. : SVO26796 Calibration No.: SA2023001 Judgment : Pass According to note :

Reference Equipment

WTM Model:	W-NK-5B	Serial No.:	546321
Gamma:	0.9976	Cal.Due	24-Mar-24
Thermometer:	FLUKE714	Serial No.:	9038005

Factors/Conversions

Std. Temp. (K):	298.15
Std. Press. (mm Hg):	760
K_1 (K/mm Hg):	0.3923

UUT Meter (DGM) / **Reference Meter (WTM)**

Run Time (seconds)	Orifice, ΔH (mm H2O)	UUT Meter (DGM) Volume (L)			UUT Meter (DGM) Meter Temperature (°C)		Meter Pressure (mm H2O)	Reference Meter (WTM) Volume (L)			Reference Meter (WTM) Outlet Temperature (°C)	
		Initial	Final	Total	Initial	Final		Initial	Final	Total	Initial	Final
Θ	$P_{m(g)}$	V_{mi}	V_{mf}	V_m	t_{mi}	t_{mf}	P_w	V_{wi}	V_{wf}	V_w	t_{wi}	t_{wf}
900	13.00	512699.1	512869.5	170.4	28.0	28.0	-1.0	431236.86	431410.21	173.4	26.5	26.5
600	25.00	511923.9	512081.6	157.7	28.0	28.0	-1.0	430461.99	430622.64	160.7	26.5	26.5
480	50.00	512090.4	512268.0	177.6	28.0	28.0	-1.0	430633.55	430815.39	181.8	26.5	26.5
420	80.00	512282.1	512480.5	198.4	28.0	28.0	-1.0	430825.43	431026.44	201.0	26.5	26.5
300	120.00	512512.2	512681.9	169.7	28.0	28.0	-1.0	431052.74	431225.49	172.8	26.5	26.5

Standardized Data / **Calibration Results**

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H2O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variation	0.0212 SCMM	Variance
$V_{w(std)}$	$Q_{w(std)}$	$V_{m(std)}$	$V_{w(std)}$	Y	ΔY	ΔH@	ΔΔH@
170.71	11.38	168.00	11.4	1.0161	0.0035	45.0	-0.368
158.20	15.82	155.66	15.8	1.0164	0.0037	44.8	-0.532
179.07	22.38	175.73	22.4	1.0190	0.0064	44.9	-0.466
197.95	28.28	196.88	28.3	1.0054	-0.0072	45.1	-0.223
170.12	34.02	169.05	34.0	1.0063	-0.0063	46.9	1.589
				1.0127	= Y Avg.	**45.3**	= ΔH@ Avg. (Metric)

Note1 : For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

Note2 : For $\Delta H_@$, orifice pressure differential that equates to 0.0212m^3/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H_2O.

Calibrator : [redacted] Signature : [redacted] Date : 28/Nov/23

The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.) and in reference to EPA Method 5, Section 10.3.1.

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Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Calibration No.: **SA2023001**

UUT Meter / Console Information

Model #: XC 572-V Serial number: 605186

DGM Model #: SK25EX Serial number: 0005288

Check the Diagnosis

Check the system before calibrating.

	Not Passed	Passed
-Visual instrument normalcy	☐	☑
-Electrical and Temperature Systems	☐	☑
-Inclined Manometer with Systems	☐	☑
-Pressure Gauge	☐	☑
-Leak Check	☑Vacuum : Pass	☑Pressure : Pass
☑ PM and Calibration	☐ Repairing before Calibration	

Nomenclature

Pb - Barometric Pressure
DGM - Dry Gas Meter
K_1 - Constant based on standard temp and press
Θ - Run time, in minutes
P_m - ΔH (Meter Pressure, gauge)
V_m - Volume collected by test meter, corrected for STP
$Q_{m(std)}$ - Calculated flow rate of test meter
K' - Critical orifice coefficient
P_w - Measured pressure of reference meter
t_w - Temperature measured in reference meter
t_m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice

Equations

$$K_1 = \frac{T_{std}}{P_{std}}$$

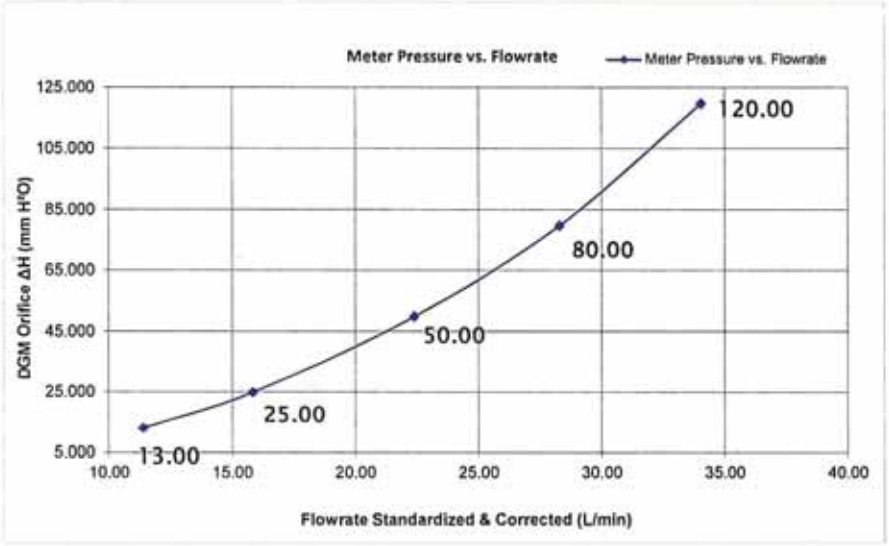
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$$

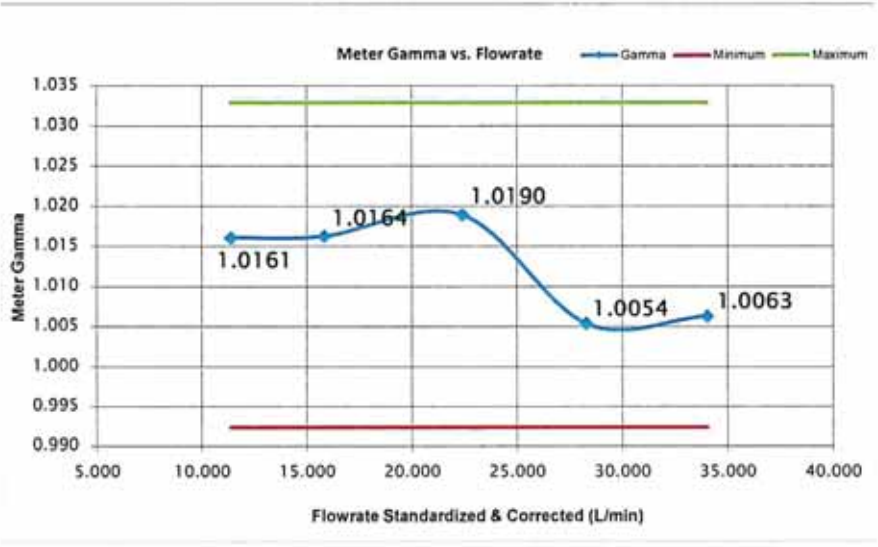
$$V_{m(std)} = \frac{K_1 V_m (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

$$Y = \frac{V_{w(std)}}{V_{m(std)}} \qquad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric\ \Delta H_\Theta = \frac{P_{m(g)} * 0.0011696 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m} * \left(\frac{T_w * \Theta}{V_w * P_{bar}}\right)^2$$

Calibration Graphs





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Revised: 2023/01/03

Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #:	XC-572
Serial #:	605186
Units:	Metric

Calibration Conditions

Pbar (mm. Hg):	759.60
Humidity (%):	65
Tamb (°C):	25.6
Elevation (m):	1.5
Corr. Pbar (mm. Hg):	759.60

Calibration Reference

Calibration No. :	**SA2023001**
Work No. :	SVO26796

Reference Devices

TC Calibrator Model:	FLUKE 714
Serial No.:	9038005

Temperature Sensors Calibration Data

Reference Temp.		Test Thermocouple Calibrations						Reference Point Status[2]
		Aux	Stack	Probe	Oven	Filter	Exit	
Point	*°C*	*°C*	*°C*	*°C*	*°C*	*°C*	*°C*	*Pass/Fail*
1	-18	-17	-17	-17		-17	-17	PASS
2	38	38	38	38		39	39	PASS
3	93	94	94	94		95	94	PASS
4	149	151	151	150		150	150	PASS
5	260	261	261	261		261		PASS
6	371		374					PASS
7	482		486					PASS
8	593		597					PASS
9	816		824					PASS
10	1038		1046					PASS
		±3.0°C,5.4°F	1.50%	±3.0°C,5.4°F	±3.0°C,5.4°F	±3.0°C,5.4°F	±1.0°C,2.0°F	**PASS**

Overall Audit Status

DGM Temperature Sensor

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	Δt_{abs}	Maximum	Reference Status[2] (±1%)
#	*°C*	*°C*	*°C*	%	*Pass/Fail*
Ice Water	0.2	0	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Temperature Controller

Heater Controller Set point	Reference Measure (μ)	XC-572 Thermometer	Deviated to set point	ΔT_{abs} ±3%	Temp. Controler Status[3]
120 °C	*°C*	*°C*	*°C*	*°C*	*Pass/Fail*
Probe	123	125	-2	0.50%	PASS
Filters	120	121	-1	0.25%	PASS
Heated Box	120	119	1	0.25%	PASS

Notes

[1] Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.

2 For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[3] Heater control acceptance limit Temperature can be maintained at 120 °C ±14 °C, ±57 °F within ±1.5%(2) at a flow rate of 20 lpm.

Signature: [redacted] Date : 28/Nov/23

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60.

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Revised: 2023/01/01

Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #:	XC-572
Serial #:	605186
Units:	Metric

Calibration Conditions

Pbar (mm. Hg):	30.00
Humidity (%):	65%
Amb. Temp. (°C):	69
Altitude (m):	100.0
Corrected Pbar (mm. Hg):	29.90

Calibration No. :	**SA2023001**
Work No. :	SVO26796

Reference Devices

TC Calibrator Model:	FLUKE 714
Serial No.:	9038005
Digital Manometer Model:	Dwyer DPGA-00
Serial No.:	721

Audit Data

Reference Point	Reference Temp.	Console Thermocouple Audit						Reference Point Status[1]
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	*Pass/Fail*
1	26.5	27	27	27	27	27	27	PASS
Acceptance criteria		3.0°C,5.4°F	1.50%	3.0°C,5.4°F			1.0°C,2.0°F	

Reference Thermocouple ID: 90728323

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	ΔTabs4	Maximum	Reference Status (±1%)
#	°C	°C	°C	%	*Pass/Fail*
Ice Water	0.2	0	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Internal temperature thermocouple is not audited to EPA standards, and should not be used as an official reference for ambient temperature.

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status[3]
#	*mm. Hg*	*mm. Hg*	*Pass/Fail*
1	23.90	24.00	PASS

Notes

[1]For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[3]For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (12.5 mm Hg)

Signature: [redacted] Date: 28/Nov/23

I certify that the above Thermocouple, Barometric, and Vacuum Sensors were calibrated and audited in accordance with US EPA Methods, CFR 40 Part 60.

