

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Trade & Engineering

TSP High Volume Sampler
TE-5000 TSP Sampler Verification
Site Information

Location: -	Site ID: -	Date: 16 Oct. 23
Sampler: TE-5000 TSP	Serial No: 3273	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 27.50	Corrected Pressure (mm Hg): 698.5
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 27.00	Corrected Average (mm Hg): 685.8
Average Temp (Deg F): 75.5	Average Temp: (Deg K): 297.3

Calibration Orifice

Make: Tisch	Qstd Slope: 1.56304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date: 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	6.60	1.566	61.0	58.52	Slope: 39.0390
2	5.50	1.431	57.9	55.55	Intercept: -1.2149
3	4.20	1.252	51.3	49.21	Corr. Coeff: 0.9826
4	3.70	1.175	47.3	45.38	
5	3.00	1.059	40.0	38.37	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [(\text{Sqrt}(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I) \text{Sqrt}(298/Tav)(Pav/760))-b]$$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average 1 (chart): 51.5
Average Flow Calculation m3/min 1.28570333
Average Flow Calculation in cfm 45.39912828
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 1851.412795
Total flow in 24 hours cfm 65374.74472

NOTE: Ensure calibration orifice has been certified within 12 months of use

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Trade & Engineering

TSP High Volume Sampler
TE-5000 TSP Sampler Verification
Site Information

Location: -	Site ID: -	Date: 16 Oct. 23
Sampler: TE-5000 TSP	Serial No: 3270	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 27.60	Corrected Pressure (mm Hg): 701.0
Temperature (deg F): 76.0	Temperature (deg K): 297.6
Average Press. (in Hg): 27.50	Corrected Average (mm Hg): 698.5
Average Temp (Deg F): 74.8	Average Temp: (Deg K): 296.9

Calibration Orifice

Make: Tisch	Qstd Slope: 1.56304
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date: 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.80	1.705	60.1	57.76	Slope: 28.1557
2	6.00	1.497	57.2	54.97	Intercept: 11.0629
3	5.30	1.407	53.4	51.32	Corr. Coeff: 0.9717
4	4.50	1.297	49.7	47.77	
5	3.90	1.209	45.6	43.83	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [(\text{Sqrt}(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I) \text{Sqrt}(298/Tav)(Pav/760))-b]$$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Enter Average 1 (chart): 53.2
Average Flow Calculation m3/min 1.421779972
Average Flow Calculation in cfm 50.2040944
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 2047.36316
Total flow in 24 hours cfm 72293.89593

NOTE: Ensure calibration orifice has been certified within 12 months of use

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Trade & Engineering

TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: -	Site ID: -	Date: 14 Oct 24
Sampler: TE-5000 TSP	Serial No: 3270	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 28.00	Corrected Pressure (mm Hg): 711.2
Temperature (deg F): 75.5	Temperature (deg K): 297.3
Average Press. (in Hg): 27.29	Corrected Average (mm Hg): 693.2
Average Temp (Deg F): 75.3	Average Temp: (Deg K): 297.2

Calibration Orifice

Make: Tisch	Qstd Slope: 1.57894
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 10 December 2024

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.25	1.771	60.2	58.30	Slope: 38.4149
2	6.60	1.585	55.6	53.85	Intercept: -8.6412
3	5.30	1.422	47.7	46.20	Corr. Coeff: 0.9946
4	4.60	1.325	43.2	41.84	
5	4.15	1.112	34.9	33.80	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

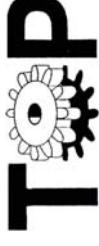
For subsequent calculation of sampler flow:

$$1/m(1)[\text{Sqrt}(298/Tav)(Pav/760)]-b]$$

Enter Average I (chart): 48.3
Average Flow Calculation m3/min 1.427813103
Average Flow Calculation in cfm 50.41712868
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 2056.050868
Total flow in 24 hours cfm 72600.6653

NOTE: Ensure calibration orifice has been certified within 12 months of use

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Trade & Engineering

TSP High Volume Sampler
TE-5000 TSP Sampler Verification

Site Information

Location: -	Site ID: -	Date: 14 Oct 24
Sampler: TE-5000 TSP	Serial No: 3269	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 27.75	Corrected Pressure (mm Hg): 704.9
Temperature (deg F): 76.5	Temperature (deg K): 297.9
Average Press. (in Hg): 27.31	Corrected Average (mm Hg): 693.7
Average Temp (Deg F): 74.9	Average Temp: (Deg K): 297.0

Calibration Orifice

Make: Tisch	Qstd Slope: 1.57894
Model: TE-5028A	Qstd Intercept: -0.01520
Serial#: 1179	Calibration Due Date 10 December 2024

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.00	1.735	60.1	57.89	Slope: 39.5761
2	6.55	1.571	55.7	53.65	Intercept: -9.7403
3	5.15	1.394	47.8	46.04	Corr. Coeff: 0.9955
4	4.55	1.311	43.3	41.71	
5	4.00	1.112	35.2	33.91	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m(1)[\text{Sqrt}(298/Tav)(Pav/760)]-b]$$

Enter Average I (chart): 48.4
Average Flow Calculation m3/min 1.416976485
Average Flow Calculation in cfm 50.03447975
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 2040.446139
Total flow in 24 hours cfm 72049.65084

NOTE: Ensure calibration orifice has been certified within 12 months of use

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PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 3211 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.10 Corrected Pressure (mm Hg): 688.3
Temperature (deg F): 75.3 Temperature (deg K): 297.0
Average Press. (in Hg): 26.55 Corrected Average (mm Hg): 674.4
Average Temp. (deg F): 76.2 Average Temp. (deg K): 297.6

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 12 Dec 23

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart) (corrected)	IC	Linear Regression Slope	Intercept	Corr. Coeff	SFR	SSP	# of Observations:
1	9.60	1.295	60.7	39.87	34.8028	-4.2838	0.9827	1.105	52.02	5
2	7.50	1.146	55.5	36.46						
3	6.45	1.063	50.8	33.37						
4	5.35	0.969	45.9	30.15						
5	4.60	0.900	39.2	25.75						

of Observations: 5

Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

m = sampler slope
b = sampler intercept
I = chart response

Tav = daily average temperature
Pav = daily average pressure

SFR = sampler set point flow rate
SSP = sampler chart set point

m = sampler slope

b = sampler intercept

Ta = actual temperature (deg K)

Pa = actual pressure (mm Hg)

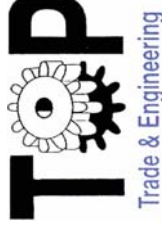
Ts = Average temperature (deg K)

Ps = Average pressure (mm Hg)

For subsequent calculation of sampler flow:

Average I (chart): 50.4
Average Flow over Sample (m3/min) 1.085070646
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min) 1562.501731
Total flow over sample (CFM) 55171.9361

NOTE: Ensure calibration orifice has been certified within 12 months of use



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 3183 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.02 Corrected Pressure (mm Hg): 686.3
Temperature (deg F): 75.3 Temperature (deg K): 297.1
Average Press. (in Hg): 26.70 Corrected Average (mm Hg): 678.2
Average Temp. (deg F): 76.1 Average Temp. (deg K): 297.5

Calibration Orifice

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304
Model: TE-5028A Qstd Intercept: -0.01520
Serial#: 1179 Calibration Due Date: 12 Dec 23

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart) (corrected)	IC	Linear Regression Slope	Intercept	Corr. Coeff	SFR	SSP	# of Observations:
1	9.45	1.287	60.5	39.80	36.1461	-6.1754	0.9935	1.115	51.87	5
2	7.75	1.167	55.3	36.38						
3	6.50	1.069	50.7	33.36						
4	5.75	1.006	45.3	29.80						
5	4.60	0.901	39.6	26.05						

of Observations: 5

Calculations

Qa = 1/m(Sqrt((H2O)(Ta/Pa))-b)
IC = I(Sqrt(Ta/Pa))

m = sampler slope
b = sampler intercept
I = chart response

Tav = daily average temperature
Pav = daily average pressure

SFR = sampler set point flow rate
SSP = sampler chart set point

m = sampler slope

b = sampler intercept

Ta = actual temperature (deg K)

Pa = actual pressure (mm Hg)

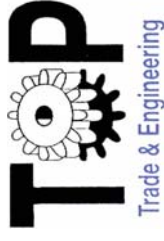
Ts = Average temperature (deg K)

Ps = Average pressure (mm Hg)

For subsequent calculation of sampler flow:

Average I (chart): 50.3
Average Flow over Sample (m3/min) 1.092521097
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min) 1573.23038
Total flow over sample (CFM) 55550.76473

NOTE: Ensure calibration orifice has been certified within 12 months of use



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 3245 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.50
Corrected Pressure (mm Hg): 698.5
Temperature (deg F): 75.2
Temperature (deg K): 297.0
Average Press. (in Hg): 26.48
Corrected Average (mm Hg): 672.6
Average Temp. (deg F): 76.0
Average Temp. (deg K): 297.4

Calibration Orifice

Make: Tisch Environmental, Inc.
Model: TE-5028A
Serial#: 1179
Qstd Slope: 1.58304
Qstd Intercept: -0.01520
Calibration Due Date: 12 Dec 23

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope	Linear Regression Intercept	Linear Regression Corr. Coeff	SFR	SSP	# of Observations:
1	9.35	1.269	60.0	39.12	36.0	36.6800	-6.6541	0.9908	50.91	5
2	7.65	1.149	55.4	36.12	36.0	36.6800	-6.6541	0.9908	50.91	5
3	6.55	1.064	50.9	33.19	36.0	36.6800	-6.6541	0.9908	50.91	5
4	5.70	0.993	45.5	29.67	36.0	36.6800	-6.6541	0.9908	50.91	5
5	4.65	0.898	39.4	25.69	36.0	36.6800	-6.6541	0.9908	50.91	5

of Observations: 5

Calculations

Qa = $1/m(\sqrt{(H_2O)(T_a/P_a)}) - b$
IC = $I(\sqrt{(T_a/P_a)})$

SFR = $1.13(P_s/P_a)(T_a/T_s)$
SSP = $(m^*SFR + b)(\sqrt{(P_a/T_a)})$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation of sampler flow:

SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

Average I (chart): 50.2
Average Flow over Sample (m3/min): 1.091533108
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1571.807676
Total flow over sample (CFM): 55500.52903

NOTE: Ensure calibration orifice has been certified within 12 months of use

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PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 20 September 2024
Sampler: TE-6070 PM10 Serial No: 3183 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 27.03
Corrected Pressure (mm Hg): 686.6
Temperature (deg F): 75.4
Temperature (deg K): 297.1
Average Press. (in Hg): 26.73
Corrected Average (mm Hg): 678.9
Average Temp. (deg F): 75.9
Average Temp. (deg K): 297.4

Calibration Orifice

Make: Tisch Environmental, Inc.
Model: TE-5028A
Serial#: 1179
Qstd Slope: 1.57894
Qstd Intercept: -0.01520
Calibration Due Date: 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression Slope	Linear Regression Intercept	Linear Regression Corr. Coeff	SFR	SSP	# of Observations:
1	9.40	1.287	60.0	39.47	30.7100	30.7100	0.7813	0.9489	53.31	5
2	7.80	1.173	57.3	37.69	30.7100	30.7100	0.7813	0.9489	53.31	5
3	6.50	1.072	52.9	34.80	30.7100	30.7100	0.7813	0.9489	53.31	5
4	5.80	1.037	50.3	33.09	30.7100	30.7100	0.7813	0.9489	53.31	5
5	5.05	1.006	45.7	30.06	30.7100	30.7100	0.7813	0.9489	53.31	5

of Observations: 5

Calculations

Qa = $1/m(\sqrt{(H_2O)(T_a/P_a)}) - b$
IC = $I(\sqrt{(T_a/P_a)})$

SFR = $1.13(P_s/P_a)(T_a/T_s)$
SSP = $(m^*SFR + b)(\sqrt{(P_a/T_a)})$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
For subsequent calculation of sampler flow:

SFR = sampler set point flow rate
SSP = sampler chart set point
m = sampler slope
b = sampler intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

Average I (chart): 53.2
Average Flow over Sample (m3/min): 1.121929464
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1615.578428
Total flow over sample (CFM): 57046.0743

NOTE: Ensure calibration orifice has been certified within 12 months of use

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Certificate of Analyzer Performance Testing

Calibrated Date : 22-Jul-23 Certificate No. : 0723-001 Page : 1/1

Analyzer Instruments : CO Analyzer
Model : 48C
Manufacturer : Thermo Environmental
Serial No. : 508011061

Environmental
Temperature : 24.2 °C
Humidity : 55.0 %RH

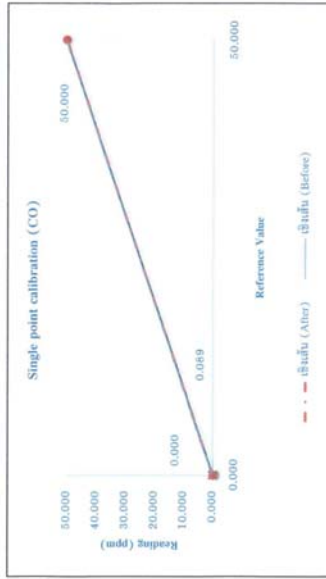
Calibration System

Calibrator Units : Thermo Environmental
Gas Calibration : Zero Air Generator
Model : 701
Serial No. : 179

Standard Gas
NO Conc. : 2 ppm
SO2 Conc. : 2 ppm
CO Conc. : 50 ppm
Cylinder No. : CC750227
Expire Date : 21-Nov-23

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.089	0.000	0.089	Before		
				50.2	50.000	0.40
CO	0.000	0.000	0.000	After		
				50.0	50.000	0.00



Calibrated by :

Tong
(Mr. Tong Pima)



PM10 High Volume Sampler Verification

Site Information

Location : - Site ID : - Date : 20 September 2024
Sampler : TE-6070 PM10 Serial No : 3245 Tech : Tong P.

Site Conditions

Barometric Pressure (in Hg) : 27.07
Temperature (deg F) : 75.8
Average Press. (in Hg) : 26.80
Average Temp. (deg F) : 76.0
Corrected Pressure (mm Hg) : 687.6
Temperature (deg K) : 297.3
Corrected Average (mm Hg) : 680.7
Average Temp. (deg K) : 297.4

Calibration Orifice

Make : Tisch Environmental, Inc.
Model : TE-5028A
Serial# : 1179
Qstd Slope : 1.57894
Qstd Intercept : -0.01520
Calibration Due Date : 10 Dec 24

Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	9.45	1.290	61.1	40.18	Slope 30.4605
2	7.85	1.177	57.7	37.94	Intercept 1.5124
3	6.55	1.076	53.4	35.12	Corr. Coeff 0.9651
4	5.85	1.037	51.2	33.67	SFR 1.118
5	5.10	1.006	46.8	30.78	SSP 54.10

of Observations: 5

Calculations

$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)}) - b$
 $IC = 1(\sqrt{(Ta/Pa)})$
SFR = $1.13(Ps/Pa)(Ta/Ts)$
SSP = $(m^2SFR - b)/(\sqrt{(Ta/Pa)})$

Qa = actual flow rate
IC = corrected chart response
m = calibrator slope
b = calibrator intercept
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)
Ts = average temperature (deg K)
Ps = average pressure (mm Hg)
For subsequent calculation of sampler flow:

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure

Average I (chart): 54.0
Average Flow over Sample (m3/min): 1.123074473
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1617.227241
Total flow over sample (CFM): 57104.29387

NOTE: Ensure calibration orifice has been certified within 12 months of use

Certificate of Analyzer Performance Testing

Calibrated Date : 28-Mar-24 Certificate No. : 0324-005 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
 Model : 48C Serial No. : 401304281

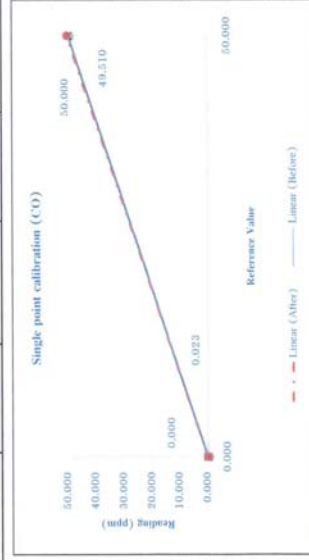
Environmental
 Temperature : 25.1 °C
 Humidity : 46.9 %RH

Calibration System
 Calibrator Units : Thermo Environmental : API
 Gas Calibration : 146C Model : 701
 Serial No. : 514611456 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm Cylinder No. : 307199
 SO2 Conc. : 2 ppm Expire Date : 10-Oct-25
 CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.023	0.000	0.02	49.510	50.000	-0.98
				50.000	50.000	0.00
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Topper
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 5-Mar-24 Certificate No. : 0324-002 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental
 Model : 48C Serial No. : 65775350

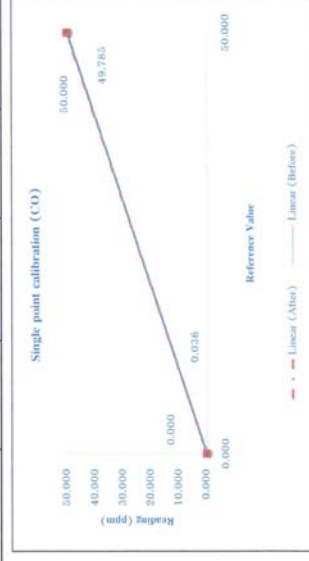
Environmental
 Temperature : 25.2 °C
 Humidity : 44.6 %RH

Calibration System
 Calibrator Units : Thermo Environmental : API
 Gas Calibration : 146C Model : 701
 Serial No. : 514611456 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm Cylinder No. : 307199
 SO2 Conc. : 2 ppm Expire Date : 10-Oct-25
 CO Conc. : 50 ppm

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.026	0.000	0.04	49.785	50.000	-0.43
				50.000	50.000	0.00
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Topper
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-003 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 48C
 Manufacturer : Thermo Environmental
 Serial No. : 508011069

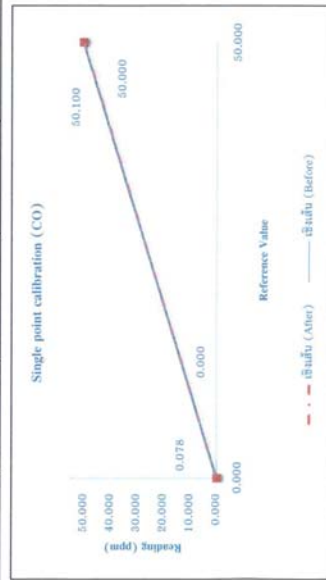
Environmental
 Temperature : 25.5 °C
 Humidity : 53.7 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : CC750227
 Expire Date : 21-Nov-23

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.076	0.000	0.08	50.1	50.000	0.20
CO	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 48C
 Manufacturer : Thermo Environmental
 Serial No. : 401304261

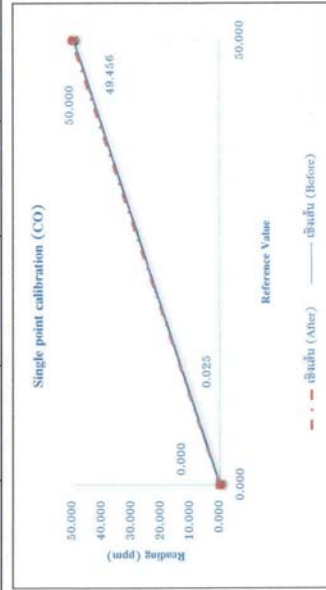
Environmental
 Temperature : 25.2 °C
 Humidity : 52.3 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : CC750227
 Expire Date : 21-Nov-23

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.025	0.000	0.03	49.456	50.000	-1.09
CO	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24 Certificate No. : 0824-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 48C
 Manufacturer : Thermo Environmental
 Serial No. : 508011068

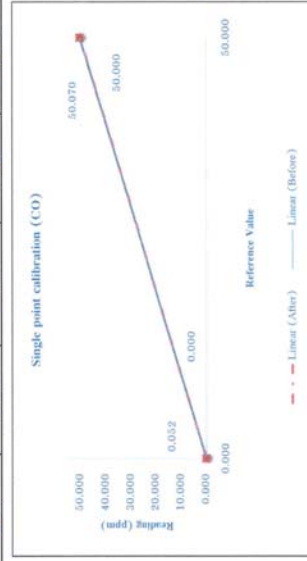
Environmental
 Temperature : 25.0 °C
 Humidity : 51.5 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : 307199
 Expire Date : 10-Oct-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.052	0.000	0.05	Before		
				50.070	50.000	0.14
CO	0.000	0.000	0.00	After		
				50.000	50.000	0.00



Calibrated by : *Top*
 (Mr. Teeng Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-006 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 48C
 Manufacturer : Thermo Environmental
 Serial No. : 508011064

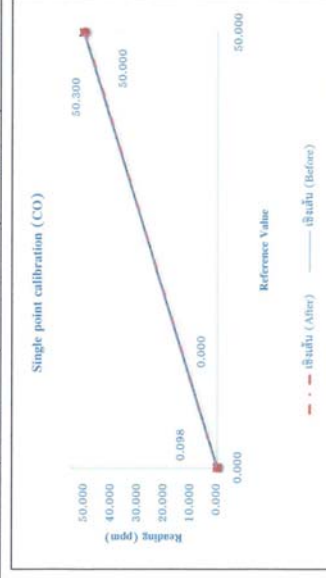
Environmental
 Temperature : 24.9 °C
 Humidity : 41.3 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : CC750227
 Expire Date : 21-Nov-23

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.098	0.000	0.10	Before		
				50.3	50.000	0.60
CO	0.000	0.000	0.00	After		
				50.0	50.000	0.00



Calibrated by : *Top*
 (Mr. Teeng Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 1-Feb-24 Certificate No. : 0224-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 486
 Manufacturer : Thermo Environmental
 Serial No. : 1172750062

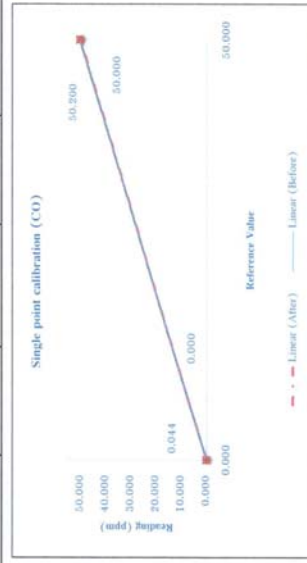
Environmental
 Temperature : 23.8 °C
 Humidity : 42.5 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : 307199
 Expire Date : 10-Oct-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.044	0.000	0.04	50.2	50.0	0.20
	0.000	0.000	0.00	50.0	50.0	0.00



