

ภาคผนวก 7-1

สำเนา ใบสอบเทียบเครื่องมือตรวจวัด
และวิเคราะห์

PM10 Sampler Calibration

SITE

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

DETAIL OF SAMPLER

Sampler Model: TE-6070 PM-10
Motor Model: TISCH
Motor Serial No.: 2184

CONDITIONS

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

CALIBRATION ORIFICE

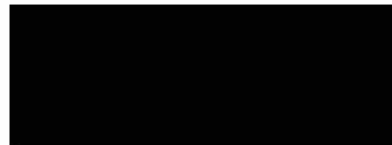
Make : Tisch	Slope :	1.26202
Model : TE-5025A	Intercept:	-0.01176
Serial#: 5		

CALIBRATION

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

of Observations: 5

Calibrated by:



Approved by :



Industrial Hygiene Specialist

PM10 Sampler Calibration

SITE

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

DETAIL OF SAMPLER

Sampler Model: TE-6070 PM-10
Motor Model: TISCH
Motor Serial No.: 2182

CONDITIONS

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

CALIBRATION ORIFICE

Make : Tisch Slope : 1.26202
Model : TE-5025A Intercept: -0.01176
Serial#: 5

CALIBRATION					
Plate or	H ₂ O	Qa	I	IC	LINEAR
Test #	(in)	(m ³ /min)	(chart)	(corrected)	REGRESSION
1	11.40	1.704	56.0	35.48	Slope = 20.1129
2	9.20	1.532	52.0	32.94	Intercept = 1.5322
3	7.30	1.366	46.0	29.14	Corr. coeff. = 0.9966
4	4.70	1.098	36.0	22.81	SFR = 1.140
5	2.80	0.849	30.0	19.00	SSP = 37.75

of Observations: 5

Calibrated by:



Approved by :



Industrial Hygiene Specialist

PM10 Sampler Calibration

SITE

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

DETAIL OF SAMPLER

Sampler Model: TE-6070 PM-10
Motor Model: TISCH
Motor Serial No.: 2095

CONDITIONS

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

CALIBRATION ORIFICE

Make : Tisch Slope : 1.26202
Model : TE-5025A Intercept: -0.01176
Serial#: 5

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

of Observations: 5

Calibrated by:



Approved by :



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 038534

Model : 224-PC X R8

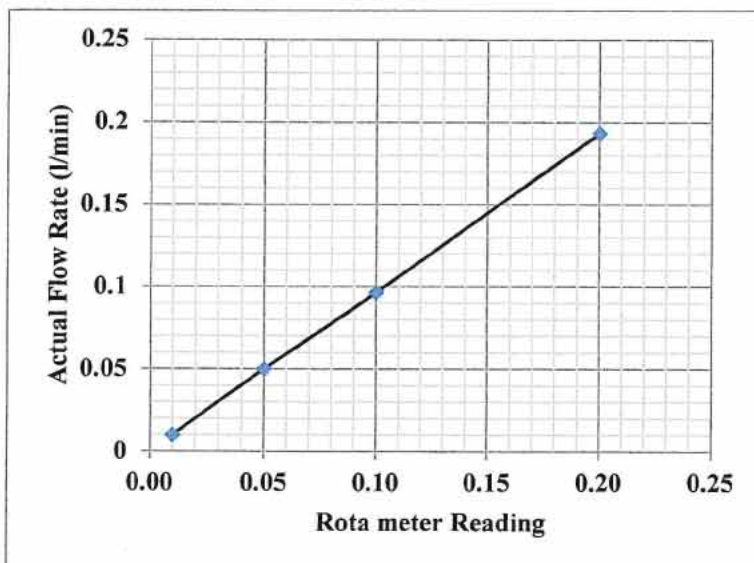
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-14

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.19	0.19	0.20	0.193	0.0058	±0.20	Pass



Calibrated by

[Redacted Signature]

Approved by

[Redacted Signature]

Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 038545

Model : 224-PC X R8

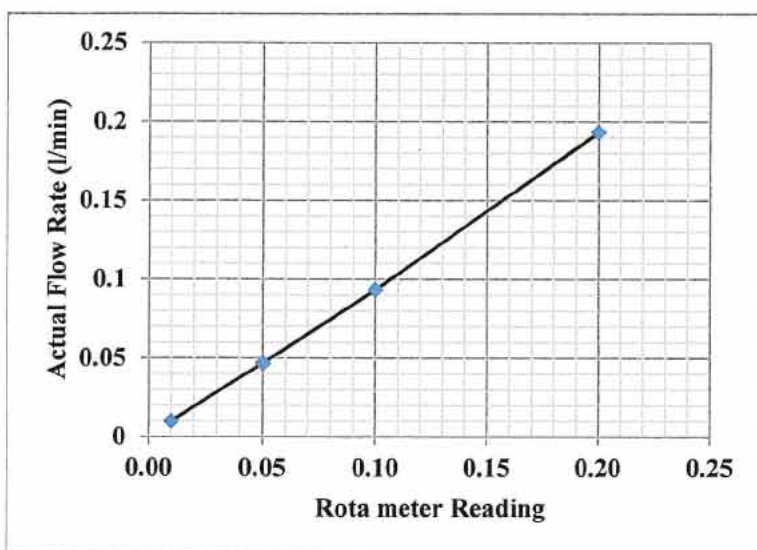
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-17

Next Time Calibration : MARCH 11, 2024

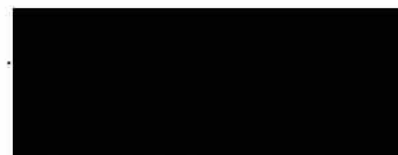
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.05	0.04	0.047	0.0058	±0.10	Pass
0.10	0.10	0.09	0.09	0.093	0.0058	±0.15	Pass
0.20	0.20	0.19	0.19	0.193	0.0058	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. A122843

Model : 224-PC X R8

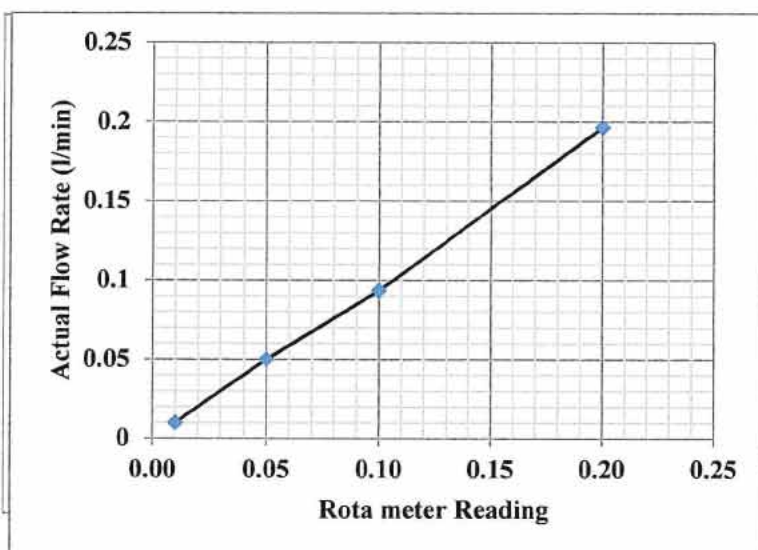
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

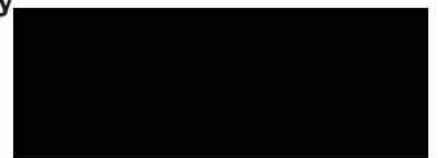
AM-22

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.09	0.093	0.0058	±0.15	Pass
0.20	0.20	0.19	0.20	0.197	0.0058	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. A122854

Model : 224-PC X R8

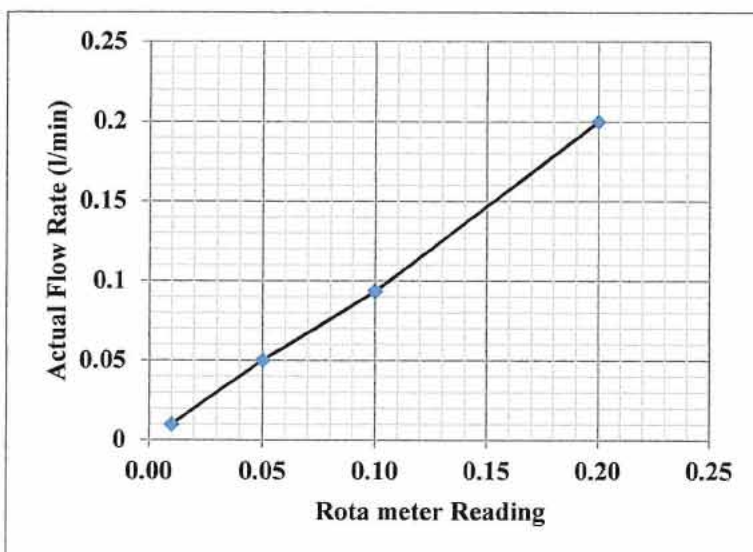
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-23

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.09	0.10	0.09	0.093	0.0058	±0.15	Pass
0.20	0.19	0.20	0.21	0.200	0.0100	±0.20	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20150601076

Model : BDX-II

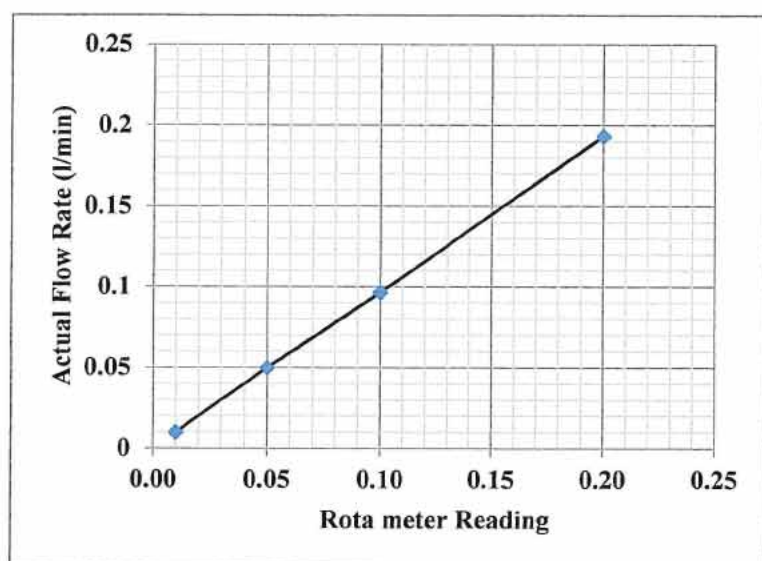
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-01

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.19	0.20	0.19	0.193	0.0058	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20150601080

Model : BDX-II

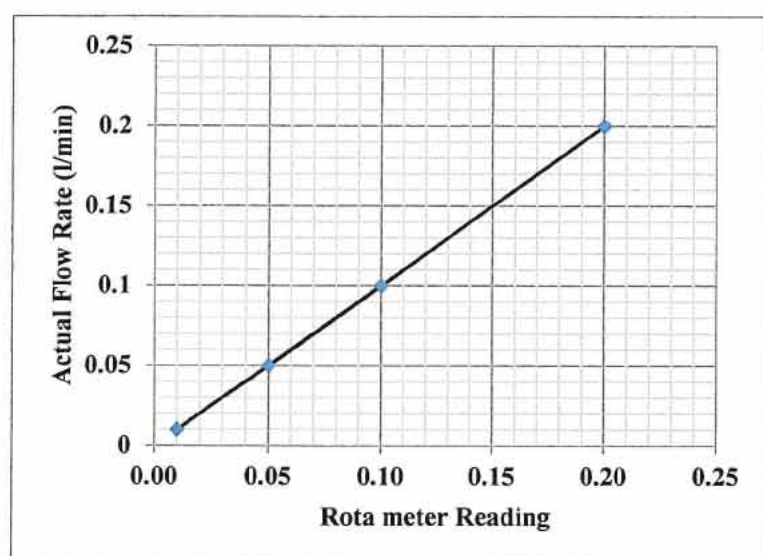
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-04

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.10	0.10	0.100	0.0000	±0.15	Pass
0.20	0.20	0.20	0.20	0.200	0.0000	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104062

Model : BDX-II

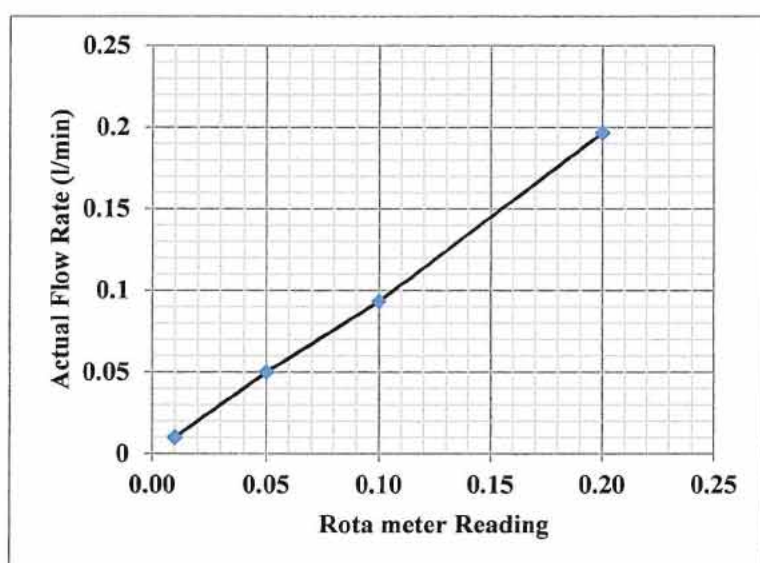
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-08

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.09	0.09	0.10	0.093	0.0058	±0.15	Pass
0.20	0.19	0.20	0.20	0.197	0.0058	±0.15	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104063

Model : BDX-II

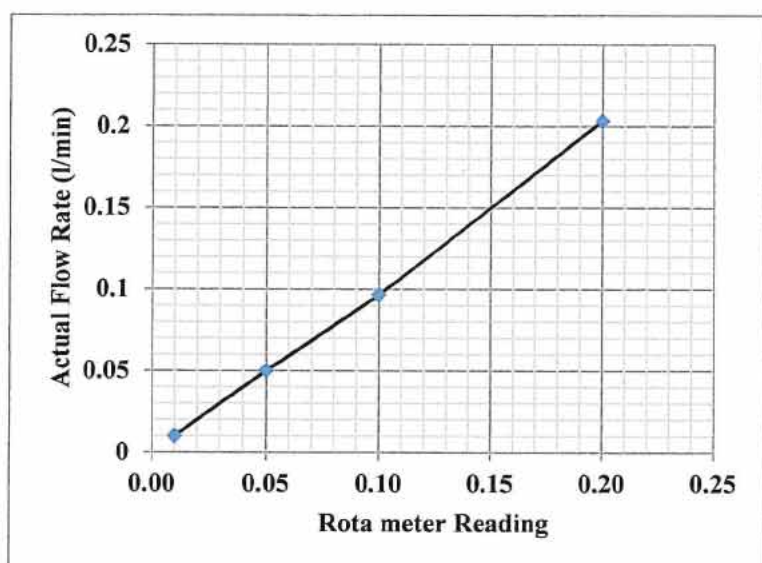
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-09

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.09	0.10	0.10	0.097	0.0058	±0.15	Pass
0.20	0.21	0.20	0.20	0.203	0.0058	±0.15	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104065

Model : BDX-II

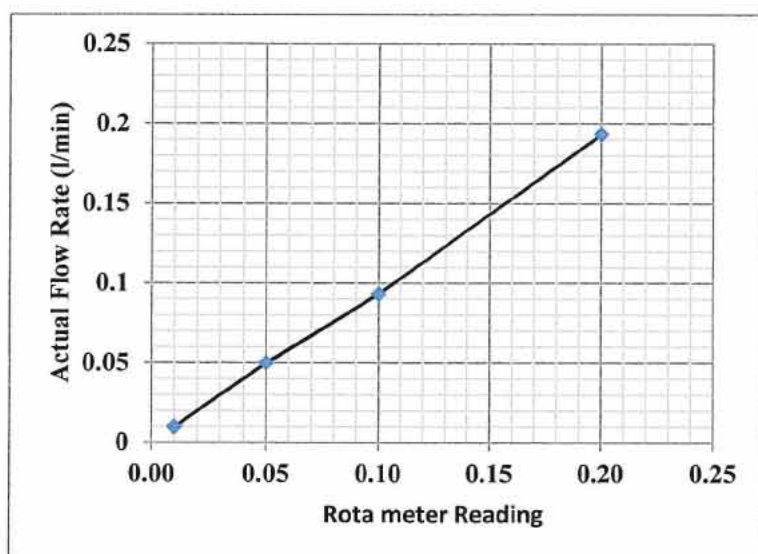
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

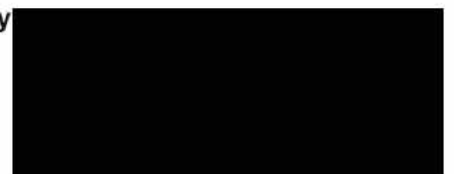
GN-11

Next Time Calibration : MARCH 11, 2024

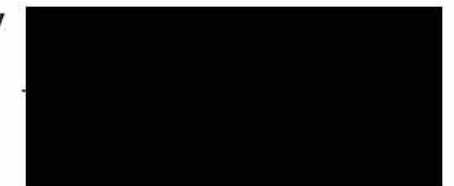
Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.05	0.05	0.050	0.0000	±0.10	Pass
0.10	0.10	0.09	0.09	0.093	0.0058	±0.15	Pass
0.20	0.19	0.19	0.20	0.193	0.0058	±0.20	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104068