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Revised: 2023/01/04

Nozzle Calibration

Nozzle Information

Manufacturer: Apex
Type: Stainless Steel
Identification: -

Calibration Conditions

Bar. Pressure (mm Hg): 756.5
Ambient Temperature (°C): 26.0
Relative Humidity (%): 65

Calibration Reference

Calibration No.: SA2023001
Work No. : SVO26796
Units: Metric

Reference Equipment	Serial No	Cal No.:	Cal.due:
Vernier, 0-250mm 0.01 mm increments model Mitutoyo	3038570	L202310355-0001	07/Nov/23

Calibration Method

Follow the USEPA Method 5 nozzle size calibration procedure. (ref. 40 CFR PART 60).

Calibration Result

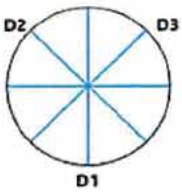
ID No.	Sizes	measured every 60° nozzle			$(D_1 + D_2 + D_3) / 3$	Different ≤ 0.100 mm.	
	mm.	D_1	D_2	D_3	Davg	1	Judgment
4	3.1	3.18	3.17	3.17	3.173	0.010	PASS
6	4.6	4.42	4.44	4.46	4.440	0.040	PASS
8	6.2	6.22	6.19	6.23	6.213	0.040	PASS
10	7.8	7.78	7.78	7.77	7.777	0.010	PASS
12	9.4	9.37	9.39	9.40	9.387	0.030	PASS
14	10.9	10.85	10.87	10.87	10.863	0.020	PASS
16	12.6	12.74	12.75	12.78	12.757	0.040	PASS

Where :

D1, D2, D3 = There difference nozzle diamiters at 60 degrees to each other, each measured to the nearest 0.025 mm or 0.001 inch

ΔD = Maximum difference between any two diameters, must be $\leq$ 0.100 mm or 0.004 inch

D avg = $(D_1 + D_2 + D_3) / 3$



Signature [redacted]

Date : 28/Nov/23

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Revised: 2023/01/04

Sampling Probe and Pitot validation

Samplig Probe Information

Manufacturer:	Apex
Probe Type:	SS , 6ft
Probe No. :	-
Pitot tube Type:	S Type 3/8 Inc.
Pitot tube No.:	-

Calibration Conditions

Bar. Pressure (mm Hg):	759.5
Ambient Temperature (°C):	26.0
Relative Humidity (%):	53
Units:	Metric

Calibration Reference

Calibration No.: **SA2023001**

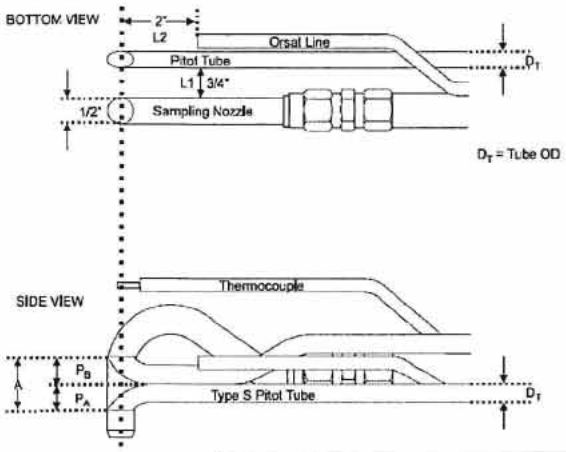
Work No.: SVO26796

Reference Devices

- Vernier, 0-250mm 0.01 mm increments

Model: Mitutoyo,ID No.:EPD1-VER-57-1-CEN-01

Validation method : Follow the USEPA Method 5 pitot tubs (S type) calibration procedure. (ref. 40 CFR PART 60).



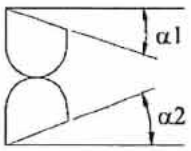
Sampling Probe Validation with Tune up

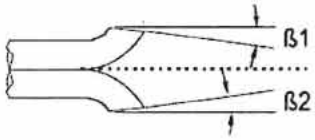
☑ : Measuring and aligning with 1/2" sample nozzle(12.7 mm)

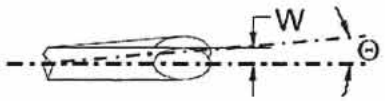
	Measured	Acceptance Standard
L_1 =	18.56 mm	(19.05 mm. or 0.75 in.)
L_2 =	47.69 mm	(50.8 mm. or 2.0 in.)
D_T =	9.52 mm	(9.525 mm., 0.375 in.)
A =	22.07 mm	(2.1 $D_T \leq A \leq 3D_T$)
$A/2D_T$ =	1.159 mm	(1.05 $P_A / D_T \leq A \leq 1.5$)

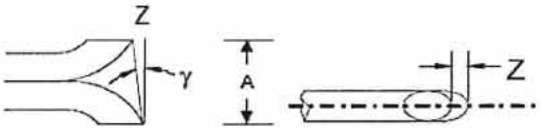
Pitot Tube Validations and Engles measurement Result

☑ : Measure results after maintenance and adjustments.









	Size	Acceptancnce of correctness
P_B Size		
α_1 =	0.55 °	≤ 10°
β_1 =	2.15 °	≤ 5°
P_A Size		
α_2 =	0.65 °	≤ 10°
β_2 =	1.90 °	≤ 5°

Engles measurement		fhy Calculated Result	Acceptance Criteria
W =	0.80 °	0.318 mm	W < 0.0794 mm. (0.03125 ir
Z =	0.30 °	0.116 mm	Z < 3.175 mm. (0.125 in.)

Can be use **0.84** for Cp(s) if the type of face-opening misafgnment show above with not affect the base line value of Cp(s) Solong as standard range.

Signature: [redacted]

Date: 28/Nov/23

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Certificate of Calibration

DGM with Totallizer Calibration - Liters (L)

UUT Meter Console Information	
Model :	XC-572
Serial :	605186
Totalizer display:	N/A
DGM model :	SK25EX
Serial :	0005288

Calibration Conditions	
Bar. Pressure (mm Hg):	756.0
Ambient Temperature (°C):	25.7
Relative Humidity (%):	65
Altitude (m):	1.50

Factors/Conversions	
Std. Temp. (K):	298.15
Std. Press. (mm Hg):	760
K_1 (K/mm Hg):	0.3923

Work No.: SVO26769

Calibration No. : SA2023001

Reference Equipment

WTM Model:	W-NK-5A	WTM Serial:	535476
WTM Cal. Due Date:	25-Mar-23	Gamma:	0.9976
Thermometer:	Fluke 714	Serial #:	N/A

UUT Meter (DGM)

Run Time (seconds)	Flow Rate (Rotameter)	Volume(L)			Meter Temperature (°C)	
		Initial	Final	Total	Initial	Final
Θ	(L/Min)	V_{wi}	V_{wf}	V_w	t_{mi}	t_{mf}
900	1.00	514431.90	514445.70	13.80	27.0	27.0
600	2.00	514399.70	514419.40	19.70	27.0	27.0
480	2.50	514488.80	514508.20	19.40	27.0	27.0
420	3.00	514354.30	514375.50	21.20	27.0	27.0
300	4.00	514285.50	514305.70	20.20	27.0	27.0

Reference Meter (WTM)

Meter Pressure ($mm H_2O$)	Volume (L)			Outlet Temperature (°C)	
	Initial	Final	Total	Initial	Final
P_w	V_{wi}	V_{wf}	V_w	t_{wi}	t_{wf}
-1.0	433294.69	433308.92	14.23	27.0	27.0
-1.0	433262.98	433283.21	20.23	27.0	27.0
-1.0	433352.74	433372.69	19.95	27.0	27.0
-1.0	433214.91	433236.63	21.72	27.0	27.0
-1.0	433129.27	433149.95	20.68	27.0	27.0

Standardized Data

Scaling Factor **Calibration Results**

Test meter		Reference Meter		Gamma		Rotameter Calibration		
Std. Vol.	Std. Flow Rate	Std. Volume	Std. Flow Rate	Value	Variation	Rotameter	Std. Flow.	Variation
Vm_{std} (L)	Qw_{std} (L/min)	Vw_{std} (L)	Qw_{std} (L/min)	Y	ΔY	(L/Min)	(L/min)	(L/min)
13.637	0.935	14.026	0.935	1.0285	0.004	1.00	0.94	0.06
19.470	1.994	19.940	1.994	1.0241	0.000	2.00	1.99	0.01
19.174	2.458	19.664	2.458	1.0255	0.001	2.50	2.46	0.04
20.954	3.058	21.408	3.058	1.0217	-0.002	3.00	3.06	-0.06
19.968	4.077	20.383	4.077	1.0208	-0.003	4.00	4.08	-0.08
				1.0241	**DGM Y Avg.(1)**			

Note:1. For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

Note:2. For the Scaling Calibration Factor.(SC), it is the ratio of the display to adjust the Y value to be close to 1.000, equal to the reference standard.

Technical: [redacted] Signature: [redacted] Date: 28/Nov/2023

The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.) and in reference to EPA Method 5, Section 10.3.1. and EPA Method 6, Section 10.1.3.

Calibration Certificate Appendix

DGM with Totallizer Calibration

Nomenclature

P_b - Barometric Pressure

DGM - Dry Gas Meter

K_1 - Constant based on standard temp and press

Θ - Run time, in minutes

P_m - ΔH (Meter Pressure, gauge)

V_m - Volume collected by test meter, corrected for STP

$Q_{m(std)}$ - Calculated flow rate of test meter

K' - Critical orifice coefficient

P_w - Measured pressure of reference meter

t_w - Temperature measured in reference meter

t_m - Temperature measured in test meter

Y - Ratio of volume collected from test meter and orifice

sc - Scaling Factor

$Counts_{std}$ - Number of pulse counts, standardized

C_{total} - Number of raw pulse counts of a calibration run

Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$$

$$K_1 = \frac{T_{std}}{P_{std}}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

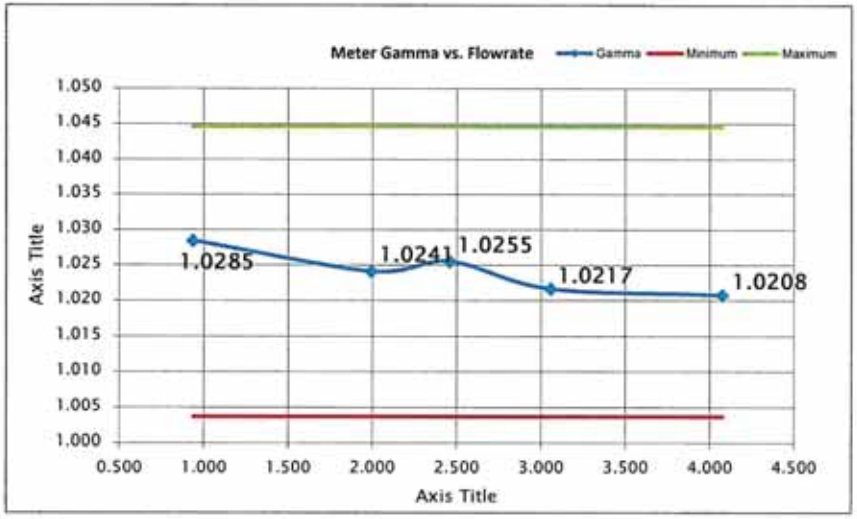
$$Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