Calibrated by : *Tong Pina*
 (Mr. Tong Pina)

Certificate of Analyzer Performance Testing

Calibrated Date : 16-Jan-24 Certificate No. : 0124-003 Page : 1/1

Analyzer Instruments
 Analyzer Type : CO Analyzer
 Model : 48C
 Manufacturer : Thermo Environmental
 Serial No. : 71021-367

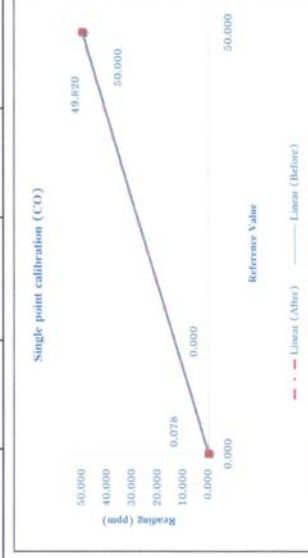
Environmental
 Temperature : 26.6 °C
 Humidity : 46.7 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811458
 Zero Air Generator : API
 Model : 701
 Serial No. : 179

Standard Gas
 NO Conc. : 2 ppm
 SO2 Conc. : 2 ppm
 CO Conc. : 50 ppm
 Cylinder No. : 307199
 Expire Date : 10-Oct-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.078	0.000	0.08	49.820	50.000	-0.36
	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by : *Tong Pina*
 (Mr. Tong Pina)

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT



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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240191EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222195 (Meter), 84163 (Microphone), - (Preamplifier)
ID No.: NS-03-025
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9609027	CB20230108EB	8 June 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20230196EA	20 March 2025 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P240029 CD20230197EA	10 April 2025 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

- Reference standards instrument for Acoustic function
- National Institute of Metrology (Thailand)
 - Reference standards instrument for Electrical function
 - National Institute of Metrology (Thailand)
 - Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240191EA
Operation No.: CP2024050161

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222195 (Meter), 84163 (Microphone), - (Preamplifier)
ID No.: NS-03-025
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 9 May 2024

Calibrated Date: 27 - 28 May 2024

Issued Date: 30 May 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240191EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	120.9	-0.1	±1.1

Certificate No.: CP20240191EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.0

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.8
C-weighting	32.7
Z-weighting	36.5

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
125	0.1	0.0	0.1
1000	-0.3	-0.3	-0.3
8000	0.6	0.7	0.8

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
63	-0.1	-0.1	-0.1
125	0.0	-0.1	-0.1
250	-0.1	-0.1	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	-0.1	-0.1	-0.1
4000	-0.4	-0.3	-0.1
8000	-0.4	-0.4	-0.1

Certificate No.: CP20240191EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	99.0	0.0	+1.0 ; -2.5
	0.25	89.9	-0.1	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
	200	109.9	-0.1	±1.0
LAE	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.5	0.1	±3.0
Positive half cycle	124.4	124.3	-0.1	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
	Negative one-half cycle	-		

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Certificate No.: CP20240191EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.3	0.3	±1.1
34.0	35.2	1.2	±1.1
33.0	34.5	1.5	±1.1
32.0	33.8	1.8	±1.1
31.0	33.3	2.3	±1.1
30.0	32.7	2.7	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	30.4	5.4	±1.1
20-90	25.0	30.3	5.3	±1.1
20-100	25.0	30.3	5.3	±1.1
20-110	25.0	30.4	5.4	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	43.9	-1.1	±1.1



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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240128EA
Operation No.: CP2024030097

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222189 (Meter), 84153 (Microphone), - (Preamplifier)
ID No.: NS-03-019

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 7 March 2024

Calibrated Date: 18 - 19 March 2024

Issued Date: 21 March 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240191EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
3. The acceptance limit is for the deviated value.
4. Acceptance limits was IEC61672-3:2013 Class 2.
5. The coverage factor $k = 2.00$

-- End of Report --



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ELECTRICAL AND ELECTRONICS INSTITUTE
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Certificate No.: CP20240128EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
20.7

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	17.2
C-weighting	24.8
Z-weighting	32.1

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
125	0.2	0.1	0.1
1000	-0.2	-0.2	-0.2
8000	-0.5	-0.4	-0.3

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
63	-0.1	-0.2	0.0
125	0.0	-0.2	0.1
250	0.0	0.0	0.0
500	0.1	0.0	0.1
1000	0.0	0.0	0.0
2000	-0.1	0.0	0.0
4000	-0.3	-0.3	0.0
8000	-0.5	-0.4	-0.2

Certificate No.: CP20240128EA

Calibration Report

Equipment:

Manufacturer:

Model/Type:

Serial No.:

ID No.:

Ambient Temperature:

Relative Humidity:

Pressure:

Method of Calibration :-

IEC61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9609027	CB20230108EB	8 June 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U89038	MY56510003	CB20240035EA CK20230072EA	13 February 2025 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-



Certificate No.: CP20240128EA

CP20240128EA

Calibration Report

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Function : 5. Frequency and time weighting at 1 kHz

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	34.0	0.0	±1.1
33.0	33.1	0.1	±1.1
32.0	32.2	0.2	±1.1
31.0	31.3	0.3	±1.1
30.0	30.4	0.4	±1.1
29.0	29.5	0.5	±1.1

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.3	0.3	±1.1
20-90	25.0	25.3	0.3	±1.1
20-100	25.0	25.2	0.2	±1.1
20-110	25.0	25.5	0.5	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1

Certificate No.: CP20240128EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
3. The acceptance limit is for the deviated value.
4. Acceptance limits was IEC61672-3:2013 Class 2.
5. The coverage factor $k = 2.00$

-- End of Report --

Certificate No.: CP20240128EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.9	-0.1	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
	200	109.9	-0.1	±1.0
LAE	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.4	0.0	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
	Negative one-half cycle			
-	-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3



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Certificate No.: CP20240127EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222187 (Meter), 84151 (Microphone), - (Preamplifier)
ID No.: NS-03-017
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9609027	CB20230108EB	8 June 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EA CK20230072EA	13 February 2025 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240127EA

Operation No.: CP2024030096

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052NR (Microphone), - (Preamplifier)
Serial No.: 222187 (Meter), 84151 (Microphone), - (Preamplifier)
ID No.: NS-03-017
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 7 March 2024

Calibrated Date: 13 - 18 March 2024

Issued Date: 19 March 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240127EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1

Certificate No.: CP20240127EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
21.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	17.0
C-weighting	24.7
Z-weighting	31.7

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
125	0.1	-0.2	0.0
1000	-0.2	-0.2	-0.2
8000	-0.2	-0.1	0.1

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
63	-0.1	-0.2	0.0
125	0.1	-0.2	0.0
250	0.0	-0.1	0.0
500	0.1	0.0	0.0
1000	0.0	0.0	0.0
2000	-0.1	0.0	0.0
4000	-0.4	-0.3	-0.1
8000	-0.5	-0.4	-0.1

Certificate No.: CP20240127EA

CP20240127EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.8	-0.2	+1.5 ; -5.0
Slow	200	109.4	-0.2	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
	0.25	109.9	-0.1	±1.0
LAE	200	90.0	0.0	+1.0 ; -2.5
	2	80.8	-0.2	+1.5 ; -5.0
	0.25			

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.3	-0.1	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
	Negative one-half cycle			
-	-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Certificate No.: CP20240127EA

CP20240127EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	68.9	-0.1	±1.1
64.0	63.8	-0.2	±1.1
59.0	58.8	-0.2	±1.1
54.0	53.8	-0.2	±1.1
49.0	48.8	-0.2	±1.1
44.0	43.8	-0.2	±1.1
39.0	38.8	-0.2	±1.1
34.0	33.9	-0.1	±1.1
33.0	33.0	0.0	±1.1
32.0	32.0	0.0	±1.1
31.0	31.1	0.1	±1.1
30.0	30.2	0.2	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.4	0.4	±1.1
20-90	25.0	25.4	0.4	±1.1
20-100	25.0	25.5	0.5	±1.1
20-110	25.0	25.3	0.3	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1



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Certificate No.: CP20240384EA
Operation No.: CP2024100365

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: ACO
Model/Type: 6236 (Meter), 7052 (Microphone), - (Preamplifier)
Serial No.: 222129 (Meter), 72838 (Microphone), - (Preamplifier)
ID No.: NS-03-014

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 29 October 2024

Calibrated Date: 8 - 11 November 2024

Issued Date: 15 November 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240127EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
3. The acceptance limit is for the deviated value.
4. Acceptance limits was IEC61672-3:2013 Class 2.
5. The coverage factor $k = 2.00$

-- End of Report --



Certificate No.: CP20240384EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)	
20.7	

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	15.5
C-weighting	20.6
Z-weighting	26.5

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
125	-0.4	-0.6	-0.5
1000	-0.7	-0.7	-0.7
8000	1.5	1.8	1.8
			Acceptance limits (dB)
			±1.5
			±1.0
			±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve		
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)
63	0.0	-0.2	-0.1
125	0.0	-0.2	0.0
250	0.0	-0.1	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	-0.1	0.0
4000	-0.3	-0.3	-0.1
8000	-0.4	-0.4	-0.1
			Acceptance limits (dB)
			±2.0
			±1.5
			±1.5
			±1.5
			±2.0
			±3.0
			±5.0

Certificate No.: CP20240384EA

Calibration Report

Equipment:

Sound Level Meter

ACO

Manufacturer:
6236 (Meter), 7052 (Microphone), - (Preamplifier)

Model/Type:
222129 (Meter), 72838 (Microphone), - (Preamplifier)

Serial No.:

NS-03-014

ID No.:

(23 ± 2) °C

Ambient Temperature:

(50 ± 15) %

Relative Humidity:

(101.3 ± 1.5) kPa

Pressure:

Method of Calibration :-

IEC61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1007-24	6 June 2025
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2913	EF-0021-24	3 June 2025
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.01119

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.01119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-



Certificate No.: CP20240384EA

CP20240384EA

Calibration Report

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Function : 5. Frequency and time weighting at 1 kHz

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	58.9	-0.1	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
33.0	33.0	0.0	±1.1
32.0	32.1	0.1	±1.1
31.0	31.2	0.2	±1.1
30.0	30.4	0.4	±1.1
29.0	29.7	0.7	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.0	0.0	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.5	0.5	±1.1
20-90	25.0	25.7	0.7	±1.1
20-100	25.0	25.8	0.8	±1.1
20-110	25.0	25.7	0.7	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1

Certificate No.: CP20240384EA

CP20240384EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.1	0.1	±1.1
121.0	121.1	0.1	±1.1
122.0	122.0	0.0	±1.1
123.0	123.0	0.0	±1.1

Certificate No.: CP20240384EA

Calibration Report

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.24	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. Overload indication can not measured because sound level meter can not set to Reference value of the standard calibration.
3. The acceptance limit is for the deviated value.
4. Acceptance limits was IEC61672-3:2013 Class 2.
5. The coverage factor $k = 2.00$

-- End of Report --

Certificate No.: CP20240384EA

Calibration Report

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	98.9	-0.1	+1.0 ; -2.5
	0.25	89.8	-0.2	+1.5 ; -5.0
Slow	200	109.5	-0.1	±1.0
	2	89.8	-0.2	+1.0 ; -5.0
	200	109.9	-0.1	±1.0
LAE	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.1	-0.3	±3.0
Positive half cycle	124.4	124.2	-0.2	±2.0
Negative half cycle	124.4	124.2	-0.2	±2.0

Function : 11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
	Negative one-half cycle			
-	-	-	-	-

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
C	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
Z	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-25

Job No. : 66S1031

Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co., Ltd.