Model : BDX-II

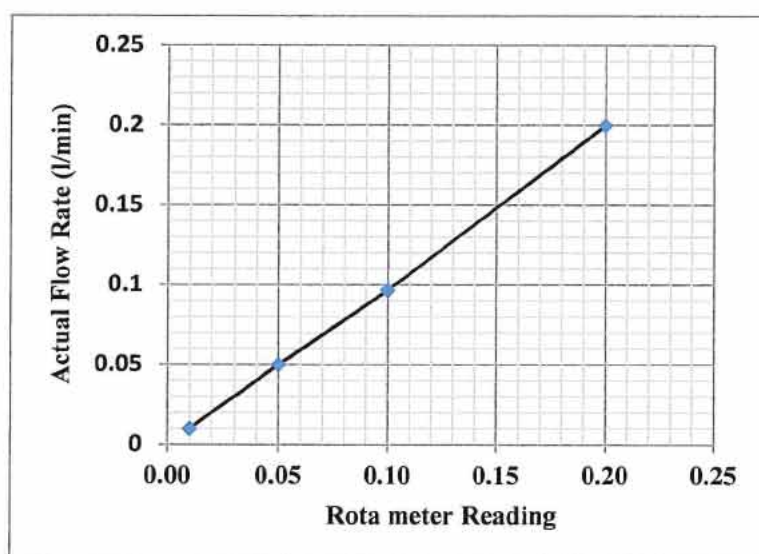
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

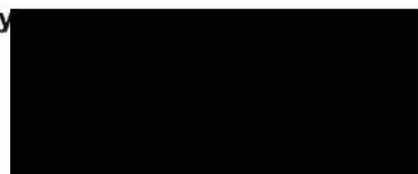
GN-14

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 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	0.09	0.10	0.10	0.097	0.0058	±0.15	Pass
0.20	0.21	0.20	0.19	0.200	0.0100	±0.20	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 038534

Model : 224-PC X R8

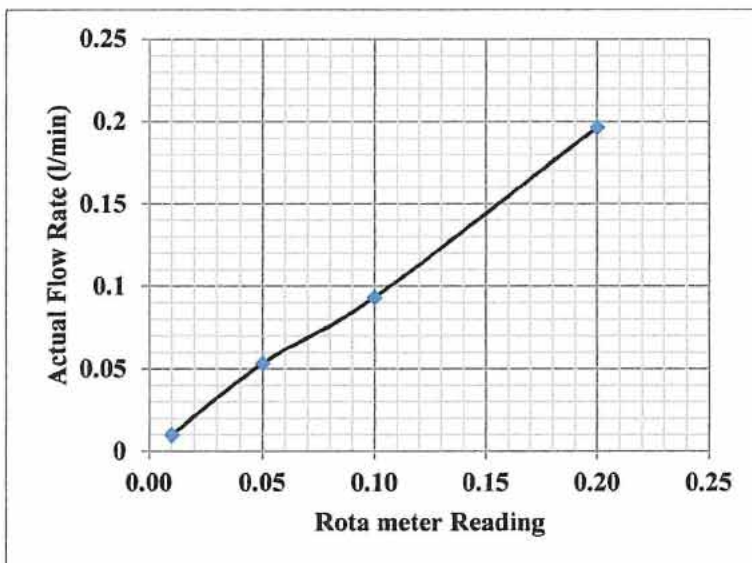
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

AM-14

Next Time Calibration : MARCH 11, 2025

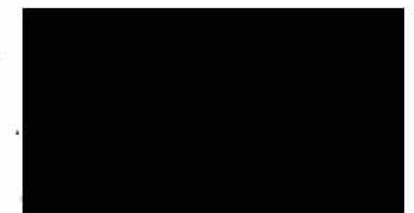
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.06	0.05	0.053	0.0058	±0.10	Pass
0.10	0.09	0.09	0.10	0.093	0.0058	±0.15	Pass
0.20	0.20	0.19	0.20	0.197	0.0058	±0.20	Pass



Calibrated by



Approved by



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 038545

Model : 224-PC X R8

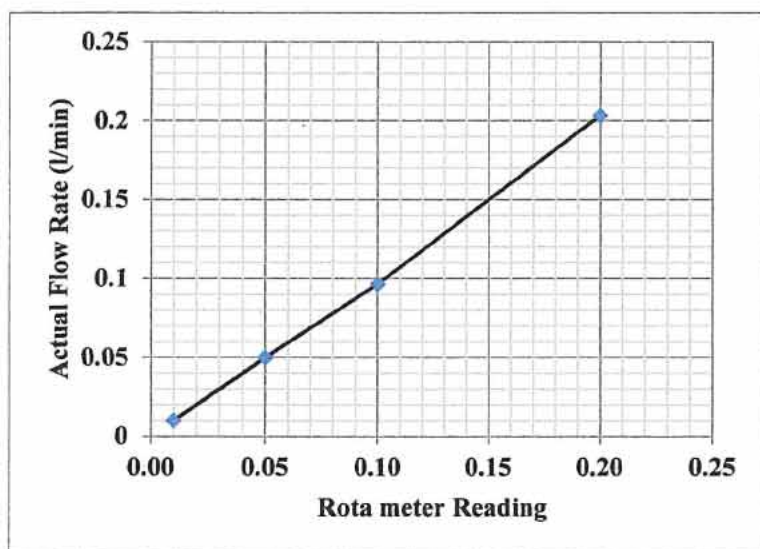
Manufacture : SKC (INC)

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

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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. A122843

Model : 224-PC X R8

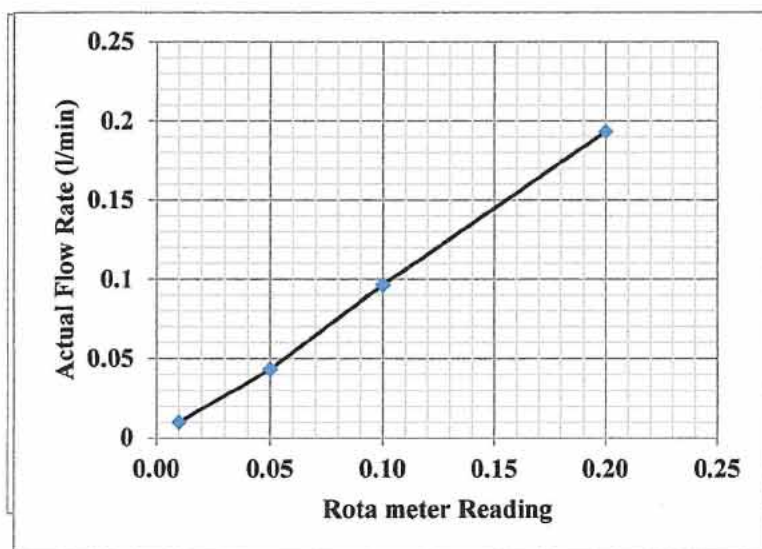
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

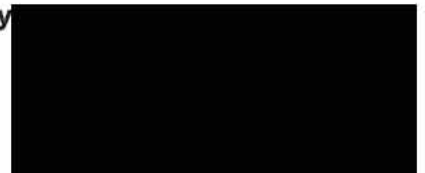
AM-22

Next Time Calibration : MARCH 11, 2025

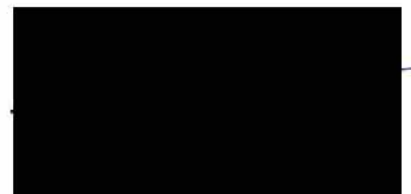
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.04	0.04	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



Approved by



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. A122854

Model : 224-PC X R8

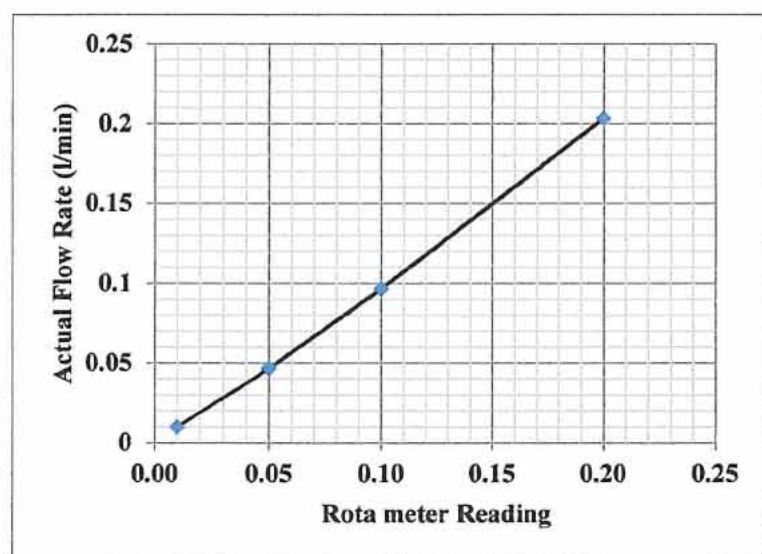
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

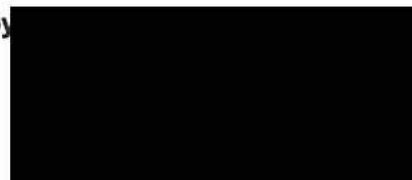
AM-23

Next Time Calibration : MARCH 11, 2025

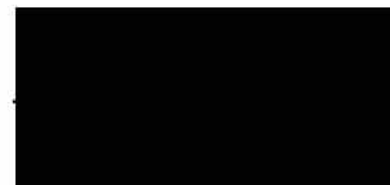
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.04	0.05	0.05	0.047	0.0058	±0.10	Pass
0.10	0.10	0.10	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



Approved by



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20150601076

Model : BDX-II

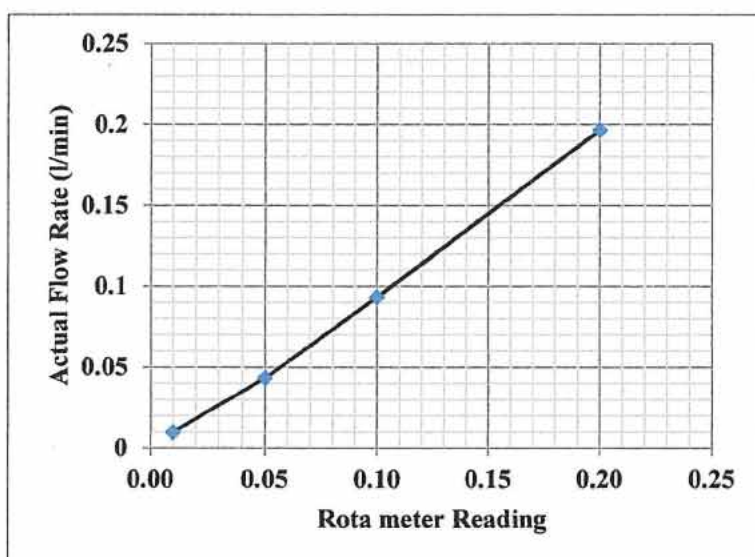
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-01

Next Time Calibration : MARCH 11, 2025

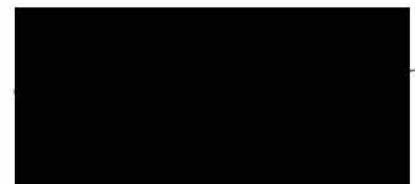
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±0.05	Pass
0.05	0.05	0.04	0.04	0.043	0.0058	±0.10	Pass
0.10	0.09	0.09	0.10	0.093	0.0058	±0.15	Pass
0.20	0.20	0.20	0.19	0.197	0.0058	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20150601080

Model : BDX-II

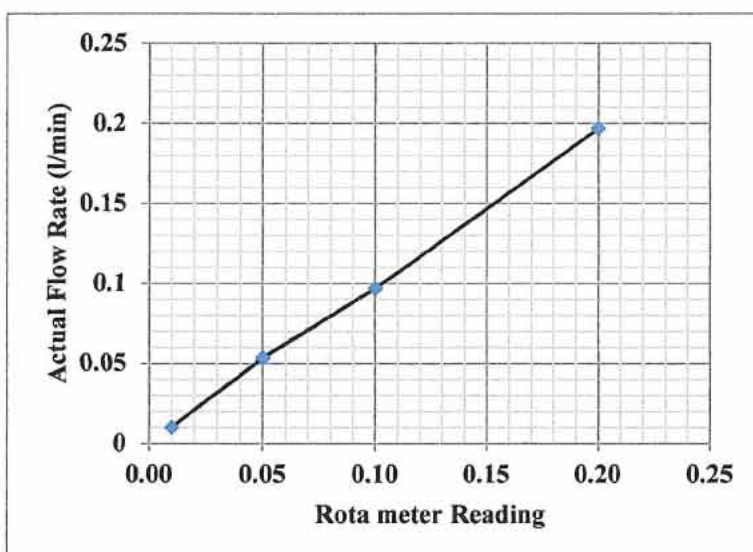
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

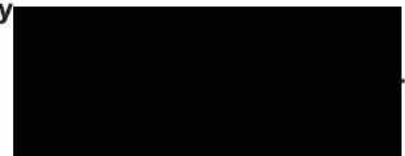
GN-04

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



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104062

Model : BDX-II

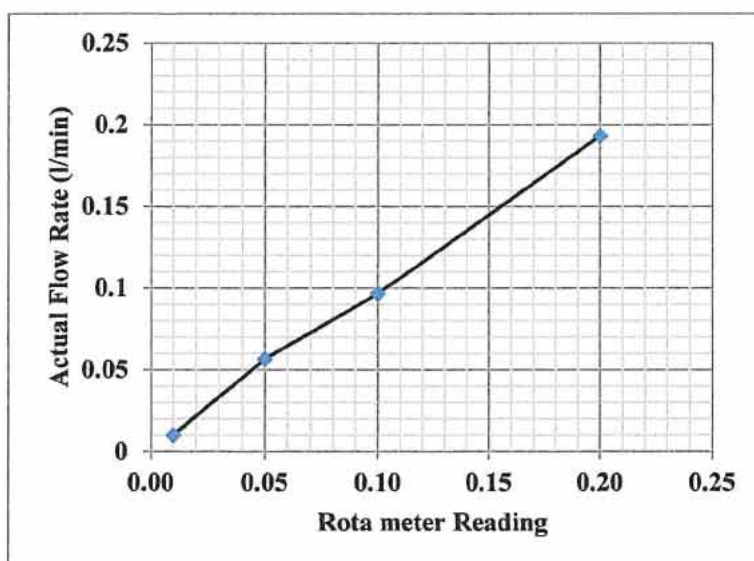
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-08

Next Time Calibration : MARCH 11, 2025

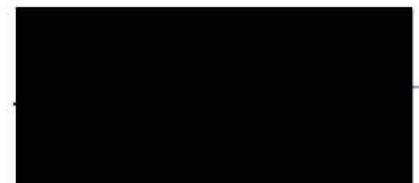
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.01	0.01	0.01	0.01	0.010	0.0000	±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



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104063

Model : BDX-II

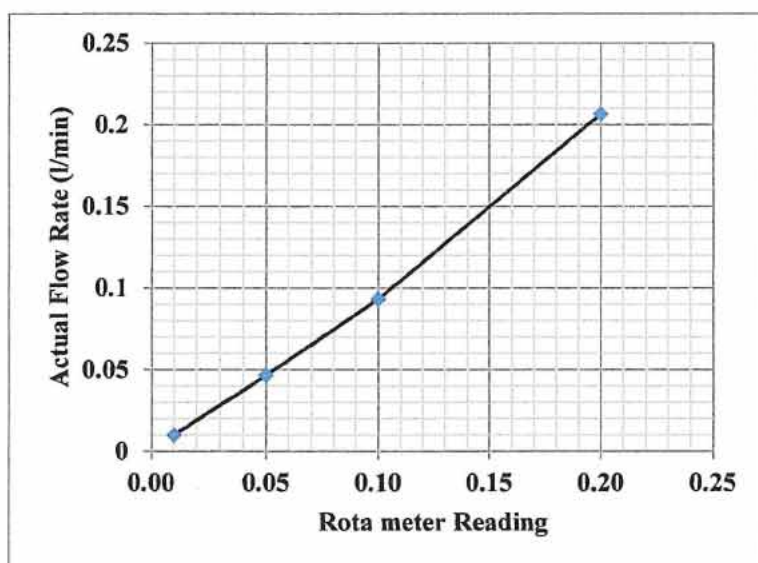
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-09

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	0.09	0.09	0.10	0.093	0.0058	±0.15	Pass
0.20	0.21	0.21	0.20	0.207	0.0058	±0.15	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104065

Model : BDX-II

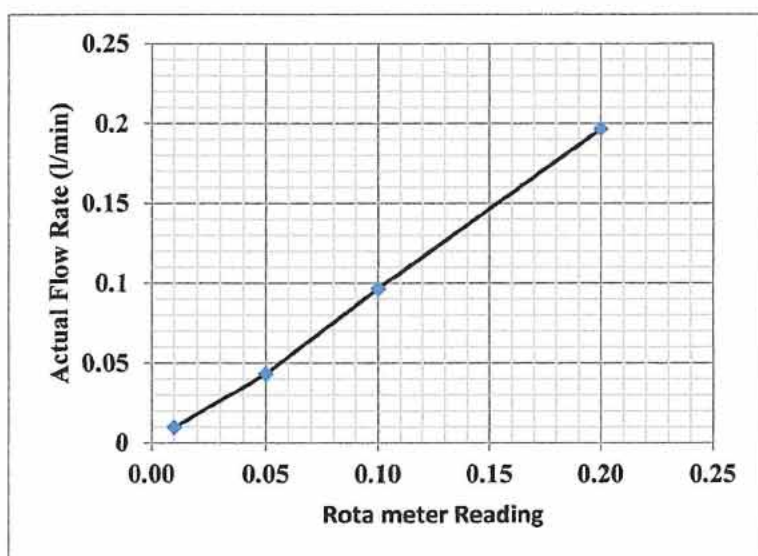
Manufacture : Gillan

Date of Calibration : MARCH 11, 2024

GN-11

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	0.04	0.043	0.0058	±0.10	Pass
0.10	0.10	0.10	0.09	0.097	0.0058	±0.15	Pass
0.20	0.19	0.20	0.20	0.197	0.0058	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (Low Flow)