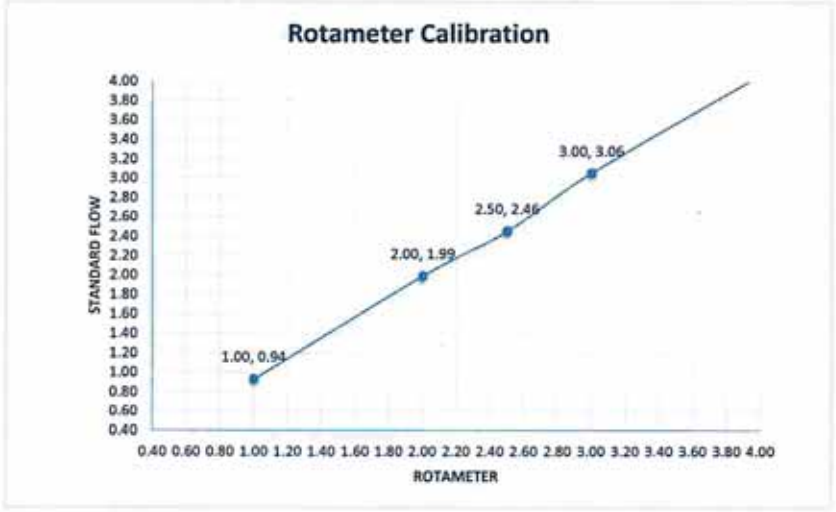
$$Counts_{std} - K_1 \frac{C_{total} * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$$

$$Y_{sc} - \frac{V_{w(std)}}{Counts_{std}}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}}$$

Calibration Graphs





SITHIPORN associates

Revised: 2023/01/03

Certificate of Calibration

Method 6 Console Sensor Calibration - Metric Units

Console Information	
Model #:	XC-572
Serial #:	605186
Temp Dsp	LASCAR
Serial :	DTM-995B
Units:	Metric

Calibration Conditions	
Pbar (mm. Hg):	759.40
Humidity (%):	47
Tamb (°C):	24.44
Elevation (m):	1.5
Corr. Pbar (mm. Hg):	759.4

Calibration Reference	
Calibration No. :	SA2023001
Work No. :	SVO26769
Reference Devices	
TC Calibrator Model:	FLUKE 714
Serial No.:	9038005

Temperature Sensors Calibration Data

Reference Temp.		Test Thermocouple Calibrations					Reference Point Status[2]
		Aux	Stack	Probe	Filter	Exit	
Point	*°C*	*°C*	*°C*	*°C*	*°C*	*°C*	*Pass/Fail*
1	-18	-18	-18	-18	-18	-18	PASS
2	38	39	39	39	39	39	PASS
3	93	95	95	95	95		PASS
4	149	150	150	150	150		PASS
5	260	261	262	262	262		PASS
6	371		374				PASS
7	482		484				PASS
8	593		597				PASS
9	816		823				PASS
10	1038		1049				PASS
		±3.0°C,5.4°F	1.50%	±3.0°C,5.4°F	±3.0°C,5.4°F	±2.0°C,3.6°F	**PASS**

Overall Audit Status

DGM Temperature Sensor

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	Δt_{abs}	Maximum	Reference Status[2] (±1%)
#	*°C*	*°C*	*°C*	%	*Pass/Fail*
Ice Water	0.2	0	0.07%	0.45%	PASS
Ambient	25.6	28	0.45%		

Temperature Controller

Heater Controller Set point	Reference Measure (μ)	XC-572 Thermometer	Deviated to set point	ΔT_{abs} ±3%	Temp. Controler Status[3]
120 °C	*°C*	*°C*	*°C*	*°C*	*Pass/Fail*
Probe	123	125	-2	0.50%	PASS
Filters	120	121	-1	0.50%	PASS

Notes

[1] Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.

2 For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[3] Heater control acceptance limit Temperature can be maintained at 120 °C ±14 °C, ±57 °F within ±1.5%(2) at a flow rate of 20 lpm.

Signature: [redacted] Date : 28/Nov/23

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. : 24P202
Page : 1 of 2

Equipment : Digital Manometer
Manufacturer: Dwyer
Model : 477
Serial No.: 477-5-FM
ID No.: SP-362
Condition As-Received: Used Item
Received Date: 09 January 2024
Calibration Date: 17 January 2024

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.

Reference: 2401-0234WN
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1014 mbar

Submitted by: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-Nuch 64, Srinakarin Road,
On-Nuch, Suanluang, Bangkok 10250

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

Condition of this result of calibration

1.Reference standards instruments :

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

2.This instrument was installed in vertical orientation and lower groove of pressure sensor was used as the reference level.

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

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

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

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

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Kaerkpon Saivichai
Issue Date : 19 January 2024

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

R 0332925

Result of calibration:- Without adjustment **Range :** 0 mmHg to 1034 mmHg

Function:- Pressure Measurement **Resolution :** 1 mmHg

Increasing Pressure

Applied Pressure (mmHg)	0.0	99.8	199.8	299.7	399.7	499.7	599.7	699.6	799.6	899.5	1033.4
UUC* Indication (mmHg)	0	99	198	298	398	497	597	697	797	897	1030
Error (mmHg)	0.0	-0.8	-1.8	-1.7	-1.7	-2.7	-2.7	-2.6	-2.6	-2.5	-3.4

Decreasing Pressure

Applied Pressure (mmHg)	1033.4	899.5	799.6	699.6	599.7	499.7	399.7	299.7	199.8	99.8	0.0
UUC* Indication (mmHg)	1030	897	797	697	597	497	398	298	198	99	0
Error (mmHg)	-3.4	-2.5	-2.6	-2.6	-2.7	-2.7	-1.7	-1.7	-1.8	-0.8	0.0

The uncertainty of measurement was ± 1.0 mmHg

* UUC = Unit Under Calibration

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

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Attapol P.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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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. : 24P205
Page : 1 of 2

Equipment : Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: BM-06
Condition As-Received: Used Item
Received Date: 12 January 2024
Calibration Date: 17 January 2024

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.

Reference: 2401-0387WN
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1013 mbar

Submitted by: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-Nuch 64, Srinakarin Road,
On-Nuch, Suanluang, Bangkok 10250

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

Condition of this result of calibration

1.Reference standards instruments :

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

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

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

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 18 January 2024

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

B 0332879

Result of calibration:- Without adjustment **Range :** 730 mmHg to 770 mmHg

Function:- Absolute Pressure Measurement **Scale Interval :** 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	735.17	744.69	753.26	761.80	770.67
UUC* Indication (mmHg)	730.0	740.0	750.0	760.0	770.0
Error (mmHg)	-5.17	-4.69	-3.26	-1.80	-0.67

Decreasing Pressure

Applied Pressure (mmHg)	770.67	760.89	751.95	743.88	735.28
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0
Error (mmHg)	-0.67	-0.89	-1.95	-3.88	-5.28

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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ENTECH
Where Solutions Begin

Calibration Certificate

Certificate No: G 670046
Date of issue : 23-Jan-24

Instrument description	:	Gas Analyzer
Instrument model	:	EC 9832 Series CO
Control unit serial no.	:	-
Instrument serial no.	:	13-1210
ID no. or control no.	:	-
Manufacturer	:	Ecotech
Probe description	:	-
Probe model	:	-
Probe serial no.	:	-
Customer name	:	Life & Environment Co., Ltd. (Head Office)
Customer address	:	90,92,94 Soi On-Nuch 64, Srinakarin Road, Suanluang, Bangkok 10250
Total pages of certificate	:	2 Pages
Receiving no.	:	L-240219
Receiving date.	:	22-Jan-24
Parameter of calibration	:	Gas Calibration(Carbon Monoxide 1003 ppm)
Condition of UUC.	:	Used
Ambient condition	:	All of the Measurment ware caried out the stabilized labotary Temperature : 23 ±5 °C Humidity : 55 ± 15 %RH
Calibration place	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no.	:	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-19-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 23-Jan-24

[redacted]
Calibration Technician

[redacted]
Technical Manager

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

ENTECH
Where Solutions Begin

Calibration Certificate

Certificate No.: G 670046

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25

Measured room conditions

Temperature : 22.9 °C Humidity : 60.3 %RH Pressure : 1012.8 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,500 ml/min Gas pressure : 1018.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
CO (ppm)	1003	1219.99	216.99	12

Remark : 1 µmol/mol = 1 ppm.

End of Report

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

ENTECH
Where Solutions Begin

Testing Report

General Information

Measuring Site :	Entech Industril Solution Co.,Ltd.	Report No. :	R 670002
Address :	17/121 Soi Ngamwongwan 47 Yaek 48 , Toongsonghong, Laksi, Bangkok 10210 THAILAND	Date of Issue :	20-Feb-24
Parameter :	Gas	Date of testing :	20-Feb-24

Customer Devices Information

Instrument Description	:	Flue Gas Analyzer
Instrument Model	:	Testo 330-1LL
Instrument S/N	:	01688735
ID no. or Control no.	:	-
Manufacturer	:	Testo SE & Co. KGaA
Receiving no	:	L-240646

Standard Reference

Standard	Reference No.	Traceability	Due Date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon Monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon Monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon Monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25

Results : The testing results were reported in the table below

No.	Gas	Standard Gas	UUT Mean	Error
1	O2	2.50	2.6	0.10
2	O2	10.04	10.2	0.16
3	O2	21.02	21.2	0.18
4	CO	80.14	79	-1.14
5	CO	302	302	0
6	CO	1003	1001	-2

[redacted]

[redacted]

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Hanna
Model :	HI 3222
Serial No. :	08645111
ID No. :	-
Condition As-Received:	Used Item
Received Date :	09 January 2024
Calibration Date :	10 January 2024
Reference :	2401-0234WN-1
Submitted by :	LIFE & ENVIRONMENT CO., LTD. 90, 92, 94 Soi On-Nuch 64, Srinakarin Road, On-Nuch, Suanluang, Bangkok 10250
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)

Calibrated by :

Approved by :

[redacted]
Approved Signatory

(✓) Saithip Meangmai
( ) Warakorn Lerngagtrakul
( ) Ponpan Paipim

Issue Date : 12 January 2024

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

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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 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 2025
pH 6.986	CPA chem	931959	01 Oct 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	177.3	4.000	0.058	2.00
S/N.: 08645111	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	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 Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.011	167.5	0.0045	2.00
S/N.: 092818FN	6.986	7.006	-7.6	0.0084	2.00
	9.997	9.997	-181.7	0.0065	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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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Cooled Incubator	Certificate No.:	C31232288
Model:	i250	Issued Date:	14 November 2023
Serial No.(or ID):	0812-0416 (W-BOD-01/55)	Job No.:	WO-00008954
Manufacturer:	Accuplus	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	None
Shelves(pc.):	2		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	21 °C	±	1.4	°C
Humidity:	61 %RH	±	5.2	%RH
Voltage:	229 VAC	±	2.9	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 06 November 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230012

[redacted]

Person in charge

[redacted]