Address : 31/8 Moo 13, Raikhing, Samphan,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter Ambient temperature : $(20 \pm 2) ^\circ\text{C}$
 Manufacturer : ACO Relative humidity : $(50 \pm 15) \%$
 Model : 6236 Atmospheric pressure : -
 Serial No. : 222128 Date of received : 26-Oct-2023
 Identity No. : NS-03-013 Date of calibration : 30-Oct-2023
 Range : See to Data Date of issued : 01-Nov-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/0666	21-Jun-2025

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Ms. Bhacharin Phannangkuew (MD)

Reviewed By : Mr. Sompong Srisert

Mr. Boonyarit Auejirakarn

Ms. Natthaprakarn Thammaphan

The reported expanded uncertainty is based on uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence approximately 95%. This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	0.1	0.20
	104	104.2	0.2	0.20
	114	114.2	0.2	0.20
C	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.1	0.1	0.20
Z	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.1	0.1	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S1031-24

Job No. : 66S1031

Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co., Ltd.

Address : 31/8 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : ACO

Relative humidity : (50 ± 15) %

Model : 6236

Atmospheric pressure : -

Serial No. : 222129

Date of received : 26-Oct-2023

Identity No. : NS-03-014

Date of calibration : 30-Oct-2023

Range : See to Data

Date of issued : 01-Nov-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/06666	21-Jun-2025

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Reviewed By : [] Mr. Sompong Srisert

✓ [] Ms. Natthaprakarn Thammaphan

✓ [] Ms. Bhacharin Phuangkaew (MD)

✓ [] Mr. Boonyarit Auejirakarn

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.5	0.5	0.20
	104	104.5	0.5	0.20
	114	114.5	0.5	0.20
C	94	94.5	0.5	0.20
	104	104.4	0.4	0.20
	114	114.4	0.4	0.20
Z	94	94.5	0.5	0.20
	104	104.4	0.4	0.20
	114	114.4	0.4	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S1229-11

Job No. : 66S1229

Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co.,Ltd.

Address : 31/8 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter Ambient temperature : $(20 \pm 2) ^\circ\text{C}$

Manufacturer : ACO Relative humidity : $(50 \pm 15) \%$

Model : 6236 Atmospheric pressure : -

Serial No. : 222185 Date of received : 12-Dec-2023

Identity No. : NS-03-015 Date of calibration : 15-Dec-2023

Range : See to Data Date of issued : 18-Dec-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/0666	21-Jun-2025

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Ms. Bhacharin Phanangkaew (MD)

Reviewed By : Mr. Sompong Srisert

Ms. Natthaparakarn Thammaphan

Mr. Boonyarit Auejirakarn

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
B	94	93.9	-0.1	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
Z	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0929-2

Job No. : 66S0929

Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co.,Ltd.

Address : 31/8 Moo 13, Raikhang, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : BSWA Tech

Relative humidity : (50 ± 15) %

Model : BSWA 309

Atmospheric pressure : -

Serial No. : 590101

Date of received : 11-Sep-2023

Identity No. : NS-04-002

Date of calibration : 14-Sep-2023

Range : See to Data

Date of issued : 18-Sep-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.40/0666	21-Jun-2025

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

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Reviewed By : Mr. Sompong Srisert

Mr. Bhacharin Phangkaew (MD)

Mr. Natthaparakarn Thammaphan

Mr. Boonyarit Auejirakarn

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor k = 2, providing a level of confidence approximately 95%.
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
B	94	94.0	0.0	0.20
	104	103.9	-0.1	0.20
	114	113.9	-0.1	0.20
Z	94	94.1	0.1	0.20
	104	104.1	0.1	0.20
	114	114.0	0.0	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0929-1

Job No. : 66S0929

Page : 1 of 2

Customer : C.E.M. Technology (Thailand) Co.,Ltd.

Address : 31/8 Moo 13, Ruikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

Ambient temperature : (20 ± 2) °C

Manufacturer : BSWA Tech

Relative humidity : (50 ± 15) %

Model : BSWA 309

Atmospheric pressure : -

Serial No. : 590102

Date of received : 11-Sep-2023

Identity No. : NS-04-003

Date of calibration : 14-Sep-2023

Range : See to Data

Date of issued : 18-Sep-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL BP.40/0666	21-Jun-2025

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

☐ Ms. Bhacharin Phanangkaew (MD)

☐ Mr. Boonyarit Auejirakarn

Reviewed By : ☐ Mr. Sompong Srisert

☒ Ms. Natthaparakarn Thammaphan

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor k = 2, providing a level of confidence approximately 95%
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2311033-5

Page 2 of 3

Standards Equipment Used

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	N975186	5523631030478623	Nov 9, 2024	ANAB : AC-1969

Traceability

This calibration is traceable to the International System of Unit via :
- ANAB : The ANSI National Accreditation Board.



SMART TECH CALIBRATION & SERVICES CO., LTD.
14506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND
Tel. +662-114-3148 Email : stcal.m@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2311033-5
Work Order No. STCR-2311033
Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District, Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2297
Control Number : NS-08-001
Received Date : Nov 15, 2023
Calibration Date : Nov 16, 2023
Recommended Due Date : Nov 16, 2024
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

Condition as received

: Normal

Calibration Result

: See data attached

- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
- This results of this report only to the items calibrated.



Date of Issue : Nov 17, 2023
Calibrated by : A. Somchai

Approved by :





SMART TECH CALIBRATION & SERVICES CO., LTD.
14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND
Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-call.com



Certificate of Calibration

Certificate No. STCR-2311033-6
Work Order No. STCR-2311033
Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.
31/8 Moo.13 Raikhing Sub-district, Samphran District, Nakhonpathom, 73210

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2367
Control Number : NS-08-007
Received Date : Nov 15, 2023
Calibration Date : Nov 16, 2023
Recommended Due Date : Nov 16, 2024
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions
Ambient Temperature : (25 ± 2) °C
Ambient Relative Humidity : (50 ± 15) %RH
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal
Calibration Result : See data attached

- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
- This results of this report only to the items calibrated.

Date of Issue : Nov 17, 2023
Calibrated by : A. Somchai



Approved by :

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2311033-5

Page 3 of 3

UUC Range : (20 to 140) dB
Resolution : 0.1 dB
Results of Calibration: [] Without adjustment [✓] With adjustment
Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	92.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	112.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	92.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	112.6 dB	113.9 dB	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	92.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	112.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	92.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	112.6 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2311033-6

Page 3 of 3

UUC Range : (20 to 140) dB Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB 114.07 dB	91.4 dB 111.3 dB	94.0 dB 113.9 dB	0.09 dB 0.17 dB	0.40 dB 0.40 dB
SLOW	94.09 dB 114.07 dB	91.4 dB 111.3 dB	93.9 dB 113.9 dB	0.19 dB 0.17 dB	0.40 dB 0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB 114.07 dB	91.4 dB 111.4 dB	94.0 dB 113.9 dB	0.09 dB 0.17 dB	0.40 dB 0.40 dB
SLOW	94.09 dB 114.07 dB	91.4 dB 111.4 dB	94.0 dB 113.9 dB	0.09 dB 0.17 dB	0.40 dB 0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2311033-6

Page 2 of 3

Standards Equipment Used

Equipment Name : Sound Calibrator
Serial No. : N975186
Certificate No. : 5523631030478623
Due Date : Nov 9, 2024
Traceability to : ANAB : AC-1969

Traceability

This calibration is traceable to the International System of Unit via :
- ANAB : The ANSI National Accreditation Bord.



Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
ID No. : CEM-SI-01
RECEIVED DATE : 23-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C
RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE
1) MULTIFUNCTION 1986 01827 EEL BP.67/0874 10-Jan-25

SOUND CALIBRATOR.

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO :-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION :

WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-16.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

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 APPROXIMATELY 95%

END OF CALIBRATION REPORT

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 060209
ID No. : CEM-SI-01
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY

25-April-24

CALIBRATION DATE

APPROVED BY

25-April-24

ISSUED DATE

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
ID No. : CEM-SI-02
RECEIVED DATE : 23-April-24
AMBIENT TEMPERATURE : 22 °C ± 3°C
RELATIVE HUMIDITY : 50%RH ± 20%RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE
1) MULTIFUNCTION 1986 01827 EEL BR 67/0974 10-Jan-25
SOUND CALIBRATOR.

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO :-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION :

WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

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 APPROXIMATELY 95%.

END OF CALIBRATION REPORT

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
SERIAL No. : 090057
ID No. : CEM-SI-02
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
219/43 MOO 12, PETCHKASEM RD., OMNOI,
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY

25-April-24

CALIBRATION DATE

APPROVED BY

25-April-24

ISSUED DATE

เอกสารการสอบเทียบเครื่องมือตรวจวัดความชื้นสะท้อน



Certificate No.: CP20240134EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM16048
ID No.: VB-01-003

Ambient Temperature: (23 ± 5) °C
Relative Humidity: (50 ± 15) %

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0001-23	20-Jul-2024
2) Measuring Amplifier	2525	2685967	AV-0044-23	20-Jul-2024
3) PULSE Multi-analyzer system	3050-A-060	3050-110127	CQ20230024EA	5-Nov-2024
4) PULSE Multi-analyzer system	3160-4-042	3060-106135	CQ20230025EA	5-Nov-2024
5) Humidity and Temperature Transmitter	HMT331	K3810009	CD20230166EA	14-Jun-2024

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

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

- National Institute of Metrology (Thailand)



Certificate No.: CP20240134EA
Operation No.: CP2024030105

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM16048
ID No.: VB-01-003
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210
Received Date: 15 March 2024
Calibrated Date: 19 - 20 March 2024
Issued Date: 21 March 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240134EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.008	9.876	-0.132	1.50	Transverse (T)
5.0	10.000	10.006	9.971	-0.035	1.50	
6.3	10.000	10.001	10.183	0.182	1.50	
8.0	10.000	10.001	10.049	0.048	1.50	
10.0	10.000	10.001	10.041	0.040	1.50	
12.5	10.000	10.014	10.034	0.020	1.50	
16.0	10.000	10.011	10.065	0.054	1.50	
	20.000	19.997	20.138	0.141	1.50	
	30.000	30.010	30.124	0.114	1.50	
	50.000	49.992	50.234	0.242	1.50	
20.0	10.000	9.998	10.144	0.146	1.50	
25.0	10.000	10.006	10.207	0.201	1.50	
31.5	10.000	10.000	10.231	0.231	1.50	
40.0	10.000	9.999	10.302	0.303	1.50	
50.0	10.000	9.998	10.372	0.374	1.50	
52.0	10.000	9.998	10.396	0.398	1.50	
63.0	10.000	9.998	10.585	0.587	1.50	
80.0	10.000	10.007	10.908	0.901	1.50	

Certificate No.: CP20240134EA

Calibration Report

Result of Calibration:-
Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.015	9.576	-0.439	1.50	Longitudinal (L)
5.0	10.000	10.000	9.679	-0.321	1.50	
6.3	10.000	9.998	9.939	-0.059	1.50	
8.0	10.000	10.008	9.805	-0.203	1.50	
10.0	10.000	10.015	9.852	-0.163	1.50	
12.5	10.000	10.001	9.884	-0.117	1.50	
16.0	10.000	10.004	9.915	-0.089	1.50	
	20.000	19.983	19.917	-0.066	1.50	
	30.000	29.995	29.927	-0.068	1.50	
	50.000	49.992	49.884	-0.108	1.50	
20.0	10.000	10.001	10.026	0.025	1.50	
25.0	10.000	10.006	10.073	0.067	1.50	
31.5	10.000	10.015	10.104	0.089	1.50	
40.0	10.000	10.000	10.168	0.168	1.50	
50.0	10.000	10.001	10.238	0.237	1.50	
52.0	10.000	10.000	10.278	0.278	1.50	
63.0	10.000	10.003	10.467	0.464	1.50	
80.0	10.000	9.998	10.617	0.619	1.50	



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240107EA

Certificate No.: CP20240107EA
Operation No.: CP2024020076

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: InstanTel
Model/Type: Micromate
Serial No.: UM15904
ID No.: VB-01-002
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 19 February 2024
Calibrated Date: 5 - 8 March 2024
Issued Date: 11 March 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20240134EA
Function : Frequency response and Linearity test at 16 Hz (Cont.)