Serial No. 20170104068

Model : BDX-II

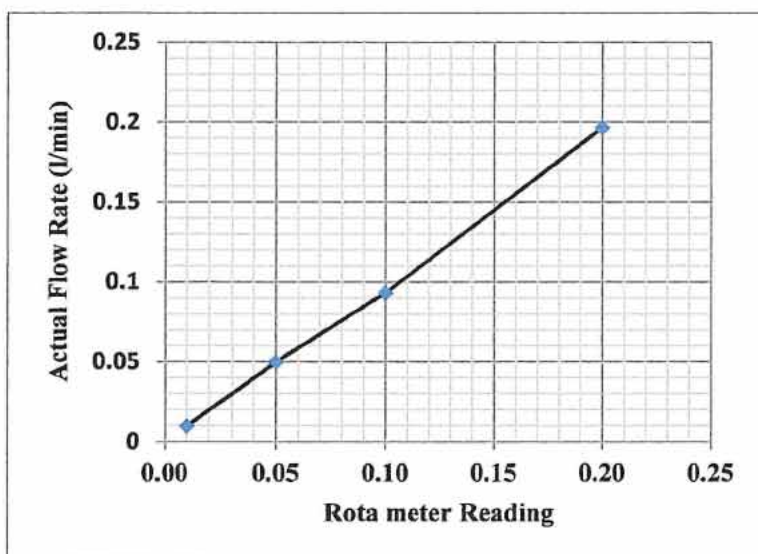
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-14

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	0.05	0.04	0.050	0.0100	±0.10	Pass
0.10	0.09	0.09	0.10	0.093	0.0058	±0.15	Pass
0.20	0.21	0.19	0.19	0.197	0.0115	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 038534

Model : 224-PC X R8

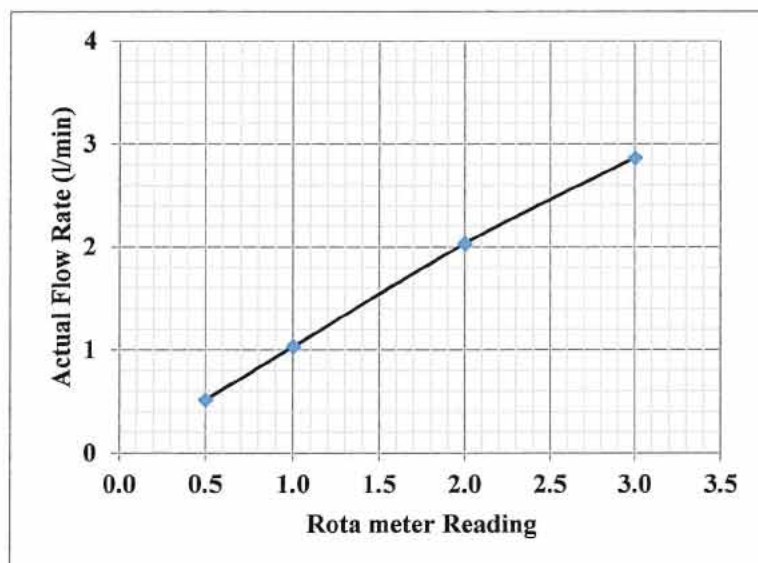
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

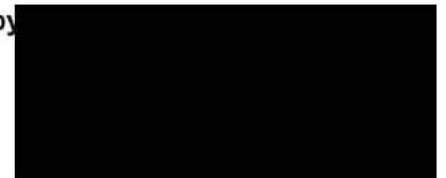
AM-14

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 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	1.05	1.05	1.033	0.0289	±0.10	Pass
2.0	2.05	2.05	2.00	2.033	0.0289	±0.15	Pass
3.0	2.85	2.95	2.80	2.867	0.0764	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 038545

Model : 224-PC X R8

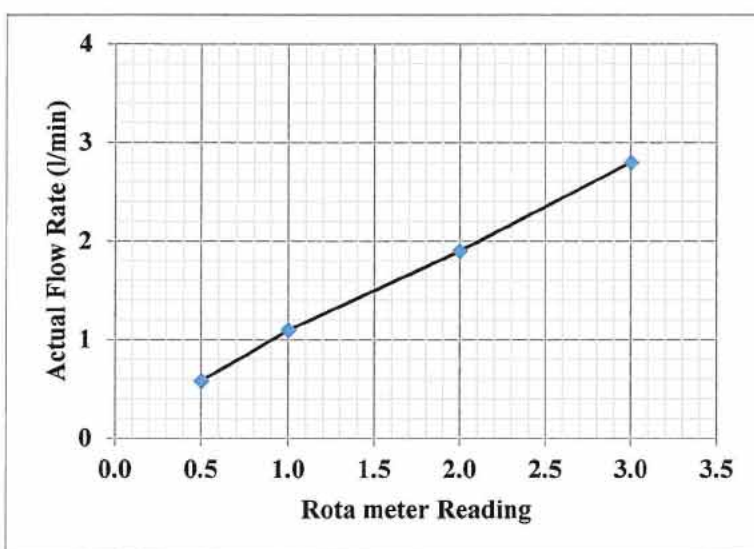
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-17

Next Time Calibration : MARCH 11, 2024

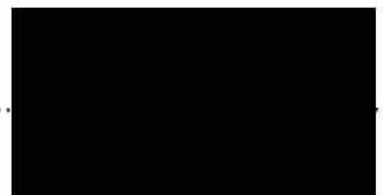
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.60	0.60	0.55	0.583	0.0289	±0.05	Pass
1.0	1.10	1.05	1.15	1.100	0.0500	±0.10	Pass
2.0	1.95	1.85	1.90	1.900	0.0500	±0.15	Pass
3.0	2.85	2.80	2.75	2.800	0.0500	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. A122843

Model : 224-PC X R8

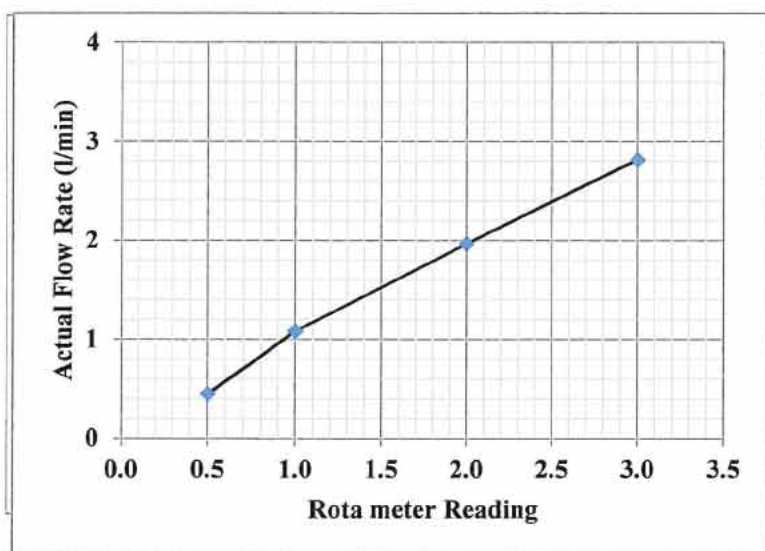
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-22

Next Time Calibration : MARCH 11, 2024

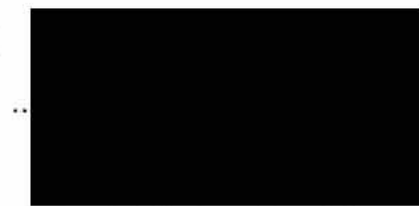
Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.45	0.45	0.45	0.450	0.0000	±0.05	Pass
1.0	1.00	1.10	1.15	1.083	0.0764	±0.10	Pass
2.0	2.05	1.90	1.95	1.967	0.0764	±0.15	Pass
3.0	2.90	2.80	2.75	2.817	0.0764	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. A122854

Model : 224-PC X R8

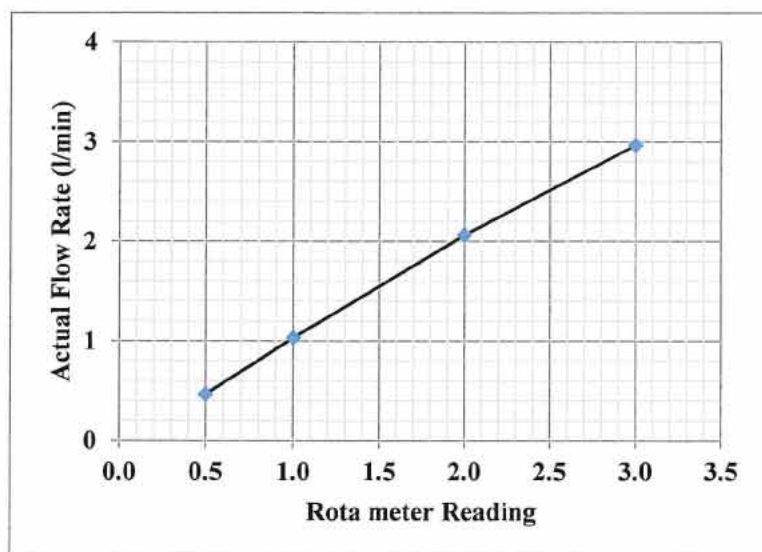
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2023

AM-23

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 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	1.00	1.10	1.00	1.033	0.0577	±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



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20150601076

Model : BDX-II

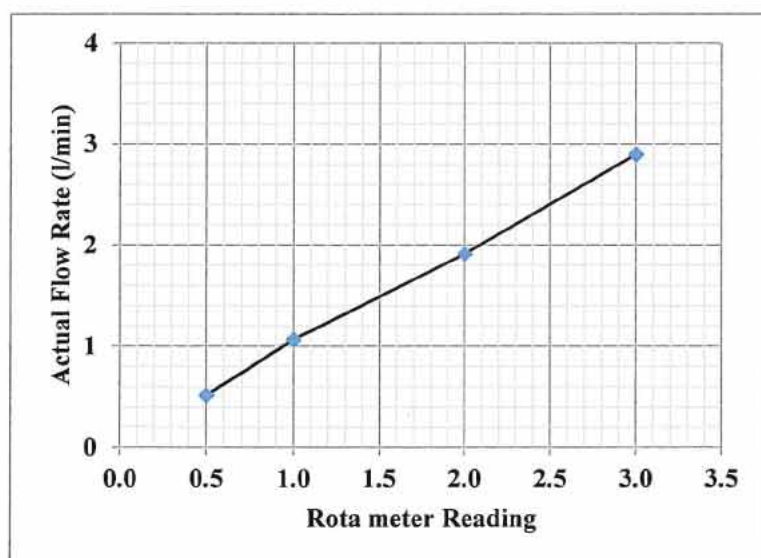
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-01

Next Time Calibration : MARCH 11, 2024

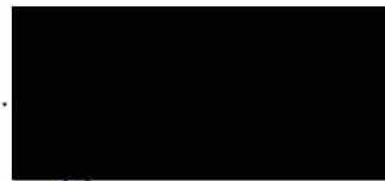
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.50	0.50	0.517	0.0289	±0.05	Pass
1.0	1.10	1.05	1.05	1.067	0.0289	±0.10	Pass
2.0	2.00	1.95	1.80	1.917	0.1041	±0.15	Pass
3.0	3.05	2.80	2.85	2.900	0.1323	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20150601080

Model : BDX-II

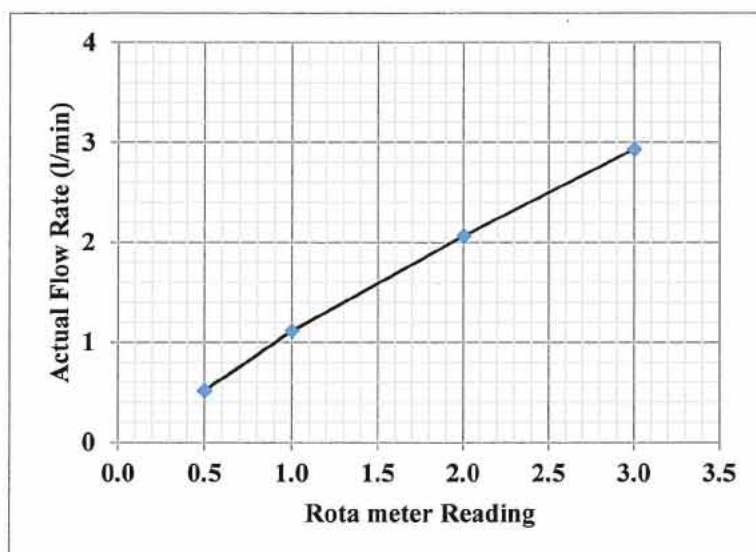
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-04

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 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	1.05	1.15	1.15	1.117	0.0577	±0.10	Pass
2.0	2.00	2.10	2.10	2.067	0.0577	±0.15	Pass
3.0	3.00	3.00	2.80	2.933	0.1155	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104062

Model : BDX-II

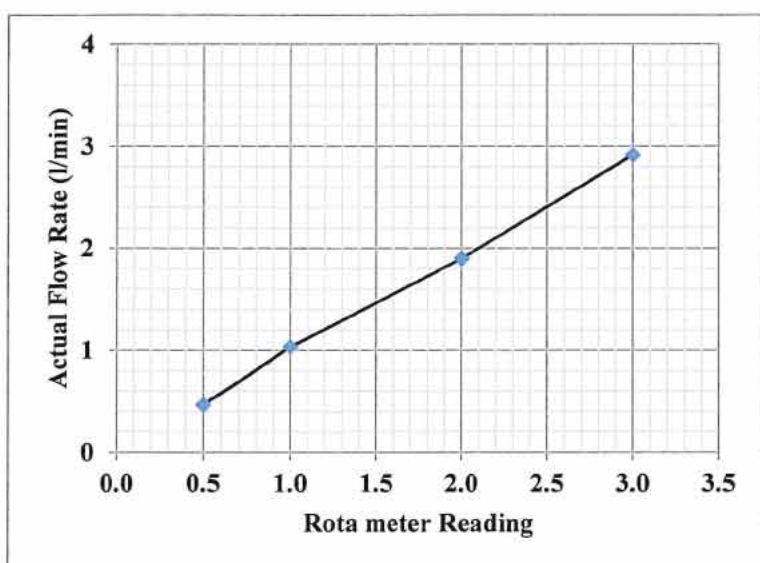
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-08

Next Time Calibration : MARCH 11, 2024

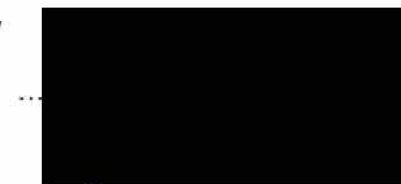
Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.45	0.45	0.467	0.0289	±0.05	Pass
1.0	1.00	1.05	1.05	1.033	0.0289	±0.10	Pass
2.0	2.00	1.80	1.90	1.900	0.1000	±0.15	Pass
3.0	3.00	2.90	2.85	2.917	0.0764	±0.15	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104063

Model : BDX-II

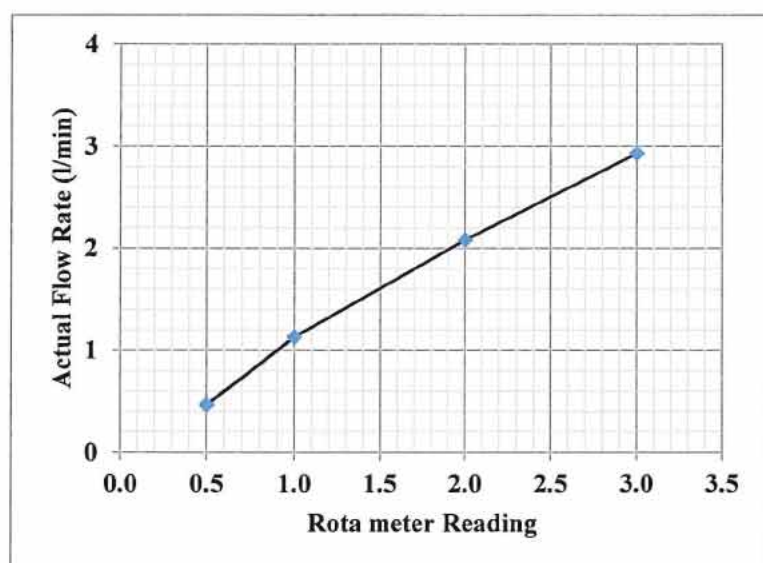
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-09

Next Time Calibration : MARCH 11, 2024

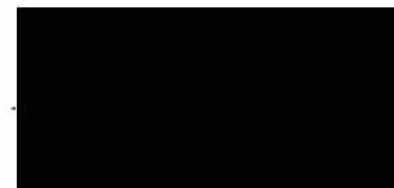
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.45	0.45	0.467	0.0289	±0.05	Pass
1.0	1.10	1.15	1.15	1.133	0.0289	±0.10	Pass
2.0	2.05	2.10	2.10	2.083	0.0289	±0.15	Pass
3.0	2.95	3.00	2.85	2.933	0.0764	±0.15	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104065

Model : BDX-II

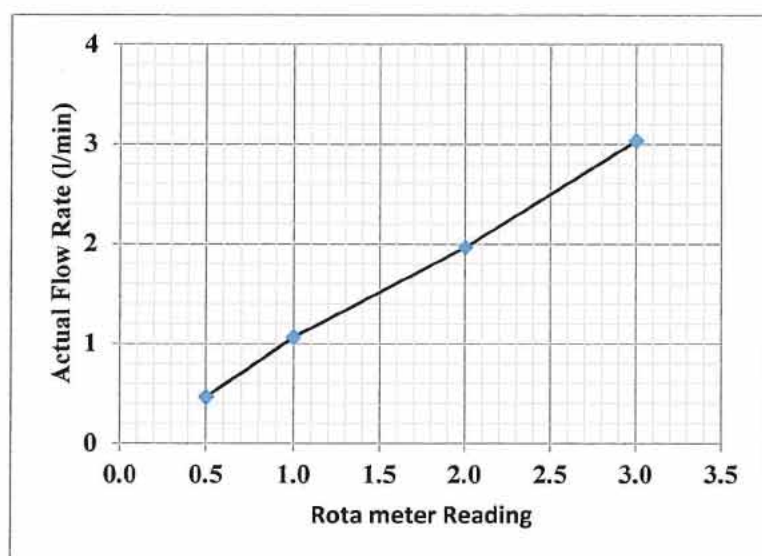
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-11