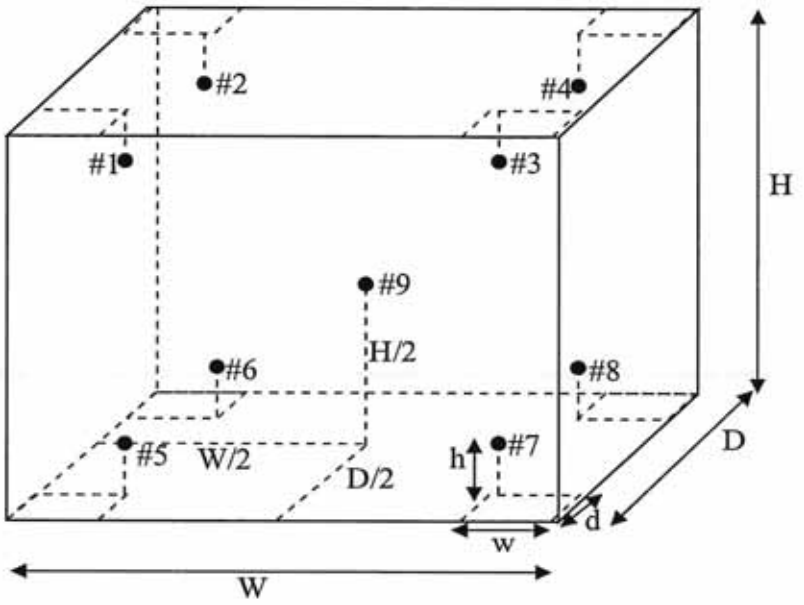
Authorized signatory

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



Standard Installation Locations

Volume (Calibration Zone)= 102 (Liters)

Inside chamber:	W = 50 (cm)	D = 50 (cm)	H = 104 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 30 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 10 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.20	0.20	0.23
#2	20.38	0.38	0.24
#3	20.01	0.01	0.23
#4	20.26	0.26	0.23
#5	19.98	-0.02	0.26
#6	20.15	0.15	0.23
#7	20.02	0.02	0.26
#8	19.84	-0.16	0.23
#9	20.26	0.26	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	20.20	20.38	20.01	20.26	19.98	20.15	20.02	19.84	20.26	0.26

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.45	0.13	0.71

Note: * Maximum uncertainty of the each position

The End of Certificate

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Certificate of Calibration

Equipment:	COD Reactor	Certificate No.:	C17240092
Model:	HI 839150-02	Issued Date:	13 June 2024
Serial No. (or ID.):	101380040111	Job No.:	WO-00030976
Manufacturer:	HANNA	Page:	1 of 4
Condition:	In Condition		
Covers: Open (Max)	Locations heating Block: Single		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	23 °C	±	5.0 °C
Humidity:	50 %RH	±	15.0 %RH
Voltage:	230 VAC	±	11.0 VAC

Calibration Place: Temperature Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Vanasapol Lerksanthia

Calibration Date: 13 June 2024

The Method used: In house method, CAL-WI-59, base on Direct Measurement with Standard Thermometer

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240011

[redacted]

Person in charge

[redacted]

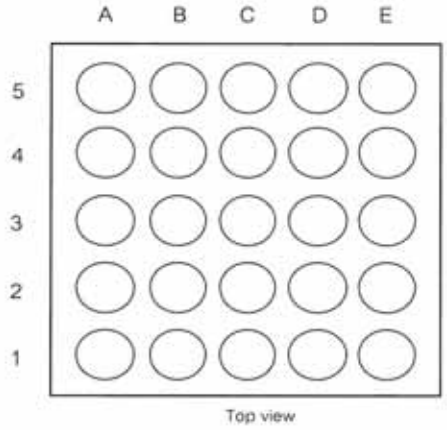
Authorized signatory

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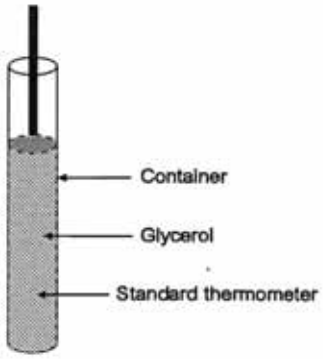
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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Calibration Results:

Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Single	150.0	150.0

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	149.14	-0.86	0.33
A2	150.86	0.86	0.34
A3	149.81	-0.19	0.37
A4	148.95	-1.05	0.42
A5	149.83	-0.17	0.38
B1	149.16	-0.84	0.37
B2	150.42	0.42	0.50
B3	151.11	1.11	0.48
B4	150.07	0.07	0.57
B5	149.25	-0.75	0.52
C1	149.51	-0.49	0.45
C2	151.09	1.09	0.55
C3	151.12	1.12	0.43
C4	149.70	-0.30	0.41
C5	149.53	-0.47	0.51
D1	149.29	-0.71	0.45
D2	150.91	0.91	0.55
D3	151.07	1.07	0.43
D4	149.88	-0.12	0.41
D5	149.47	-0.53	0.51
E1	149.38	-0.62	0.45
E2	150.96	0.96	0.55
E3	150.75	0.75	0.43
E4	149.82	-0.18	0.42
E5	149.63	-0.37	0.51

Characterization of the unit under calibration:

Locations heating Block	Desired	Unit Under Calibration (°C)		Measured Temperature (°C)
	(°C)	Setting	Reading	Stability (±°C)
Single	150.0	150.0	150.0	0.43

The End of Certificate

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DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Cooled Incubator	Certificate No.:	C31232287
Model:	i250	Issued Date:	14 November 2023
Serial No.(or ID):	0812-0414 (W-RE-01/55)	Job No.:	WO-00008954
Manufacturer:	Accuplus	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	None
Shelves(pc.):	2		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:				
Temperature:	21 °C	±	1.4	°C
Humidity:	61 %RH	±	5.2	%RH
Voltage:	229 VAC	±	2.9	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 06 November 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230012

[redacted]

Person in charge

[redacted]

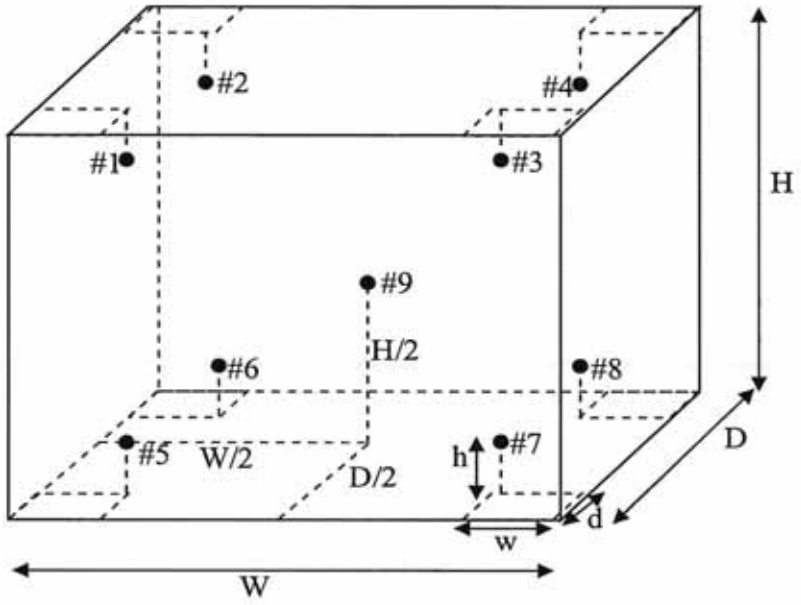
Authorized signatory

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Standard Installation Locations

Volume (Calibration Zone)= 102 (Liters)

Inside chamber:	W = 50 (cm)	D = 50 (cm)	H = 104 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 30 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 10 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 4.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	3.79	-0.21	0.79
#2	3.56	-0.44	0.92
#3	4.05	0.05	0.67
#4	3.84	-0.16	0.84
#5	4.12	0.12	0.45
#6	3.80	-0.20	0.74
#7	3.99	-0.01	0.52
#8	4.09	0.09	0.51
#9	3.69	-0.31	0.75

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
4.0	4.0	4.0	3.79	3.56	4.05	3.84	4.12	3.80	3.99	4.09	3.69	0.92

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
4.0	0.75	0.75	1.72

Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Cooled Incubator	Certificate No.:	C31242227
Model:	i250	Issued Date:	08 November 2024
Serial No.(or ID):	0812-0414 (W-RE-01/55)	Job No.:	WO-00047861
Manufacturer:	Accuplus	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	None
Shelves(pc.):	2		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	26 °C	±	0.5	°C
Humidity:	51 %RH	±	5.2	%RH
Voltage:	229 VAC	±	2.0	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 05 November 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240015

[redacted]

Person in charge

[redacted]

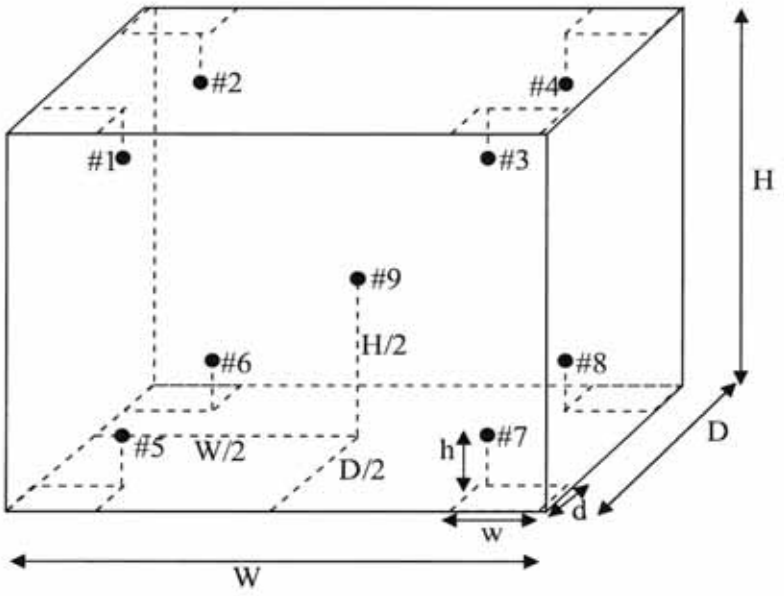
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Standard Installation Locations

Volume (Calibration Zone)= 102 (Liters)

Inside chamber:	W = 50 (cm)	D = 50 (cm)	H = 104 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 30 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 10 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 4.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	3.67	-0.33	0.81
#2	3.47	-0.53	0.89
#3	4.18	0.18	0.67
#4	3.80	-0.20	0.96
#5	4.23	0.23	0.51
#6	3.92	-0.08	0.68
#7	3.85	-0.15	0.66
#8	4.08	0.08	0.59
#9	3.85	-0.15	0.60

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
4.0	4.0	4.0	3.67	3.47	4.18	3.80	4.23	3.92	3.85	4.08	3.85	0.96

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
4.0	0.69	0.80	1.89

Note: * Maximum uncertainty of the each position

The End of Certificate

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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Incubator	Certificate No.:	C31232289
Model:	INE 400	Issued Date:	14 November 2023
Serial No.(or ID):	E407.1277 (WM-IB-02/51)	Job No.:	WO-00008954
Manufacturer:	Memmert	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	24 °C	±	0.6	°C
Humidity:	50 %RH	±	4.4	%RH
Voltage:	224 VAC	±	2.5	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiological Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphakorn Sookmee

Calibration Date: 06 November 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230019