Calibration Report

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.020	9.915	-0.105	1.50	Vertical (V)
5.0	10.000	10.021	10.057	0.036	1.50	
6.3	10.000	10.017	10.317	0.300	1.50	
8.0	10.000	10.000	10.144	0.144	1.50	
10.0	10.000	9.996	10.073	0.077	1.50	
12.5	10.000	9.998	10.160	0.162	1.50	
16.0	10.000	9.997	10.199	0.202	1.50	
	20.000	19.997	20.177	0.180	1.50	
	30.000	29.995	30.219	0.224	1.50	
20.0	50.000	49.978	50.554	0.576	1.50	
	10.000	9.998	10.137	0.139	1.50	
	25.0	10.000	10.026	0.025	1.50	
31.5	10.000	9.998	10.309	0.311	1.50	
40.0	10.000	10.000	10.428	0.428	1.50	
50.0	10.000	10.001	10.617	0.616	1.50	
52.0	10.000	9.998	10.672	0.674	1.50	
63.0	10.000	10.004	10.743	0.739	1.50	
80.0	10.000	10.013	11.098	1.085	1.50	

Remark 1. UUC: Unit Under Calibration
2. The coverage factor $k = 2.00$

-- End of Report --



Certificate No.: CP20240107EA

Certificate No.: CP20240107EA

Calibration Report

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.003	9.947	-0.056	1.50	Longitudinal (L)
5.0	10.000	10.006	9.931	-0.075	1.50	
6.3	10.000	9.996	10.175	0.179	1.50	
8.0	10.000	10.004	9.971	-0.033	1.50	
10.0	10.000	10.017	9.986	-0.031	1.50	
12.5	10.000	10.008	9.994	-0.014	1.50	
16.0	10.000	10.021	10.041	0.020	1.50	
	20.000	19.997	20.075	0.078	1.50	
	30.000	29.995	29.990	-0.005	1.50	
	50.000	49.992	50.042	0.050	1.50	
20.0	10.000	10.000	10.104	0.104	1.50	
25.0	10.000	9.998	10.160	0.162	1.50	
31.5	10.000	10.007	10.175	0.168	1.50	
40.0	10.000	10.000	10.215	0.215	1.50	
50.0	10.000	10.003	10.396	0.393	1.50	
52.0	10.000	10.006	10.404	0.398	1.50	
63.0	10.000	10.011	10.640	0.629	1.50	
80.0	10.000	10.003	10.861	0.858	1.50	

Equipment: Vibration Meter

Manufacturer: Instantel

Model: Micromate

Serial No.: UM15904

ID No.: VB-01-002

Ambient Temperature: (23 ± 5) °C

Relative Humidity: (50 ± 15) %

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0001-23	20-Jul-2024
2) Measuring Amplifier	2525	2685967	AV-0044-23	20-Jul-2024
3) PULSE Multi-analyzer system	3050-A-060	3050-110127	CQ20230024EA	5-Nov-2024
4) PULSE Multi-analyzer system	3160-4-042	3060-106135	CQ20230025EA	5-Nov-2024
5) Humidity and Temperature Transmitter	HMT331	K3810009	CD20230166EA	14-Jun-2024

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

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

- National Institute of Metrology (Thailand)



Certificate No.: CP20240107EA

CP20240107EA

Calibration Report

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	9.997	9.482	-0.515	1.50	Vertical (V)
5.0	10.000	9.996	9.576	-0.420	1.50	
6.3	10.000	10.013	9.821	-0.192	1.50	
8.0	10.000	10.000	9.734	-0.266	1.50	
10.0	10.000	9.997	9.789	-0.208	1.50	
12.5	10.000	10.014	9.978	-0.036	1.50	
16.0	10.000	9.997	10.081	0.084	1.50	
	20.000	19.997	20.177	0.180	1.50	
	30.000	29.995	30.219	0.224	1.50	
20.0	50.000	49.978	50.586	0.608	1.50	
	10.000	10.001	10.207	0.206	1.50	
	10.000	10.003	10.065	0.062	1.50	
25.0	10.000	10.001	10.302	0.301	1.50	Transverse (T)
31.5	10.000	9.997	10.467	0.470	1.50	
40.0	10.000	10.001	10.664	0.663	1.50	
50.0	10.000	9.996	10.830	0.834	1.50	
63.0	10.000	10.004	10.869	0.865	1.50	
80.0	10.000	9.997	11.515	1.518	1.50	

- Remark
1. UUC: Unit Under Calibration
 2. The coverage factor $k = 2.00$

-- End of Report --



Merci d'avoir choisi Instantel!

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« **les moniteurs les plus fiables au monde** »
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Grâce à votre achat, vous êtes à la pointe de la technologie en matière de moniteurs. Au nom de tous les collaborateurs d'Instantel, nous vous remercions d'avoir fait choisir nos produits pour la réalisation de vos projets. Les produits Instantel incluent les éléments les plus aboutis du domaine tels que:

- 1) Plus de 30 années au service des secteurs du bâtiment, d'activités minières et de géotechnologie
- 2) Des conceptions durables et résistantes
- 3) Des produits faciles à utiliser grâce à une interface intuitive
- 4) Des options étendues de conformité réglementaire
- 5) Un programme d'assistance, un service technique et une aide en ligne complets
- 6) Logiciel THOR® disponible en téléchargement gratuit sur le site Web d'Instantel: www.instantel.com
- 7) Garantie d'un an sur les pièces; si un moniteur ou un capteur est ramené à l'usine pour étalonnage jusqu'à un an après la date d'achat, la garantie sera automatiquement prolongée d'un an supplémentaire

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Calibration Certificate


Part Number: 721A2601
Description: Micromate with DIN Geophone
Serial Number: UM21467
Calibration Date: MAY 29 2023
Calibration Reference Equipment: 71417403

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology, or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: 
Xiaoming Yang

Instantel 309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642



Certificate No.: CP20230379EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Ambient Temperature: (23 ± 5) °C
Relative Humidity: (50 ± 15) %

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard Accelerometer	8305	2708237	AV-0001-23	20-Jul-2024
2) Measuring Amplifier	2525	2685967	AV-0044-23	20-Jul-2024
3) PULSE Multi-analyzer system	3560-C	2705645	CQ20230003EA	25-Dec-2023
4) Humidity and Temperature Transmitter	HMT331	K3810009	CD20230166EA	14-Jun-2024

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

3. This certification is traceable to the international system of unit maintained at :-
- National Institute of Metrology (Thailand)



Certificate No.: CP20230379EA
Operation No.: CP2023100002

Certificate of Calibration

Equipment: Vibration Meter
Manufacturer: Instantel
Model/Type: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Customer: C.E.M. Technology (Thailand) Co.,Ltd.
Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,
Nakorn Phatom 73210

Received Date: 6 October 2023

Calibrated Date: 18 - 20 October 2023

Issued Date: 31 October 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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Certificate No.: CP20230379EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	9.997	10.372	0.375	1.50	Transverse (T)
5.0	10.000	9.991	10.325	0.334	1.50	
6.3	10.000	10.000	10.501	0.501	1.50	
8.0	10.000	10.008	10.357	0.349	1.50	
10.0	10.000	10.015	10.294	0.279	1.50	
12.5	10.000	9.997	10.231	0.234	1.50	
16.0	10.000	10.004	10.191	0.187	1.50	
	20.000	20.011	20.248	0.237	1.50	
	30.000	29.995	30.298	0.303	1.50	
20.0	50.000	49.978	50.562	0.584	1.50	
	10.000	10.001	10.144	0.143	1.50	
	10.000	9.997	10.120	0.123	1.50	
25.0	10.000	9.998	10.144	0.146	1.50	
31.5	10.000	10.013	10.246	0.233	1.50	
40.0	10.000	9.991	10.388	0.397	1.50	
50.0	10.000	10.006	10.404	0.398	1.50	
52.0	10.000	10.013	10.696	0.683	1.50	
63.0	10.000	9.991	11.098	1.107	1.50	
80.0	10.000					



Certificate No.: CP20230379EA

Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.006	10.412	0.406	1.50	Longitudinal (L)
5.0	10.000	9.984	10.254	0.270	1.50	
6.3	10.000	9.991	10.483	0.492	1.50	
8.0	10.000	10.013	10.215	0.202	1.50	
10.0	10.000	10.008	10.199	0.191	1.50	
12.5	10.000	10.000	10.104	0.104	1.50	
16.0	10.000	9.993	10.073	0.080	1.50	
	20.000	19.983	20.146	0.163	1.50	
	30.000	29.995	30.219	0.224	1.50	
20.0	50.000	49.992	50.396	0.404	1.50	
	10.000	10.006	10.112	0.106	1.50	
	25.0	10.003	10.097	0.094	1.50	
31.5	10.000	10.000	10.160	0.160	1.50	
40.0	10.000	10.008	10.302	0.294	1.50	
50.0	10.000	10.006	10.357	0.351	1.50	
52.0	10.000	9.994	10.412	0.418	1.50	
63.0	10.000	10.008	10.711	0.703	1.50	
80.0	10.000	9.984	11.097	1.113	1.50	



Certificate No.: CP20230379EA

Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.008	10.002	-0.006	1.50	Vertical (V)
5.0	10.000	9.991	10.136	0.145	1.50	
6.3	10.000	9.997	10.365	0.368	1.50	
8.0	10.000	10.008	10.270	0.262	1.50	
10.0	10.000	9.990	10.278	0.288	1.50	
12.5	10.000	9.997	10.238	0.241	1.50	
16.0	10.000	9.994	10.175	0.181	1.50	
	20.000	19.997	20.445	0.448	1.50	
	30.000	29.995	30.597	0.602	1.50	
20.0	50.000	49.992	51.043	1.051	1.50	
	10.000	10.003	10.231	0.228	1.50	
	25.0	9.997	9.726	-0.271	1.50	
31.5	10.000	10.000	10.057	0.057	1.50	
40.0	10.000	9.996	10.168	0.172	1.50	
50.0	10.000	9.996	10.199	0.203	1.50	
52.0	10.000	9.994	10.309	0.315	1.50	
63.0	10.000	9.984	10.396	0.412	1.50	
80.0	10.000	9.998	10.672	0.674	1.50	