Next Time Calibration : MARCH 11, 2024

Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 758 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	1.00	1.15	1.05	1.067	0.0764	±0.10	Pass
2.0	2.00	1.95	1.95	1.967	0.0289	±0.15	Pass
3.0	3.00	3.05	3.05	3.033	0.0289	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104068

Model : BDX-II

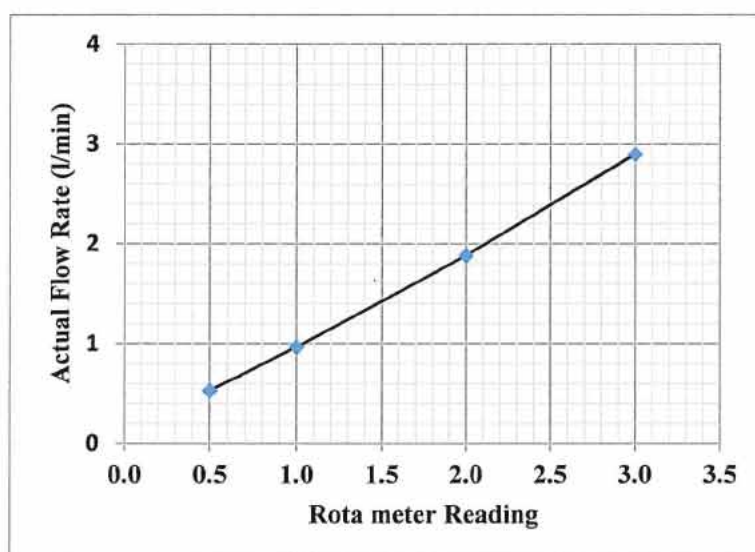
Manufacture : Gilian

Date of Calibration : MARCH 11, 2023

GN-14

Next Time Calibration : MARCH 11, 2024

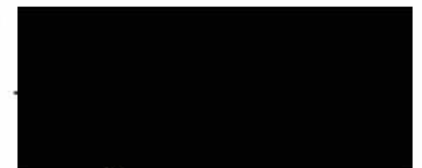
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 758 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.50	0.55	0.533	0.0289	±0.05	Pass
1.0	0.95	1.00	0.95	0.967	0.0289	±0.10	Pass
2.0	2.00	1.85	1.80	1.883	0.1041	±0.15	Pass
3.0	3.00	2.80	2.90	2.900	0.1000	±0.20	Pass



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CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 038534

Model : 224-PC X R8

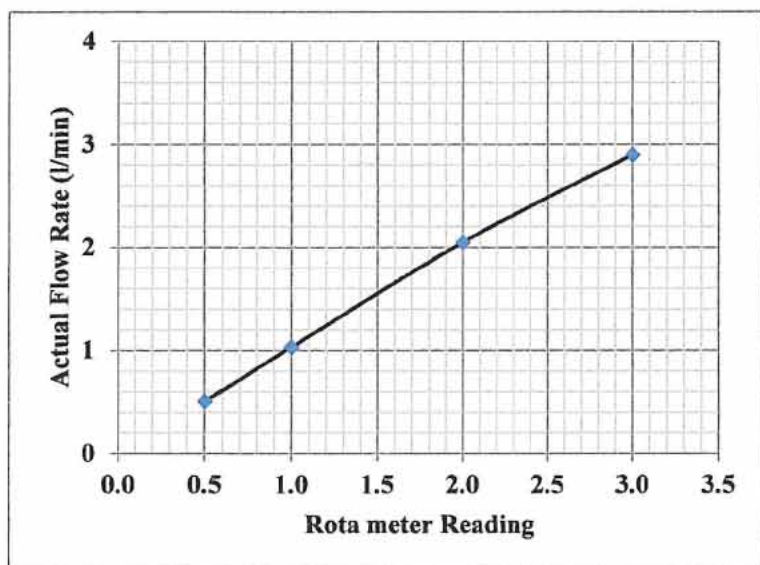
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

AM-14

Next Time Calibration : MARCH 11,2025

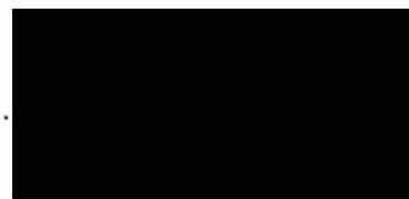
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.51	0.51	0.507	0.0058	±0.05	Pass
1.0	1.05	1.00	1.05	1.033	0.0289	±0.10	Pass
2.0	2.10	2.05	2.00	2.050	0.0500	±0.15	Pass
3.0	2.90	2.95	2.85	2.900	0.0500	±0.20	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 038545

Model : 224-PC X R8

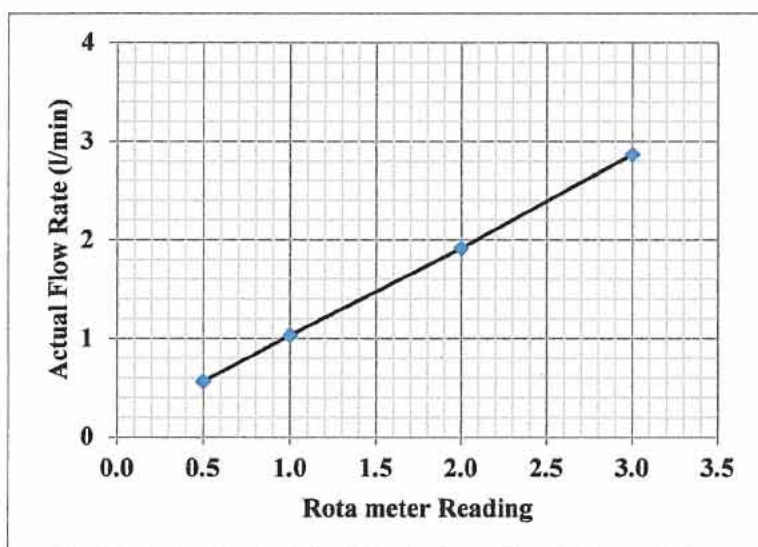
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

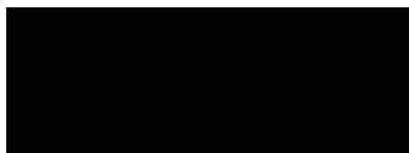
AM-17

Next Time Calibration : MARCH 11, 2025

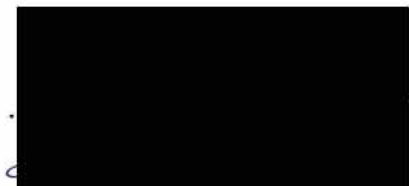
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.55	0.60	0.55	0.567	0.0289	±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



Approved by



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. A122843

Model : 224-PC X R8

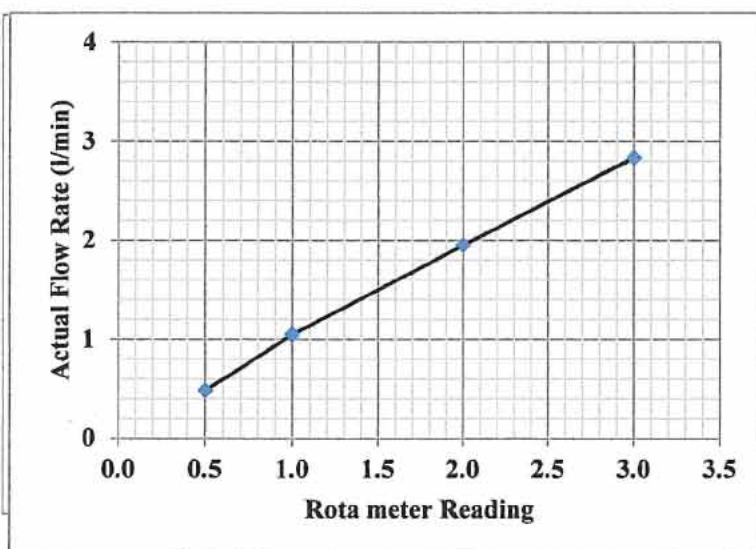
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

AM-22

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	1.00	1.00	1.15	1.050	0.0866	±0.10	Pass
2.0	2.00	1.90	1.95	1.950	0.0500	±0.15	Pass
3.0	2.90	2.85	2.75	2.833	0.0764	±0.20	Pass



Calibrated by



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. A122854

Model : 224-PC X R8

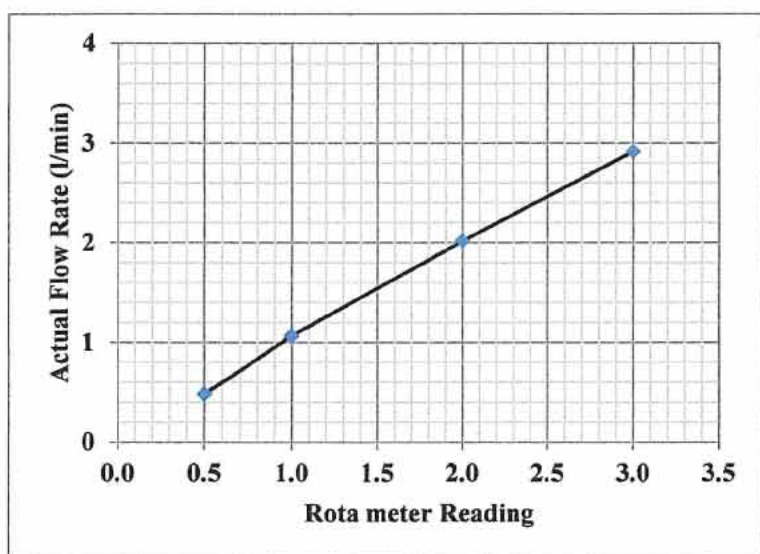
Manufacture : SKC (INC)

Date of Calibration : MARCH 11, 2024

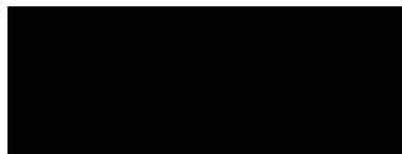
AM-23

Next Time Calibration : MARCH 11,2025

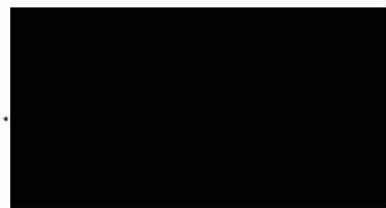
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.50	0.45	0.483	0.0289	±0.05	Pass
1.0	1.05	1.10	1.05	1.067	0.0289	±0.10	Pass
2.0	2.00	2.05	2.00	2.017	0.0289	±0.15	Pass
3.0	2.85	2.95	2.95	2.917	0.0577	±0.20	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20150601076

Model : BDX-II

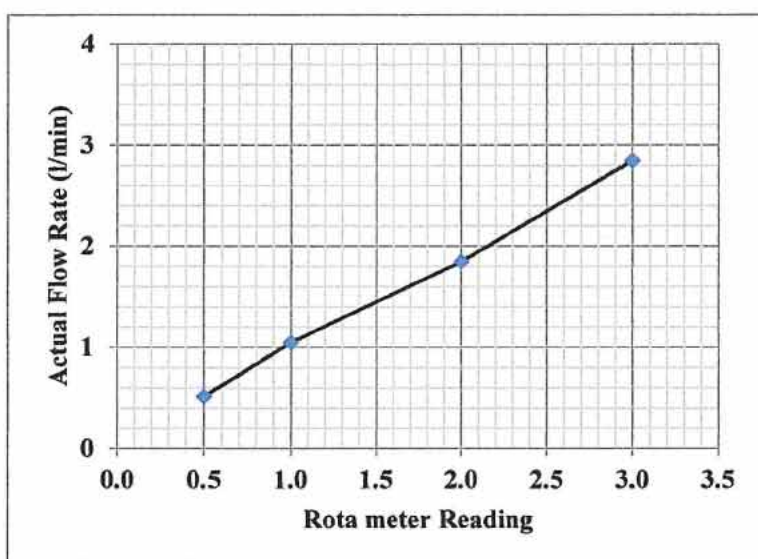
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-01

Next Time Calibration : MARCH 11,2025

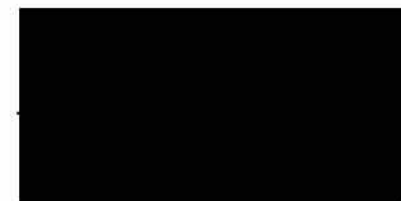
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.55	0.50	0.517	0.0289	±0.05	Pass
1.0	1.10	1.00	1.05	1.050	0.0500	±0.10	Pass
2.0	1.80	1.95	1.80	1.850	0.0866	±0.15	Pass
3.0	2.90	2.80	2.85	2.850	0.0500	±0.20	Pass



Calibrated by



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20150601080

Model : BDX-II

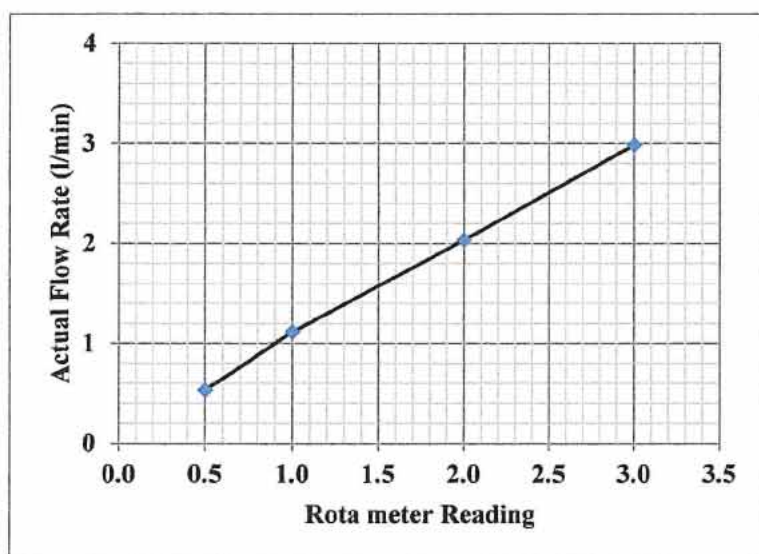
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

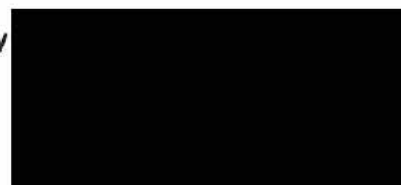
GN-04

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



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104062

Model : BDX-II

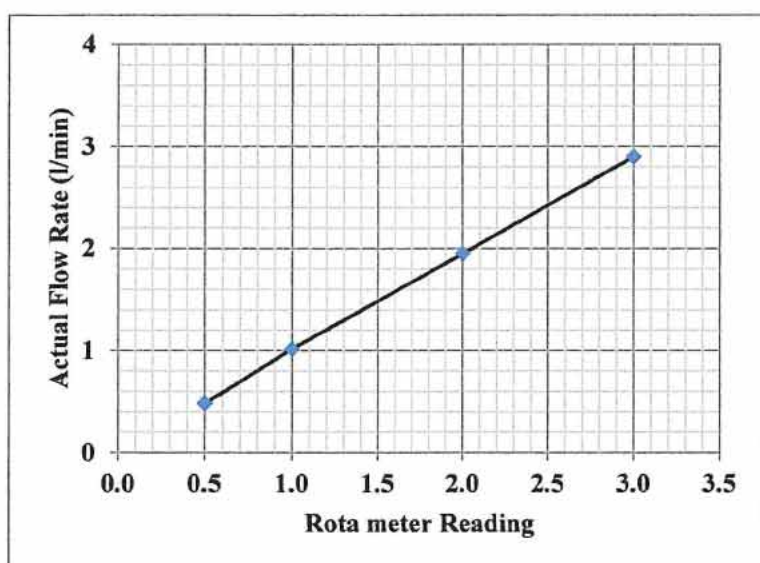
Manufacture : Gillan

Date of Calibration : MARCH 11, 2024

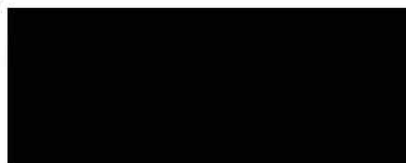
GN-08

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



Approved by



Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104063

Model : BDX-II

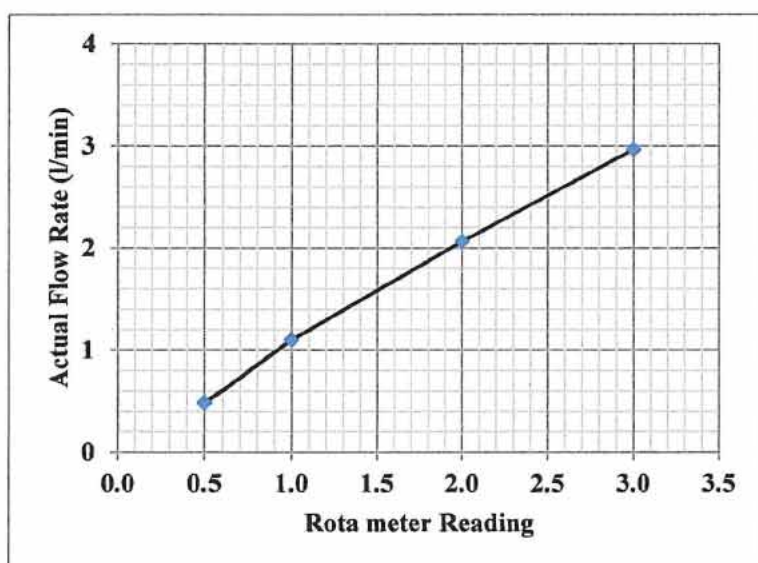
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-09