[redacted]
Person in charge

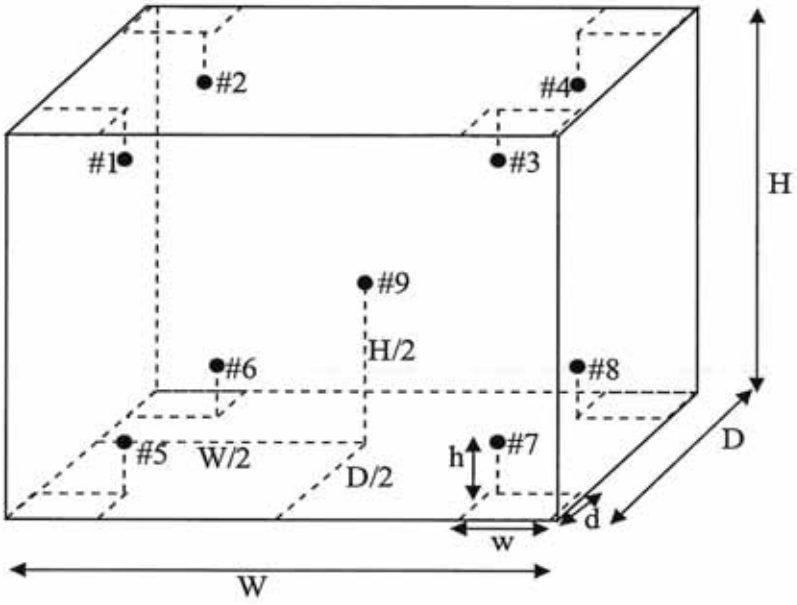
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Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:	W = 40 (cm)	D = 33 (cm)	H = 40 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.16	0.16	0.27
#2	34.98	-0.02	0.29
#3	35.13	0.13	0.33
#4	34.98	-0.02	0.27
#5	35.51	0.51	0.33
#6	35.58	0.58	0.35
#7	35.63	0.63	0.30
#8	35.70	0.70	0.33
#9	35.00	0.00	0.28

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	35.0	35.16	34.98	35.13	34.98	35.51	35.58	35.63	35.70	35.00	0.35

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.85	0.11	0.90

Note: * Maximum uncertainty of the each position

The End of Certificate

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Incubator	Certificate No.:	C31242228
Model:	INE 400	Issued Date:	08 November 2024
Serial No.(or ID):	E407.1277 (WM-IB-02/51)	Job No.:	WO-00047861
Manufacturer:	Memmert	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	25 °C	±	1.3	°C
Humidity:	51 %RH	±	5.2	%RH
Voltage:	229 VAC	±	2.0	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiological Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 05 November 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240015

[redacted]

Person in charge

[redacted]

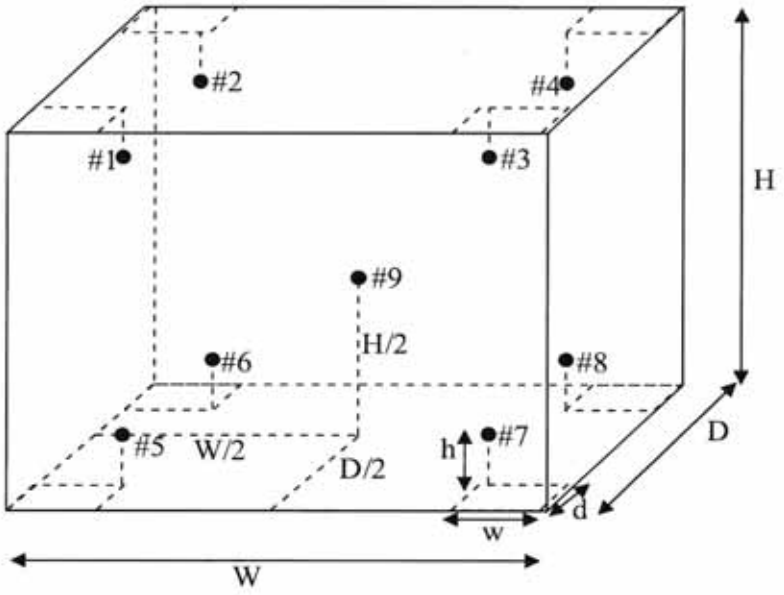
Authorized signatory

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:	W = 40 (cm)	D = 33 (cm)	H = 40 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.11	0.11	0.26
#2	34.95	-0.05	0.23
#3	35.02	0.02	0.24
#4	34.92	-0.08	0.23
#5	35.42	0.42	0.24
#6	35.29	0.29	0.25
#7	35.32	0.32	0.23
#8	35.38	0.38	0.25
#9	35.40	0.40	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	35.0	35.11	34.95	35.02	34.92	35.42	35.29	35.32	35.38	35.40	0.26

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.55	0.07	0.56

Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31231015
Model:	UFE 400	Issued Date:	16 May 2023
Serial No.(or ID):	G412.0022	Job No.:	KSPR2307253
Manufacturer:	Memmert	Page:	1 of 5
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Bangkok 10250 Thailand

Environment Condition:

Temperature:	27 °C	±	1.1	°C
Humidity:	58 %RH	±	5.2	%RH
Voltage:	224 VAC	±	1.4	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD.(Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Bangkok 10250 Thailand

Calibration By: Mr. Bovon Jannantha

Calibration Date: 16 May 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230015

[redacted]
Person in charge

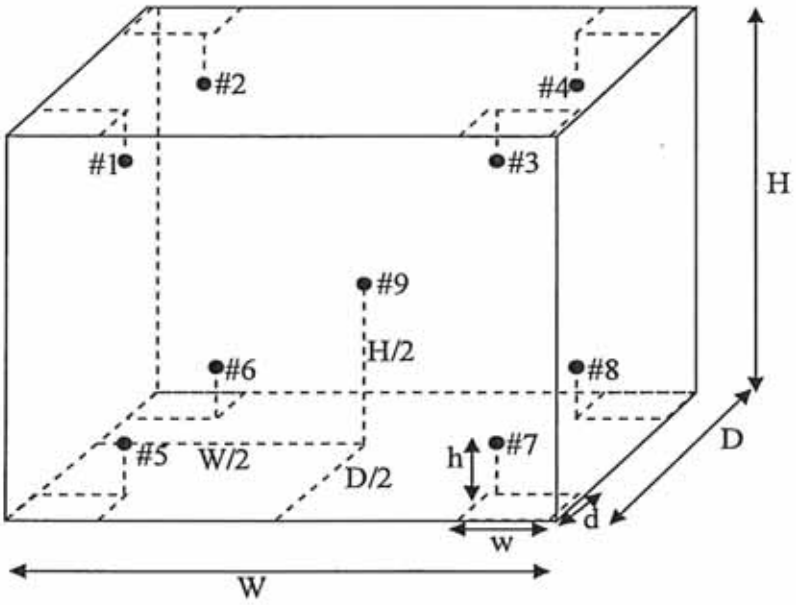
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Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:	W = 40 (cm)	D = 33 (cm)	H = 40 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.26	0.26	0.39
#2	104.22	0.22	0.39
#3	103.67	-0.33	0.39
#4	103.89	-0.11	0.39
#5	104.09	0.09	0.39
#6	103.69	-0.31	0.39
#7	103.98	-0.02	0.39
#8	104.11	0.11	0.39
#9	103.82	-0.18	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.26	104.22	103.67	103.89	104.09	103.69	103.98	104.11	103.82	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.48	0.09	0.70

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 150.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	150.43	0.43	0.39
#2	150.43	0.43	0.39
#3	149.54	-0.46	0.39
#4	149.78	-0.22	0.39
#5	150.30	0.30	0.39
#6	149.56	-0.44	0.39
#7	149.86	-0.14	0.39
#8	150.05	0.05	0.39
#9	149.86	-0.14	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
150.0	150.0	150.0	150.43	150.43	149.54	149.78	150.30	149.56	149.86	150.05	149.86	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
150.0	0.61	0.10	1.05

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	180.53	0.53	0.42
#2	180.59	0.59	0.42
#3	179.43	-0.57	0.42
#4	179.66	-0.34	0.42
#5	180.53	0.53	0.42
#6	179.48	-0.52	0.42
#7	179.93	-0.07	0.42
#8	180.10	0.10	0.42
#9	180.00	0.00	0.42

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.53	180.59	179.43	179.66	180.53	179.48	179.93	180.10	180.00	0.42

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	0.67	0.08	1.30

Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31241025
Model:	UFE 400	Issued Date:	17 May 2024
Serial No.(or ID):	G412.0022	Job No.:	WO-00027714
Manufacturer:	Memmert	Page:	1 of 5
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	27 °C	±	1.0	°C
Humidity:	56 %RH	±	5.7	%RH
Voltage:	230 VAC	±	2.1	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Nakarin Ruenros

Calibration Date: 16 May 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230023

[redacted]
Person in charge

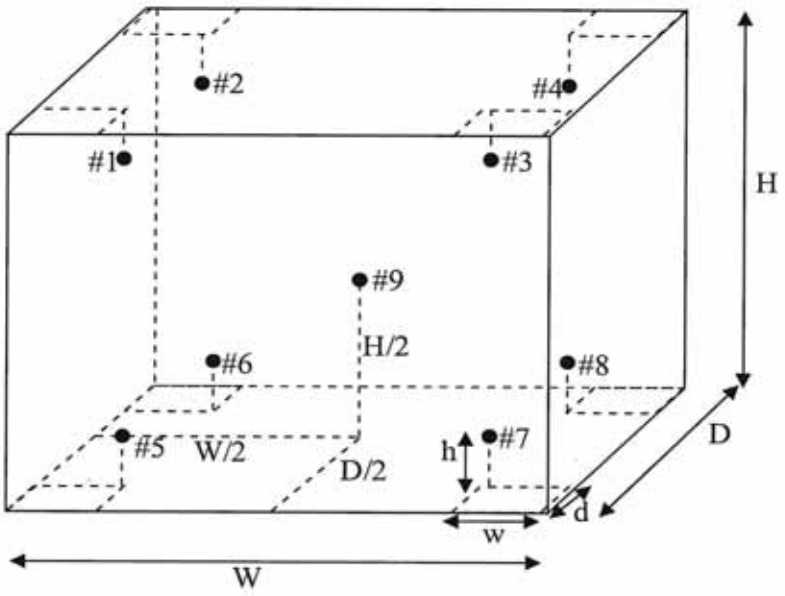
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Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:	W = 40 (cm)	D = 33 (cm)	H = 40 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

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Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.27	0.27	0.39
#2	104.30	0.30	0.39
#3	103.80	-0.20	0.39
#4	104.15	0.15	0.39
#5	104.26	0.26	0.39
#6	104.15	0.15	0.39
#7	103.79	-0.21	0.39
#8	103.98	-0.02	0.39
#9	104.33	0.33	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.27	104.30	103.80	104.15	104.26	104.15	103.79	103.98	104.33	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.65	0.10	0.72

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 150.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	150.35	0.35	0.39
#2	150.43	0.43	0.39
#3	149.42	-0.58	0.39
#4	150.13	0.13	0.39
#5	150.51	0.51	0.39
#6	150.30	0.30	0.39
#7	149.56	-0.44	0.40
#8	150.00	0.00	0.39
#9	150.33	0.33	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
150.0	150.0	150.0	150.35	150.43	149.42	150.13	150.51	150.30	149.56	150.00	150.33	0.40

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
150.0	0.99	0.09	1.21

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	180.31	0.31	0.49
#2	180.46	0.46	0.49
#3	179.05	-0.95	0.50
#4	179.99	-0.01	0.49
#5	180.71	0.71	0.49
#6	180.36	0.36	0.50
#7	179.39	-0.61	0.50
#8	180.02	0.02	0.49
#9	180.51	0.51	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.31	180.46	179.05	179.99	180.71	180.36	179.39	180.02	180.51	0.50