Remark

1. UUC: Unit Under Calibration
2. The coverage factor $k = 2.00$

-- End of Report --

Calibration Certificate

Part Number: 721A2601
Description: Micromate with DIN Geophone
Serial Number: UM20453
Calibration Date: April 21, 2023
Calibration Reference Equipment: SRV-AFR 71417401
*Calibrated with Geo UM6231

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: Yaksh Patel

Instantel
309 Leggett Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642

Calibration Certificate

Part Number: 721A2601
 Description: Micromate with DIN Geophone
 Serial Number: UM20454
 Calibration Date: April 21, 2023
 Calibration Reference Equipment: SRV-AFR 71417401

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology, or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

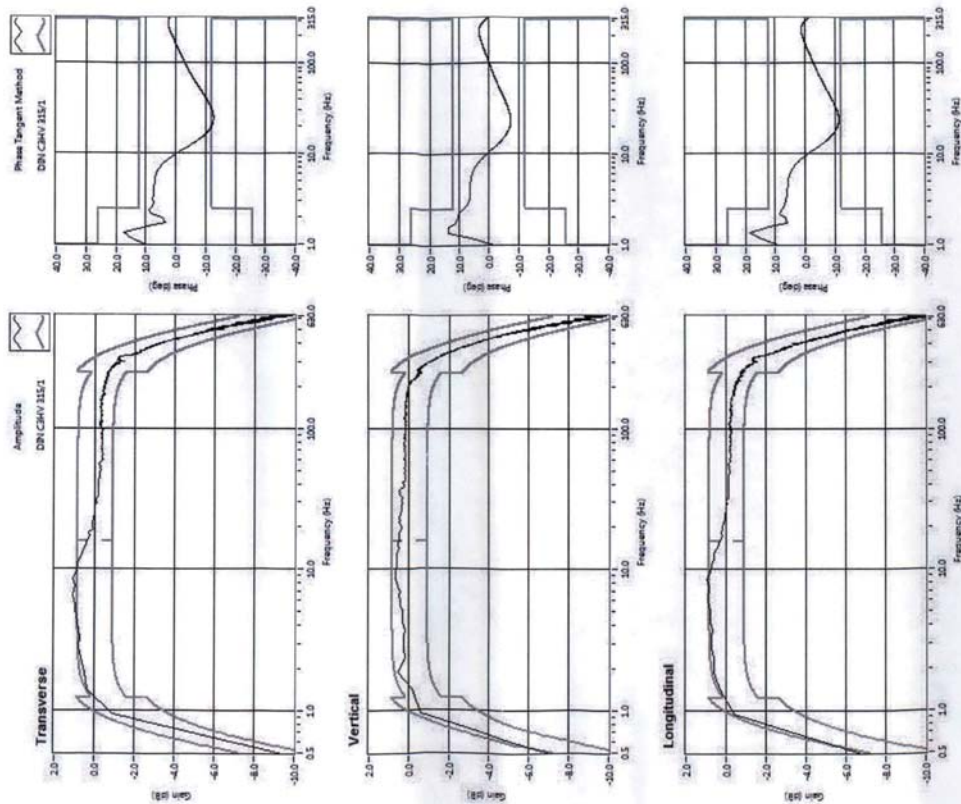
Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: 
 Martin Hogue

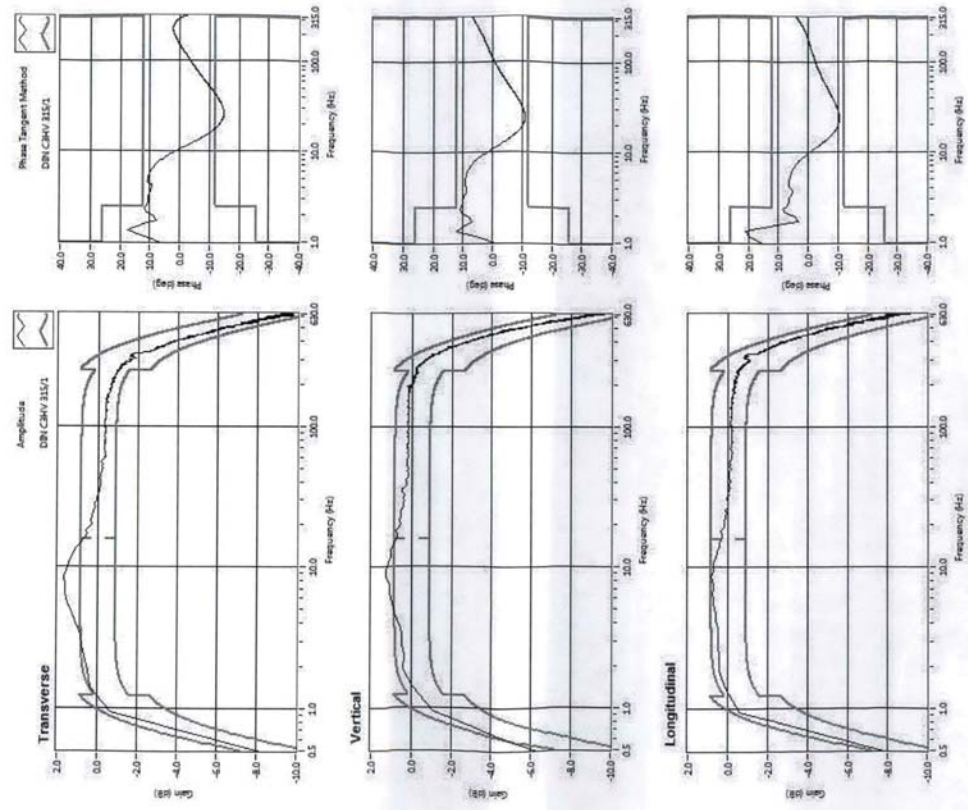
Instantel 309 Leggett Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642

Instantel

Frequency Response of UM20453 (As Found)



Frequency Response of UM20454 (As Found)



เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 67-420018-1

Page : 1 of 2

Submitted by : C.E.M Technology (Thailand) Co., Ltd.

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

Serial No. : 12260 ID No. : WW-03-001

Electrode

Model : 9156BNWP Serial No. : VV1-15843

ID No. : WW-03-001

Environment : On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0)°C

Relative Humidity : (50 to 55) %

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)


Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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Certificate of Calibration

Certificate No. : 67-420018-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.4	0.1	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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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CAL-F0031-03

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Certificate of Calibration

Certificate No. : 67-400074-1

Page : 1 of 2

Submitted by : C.E.M Technology (Thailand) Co.,Ltd.
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A °C Resolution : 0.1 °C

Serial No. : 12260 ID No. : WW-03-001

Thermistor probe

Model : N/A Sheath Material : Stainless

Diameter : 6.5 mm. Length : 120 mm.

Serial No. : PT1-18812 ID No. : WW-03-001

Environment : On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003
by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
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400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)
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2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
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400033	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)
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Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400074-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	25.002	25.0	0.0	0.19

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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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ABJ



CAL-F0031-03

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 67-420018-3

Page : 1 of 2

Submitted by : C.E.M Technology (Thailand) Co., Ltd.
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : pH Meter with electrode
pH meter
Manufacturer : Apera Model : PC 910
Range : N/A pH Resolution : 0.01 pH
Serial No. : PC910X1220811001 ID No. : WW-03-002
Electrode
Model : LabSen 211 Serial No. : 2110009/213
ID No. : WW-03-002

Environment : On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.
Ambient Temperature : (23.0 to 24.0) °C
Relative Humidity : (50 to 55) %

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpoon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)


Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 67-420018-3

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177	0	0.59
	0.0000	7	7.00	0	0	0.58
	-177.4800	10	10.00	-178	1	0.59

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.00	0.00	0.010
	6.986	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- 000 -



CAL-F0031-03

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Certificate of Calibration

Certificate No. : 67-400074-2

Page : 1 of 2

Submitted by :

C.E.M Technology (Thailand) Co.,Ltd.
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer : Apera

Model : PC 910

Range : N/A °C

Resolution : 0.1 °C

Serial No. : PC910X1220811001

ID No. : WW-03-002

Thermistor probe

Model : N/A

Sheath Material : Stainless

Diameter : 4.8 mm.

Length : 100 mm.

Serial No. : N/A

ID No. : WW-03-002

Environment :

On site calibration was carried out at the Laboratory, C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.5 to 226.0) VAC

Date of Received : 10 February 2024

Date of Calibration : 10 February 2024

Date of Issue : 15 February 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
--------	-----------	----------	--------------

400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)
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2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
--------	-----------	----------	--------------

400033	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)
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Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 67-400074-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	25.005	25.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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 -

Signature



CAL-F0031-03



Certificate of Calibration

Equipment: Cooled Incubator
Model: KB 240
Serial No.(or ID): 20180000012164(WW-16-001)
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 3

Certificate No.: C31240373
Issued Date: 16 February 2024
Job No.: WO-00017098
Page: 1 of 3
Ventilation Valve: None

Customer: C.E.M Technology (Thailand) Co., Ltd.
31/8 Moo 13, Tambon Raikhing,
Amphur Sampran, Nakhonpathom 73210 Thailand.

Environment Condition: Temperature: 24 °C ± 1.1 °C
Humidity: 63 %RH ± 5.9 %RH
Voltage: 229 VAC ± 1.2 VAC

Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
219/43 Moo 12 Petchkasam Road,
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Ampol Srisumphan
Calibration Date: 14 February 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. C10240001



(Mr. Ampol Srisumphan)

Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phraekhong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Refer to Certificate No.: C31240373 Page: 1 of 1

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

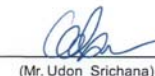
Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule : ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.

☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U).
; PFA – Probability of False Accept


(Mr. Udon Srichana)

Authorized signatory

Without adjustment

Desired Temperature : 20.0°C Tolerances : 1.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	20.17	0.17	0.49	1.0	Pass
#2	20.13	0.13	0.49	1.0	Pass
#3	19.99	-0.01	0.56	1.0	Pass
#4	19.98	-0.02	0.60	1.0	Pass
#5	20.21	0.21	0.51	1.0	Pass
#6	20.17	0.17	0.46	1.0	Pass
#7	19.97	-0.03	0.57	1.0	Pass
#8	20.07	0.07	0.47	1.0	Pass
#9	20.13	0.13	0.43	1.0	Pass

Correction* = Measured Temperature - Desired Temperature

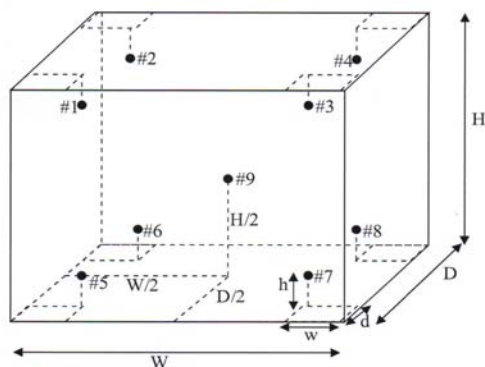
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use

The End of Statements of Conformity

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phraekhong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Standard Installation Locations

Volume (Calibration Zone)= 122 (Liters)

Inside chamber: W = 65 (cm) D = 50 (cm) H = 76 (cm)

Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 8 (cm)

Standard Locations (#5, #6, #7, #8): w = 7 (cm) d = 5 (cm) h = 8 (cm)

#9: Geometric center of the chamber

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

Definitions

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

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

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

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

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

Calibration Results:

Without adjustment

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

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.17	0.17	0.49
#2	20.13	0.13	0.49
#3	19.99	-0.01	0.56
#4	19.98	-0.02	0.60
#5	20.21	0.21	0.51
#6	20.17	0.17	0.46
#7	19.97	-0.03	0.57
#8	20.07	0.07	0.47
#9	20.13	0.13	0.43

Temperature Distribution

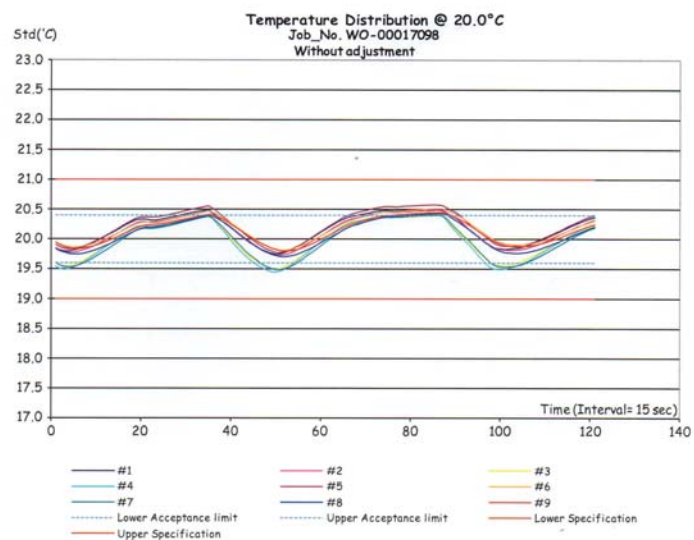
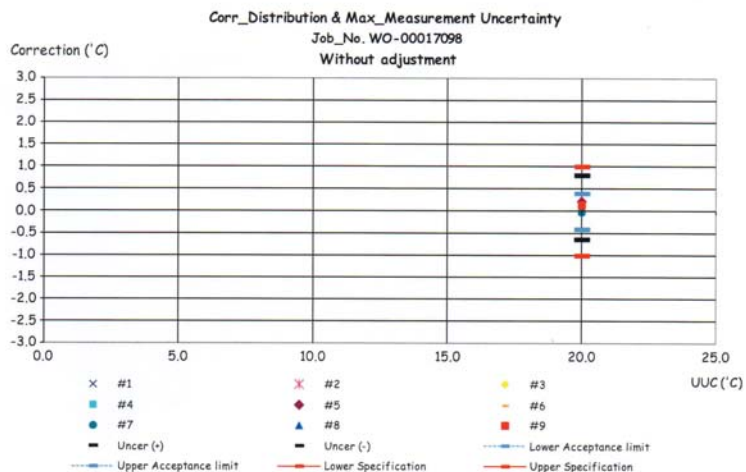
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	20.17	20.13	19.99	19.98	20.21	20.17	19.97	20.07	20.13	0.60

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.47	0.48	1.13

Note: * Maximum uncertainty of the each position

The End of Certificate



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่อง: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164(WW-16-001)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
14 Feb 2024			14 Feb 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr. Ampol Srisumphan
Service Engineer



Certificate of Calibration

Certificate No.: C31240372

Page: 2 of 5

Equipment: Hot Air Oven
Model: UF 55
Serial No.(or ID): B219.0142 (WW-05-002)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31240372
Issued Date: 15 February 2024
Job No.: WO-00017098
Page: 1 of 5
Ventilation Valve: Closed

Customer: C.E.M Technology (Thailand) Co., Ltd.
 31/8 Moo 13, Tambon Raikhing,
 Amphur Sampran, Nakhonpathom 73210 Thailand.

Environment Condition: Temperature: 29 °C ± 0.6 °C
 Humidity: 61 %RH ± 5.3 %RH
 Voltage: 230 VAC ± 1.5 VAC

Calibration Place: C.E.M Technology (Thailand) Co., Ltd. (Laboratory Room)
 219/43 Moo 12 Petchkasam Road,
 Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

Calibration By: Mr. Ampol Srisumphan

Calibration Date: 14 February 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. C10240001



(Mr. Ampol Srisumphan)

Person in charge



(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

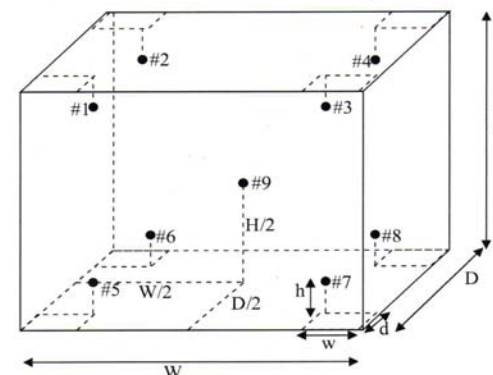
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified 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.

DKSH Technology Limited
 2533 Sukhumvit Road, Bangkok, Phra Khanong, Bangkok 10260
 Phone: +66 2539 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



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	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.

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CAL-FM-C31-10: 12 Sep 2022

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	104.38	0.38	0.39
#2	104.15	0.15	0.39
#3	104.39	0.39	0.39
#4	104.26	0.26	0.39
#5	103.88	-0.12	0.39
#6	104.13	0.13	0.39
#7	104.47	0.47	0.39
#8	104.41	0.41	0.39
#9	104.65	0.65	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	104.38	104.15	104.39	104.26	103.88	104.13	104.47	104.41	104.65	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.83	0.12	0.96

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	180.34	0.34	0.56
#2	179.98	-0.02	0.56
#3	180.46	0.46	0.56
#4	180.34	0.34	0.56
#5	180.63	0.63	0.56
#6	180.33	0.33	0.56
#7	179.22	-0.78	0.56
#8	179.80	-0.20	0.56
#9	180.74	0.74	0.56

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	180.34	179.98	180.46	180.34	180.63	180.33	179.22	179.80	180.74	0.56

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.59	0.08	1.66

Note: * Maximum uncertainty of the each position

The End of Certificate

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 110.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	110.40	0.40	0.46
#2	110.15	0.15	0.46
#3	110.45	0.45	0.46
#4	110.37	0.37	0.46
#5	110.42	0.42	0.46
#6	110.29	0.29	0.46
#7	109.86	-0.14	0.46
#8	110.12	0.12	0.46
#9	110.51	0.51	0.46

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	
110.0	110.0	110.0	110.40	110.15	110.45	110.37	110.42	110.29	109.86	110.12	110.51	0.46

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
110.0	0.71	0.11	0.86

Note: * Maximum uncertainty of the each position

Statements of conformity:


This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U).
 ; PFA – Probability of False Accept


 (Mr. Udon Srichana)
 Authorized signatory

Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.38	0.38	0.39	1.0	Pass
#2	104.15	0.15	0.39	1.0	Pass
#3	104.39	0.39	0.39	1.0	Pass
#4	104.26	0.26	0.39	1.0	Pass
#5	103.88	-0.12	0.39	1.0	Pass
#6	104.13	0.13	0.39	1.0	Pass
#7	104.47	0.47	0.39	1.0	Pass
#8	104.41	0.41	0.39	1.0	Pass
#9	104.65	0.65	0.39	1.0	Condition Pass

Correction* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use



Refer to Certificate No.: C31240372 Page: 2 of 2

Statements of conformity:(Cont.)

Without adjustment (Cont.)

Desired Temperature : 110.0°C Tolerances : 5.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 110.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	110.40	0.40	0.46	5.0	Pass
#2	110.15	0.15	0.46	5.0	Pass
#3	110.45	0.45	0.46	5.0	Pass
#4	110.37	0.37	0.46	5.0	Pass
#5	110.42	0.42	0.46	5.0	Pass
#6	110.29	0.29	0.46	5.0	Pass
#7	109.86	-0.14	0.46	5.0	Pass
#8	110.12	0.12	0.46	5.0	Pass
#9	110.51	0.51	0.46	5.0	Pass

Correction* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use

Without adjustment

Desired Temperature : 180.0°C Tolerances : 2.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	180.34	0.34	0.56	2.0	Pass
#2	179.98	-0.02	0.56	2.0	Pass
#3	180.46	0.46	0.56	2.0	Pass
#4	180.34	0.34	0.56	2.0	Pass
#5	180.63	0.63	0.56	2.0	Pass
#6	180.33	0.33	0.56	2.0	Pass
#7	179.22	-0.78	0.56	2.0	Pass
#8	179.80	-0.20	0.56	2.0	Pass
#9	180.74	0.74	0.56	2.0	Pass

Correction* = Measured Temperature - Desired Temperature

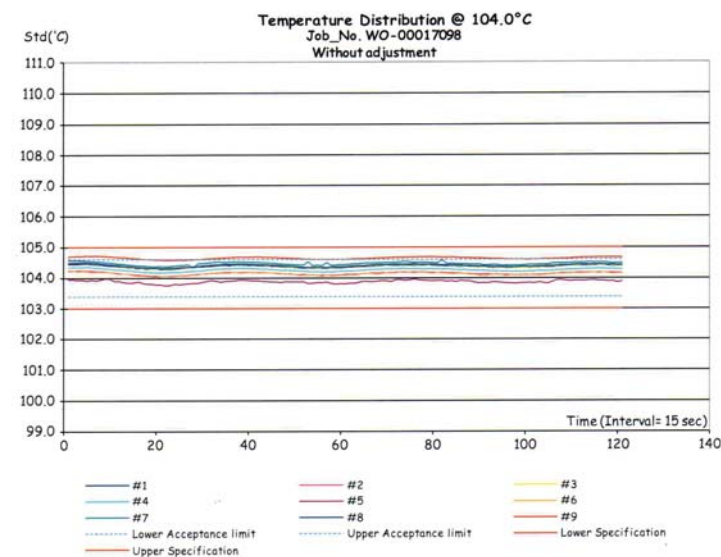
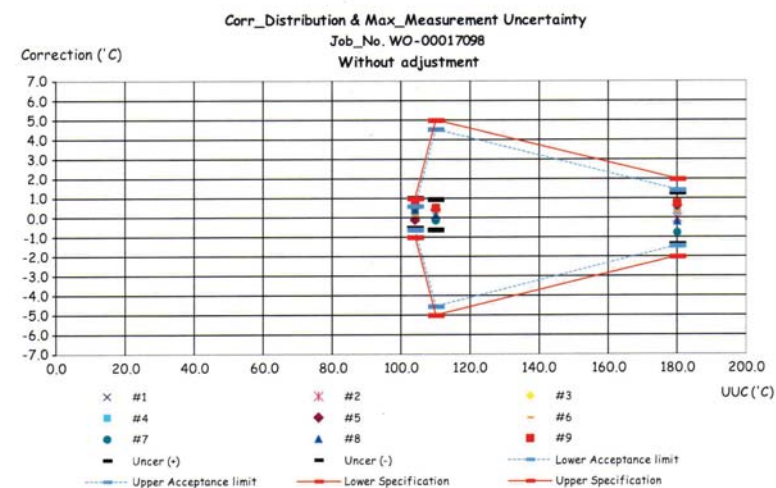
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use