Next Time Calibration : MARCH 11,2025

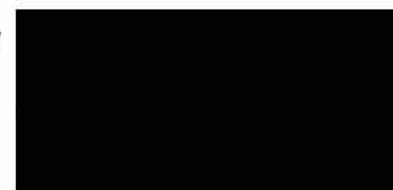
Standard Criteria : Rota Meter					Ambient Condition		
SKC Model1355EZ30 S/N 0107070345011/003					Temperature = 25.0 °C		
					Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.45	0.50	0.483	0.0289	±0.05	Pass
1.0	1.10	1.15	1.05	1.100	0.0500	±0.10	Pass
2.0	2.05	2.05	2.10	2.067	0.0289	±0.15	Pass
3.0	2.95	3.00	2.95	2.967	0.0289	±0.15	Pass



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104065

Model : BDX-II

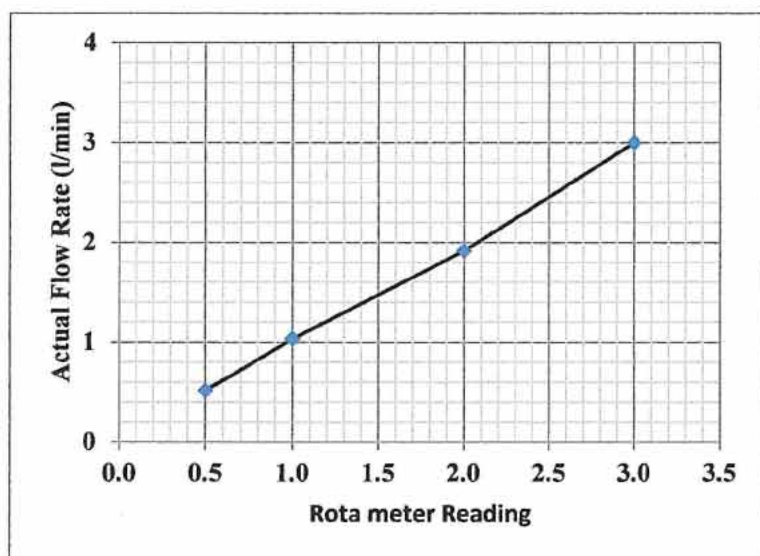
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-11

Next Time Calibration : MARCH 11,2025

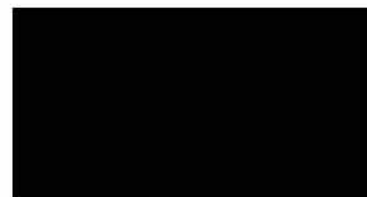
Standard Criteria : Rota Meter SKC Model1355EZ30 S/N 0107070345011/003					Ambient Condition Temperature = 25.0 °C Pressure = 759 mmHg		
Rota Meter Reading	Actual Flow Rate (l/min)				Deviation (l/min)	Permissible Deviation (l/min)	Status
	1	2	3	Average			
0.5	0.50	0.55	0.50	0.517	0.0289	±0.05	Pass
1.0	1.00	1.05	1.05	1.033	0.0289	±0.10	Pass
2.0	1.90	1.95	1.90	1.917	0.0289	±0.15	Pass
3.0	2.95	3.00	3.05	3.000	0.0500	±0.20	Pass



Calibrated by



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Industrial Hygiene Specialist

CALIBRATION TEST REPORT

Instrument : AIR CHECK SAMPLER (High Flow)

Serial No. 20170104068

Model : BDX-II

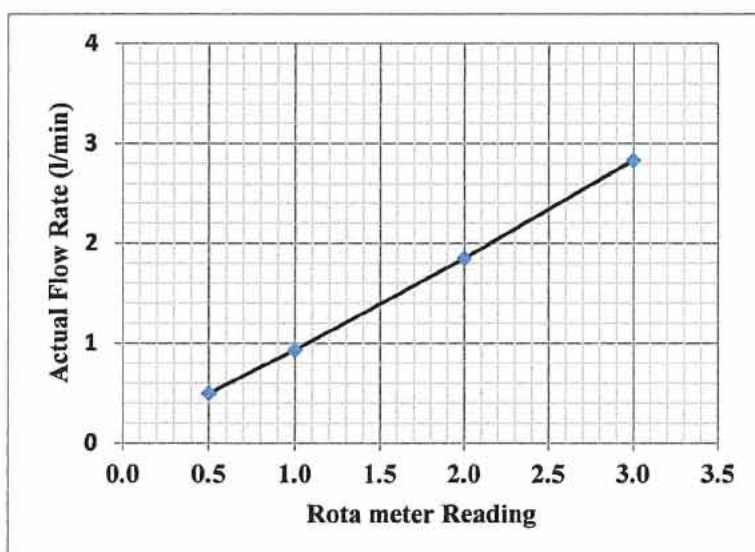
Manufacture : Gilian

Date of Calibration : MARCH 11, 2024

GN-14

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	0.55	0.500	0.0500	±0.05	Pass
1.0	0.95	1.00	0.85	0.933	0.0764	±0.10	Pass
2.0	1.90	1.85	1.80	1.850	0.0500	±0.15	Pass
3.0	2.80	2.80	2.90	2.833	0.0577	±0.20	Pass



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Approved by



Industrial Hygiene Specialist



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.



MR.Thanawat Pumpaka



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(C₁₆) 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 :



(Mr.Thanawat Pumpaka)

SERVICE ENGINEER



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



Person in charge



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.

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

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 23BCI0349

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE125P-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial QM Ident. no.	0028606077 N/A	This certificate relate and apply this equipment only.
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 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	15 Sep 2023	Approval of the Calibration Certificate	Person in charge
			
		Mr. Chonchai Inthana	Chonchai Inthana

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. $T_{\text{weights}} - T_{\text{place}}$	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/ecc _{\text{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 $|E|_{\text{max}} = 0.00001$ 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

$U_{gl}(W) = 0.000013 \text{ g} + 3.20 \cdot 10^{-8} \cdot R$

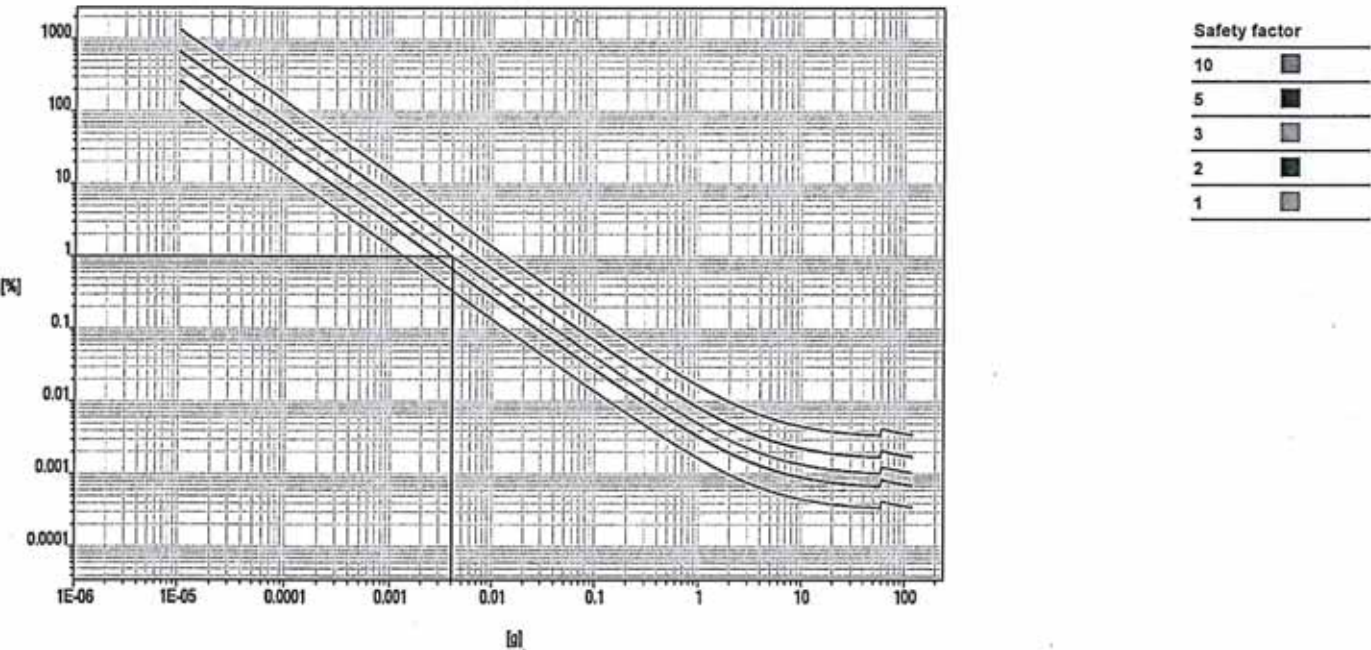
Partial weighing range 2 | 60.00000 g...120.0000 g

$U_{gl}(W) = 0.000086 \text{ g} + 2.77 \cdot 10^{-8} \cdot R$

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

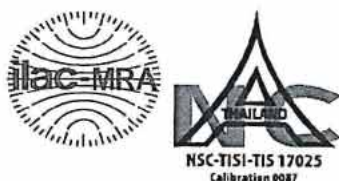
1.00 %

Safety factor

3

Minimum sample weight

0.00400 g



Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01231101
Model:	LA130S-F	Issued Date:	24 March 2023
Serial No. (or ID.):	16908811 (EP-AB-01/47)	Job No.:	KSPR2304798
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 27 °C ± 0.8 °C
Humidity 41 %RH ± 2.1 %RH

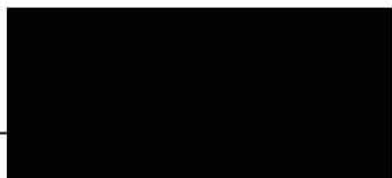
Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Air (TSP/PM10) Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Pradit Siriboot

Calibration Date: 24 March 2023

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. C02221864



Person in charge



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.

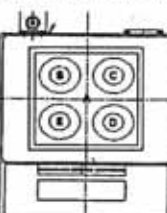
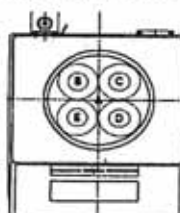
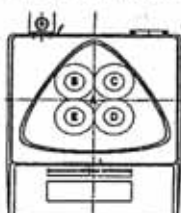
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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.

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	0.00004
10	0.00005

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	0.00010	2.03
2	2.00001	2.0000	0.0000	0.00010	2.03
3	3.00003	3.0000	0.0000	0.00011	2.02
4	4.00003	4.0000	0.0000	0.00011	2.02
5	5.00003	5.0000	0.0000	0.00010	2.03
6	6.00004	6.0000	0.0000	0.00011	2.02
7	7.00004	7.0001	0.0001	0.00011	2.02
8	8.00006	8.0001	0.0000	0.00012	2.02
9	9.00006	9.0001	0.0000	0.00012	2.01
10	10.00002	10.0001	0.0001	0.00011	2.02

The End of Certificate

UUT Meter Console Information

Model #:	XC-572
Serial #:	605186
DGM Model #:	SK25EX
DCM 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
Std. Temp. (K):	298.15
Std. Press. (mm Hg):	760
K ₁ (K/mm Hg):	0.3923

UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Volume			Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Reference Meter (WTM)		
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Outlet Temperature (°C)
Θ	P _{m(g)}	V _{m(l)}	V _{m(l)}	V _m	t _{m(l)}	t _{m(f)}	P _w	V _{w(l)}	V _{w(f)}	t _{w(f)}
900	13.00	512699.1	512869.5	170.4	28.0	28.0	-1.0	431236.86	431410.21	26.5
600	25.00	511923.9	512081.6	157.7	28.0	28.0	-1.0	430461.99	430622.64	26.5
480	50.00	512090.4	512268.0	177.6	28.0	28.0	-1.0	430633.55	430815.39	26.5
420	80.00	512282.1	512480.5	198.4	28.0	28.0	-1.0	430825.43	431026.44	26.5
300	120.00	512512.2	512681.9	169.7	28.0	28.0	-1.0	431052.74	431225.49	26.5

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH@	ΔH@
V _{w(Std)}	Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH@	ΔH@
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 ΔH_g, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Calibrator : **VAEROJN RUANGARAM**

Signature :

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 (NIST) and in reference to EPA Method 5, Section 10.3.1.

Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

SITHIPHORN
Calibration No.: **SA2023001**

UUT Meter / Console Information Model #: <u>XC 572-V</u> Serial number: <u>605186</u> DGM Model #: <u>SK25EX</u> Serial number: <u>0005288</u>	
Check the Diagnosis Check the system before calibrating. <div style="display: flex; justify-content: space-between;"> <div> -Visual instrument normalcy -Electrical and Temperature Systems -Inclined Manometer with Systems -Pressure Gauge -Leak Check <input type="checkbox"/> PM and Calibration </div> <div> Not Passed Passed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div>	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(gas)} - Calculated flow rate of test meter K' - Critical orifice coefficient P _{ref} - Measured pressure of reference meter t _{ref} - Temperature measured in reference meter t _m - Temperature measured in test meter Y - Ratio of volume collected from test meter and orifice

Equations

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

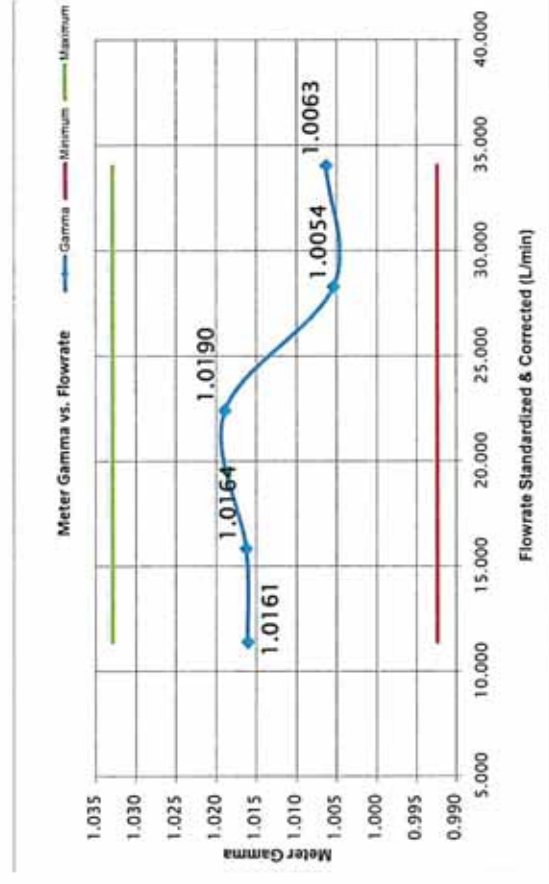
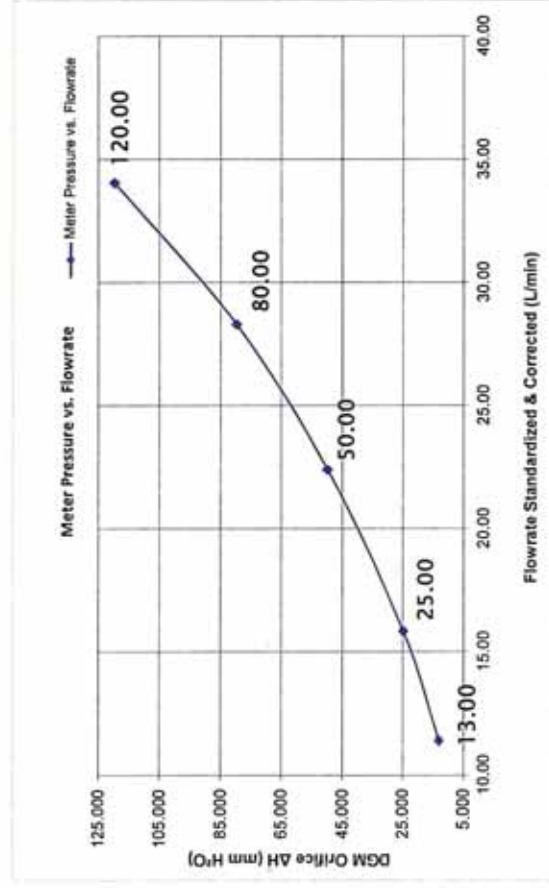
$$V_{w(std)} = Y * K_1 * \frac{V_w * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m}$$

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

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

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.001036 * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m} * \left(\frac{T_v * \Theta}{V_v * P_{bar}} \right)^2$$

Calibration Graphs



Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

page: 1/1

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	Reference Measure	XC-572	Deviated to set point	ΔT_{abs} ±3%	Temp. Controller Status ³
Set point	(μ)	Thermometer			
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: _____

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.

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

¹For 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.B)

²For 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: Vaekojn

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.

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
SITHIPORN
Work No.: SVO26796
Units: Metric

Reference Equipment

Vernier, 0-250mm 0.01 mm increments model Mitutoyo

Serial No

3038570

Cal No.:

L202310355-0001

Cal.due:

07/Nov/23

Calibration Method

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

Calibration Result

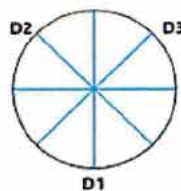
ID No.	Sizes	measured every 60° nozzle			(D ₁ + D ₂ + D ₃) / 3	Different ≤ 0.100 mm.	
	mm.	D ₁	D ₂	D ₃	D avg	1	Judgment
4	3.1	3.18	3.17	3.17	3.173	0.010	PASS
6	4.6	4.42	4.44	4.46	4.440	0.040	PASS
8	6.2	6.22	6.19	6.23	6.213	0.040	PASS
10	7.8	7.78	7.78	7.77	7.777	0.010	PASS
12	9.4	9.37	9.39	9.40	9.387	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 diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm or 0.001 inch

Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm or 0.004 inch

D avg = (D₁ + D₂ + D₃) / 3



Signature

[Redacted Signature]

Date : 28/Nov/23

Sampling Probe and Pitot validation

Sampling 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

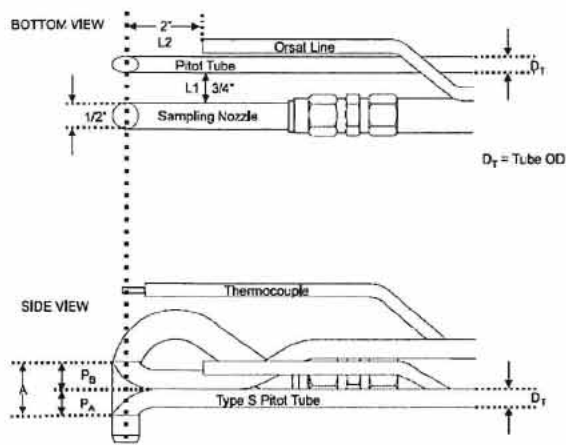
Reference Devices

- 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 tubes (S type) calibration procedure. (ref. 40 CFR PART 60).