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.65	0.11	1.83

Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31241025
Model:	UFE 400	Issued Date:	17 May 2024
Serial No.(or ID):	G412.0022	Job No.:	WO-00027714
Manufacturer:	Memmert	Page:	1 of 5
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	27 °C	±	1.0	°C
Humidity:	56 %RH	±	5.7	%RH
Voltage:	230 VAC	±	2.1	VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Nakarin Ruenros

Calibration Date: 16 May 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230023

[redacted]
Person in charge

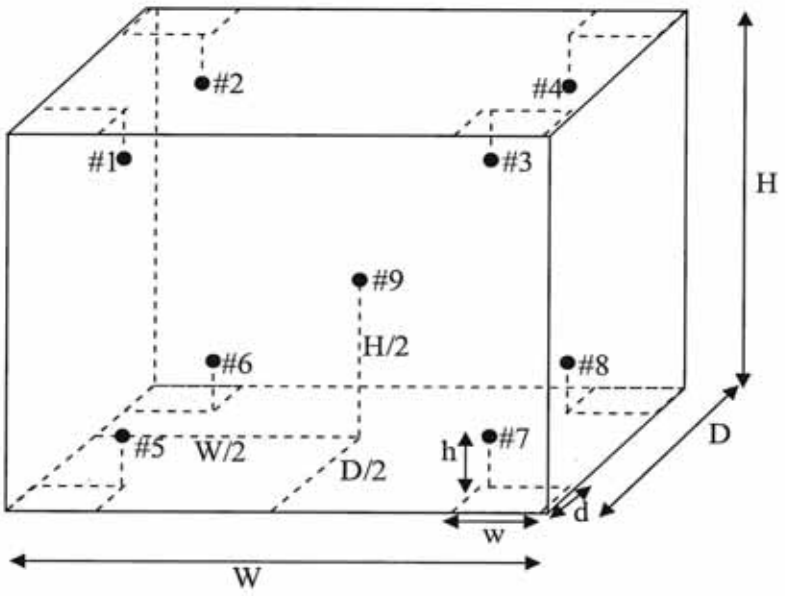
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Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:	W = 40 (cm)	D = 33 (cm)	H = 40 (cm)
Standard Locations (#1, #2, #3, #4):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 5 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.27	0.27	0.39
#2	104.30	0.30	0.39
#3	103.80	-0.20	0.39
#4	104.15	0.15	0.39
#5	104.26	0.26	0.39
#6	104.15	0.15	0.39
#7	103.79	-0.21	0.39
#8	103.98	-0.02	0.39
#9	104.33	0.33	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.27	104.30	103.80	104.15	104.26	104.15	103.79	103.98	104.33	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.65	0.10	0.72

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 150.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	150.35	0.35	0.39
#2	150.43	0.43	0.39
#3	149.42	-0.58	0.39
#4	150.13	0.13	0.39
#5	150.51	0.51	0.39
#6	150.30	0.30	0.39
#7	149.56	-0.44	0.40
#8	150.00	0.00	0.39
#9	150.33	0.33	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
150.0	150.0	150.0	150.35	150.43	149.42	150.13	150.51	150.30	149.56	150.00	150.33	0.40

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
150.0	0.99	0.09	1.21

Note: * Maximum uncertainty of the each position

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Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	180.31	0.31	0.49
#2	180.46	0.46	0.49
#3	179.05	-0.95	0.50
#4	179.99	-0.01	0.49
#5	180.71	0.71	0.49
#6	180.36	0.36	0.50
#7	179.39	-0.61	0.50
#8	180.02	0.02	0.49
#9	180.51	0.51	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.31	180.46	179.05	179.99	180.71	180.36	179.39	180.02	180.51	0.50

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.65	0.11	1.83

Note: * Maximum uncertainty of the each position

The End of Certificate

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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Liquid Bath	Certificate No.:	C13230368
Model:	1013	Issued Date:	06 November 2023
Serial No. (or ID.):	10637804J (WM-WB-01/05)	Job No.:	WO-00008954
Manufacturer:	GFL	Page:	1 of 3
Condition:	In Condition		
Forced Circulation:	None		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	24 °C	±	0.6 °C
Humidity:	50 %RH	±	4.4 %RH
Voltage:	224 VAC	±	2.5 VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiological Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphakorn Sookmee

Calibration Date: 06 November 2023

The Method used: In house method, CAL-WI-17, base on ASTM E715-80

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230019

([redacted]
Person in charge

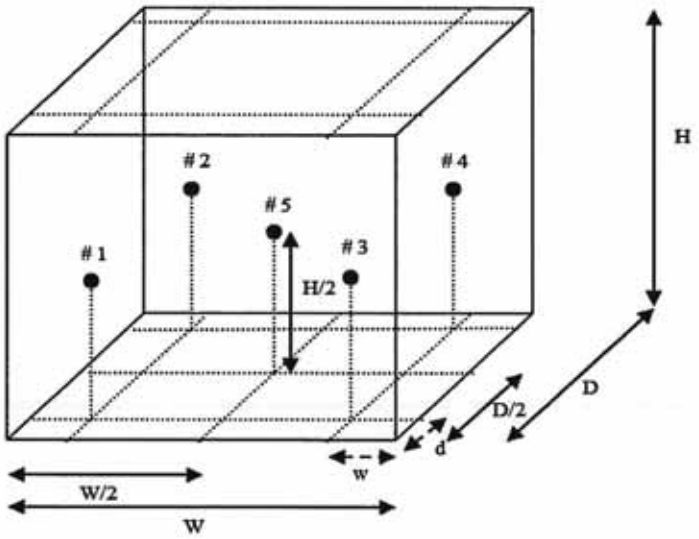
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Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath:	W =	40	(cm)	D =	25	(cm)	H = 17	(cm)	Volume = 17 (Liters)
Standard Locations #1:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #2:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #3:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #4:				w =	5	(cm)	d = 5	(cm)	

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	301	302	303	304	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the bath.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 44.5 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	44.50	0.00	0.15
#2	44.49	-0.01	0.16
#3	44.46	-0.04	0.15
#4	44.48	-0.02	0.15
#5	44.49	-0.01	0.15

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
44.5	44.5	44.5	44.50	44.49	44.46	44.48	44.49	0.16

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
44.5	0.04	0.03	0.07

Note: * Maximum uncertainty of the each position

The End of Certificate

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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Liquid Bath	Certificate No.:	C13240371
Model:	1013	Issued Date:	08 November 2024
Serial No. (or ID.):	10637804J (WM-WB-01/05)	Job No.:	WO-00047861
Manufacturer:	GFL	Page:	1 of 3
Condition:	In Condition		
Forced Circulation:	None		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	25 °C	±	1.3 °C
Humidity:	51 %RH	±	5.2 %RH
Voltage:	229 VAC	±	2.0 VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiological Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphanimit Khamnonphoem

Calibration Date: 05 November 2024

The Method used: In house method, CAL-WI-17, base on ASTM E715-80

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240005

[redacted]

Person in charge

[redacted]

Authorized signatory

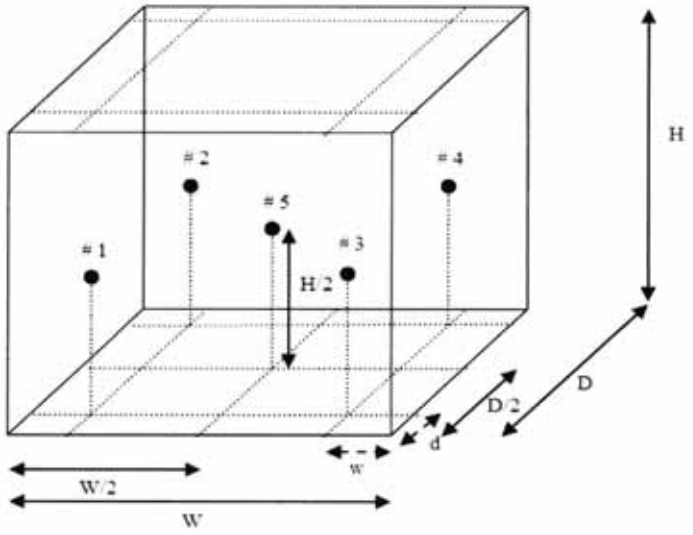
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Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath:	W =	40	(cm)	D =	25	(cm)	H = 17	(cm)	Volume = 17 (Liters)
Standard Locations #1:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #2:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #3:				w =	5	(cm)	d = 5	(cm)	
Standard Locations #4:				w =	5	(cm)	d = 5	(cm)	

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	301	302	303	304	305

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the bath.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 44.5 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	44.39	-0.11	0.15
#2	44.48	-0.02	0.15
#3	44.43	-0.07	0.15
#4	44.34	-0.16	0.15
#5	44.40	-0.10	0.16

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
44.5	44.5	44.5	44.39	44.48	44.43	44.34	44.40	0.16

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
44.5	0.12	0.03	0.16

Note: * Maximum uncertainty of the each position

The End of Certificate

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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Autoclave	Certificate No.:	C11230236
Model:	88	Issued Date:	13 December 2023
Serial No. (or ID.):	105611	Job No.:	WO-00011851
Manufacturer:	ALP	Page:	1 of 3
Condition:	In Condition		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Suanluang, Bangkok 10250 Thailand.

Environment Condition:

Temperature:	26 °C	±	0.6 °C
Humidity:	51 %RH	±	4.0 %RH
Voltage:	226 VAC	±	1.5 VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiogy Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
On-nuch, Suanluang, Bangkok 10250 Thailand.

Calibration By: Mr. Siwapan Srijan

Calibration Date: 13 December 2023

The Method used: In house method, CAL-WI-18, base on BS 2646 : Part 5

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality reborn Co., Ltd.
Certificate No.QR23-0487

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Person in charge

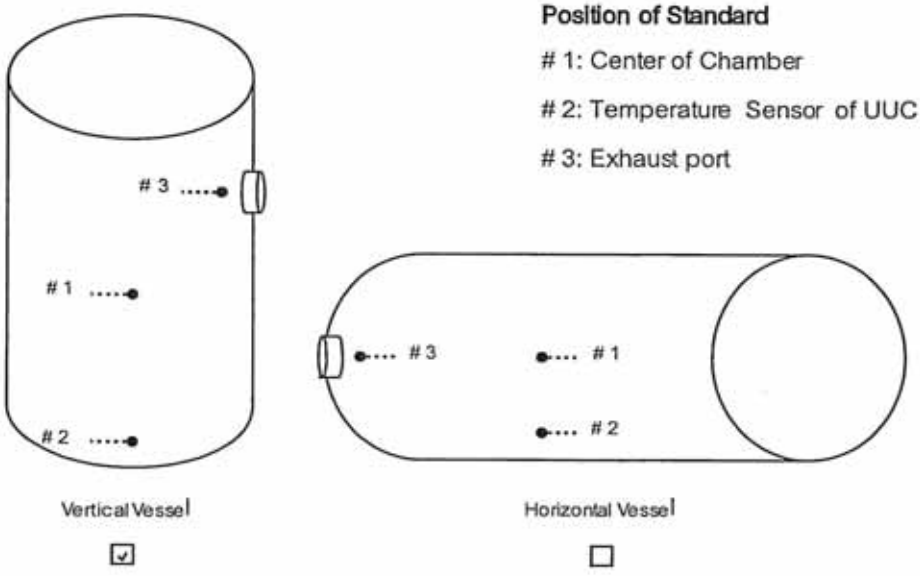
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Standard Installation Locations

Standard Locations (#1): Geometric center of the chamber

Standard Locations (#2): Distance from temperature sensor of UUC 2 (cm.)

Standard Locations (#3): Distance from the wall 5 (cm.)

Position of Std	#1	#2	#3
Channel of Logger	10	11	12

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 121 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	121.02	0.02	1.8
#2	121.02	0.02	1.9
#3	121.05	0.05	2.0

Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating kg/cm²	#1 (°C)	#2 (°C)	#3 (°C)	(± °C)*
121	121	121	1.2	121.02	121.02	121.05	2.0

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure kg/cm²	Measured Stability (± °C)
121	1.2	1.63

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

The End of Certificate

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NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Autoclave	Certificate No.:	C11240219
Model:	88	Issued Date:	13 December 2024
Serial No. (or ID.):	105611	Job No.:	WO-00054728
Manufacturer:	ALP	Page:	1 of 3
Condition:	In Condition		

Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Environment Condition:

Temperature:	27 °C	±	0.5 °C
Humidity:	53 %RH	±	3.1 %RH
Voltage:	227 VAC	±	3.6 VAC

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiogy Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Piyapat Saidoung

Calibration Date: 12 December 2024

The Method used: In house method, CAL-WI-18, base on BS 2646 : Part 5

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality reborn Co., Ltd.
Certificate No.QR24-0463

[redacted]
Person in charge

[redacted]
Authorized signatory

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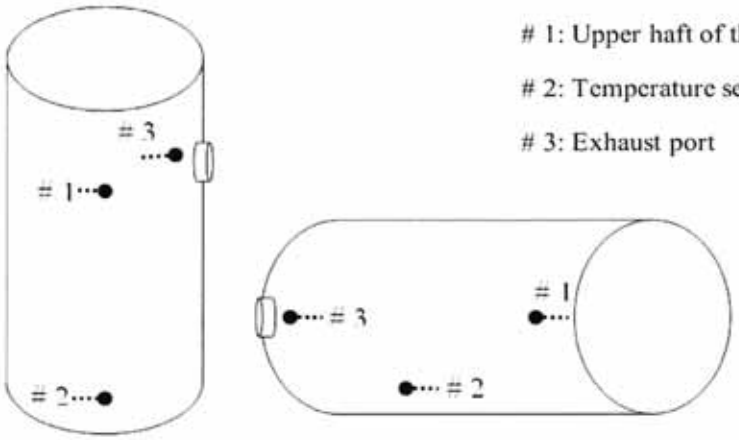
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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Position of Standards

1: Upper haft of the chamber

2: Temperature sensor of UUC

3: Exhaust port



Vertical ☑ Horizontal ☐

Standard Installation Locations

Standard Locations (#1): Geometric center of the chamber

Standard Locations (#2): Distance from temperature sensor of UUC 2 (cm.)

Standard Locations (#3): Distance from the wall 5 (cm.)

Position of Std	#1	#2	#3
Channel of Logger	10	11	12

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 121 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	121.14	0.14	2.1
#2	121.20	0.20	2.0
#3	121.15	0.15	1.9

Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating kg/cm²	#1 (°C)	#2 (°C)	#3 (°C)	(± °C)*
121	121	121	1.2	121.14	121.20	121.15	2.1

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure kg/cm²	Measured Stability (± °C)
121	1.2	1.69

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

บริษัท ปิ่นทองกรุ๊ป แมนเนจเม้นท์ แอนด์ คอนซัลแตนท์ จำกัด
PINTHONG GROUP MANAGEMENT AND CONSULTANTS CO.,LTD
27 ถนนพระรามที่ 2 แขวงท่าข้าม เขตบางขุนเทียน กรุงเทพมหานคร 10150
Tel. 02-416-9779 (12 คู่สาย) Fax 02- 417-0154-9 www.pinthong-group.com E-mail : pmc@pinthong-group.com
PINTHONG GROUP
www.pinthong-group.com

Calibration Test Report

Calibrated at : บริษัท ไทยชินกง อินดัสตรี คอร์ปอเรชั่น จำกัด
Reference Standard : Sound Calibrator Class 1 Model QC-10
Serial No.QIG030022
Date of Calibration : 07/5/2024

Date	Serial No.	Reference Standard (dB)	Insrument Reading (dB)	Adjust	Error (dB)	After Use	Error (dB)	Inspection Result	Calibrated By
19/7/2567	112033	114.0	114.0	114.0	0.0	114.0	0.0	Pass	พิทักษ์ธรรม ต.
19/7/2567	820752	114.0	114.0	114.0	0.0	114.0	0.0	Pass	พิทักษ์ธรรม ต.
19/7/2567	820755	114.0	114.0	114.0	0.0	114.0	0.0	Pass	พิทักษ์ธรรม ต.
19/7/2567	820756	114.0	114.0	114.0	0.0	114.0	0.0	Pass	พิทักษ์ธรรม ต.

หมายเหตุ : **Error ± 1.5 dB**

P.M.C. PINTHONG GROUP

Approve By : [redacted]

Date : .....19.../....ก.ค.../... 2567...

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WK Electric Co.,Ltd.
68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Certificate of Calibration

Certificate No. : WK2405-033-1

Customer : Pinthong Group Management and Consultants Co.,Ltd.
27 Rama 2 Road, Thakham,
Bangkuntien, Bangkok, 10150, Thailand.

Instrument	: Calibrator	Ambient Temperature	: (23 ± 2)°C
Manufacturer	: Quest Technologies	Humidity	: (50 ±15) %RH
Model	: QC-10	Received Date	: 3-May-24
Serial No.	: QIG030022	Calibrated Date	: 7-May-24
Identity No.	: N/A	Issued Date	: 8-May-24
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: See to Data		

Calibration Method : CP-WK-A02, CP-WK-TF03, CP-WK-E19

Reference Standard Instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Data Acquisition/Switch Unit	MY41011202	WK2401-049-1	5-Jan-25	WK Electric Co.,Ltd
Sound Level Calibrator	10049416	EEL.BP.196/0166	27-Jan-25	TISTR
Universal Counter	3416A08501	TTH-0-89055	19-Feb-26	Techmaster
Audio Analyzer	3413A14479	E3U2400174	13-Feb-26	NA

TISTR : Thailand Institute of Scientific and Technological Research.
Techmaster : Techmaster Asia (Thailand) Co., Ltd.
NA : NA Caltechnologies., Ltd.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Kritsada Ouparattha

Approved by : [redacted]
Authorized Signatory

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Calibration Results

Calibration Results

Function : Sound Level Pressure Measurement @ 1kHz

Nominal Value (dB)	STD Value (dB)	Error (dB)	(±) Uncertainty (dB)
94	113.97	0.03	0.061

Function : Frequency Measurement

Nominal Value (Hz)	STD Value (Hz)	Error (Hz)	(±) Uncertainty (Hz)
1000	1000.023	-0.023	0.58

(X) Without Adjustment ( ) After Adjustment

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**** End of Certificate****

WK Electric Co.,Ltd.
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Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Certificate of Calibration

Certificate No.: WK2403-103-2

Customer : PINTHONG GROUP MANAGEMENT AND CONSULTANTS CO.,LTD.
27 Rama 2 Road, Thakham, Bangkuntien,
Bangkok 10150 Thailand

Instrument	: Sound Level Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: N/A	Humidity	: (50 ±15) %RH
Model	: TYPE 6236	Received Date	: 11-Mar-24
Serial No.	: 112033	Calibrated Date	: 12-Mar-24
Identity No.	: N/A	Issued Date	: 18-Mar-24
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: 0.1 dB		
Calibration Method	: CP-WK-A01		

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Sound Level Calibrator	10049416	EEL.BP. 196/0166	27-Jan-25	TISTR

TISTR : Thailand Institute of Scientific and Technological Research.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr. Chanwit Phumiphaksuwan

Approved by : [redacted]

Authorized Signatory

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Calibration Results

Certificate No. : WK2403-103-2

Calibration Result of the Accuracy

Function : Sound Level Measurement at 1 kHz

Range : A Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.2	0.2	0.20

Range : A Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	93.9	-0.1	0.20
114	114.2	0.2	0.20

Range : C Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.2	0.2	0.20

Range : C Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	93.9	-0.1	0.20
114	114.2	0.2	0.20

(X) Without Adjustment ( ) After Adjustment

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**** End of Certificate****

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Certificate of Calibration

Certificate No.: WK2405-033-2

Customer : Pinthong Group Management and Consultants Co.,Ltd.
27 Rama 2 Road, Thakham,
Bangkuntien, Bangkok, 10150, Thailand.

Instrument	: Sound Level Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Scarlet Tech	Humidity	: (50 ±15)%RH
Model	: ST 21D	Received Date	: 3-May-24
Serial No.	: 820752	Calibrated Date	: 7-May-24
Identity No.	: N/A	Issued Date	: 8-May-24
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: 0.1 dB		

Calibration Method : CP-WK-A01

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Sound Level Calibrator	10049416	EEL.BP. 196/0166	27-Jan-25	TISTR

TISTR : Thailand Institute of Scientific and Technological Research.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr. Kritsada Ouparattha

Approved by : [redacted]

Authorized Signatory

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Calibration Results

Certificate No. : WK2405-033-2

Calibration Result of the Accuracy

Function : Sound Level Measurement at 1 kHz

Range : A Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

Range : A Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

Range : C Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

Range : C Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

(X) Without Adjustment ( ) After Adjustment

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Certificate of Calibration

Certificate No.: WK2405-033-4

Customer : Pinthong Group Management and Consultants Co.,Ltd.
27 Rama 2 Road, Thakham,
Bangkuntien, Bangkok, 10150, Thailand.

Instrument	: Sound Level Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Scarlet Tech	Humidity	: (50 ±15)%RH
Model	: ST 21D	Received Date	: 3-May-24
Serial No.	: 820755	Calibrated Date	: 7-May-24
Identity No.	: N/A	Issued Date	: 8-May-24
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: 0.1 dB		

Calibration Method : CP-WK-A01

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Sound Level Calibrator	10049416	EEL.BP. 196/0166	27-Jan-25	TISTR

TISTR : Thailand Institute of Scientific and Technological Research.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr. Kritsada Ouparattha

Approved by : [redacted]
Authorized Signatory

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WK Electric Co.,Ltd.
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Calibration Results

Certificate No. : WK2405-033-4

Calibration Result of the Accuracy

Function : Sound Level Measurement at 1 kHz

Range : A Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.1	0.1	0.20

Range : A Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.1	0.1	0.20

Range : C Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.0	0.0	0.20

Range : C Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.0	0.0	0.20

(X) Without Adjustment ( ) After Adjustment

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**** End of Certificate****

WK Electric Co.,Ltd.

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Certificate of Calibration

Certificate No.: WK2405-033-5

Customer : Pinthong Group Management and Consultants Co.,Ltd.
27 Rama 2 Road, Thakham,
Bangkuntien, Bangkok, 10150, Thailand.