Sampling Probe Validation with Tune up

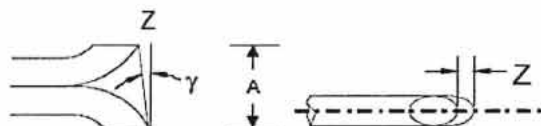
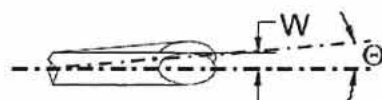
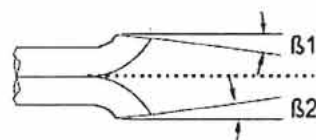
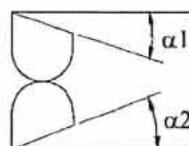
☐ : Measuring and aligning with 1/2" sample nozzle(12.7 mm)



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

Pitot Tube Validations and Engles measurement Result

☐ : Measure results after maintenance and adjustments.



P_B Size	Acceptance of correctness
$\alpha_1 = 0.55^\circ$	$\leq 10^\circ$
$\beta_1 = 2.15^\circ$	$\leq 5^\circ$
P_A Size	
$\alpha_2 = 0.65^\circ$	$\leq 10^\circ$
$\beta_2 = 1.90^\circ$	$\leq 5^\circ$

Engles measurement

Calculated Result	Acceptance Criteria
$W = 0.80^\circ$	$W < 0.0794 \text{ mm. (0.03125 in)}$
$Z = 0.30^\circ$	$Z < 3.175 \text{ mm. (0.125 in.)}$

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

Signature: _____

Date: 28/Nov/23

Certificate of Calibration

DGM with Totalizer 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.: SVO25769

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)		Reference Meter (WTM)			Outlet Temperature (°C)	
		Initial	Final	Total	Initial	Final	Meter Pressure (mm H ₂ O)	Initial	Final	Initial	Final
Θ	(L/Min)	V _{wi}	V _{wf}	V _w	t _{mi}	t _{mf}	P _w	V _{wi}	V _{wf}	t _{wi}	t _{wf}
900	1.00	514431.90	514445.70	13.80	27.0	27.0	-1.0	433294.69	433308.92	27.0	27.0
600	2.00	514399.70	514419.40	19.70	27.0	27.0	-1.0	433262.98	433283.21	27.0	27.0
480	2.50	514488.80	514508.20	19.40	27.0	27.0	-1.0	433352.74	433372.69	27.0	27.0
420	3.00	514354.30	514375.50	21.20	27.0	27.0	-1.0	433214.91	433236.63	27.0	27.0
300	4.00	514285.50	514305.70	20.20	27.0	27.0	-1.0	433129.27	433149.95	27.0	27.0

Standardized Data

Scaling Factor

Test meter		Reference Meter		Gamma	
Std. Vol.	Std. Flow Rate	Std. Volume	Std. Flow Rate	Value	Variation
V _{mstd} (L)	Q _{wstd} (L/min)	V _{wstd} (L)	Q _{wstd} (L/min)	Y	ΔY
13.637	0.935	14.026	0.935	1.0285	0.004
19.470	1.994	19.940	1.994	1.0241	0.000
19.174	2.458	19.664	2.458	1.0255	0.001
20.954	3.058	21.408	3.058	1.0217	-0.002
19.968	4.077	20.383	4.077	1.0208	-0.003
				1.0241	DGM Y Avg.⁽¹⁾

Calibration Results

Rotameter Calibration	
Rotameter	Std. Flow.
(L/Min)	(L/min)
1.00	0.94
2.00	1.99
2.50	2.46
3.00	3.06
4.00	4.08
	Variation
	(L/min)
	0.06
	0.01
	0.04
	-0.06
	-0.08

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:

VAEROJN.R

Signature:

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.

Sithiporn Associate Co.,Ltd Environmental / Hygiene Department (ENV) Web site : www.sithiporn.com # E-mail: service2-env@sithiporn.com

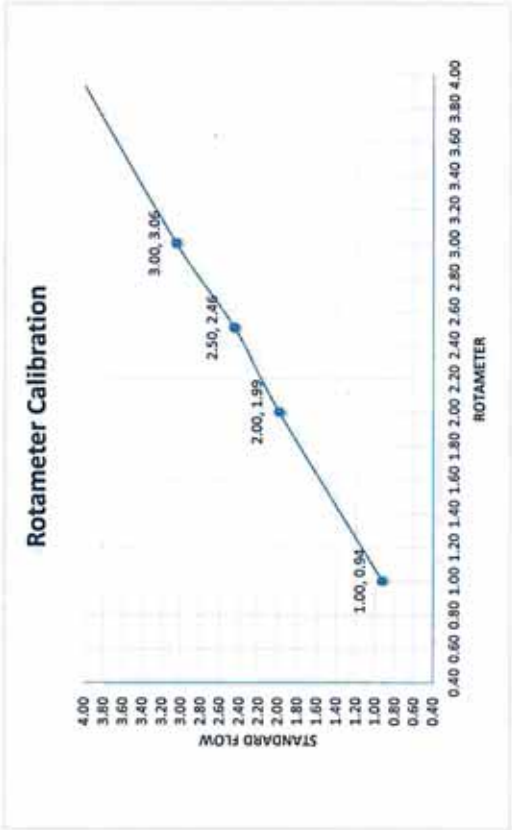
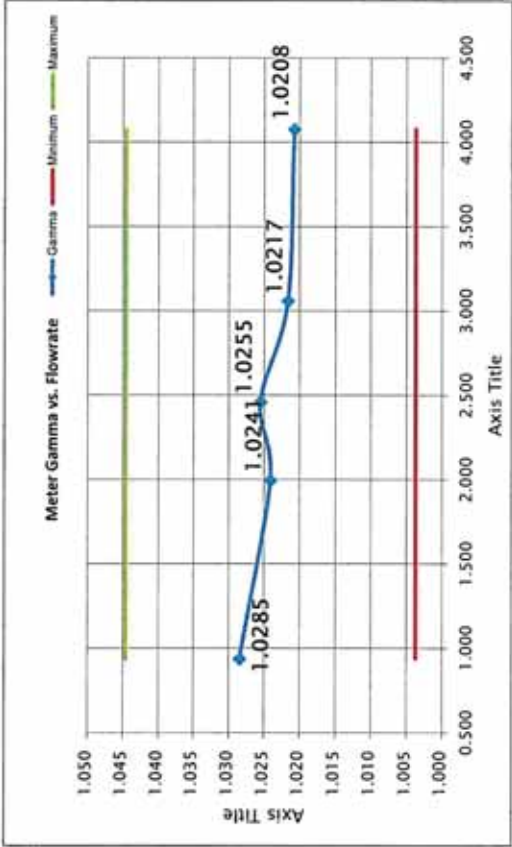
Revised: 2023/01/23

Calibration Certificate Appendix

DGM with Totalizer Calibration

Nomenclature	Equations
P_b - Barometric Pressure	
DGM - Dry Gas Meter	
K_1 - Constant based on standard temp and press	$K_1 = \frac{T_{std}}{P_{std}}$
Θ - Run time, in minutes	$Q_{w(std)} = \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$
P_m - ΔH (Meter Pressure, gauge)	$Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$
V_m - Volume collected by test meter, corrected for STP	$Y_{sc} = \frac{V_{w(std)}}{Counts_{std}}$
$Q_{m(std)}$ - Calculated flow rate of test meter	$Y = \frac{V_{cr(std)}}{V_{m(std)}}$
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	$Counts_{std} = K_1 \frac{C_{total} * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$
sc - Scaling Factor	
Counts _{gas} - Number of pulse counts, standardized	
C _{raw} - Number of raw pulse counts of a calibration run	

Calibration Graphs



Certificate of Calibration

Method 6 Console Sensor Calibration - Metric Units

page: 1/1

Console Information

Model #:	XC-572
Serial #:	605186
Temp Dsg:	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	Reference Measure	XC-572	Deviated to	ΔT_{abs}	Temp. Controller Status ³
Set point	(μ)	Thermometer	set point	±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: _____

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



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

Reference: 2401-0234WN

Submitted by: LIFE & ENVIRONMENT CO., LTD.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1014 mbar

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except with the prior written approval of the head of
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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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
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 : 

☐ Phalinee Prabpaipal

☐ Sura Suwannasri

☒ Attapol Panurach



Cert.No.: 24P202

Page: 2 of 2

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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Testing Report

General Information

Measuring Site : Entech Industrial 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 (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 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	O ₂	2.50	2.6	0.10
2	O ₂	10.04	10.2	0.16
3	O ₂	21.02	21.2	0.18
4	CO	80.14	79	-1.14
5	CO	302	302	0
6	CO	1003	1001	-2

Tested by

Approved by



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


Calibration Technician


Technical Manager

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



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TEL. 0-2717-3000-24 FAX. 0-2719-9484



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

Reference: 2401-0387WN

Submitted by: LIFE & ENVIRONMENT CO., LTD.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1013 mbar

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

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
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 :

[] Phalinee Prabpaipal

[] Sura Suwannasri

[x] Attapoi Panurach



Cert.No.: 24P205

Page: 2 of 2

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 %.

-o0o-

Attapol P.

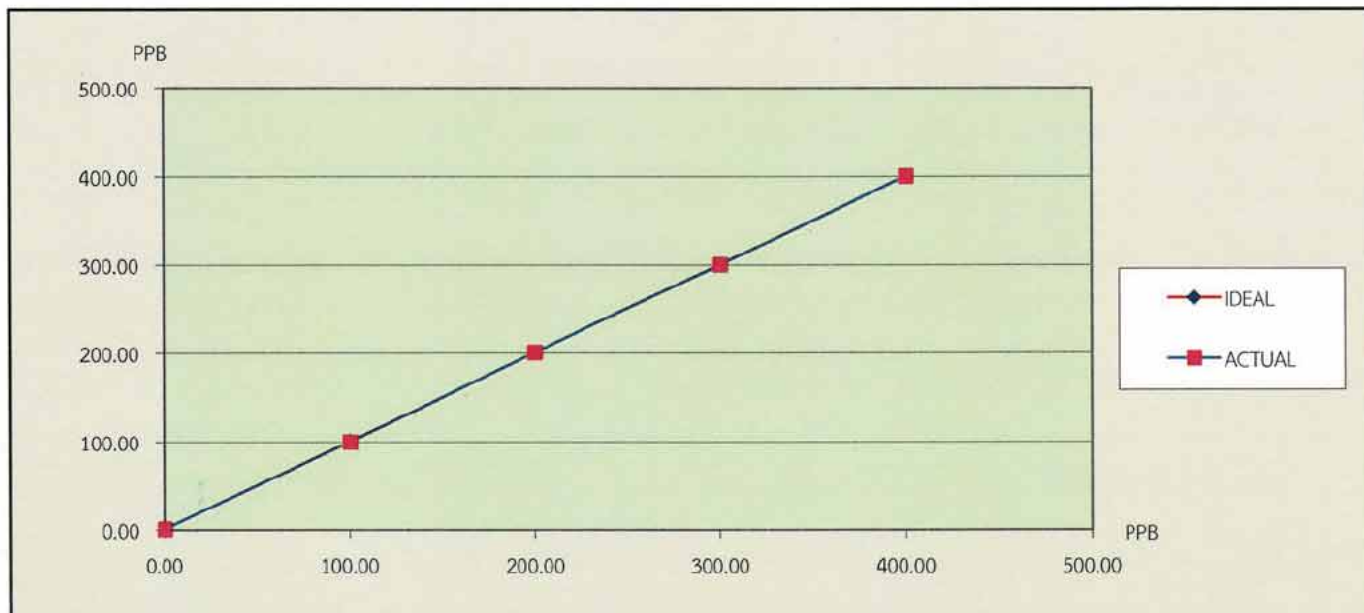
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TEST REPORT

CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQUIPMENT 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 :

DATE :

15/2/24

CHECKED BY :

DATE :

15/2/24



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

CHECK LIST

CUSTOMER NAME : All-Quip Co., Ltd. [บริษัท ออล คิวป์ 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 :



DATE : 15/2/24

CHECKED BY :

DATE : 15/2/24

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

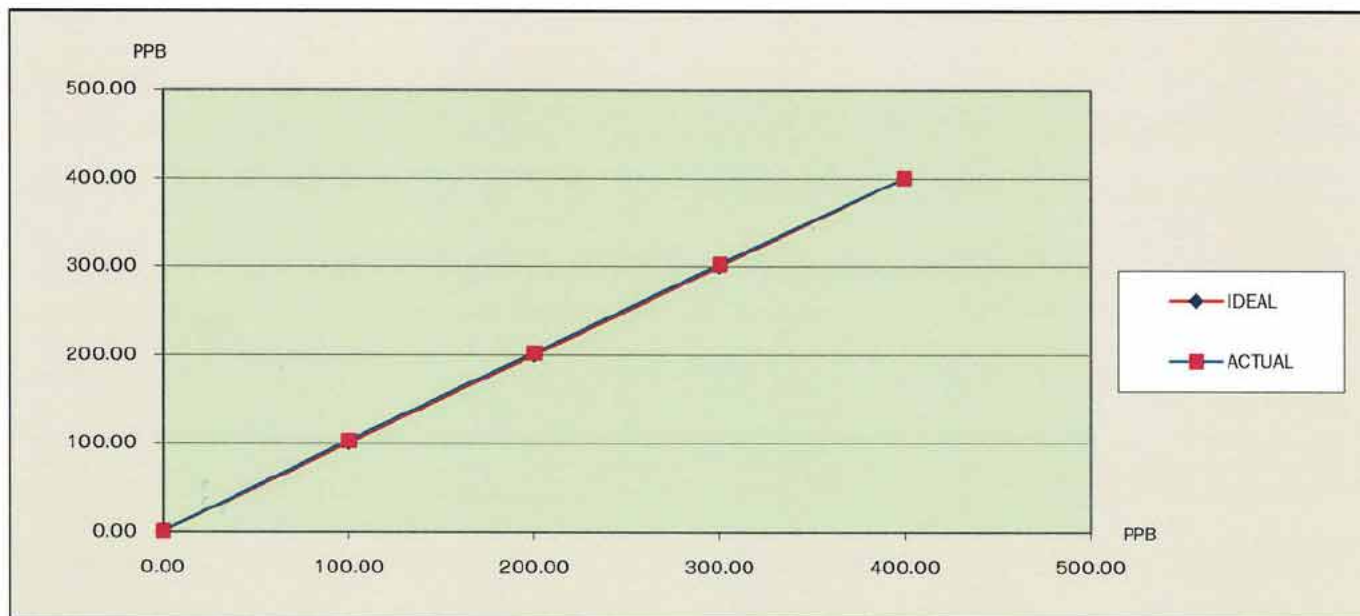
เลขที่ 63/14-15 , 67/35-36 ซอยเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร : 02-868-0812-13 โทรสาร : 02-868-1889

TEST REPORT

CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]		
EQUIPMENT 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



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



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 :



DATE : 15/2/24

CHECKED BY :

DATE : 15/2/24

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

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

Carbon Monoxide (CO)
Nitric Oxide (NO)
Sulfur Dioxide (SO₂)
Nitrogen (N₂)

Concentration

4498 PPM
45.69 PPM
45.54 PPM
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
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Signature

Approved

บริษัท สิทธิพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

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



Approved for Release

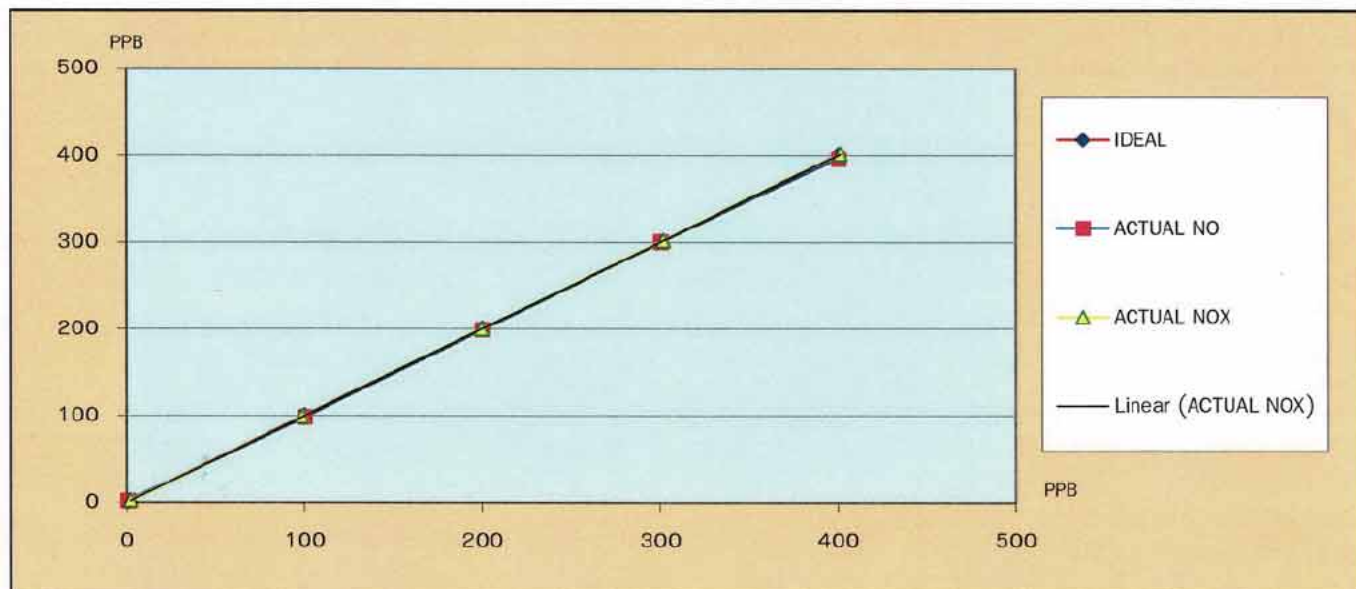


TEST REPORT

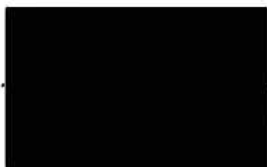
CUSTOMER NAME	: All-Quip Co., Ltd. [บริษัท ออล ควิป จำกัด (สำนักงานใหญ่)]						
EQUIPMENT NAME	: NO _x Analyzer						
MANUFACTURER	: HORIBA	MODEL	: APNA-370	SERIAL NO	: J0V032W3		
STANDARD GAS CONCENTRATION (PPM)	: 53.15 PPM			CYLINDER NO	: CC734373		
CYLINDER PRESSURE (PSI)	: 1,400 PSI			CERTIFIED DATE	: 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:



DATE : 16/2/24

CHECKED BY:

16/2/24

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

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

CHECK LIST

CUSTOMER NAME : All-Quip Co., Ltd. [บริษัท ออล คิวป์ จำกัด (สำนักงานใหญ่)]		
EQUIPMENT NAME : NO _x Analyzer		
MANUFACTURER : HORIBA	MODEL : APNA-370	SERIAL NO. : JOV032W3

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	Sampling NO Reading	PPB	1.40	2.20
9	Sampling NO ₂ Reading	PPB	5.20	19.40
10	Sampling 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 :

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

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

Carbon Monoxide (CO)

Nitric Oxide (NO)

Sulfur Dioxide (SO₂)Nitrogen (N₂)

Concentration

4498 PPM

45.69 PPM

45.54 PPM

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

Approved

บริษัท สิทธิพรแอสโซซิเอต จำกัด

SITHIPORN ASSOCIATES COMPANY LIMITED

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



Approved for Release



MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : บริษัท ชีวและสิ่งแวดล้อม จำกัด

EQUIPMENT NAME : NO_x Analyzer

MANUFACTURER : Teledyne API

MODEL : 200E

SERIAL NUMBER : 2288

STANDARD GAS CONCENTRATION (PPM) : 53.4

CERTIFIED DATE : CC745169

CYLINDER PRESSURE (PSIG) : 1600

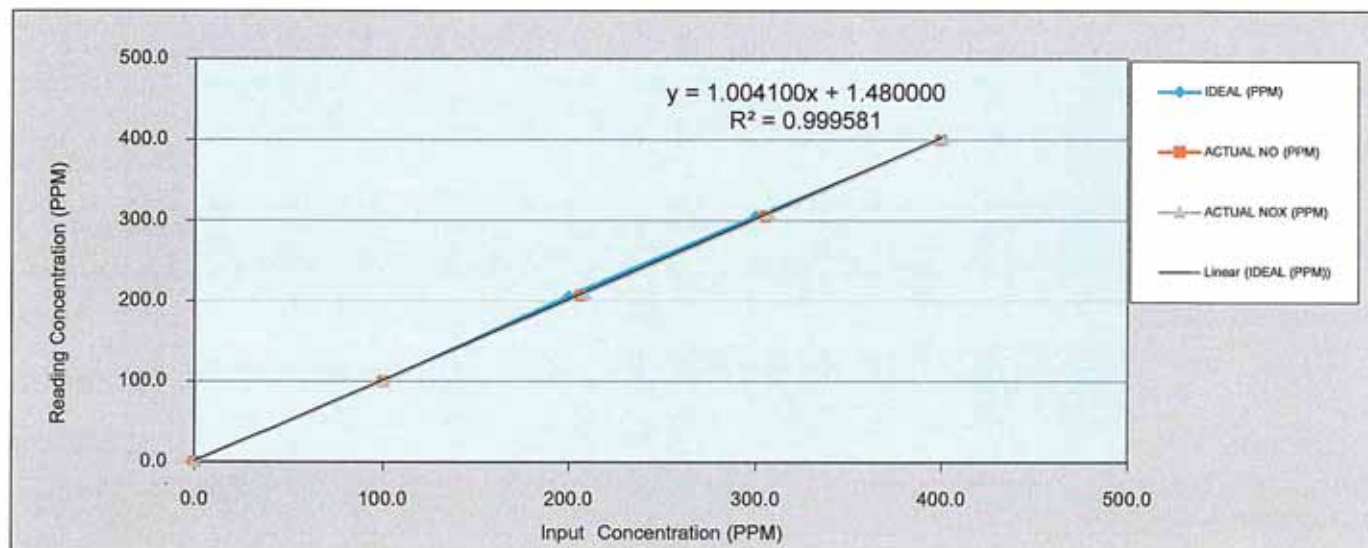
CERTIFIED DATE : Mar 10 2021

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	0.10	0.10	-	0.00	0.00	-
1	100.00	100.10	0.10	0.10	100.60	0.60	0.60
2	200.00	206.40	6.40	3.20	208.70	8.70	4.35
3	300.00	305.40	5.40	1.80	307.30	7.30	2.43
4	400.00	399.50	-0.50	-0.13	400.50	0.50	0.13
AVERAGE (%)				0.01			0.01



CALIBRATED BY : คุณพรชัย ผาติวนารักษ์

DATE : 20/02/2566

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณพรชัย ผาติวนารักษ์ โทรศัพท์ : 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : บริษัท ซีวีและสิ่งแวดล้อม จำกัด

วันที่ : 20/02/2565

รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer

บริษัทผู้ผลิต : Teledyne API

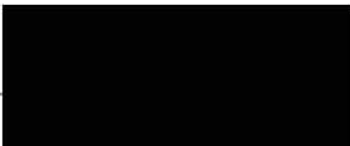
รุ่นของอุปกรณ์ / เครื่องมือ : 200E

หมายเลขอุปกรณ์ / เครื่องมือ : 2288

TEST VALUES			
API MODEL 200E		BEFORE	AFTER
1	RANGE	50 - 20,000 PPM	500.0
2	STABILITY	≤ 1 PPM	0.2
3	SAMPLE FLOW	500 ± 10% cc/min	488
4	OZONE FLOW	80 ± 10% cc/min	80
5	PMT	mV	61.1
6	NORM PMT	mV	-5.1
7	A ZERO	-20 To 150 mV	56.8
8	HPVS	400 - 900 V	728
9	RX CELL TEMP	50 ± 1 °C	49.8
10	BOX TEMP	AMBIENT ± 5 °C	28.0
11	PMT TEMP	7 ± 2 °C	6.8
12	MOLY TEMP	315 ± 5 °C	316.5
13	RX CELL PRESSURE	< 10 in - Hg-A	5.1
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	29.5
15	NOX SLOPE	1.0 ± 0.3	1.038
16	NOX OFFSET	-50 To 150	0.5
17	NO SLOPE	1.0 ± 0.3	0.998
18	NO OFFSET	-50 To 150	-2.9
19	NO SAMPLE READING	PPM	1.6
20	NO2 SAMPLE READING	PPM	3.9
21	NOX SAMPLE READING	PPM	5.5
22	OPTIC TEST	2000 ± 1000 mV	2613.6
23	ELECTRICAL TEST	2000 ± 1000 mV	2477.2
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.20/ 12.50 /15.60/ -15.14
25	ZERO GAS NO / NO _x	0.00 / 0.00 PPM	2.4/ 2.7
26	SPAN GAS NO / NO _x	400.00 / 400.00 PPM	332.1/ 209.9

หมายเหตุ

- เปลี่ยน O-Ring 6 PCs , เปลี่ยน SS Filter 3 PCs ,เปลี่ยน Spring 3 PCs


ลงนามเจ้าหน้าที่ (Signature)

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A0622
Cylinder Number: CC745169
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402045691-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 10, 2021

Expiration Date: Mar 10, 2029

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	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
NITRIC OXIDE	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable	03/03/2021, 03/10/2021
SULFUR DIOXIDE	53.00 PPM	53.79 PPM	G1	+/- 0.9% NIST Traceable	03/03/2021, 03/10/2021
CARBON MONOXIDE	4500 PPM	4512 PPM	G1	+/- 0.6% NIST Traceable	03/03/2021, 03/10/2021
NITROGEN	Balance				03/04/2021

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	07060227	EB0079116	100.3 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Jul 23, 2023
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
GMIS	124208889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	16010203	KAL003087	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
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: 28.1 Kg
Net Weight: 4.6 Kg



Approved for Release

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]

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 degree per 1 step from 0,360 , 90, 180 and 270 degree.

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

Engineer Name : 



Certificate of Calibration

Page : 1 of 3

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

ID. Number : N/A

Date of Issue : 02 Mar 2024

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

Approved by :

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020474-8

Page : 2 of 3

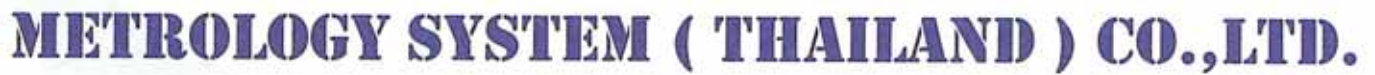
Reference Standards

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



Certificate No. : SPR24020474-8

Range : 94 to 114 dB

Function : @1kHz

Unit : dB

Select C

Unit : dB

Select Z

Unit : dB

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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24020474-9

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 : PN2450

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 29 Feb 2024

Relative Humidity : $50\% \pm 15\%$

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

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020474-9

Page : 2 of 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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24020474-9

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	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 -



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 : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 29 Feb 2024

Relative Humidity : $50\% \pm 15\%$

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 :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020474-10

Page : 2 of 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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24020474-10

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	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 -

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

CALIBRATION CERTIFICATE

Submitted by : Life and Environment Co., Ltd.

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

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

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 142011

Microphone : ACO 7052NR No.52766

Preamplifier : -

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 12 Jan. 2024

Date of Calibration : 8-9 Feb. 2024

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 8-9 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
113.98	114.0	0.0	1.0	0.30	N/A

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14.0	0.10	N/A
C-Weight	20.0	0.10	N/A
Flat	25.0	0.10	N/A

Date of Calibration : 8-9 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.4	0.4	0.4	1.5	0.45	0.6
1 000	-0.6	-0.5	-0.5	1.0	0.45	0.6
8 000	0.7	0.7	0.8	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.0	-0.1	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.1	3.0	0.20	0.6
8 000	-0.4	-0.4	-0.2	5.0	0.20	0.7

Date of Calibration : 8-9 Feb. 2024

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Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 8-9 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3

Date of Calibration : 8-9 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3
32	32.1	0.1	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	93.9	-0.1	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	93.9	-0.1	1.1	0.30	0.3

Date of Calibration : 8-9 Feb. 2024

7/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.3	0.3	1.1	0.30	0.3
20-100	25.0	25.2	0.2	1.1	0.30	0.3
20-90	25.0	24.9	-0.1	1.1	0.30	0.3
20-80	25.0	24.9	-0.1	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.6	-0.4	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.2	-0.8	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 8-9 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0204

MTC No. EEL. BP. 118/0167

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.7	0.3	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
133.0	133.0	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

Tawikiat Iamsamran

(Mr. Tawikiat Iamsamran)

Approved by :

Prawate Kluaypa

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 8-9 Feb. 2024

Date of Issue : 12 Feb. 2024

Ref : 2011267011200168002

End of Certificate

9 / 9

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.

FM.BLMTC.002 Rev.4



Certificate of Calibration

Certificate Number : SPR23060037-2

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 : 222219

ID. Number : SLM-NO.8

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 02 Jun 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 05 Jun 2023

Location of Calibration : In-Lab

Recommend Due Date : 05 Jun 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 06 Jun 2023

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.Karoon Pengsalung

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR23060037-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060037-2

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	113.8	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 -



Certificate of Calibration

Certificate Number : SPR23060037-3

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 : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 02 Jun 2023

Calibration Date : 05 Jun 2023

Recommend Due Date : 05 Jun 2024

Date of Issue : 06 Jun 2023

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.Karoon Pengsalung

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23060037-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060037-3

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	113.9	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 -



Certificate of Calibration

Certificate Number : SPR23060037-4

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 : 222221

ID. Number : SLM-NO.10

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 02 Jun 2023

Calibration Date : 05 Jun 2023

Recommend Due Date : 05 Jun 2024

Date of Issue : 06 Jun 2023

Method of Calibration

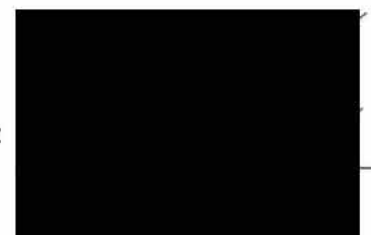
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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.Karoon Pengsalung

Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23060037-4

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060037-4

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	113.9	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 -



Certificate of Calibration

Certificate Number : SPR23060037-5

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 : 222222

ID. Number : SLM-NO.11

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 02 Jun 2023

Calibration Date : 05 Jun 2023

Recommend Due Date : 05 Jun 2024

Date of Issue : 06 Jun 2023

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.Karoon Pengsalung

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23060037-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060037-5

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	93.9	93.9	-0.1	-0.1	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 -



Certificate of Calibration

Certificate Number : SPR23090336-1

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 : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222241

ID. Number : SLM-NO.12

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 20 Sep 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 20 Sep 2023

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : SP-CPE-04-01

Date of Issue : 21 Sep 2023

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

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR23090336-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23090336-1

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	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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24040397-4

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 190500065

ID. Number : NT-03

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 30 Apr 2024

Relative Humidity : $50\% \pm 15\%$

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

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24040397-4

Page : 2 of 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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24040397-4

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	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 -



Certificate of Calibration

Certificate Number : SPR23060442-13

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 190500073

ID. Number : NT-04

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 29 Jun 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 29 Jun 2023

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : SP-CPE-04-01

Date of Issue : 30 Jun 2023

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

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR23060442-13

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060442-13

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	114.0	113.9	0.0	-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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24040397-5

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 190500072

ID. Number : NT-05

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 30 Apr 2024

Relative Humidity : $50\% \pm 15\%$

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

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24040397-5

Page : 2 of 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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24040397-5

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	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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24040397-2

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 170800272

ID. Number : NT-01

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 30 Apr 2024

Relative Humidity : $50\% \pm 15\%$

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

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24040397-2

Page : 2 of 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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24040397-2

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	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	114.2	114.2	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	114.2	114.2	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 –



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24040397-3

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 170800296

ID. Number : NT-02

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 30 Apr 2024

Relative Humidity : $50\% \pm 15\%$

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

Approved by :

Calibration Officer

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24040397-3

Page : 2 of 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



ID LINE : IEC17025

Result of Calibration

Certificate No. : SPR24040397-3

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	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 -



Certificate of Calibration

Certificate Number : SPR23060442-14

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 : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 220300020

ID. Number : NT-09

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 29 Jun 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 29 Jun 2023

Location of Calibration : In-Lab Recommend Due Date : N/A

Calibration Procedure : SP-CPE-04-01 Date of Issue : 30 Jun 2023

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 :

Authorized Signatory



Calibration Report

Certificate Number : SPR23060442-14

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060442-14

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	113.8	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	113.9	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 -



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 : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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

1 / 3

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.

FM.BL.MTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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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

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 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, 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	$\pm 1.0\%$

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	$\pm 3.0\%$

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

2/3

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.

FM.BL.MTC.002 Rev.4

Head Office

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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 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa , 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 Brüel&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 Brüel&Kjaer 4180	999.3	-0.7	± 1.5	$\pm 1.0\%$

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Jan. 2024

Date of Issue : 24 Jan. 2024

Ref : 2011267011200168001

End of Certificate

3 / 3

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.

FM.BL.MTC.002 Rev.4



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 24CH37

Page.: 1 of 2

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 :

Walalak Sirithean

Approved by :

Approved Signatory

- (☒) Saithip Meangmai
(☐) Warakorn Lerngagtrakul
(☐) Ponpan Paipim

Issue Date :

12 January 2024

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

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

A 0012728



Cert. No.: 24CH37

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
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 S/N.: 08645111	4.000	177.48	177.3	4.000	0.058	2.00
	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 S/N.: 092818FN	4.008	4.011	167.5	0.0045	2.00
	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 %.

-o0o-

Saithip

a 1197585



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

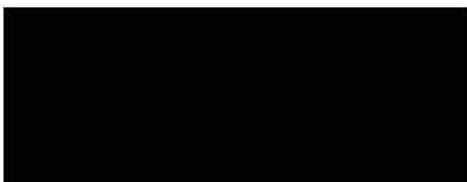
Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Water & Soil Testing Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road, On-nuch,
Suanluang, Bangkok 10250 Thailand

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



Person in charge

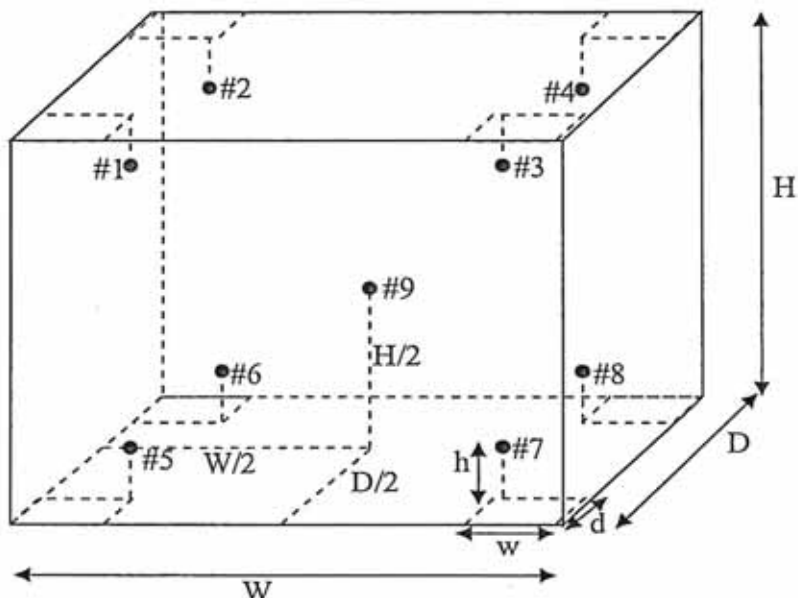


Authorized signatory

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.