Instrument	: Sound Level Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Scarlet Tech	Humidity	: (50 ±15)%RH
Model	: ST 21D	Received Date	: 3-May-24
Serial No.	: 820756	Calibrated Date	: 7-May-24
Identity No.	: N/A	Issued Date	: 8-May-24
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: 0.1 dB		

Calibration Method : CP-WK-A01

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Sound Level Calibrator	10049416	EEL.BP. 196/0166	27-Jan-25	TISTR

TISTR : Thailand Institute of Scientific and Technological Research.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr. Kritsada Ouparattha

Approved by : [redacted]
Ms. Budsagorn Patcha
Authorized Signatory

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WK Electric Co.,Ltd.

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Calibration Results

Certificate No. : WK2405-033-5

Calibration Result of the Accuracy

Function : Sound Level Measurement at 1 kHz

Range : A Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.0	0.0	0.20

Range : A Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	114.0	0.0	0.20

Range : C Mode : Fast Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

Range : C Mode : Slow Resolution : 0.1 dB

STD Setting	UUC Reading	Error	Uncertainty (± dB)
94	94.0	0.0	0.20
114	113.9	-0.1	0.20

(X) Without Adjustment ( ) After Adjustment

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**** End of Certificate****

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. : 23E3924

Equipment :	pH Meter
Manufacturer:	Mettler Toledo
Model :	SevenExcellence
Serial No.:	B834291445
ID No.:	RYG_EN0152
Condition As-Received:	Used Item
Received Date:	08 December 2023
Calibration Date:	14 December 2023
Reference:	2312-0151DSC
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 10) %

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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	5502A	2435802	EE-0041-23	26 Apr 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:-

-National Institute of Metrology Thailand (NIMT)

REVIEW BY .....[redacted]

APPROVED BY

NEXT CAL. DATE 14/12/24

Calibrated by : Napachanok Prasomsoosiri
Issue Date : 15 December 2023

Approved Signatory :

[ ] Phalinee Prabpaipal
[✓] Nuntawat Khamchai
[ ] Pongsagorn Boonyaporn

B 0331106

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

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

Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	(± μV)
-200.0000	-199.9	0.1	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	100.0	0.0	63
150.0000	150.0	0.0	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.

-o0o-

a 1193422

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

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenExcellence
Serial No. :	B834291445
ID No. :	RYG_EN0152
Condition As-Received:	Used Item
Received Date :	08 December 2023
Calibration Date :	15 December 2023
Reference :	2312-0151DSC-3
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 standard thermometer

Calibrated by : [redacted]

Approved by :

( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul
(✓) Ponpan Paipim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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
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	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 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	Coverage factor
	pH	mV	mV	pH	(±mV)	*k*
pH Meter	4.000	177.48	177.3	4.000	0.058	2.00
S/N.: B834291445	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

[redacted]

a 1193852

Calibration Results

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 Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.013	184.1	0.0045	2.00
S/N.: 3225368	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225368

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	25.003	24.3	-0.703	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-o0o-

[redacted]

a 1193851

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REVIEW BY [redacted]
APPROVED
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 Patthanakarn 40, Patthanakarn 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

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**			

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1 Name:	Front 5977A	SSL	/ External	SQ	
Setpoint Status:	**Pass**				

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

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1 Name:	Front 5977A	SSL	/ External	SQ	
Setpoint Status:	**Pass**				
Filament:	1				
Setpoint Status:	**Pass**				
Filament:	2				

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1 Name:	Front 5977A	SSL	/ External	SQ	

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: 16588

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 (µL)	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	US1415M209
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

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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

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User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX402

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

User Name: supasak.nimsongtham
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 10:24:10 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 10:34:59 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

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User Name: supasak.nimsongtham
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 10:35:00 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 13, 2023 10:35:27 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 10:36:39 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
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 11:32:38 AM	Start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:33:06 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 11:49:38 AM	Start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:49:42 AM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
December 13, 2023 11:49:43 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	AceClosed	Session	None
December 13, 2023 12:36:39 PM	Audit	AceRestarted	Session	None
December 13, 2023 12:36:40 PM	Audit	SessionReloaded	Session	None
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

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User Name: supasak.nimsongtham
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 12:37:33 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 12:39:51 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 12:39:51 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 12:42:00 PM	End	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

User Name: supasak.nimsongtham
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 12:43:54 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 : 2
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\1\data \OQ2023\S2N_F1.D
December 13, 2023 1:55:22 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 3
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 : 3
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 2:14:32 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

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 2:15:03 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 2:25:07 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 2:25:07 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:25:20 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\1\data \OQ2023\S2N_F2.D
December 13, 2023 2:25:41 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\1\data \OQ2023\S2N_F2.D

User Name: supasak.nimsongtham
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 2:41:26 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\1\data \OQ2023\S2N_F2_001.D
December 13, 2023 2:44:32 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

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User Name: supasak.nimsongtham

System Id: GM-7

Report Generated by Hostname: ASGKKWX492

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	SessionReloaded	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 3:32:15 PM	Audit	Reporting	Session	Report Generated : Report

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-OQ

REVIEW BY [redacted]

APPROVED

NEXT CAL. DATE 21-Oct-2024

System ID:	GC-5
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Phattanakan 40, Phattanakan Rd., Suan Luang, Bangkok 10250
Date:	April 21, 2023 9:43:59 AM
EQP Name:	AgilentRecommended
EQP Revision:	GC.02.52
Overall Qualification Status:	Pass

CDS Logon Verification - GC

Logon: Sunee Mongkolvorakijchai

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: **Pass**

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890

Front SSL

Setpoint Status:		**Pass**				
Pressure:		25.0	psi			
Pressure Change:		0.4	psi		/5 minutes	
Agilent Recommended:	>=	-2.0	and	<=	0.5	

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.1	psi

Accuracy: 0.1 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890

Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min

Accuracy: 0.5 mL/min

Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 390.6 mL/min

Accuracy: 9.4 mL/min

Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date: April 21, 2023 9:43:59 AM

System ID: GC-5

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Setpoint Status:	Pass					
Flow Type:	Makeup					
Setpoint:	25.0	mL/min		Measured Flow:	24.2	mL/min
Accuracy:		0.8	mL/min			
Agilent Recommended:	<=	10.0	% setpoint	(	2.5	ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:	7890					
Setpoint Status:	**Pass**					
Zone:	Oven					
	Setpoint/Actual					
Temperature:	230.0	230.9	°C			
Accuracy:		0.9	°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	100.1	°C			
Accuracy:		0.1	°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

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Setpoint Status: Pass

		Setpoint/Average	
Temperature:		100.0	100.2167 °C
Stability:			0.1 °C
Agilent Recommended:	<=		0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Injection Tower

Name: 7683B

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Name: 7890

Setpoint Status: Pass

Base Signal: 18.54 pA

		ASTM Noise pA	Drift pA/Hr
		0.05	0.10
Agilent Recommended:	<=	0.10	<= 2.50
Status:		Pass	Pass

Overall Noise and Drift Test Status

Pass

Date: April 21, 2023 9:43:59 AM
System ID: GC-5

Injection Precision

Tested Combination1	Front	SSL	/ Front	FID		
Name:	7683B					
Setpoint Status:	Pass					
Injection Volume on Column:	1.0	uL				
Area RSD:		0.56	%	Retention Time RSD:		0.24	%
Agilent Recommended:	<=	3.00			<=	1.00	

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1	Front	SSL	/ Front	FID	
	Injection Tower				
Name:	7890				
Setpoint Status:	Pass				
Signal to Noise:		765722			
Agilent Recommended:	>=	300000			

Overall Signal to Noise Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	
System ID	GC-5
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Tested Combination1	
Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683B
Model Number	G2913A
Serial Number	CN00259643
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10
Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7683A
Model Number	G2614A
Serial Number	CN81347892
Firmware Revision	A.02.01

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	US10813027
Firmware Revision	A.01.12.1
Component ID/Asset No.	GC-5
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Electronic Signature

Purpose

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Details

Full Name of Signer:	Sunee Mongkolvorakijchai
Logged On User Name:	sunee.mongkolvorakijchai@agilent.com
Signature Creation Date:	April 21, 2023
Reason for Signature:	Executed protocol and published this original version of document

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User Name: sunee.mongkolvorakijchai
Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 20, 2023 12:42:57 PM	Audit	SessionCreated	Session	None
April 20, 2023 12:42:57 PM	Start	Configuration	Session	None
April 20, 2023 12:42:57 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
April 20, 2023 12:47:02 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended],Protocol Revision :[Gc.02.52]
April 20, 2023 12:49:26 PM	End	Configuration	Session	None
April 20, 2023 12:49:31 PM	Start	Qualification	Session	OQ
April 20, 2023 12:49:31 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
April 20, 2023 3:06:36 PM	Audit	AceClosed	Session	None
April 21, 2023 8:42:16 AM	Audit	AceRestarted	Session	None
April 21, 2023 8:50:30 AM	Audit	SessionReloaded	Session	None
April 21, 2023 8:50:31 AM	Start	Qualification	Session	OQ
April 21, 2023 8:50:31 AM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
April 21, 2023 8:51:37 AM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
April 21, 2023 8:51:39 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

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User Name: sunee.mongkolvorakijchai
Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 8:52:12 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
April 21, 2023 8:52:14 AM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
April 21, 2023 8:53:27 AM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
April 21, 2023 8:53:42 AM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
April 21, 2023 8:53:44 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
April 21, 2023 8:53:54 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
April 21, 2023 8:53:56 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 8:54:15 AM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 8:54:19 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

User Name: sunee.mongkolvorakijchai
Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 8:54:22 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 8:54:49 AM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 8:54:51 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
April 21, 2023 8:54:54 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 8:55:21 AM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 8:55:23 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
April 21, 2023 8:55:25 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 8:57:54 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
April 21, 2023 8:57:57 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

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Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 8:58:00 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 8:58:41 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
April 21, 2023 8:58:43 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
April 21, 2023 8:58:47 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
April 21, 2023 9:00:20 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
April 21, 2023 9:00:25 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
April 21, 2023 9:00:28 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
April 21, 2023 9:01:10 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : E:\OQ2023 2023-04-20 15-44-25\SCOUTING.D\FID1 A.ch
April 21, 2023 9:01:51 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1

User Name: sunee.mongkolvorakijchai
Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 9:01:55 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
April 21, 2023 9:02:21 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : E:\OQ2023 2023-04-20 15-44-25\SIGNSDRF_01.D\FID1A.ch
April 21, 2023 9:02:36 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
April 21, 2023 9:02:40 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC02.D\FID1A.ch
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC03.D\FID1A.ch
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC04.D\FID1A.ch
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC05.D\FID1A.ch

User Name: sunee.mongkolvorakijchai
Hostname: 5CG841017D

System Id: GC-5
Print Date: April 21, 2023 9:44:03 AM

6006075750_OQGC5_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC06.D\FID1 A.ch
April 21, 2023 9:03:21 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2023 2023-04-20 15-44-25\INJPREC07.D\FID1 A.ch
April 21, 2023 9:04:01 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
April 21, 2023 9:04:05 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
April 21, 2023 9:04:24 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : E:\OQ2023 2023-04-20 15-44-25\SIGTON.D\FID1A.c h
April 21, 2023 9:04:38 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
April 21, 2023 9:05:27 AM	End	Qualification	Session	OQ
April 21, 2023 9:05:27 AM	Start	Reporting	Session	None
April 21, 2023 9:42:46 AM	Audit	Reporting	Session	Report Generated : Certificate