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.



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

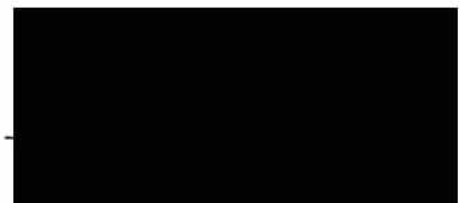
Calibration Date: 06 November 2023

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



Person in charge

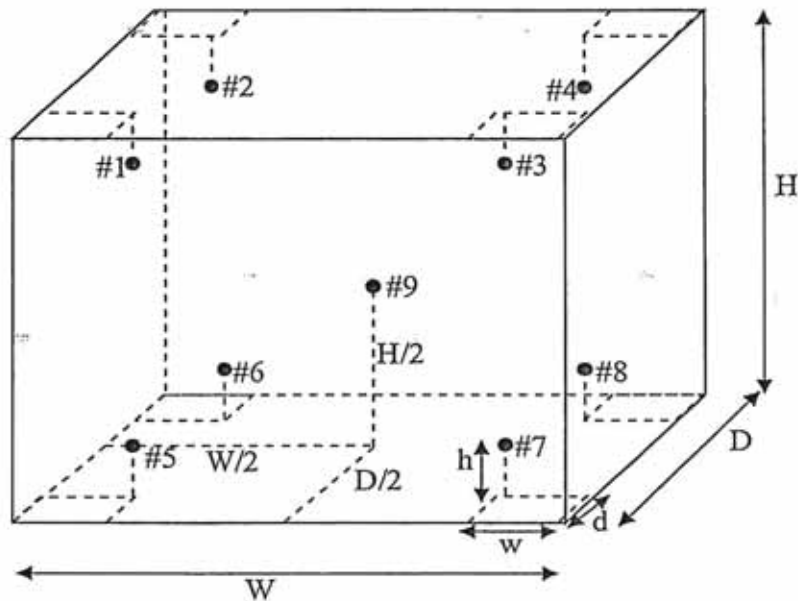


Authorized signatory

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.



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



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

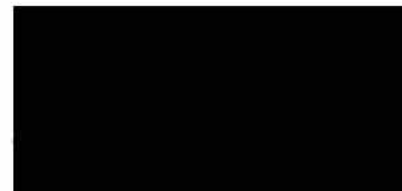
Calibration Date: 16 May 2023

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



Person in charge

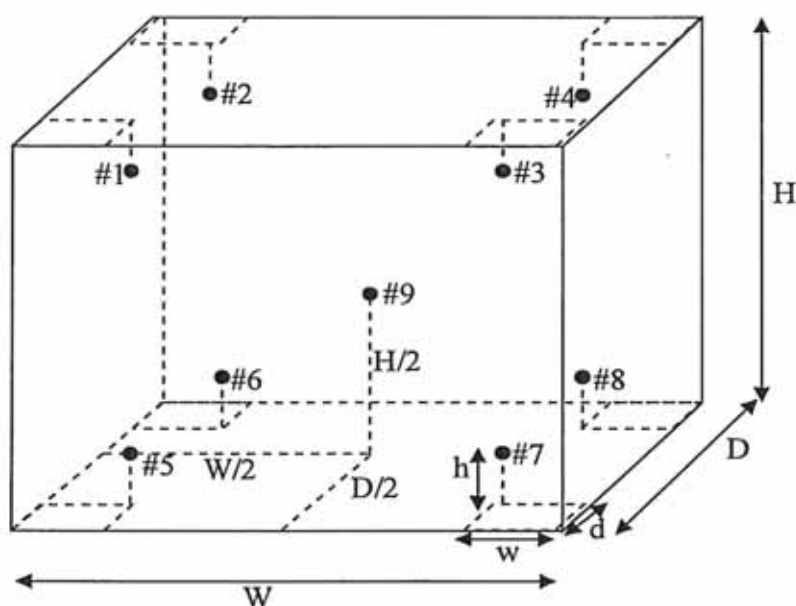


Authorized signatory

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.



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

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

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



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

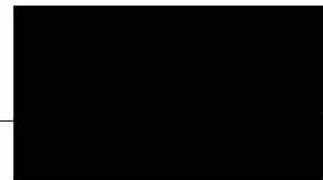
Calibration Date: 16 May 2024

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



Person in charge

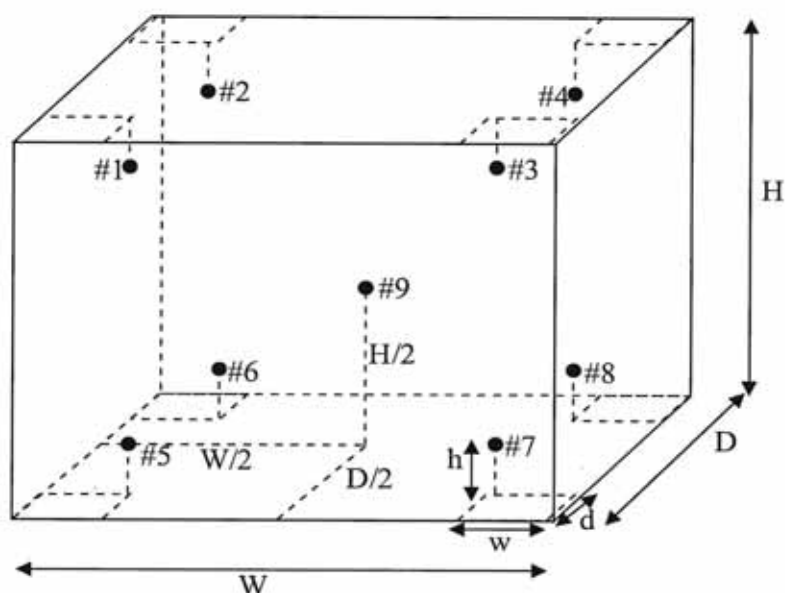


Authorized signatory

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.



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

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

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



Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01231653
Model:	40SM-200A	Issued Date:	17 May 2023
Serial No. (or ID.):	40294	Job No.:	KSPR2307254
Manufacturer:	Precisa	Page:	1 of 5
Condition:	In condition		

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

Environment Condition: Temperature 25 °C \pm 0.7 °C
Humidity 57 %RH \pm 2.8 %RH

Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Air 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-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. C02230532


Person in charge
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.

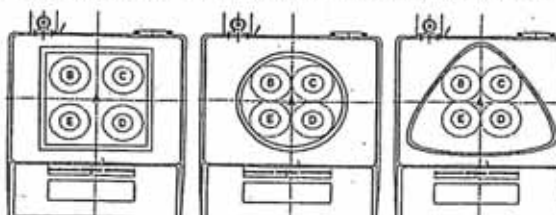
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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.

Calibration Results:

Before 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		100	(g)
Reference Points (g)						
A		B		C		D
-		0.0001		0.0001		-0.0001
						-0.0001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
5	0.000004
40	0.000004

Error of Indication from nominal or conventional mass value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.1	0.100004	0.10000	0.00000	0.000012	2.01
0.2	0.200001	0.20000	0.00000	0.000013	2.01
0.3	0.300005	0.30001	0.00000	0.000019	2.00
0.4	0.399997	0.40000	0.00000	0.000021	2.00
0.5	0.500006	0.50001	0.00000	0.000015	2.00
1	1.000015	0.99999	-0.00003	0.000018	2.00
2	2.000018	1.99997	-0.00005	0.000021	2.00
5	5.000020	4.99983	-0.00019	0.000027	2.00
10	10.000018	9.99970	-0.00032	0.000034	2.00
20	20.000018	19.99937	-0.00065	0.000048	2.00
30	30.000036	29.99907	-0.00097	0.000080	2.00
40	40.000036	39.99887	-0.00117	0.000090	2.00

Before Adjustment (Cont.)

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

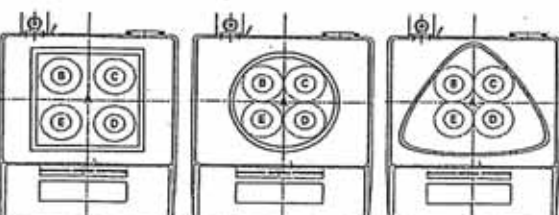
Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00004

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
0.01	0.01000	0.0100	0.0000	0.000096	2.02
0.05	0.05000	0.0500	0.0000	0.000096	2.02
0.1	0.10000	0.1000	0.0000	0.000096	2.02
0.5	0.50001	0.5000	0.0000	0.000097	2.02
1	1.00002	1.0000	0.0000	0.000097	2.02
2	2.00002	2.0000	0.0000	0.000098	2.02
5	5.00002	4.9999	-0.0001	0.000099	2.02
10	10.00002	9.9998	-0.0002	0.00010	2.02
50	50.00003	49.9986	-0.0014	0.00012	2.01
100	100.00002	99.9973	-0.0027	0.00017	2.00
150	150.00005	149.9963	-0.0038	0.00023	2.00
200	200.00000	199.9950	-0.0050	0.00029	2.00

After 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		100	(g)
Reference Points (g)						
A	B	C	D	E		
-	0.0001	0.0001	-0.0001	-0.0001		

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
5	0.000004
40	0.000004

Error of Indication from nominal or conventional mass value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
0.1	0.100004	0.10000	0.00000	0.000012	2.01
0.2	0.200001	0.20000	0.00000	0.000013	2.01
0.3	0.300005	0.30001	0.00000	0.000019	2.00
0.4	0.399997	0.40000	0.00000	0.000021	2.00
0.5	0.500006	0.50001	0.00000	0.000015	2.00
1	1.000015	1.00002	0.00000	0.000018	2.00
2	2.000018	2.00002	0.00000	0.000021	2.00
5	5.000020	5.00001	-0.00001	0.000027	2.00
10	10.000018	9.99999	-0.00003	0.000034	2.00
20	20.000018	19.99999	-0.00003	0.000048	2.00
30	30.000036	29.99999	-0.00005	0.000080	2.00
40	40.000036	39.99998	-0.00006	0.000090	2.00

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00004

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
0.01	0.01000	0.0100	0.0000	0.000096	2.02
0.05	0.05000	0.0500	0.0000	0.000096	2.02
0.1	0.10000	0.1000	0.0000	0.000096	2.02
0.5	0.50001	0.5000	0.0000	0.000097	2.02
1	1.00002	1.0000	0.0000	0.000097	2.02
2	2.00002	2.0000	0.0000	0.000098	2.02
5	5.00002	5.0000	0.0000	0.000099	2.02
10	10.00002	10.0000	0.0000	0.00010	2.02
50	50.00003	50.0000	0.0000	0.00012	2.01
100	100.00002	100.0000	0.0000	0.00017	2.00
150	150.00005	150.0001	0.0000	0.00023	2.00
200	200.00000	200.0001	0.0001	0.00029	2.00

The End of Certificate



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

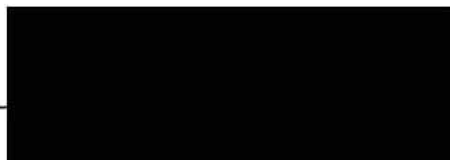
Calibration Place: LIFE & ENVIRONMENT CO., LTD. (Microbiological Laboratory)
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

Calibration By: Mr. Suphakorn Sookmee

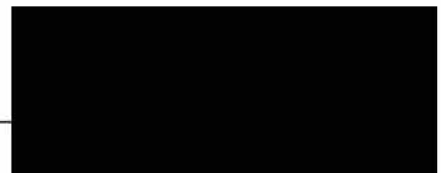
Calibration Date: 06 November 2023

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



Person in charge

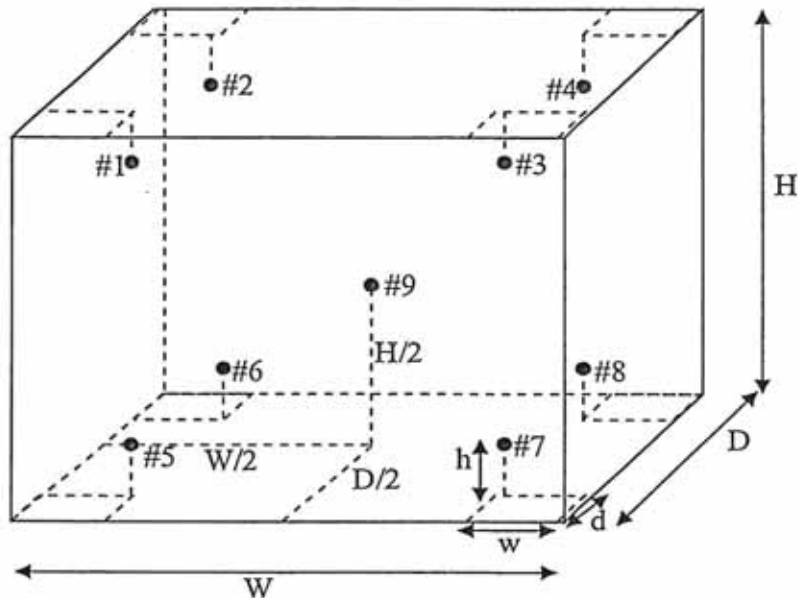


Authorized signatory

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.



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



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		

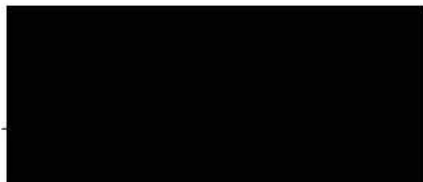
Customer: LIFE & ENVIRONMENT CO., LTD.
90, 92, 94 Soi On-nuch 64, Srinakarin Road,
Suanluang, Bangkok 10250 Thailand

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



Person in charge

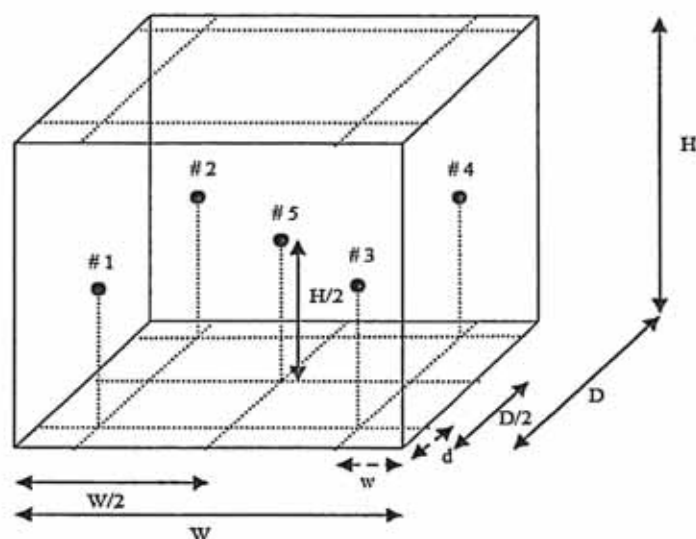


Authorized signatory

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.



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



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

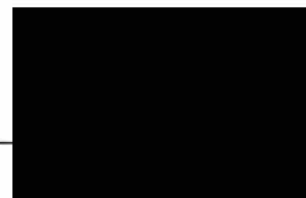
Calibration Date: 13 December 2023

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



Person in charge

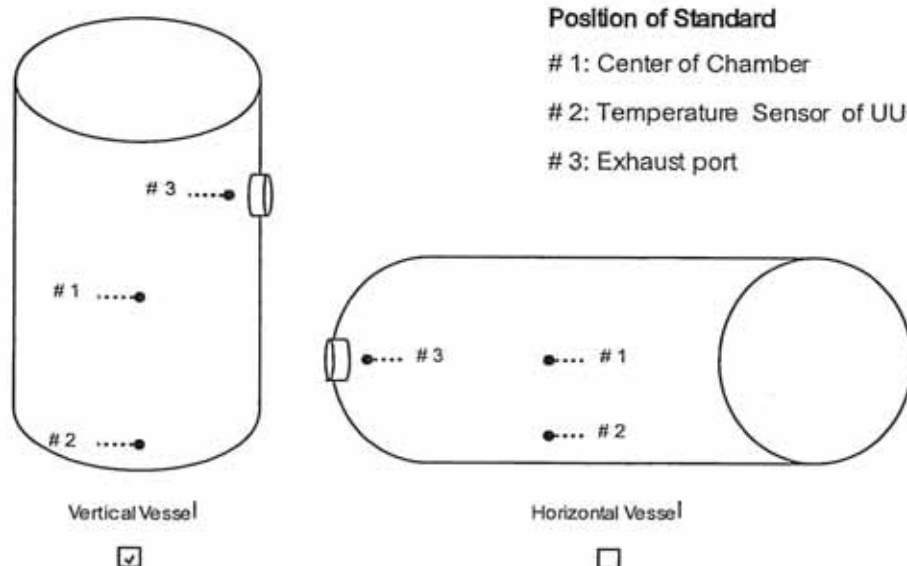


Authorized signatory

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.



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	121.02	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 (± °C)*
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating kg/cm ²	#1 (°C)	#2 (°C)	#3 (°C)	
121	121	121	1.2	121.02	121.02	121.05	2.0

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure kg/cm ²	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