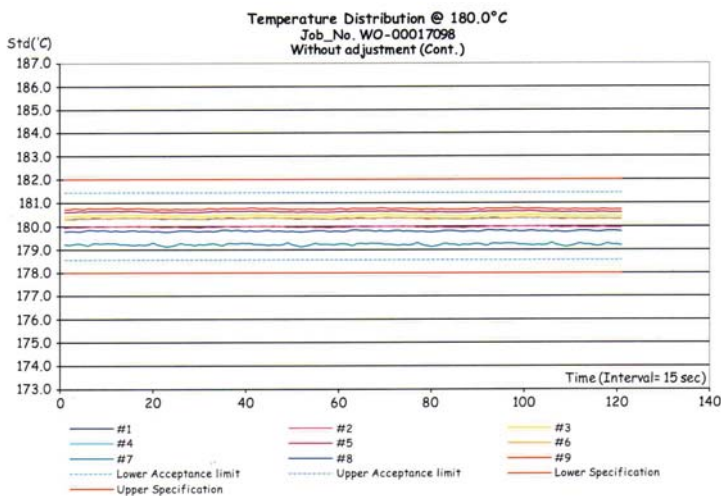
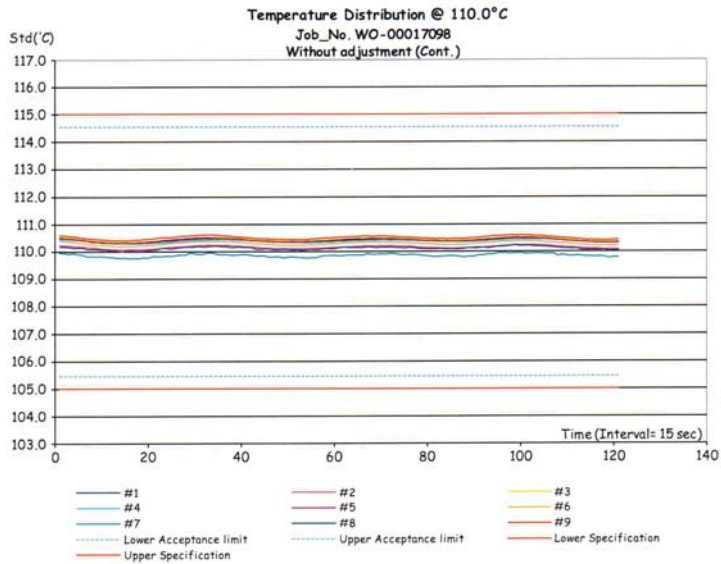
The End of Statements of Conformity

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนน สุขุมวิท แขวง คลองตันเหนือ เขต วัฒนา กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10; 12 Sep 2022





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 (WW-05-002)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
14 Feb 2024			14 Feb 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
			General		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดง Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตู้เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr. Ampol Srisumphan
Service Engineer



CERT.No.: HS-V057H

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbampnen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 16 Aug 24
Submitted by : C.E.M TECHNOLOGY (THAILAND) Co., LTD.
219/43 Moo 12, Petchkasem Road, Omnoi, Krathumban,
Samutsakorn 74130
Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt
Model : YSI 5000
S/N : 18L109487
Probe : YSI 5010
S/N : 22G100123
ID NO. : -
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : -
ID NO. HS001
Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.07	(PASS)	-
Measurement 9 (mg/l)	9.07	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-

Mean Measurement 9.08 mg/l -
Inaccuracy 0.01 mg/l -

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature
(Kittipong Maekwong)

Supreecha Su.
Laboratory Manager
(Supreecha Sumaritam)



THAI HEART CALIBRATION CO., LTD.

112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2394-2162, 0-2757-8435; 0-2757-8496 Fax. 0-2757-8507



CERTIFICATE OF CALIBRATION

Certificate No.: T1-2009013/24 Page 1 of total 5 pages

Customer C.E.M TECHNOLOGY (THAILAND) CO., LTD.
219/43 Moo 12, Petchkasem Road, Omnoi,
Krathumban, Samutsakorn 74130

Equipment Thermo Reactor
Manufacturer Merck Model TR 420
Serial No. 23290802 ID No. WW-07-003
Description Resolution of UUC : 1 °C

Environmental Conditions Ambient Temperature: 26.3 °C
Relative Humidity: 46 %
Atmospheric Pressure: -

Calibration Location Lab room
Received Date 20 September 2024
Calibration Date 20 September 2024
Date of Issue 23 September 2024

Condition of Artifacts Used conditions but can be calibrated

Checked by
Act as Technical Manager

Approved by
Representative of Managing Director

() (Krisyosl K.) () (Sakda Y.)
() (Patiphan K.) () (Onnapa P.)
(✓) (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Puttitwong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

FE-169

REV.02 02/24/21

Certificate No.: T1-2009013/24

Page 2 of total 5 pages

Reference Method :

- The calibration method used was CP-142 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	MY57010605/ MY59005437	10-0108003/24	Aug. 1, 2025	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

L

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	60	59.9	60	-0.1	0.10	0.68
# 2	60	60.1	60	0.1	0.13	
# 3	60	60.1	60	0.1	0.12	
# 4	60	60.1	60	0.1	0.13	
# 5	60	60.1	60	0.1	0.11	
# 6	60	60.2	60	0.2	0.09	
# 7	60	60.2	60	0.2	0.13	
# 8	60	60.0	60	0.0	0.11	
# 9	60	60.0	60	0.0	0.09	
# 10	60	60.1	60	0.1	0.09	
# 11	60	60.1	60	0.1	0.10	
# 12	60	60.1	60	0.1	0.12	

Calibrated by Pongsak
REV.02 02/24/21

FE-169

Certificate No.: T1-2009013/24

Page 3 of total 5 pages

Measurement Results (Cont.):

L

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.7	150	-1.3	0.12	0.68
# 2	150	148.1	150	-1.9	0.10	
# 3	150	148.2	150	-1.8	0.09	
# 4	150	148.5	150	-1.5	0.11	
# 5	150	149.0	150	-1.0	0.11	
# 6	150	148.7	150	-1.3	0.08	
# 7	150	149.7	150	-0.3	0.14	
# 8	150	149.0	150	-1.0	0.09	
# 9	150	148.8	150	-1.2	0.08	
# 10	150	148.8	150	-1.2	0.09	
# 11	150	148.2	150	-1.8	0.09	
# 12	150	148.4	150	-1.6	0.11	

R

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	60	60.2	60	0.2	0.11	0.68
# 2	60	60.2	60	0.2	0.12	
# 3	60	60.4	60	0.4	0.11	
# 4	60	60.3	60	0.3	0.09	
# 5	60	60.4	60	0.4	0.10	
# 6	60	60.0	60	0.0	0.09	
# 7	60	60.2	60	0.2	0.12	
# 8	60	60.3	60	0.3	0.10	
# 9	60	60.1	60	0.1	0.07	
# 10	60	60.5	60	0.5	0.10	
# 11	60	60.4	60	0.4	0.09	
# 12	60	60.3	60	0.3	0.11	

Calibrated by Pongsak
REV.02 02/24/21

FE-169

Certificate No.: T1-2009013/24

Page 4 of total 5 pages

Measurement Results (Cont.):

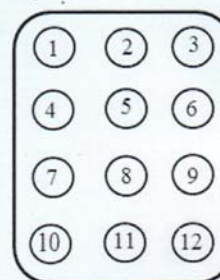
R

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	149.4	150	-0.6	0.10	0.68
# 2	150	148.4	150	-1.6	0.10	
# 3	150	149.2	150	-0.8	0.12	
# 4	150	149.0	150	-1.0	0.11	
# 5	150	149.4	150	-0.6	0.07	
# 6	150	148.7	150	-1.3	0.07	
# 7	150	149.4	150	-0.6	0.10	
# 8	150	148.8	150	-1.2	0.07	
# 9	150	148.8	150	-1.2	0.11	
# 10	150	150.1	150	0.1	0.14	
# 11	150	149.8	150	-0.2	0.11	
# 12	150	149.0	150	-1.0	0.10	

Certificate No.: T1-2009013/24

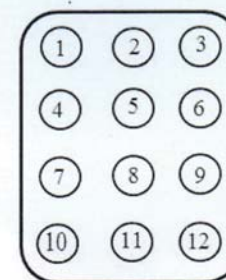
Page 5 of total 5 pages

Measurement Results (Cont.):



Front View

L



Front View

R

The above 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 -

PREVENTIVE MAINTENANCE

Atomic Absorption Spectrometer



Instrument List is System

Equipment	
Model	Serial Number
SavantAA	A7310

Date :	18/06/2024
Contact person :	คุณอัจฉรา ทองสี / 081-351-0828
Place of installation :	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด
Customer :	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด
Address :	219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะห้มนั่น จังหวัดสมุทรสาคร 74130

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
โทรศัพท์ 02-639 7000, www.dksh.com

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☎ 02 639 7000

Job No. WO-00029207
☒ Service contract Basic Plan
☐ Service contract Performance Plan

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 17/06/24

Customer : บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด
Address : 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย
อำเภอกะห้มนั่น จังหวัดสมุทรสาคร 74130
Contract :
Manufacturer : GBC Scientific Equipment Pty Ltd.
Model : SavantAA
Serial No : A7310
Location :

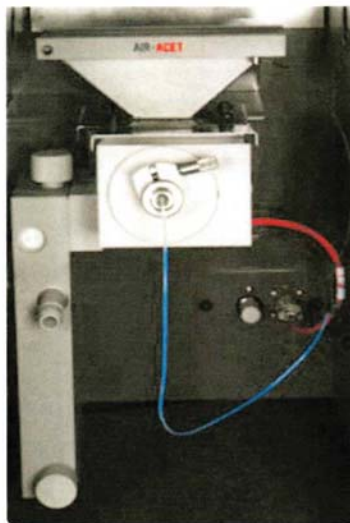
Power on switch and initial status

Instrument Ready for use

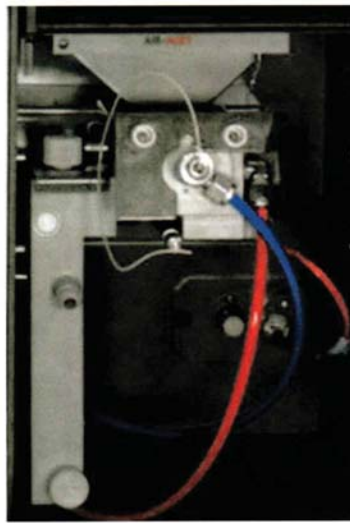
Preventive Maintenance	Pass	Fail	Remarks
Electrical Voltage			
- Main voltage (power supply check 220V \pm 10V).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	220.1VAC
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
Environment			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	27.2C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	44 %
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
Optics			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
Gas system			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4 bar
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9 bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input type="checkbox"/>	
Computer			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 7 Pro
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ver. 0.11A
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
Flame system			
- Burner head (Clean the jaws using GBC Burner Cleaning Card).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner mount (Check for wear. Replace the burner retaining plate if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Spray chamber (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Safety interlocks			
➢ Burner (Check for interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
➢ Spray chamber (Check for interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Pressure relief bung. (Check or replace O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Nebulizer (Clean and check operation / Replace the O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Gas connections (Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Capillary tube (Check bends and clog).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Liquid trap (Drain / clean and replace O-ring).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Gas Flow Optimisation	Pass	Fail	Remark
- Bleed gas lines (Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Ignitor (ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Extinguish (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner Adjuster (Check operation for ABR Spray Chamber)			
➢ Burner Angle (° C)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Work head Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Work head Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

Before PM immersion Cu ppm, = 0.1xx Abs
 - นำหลอดดูดสารละลาย Sample Tube (immersion) 3

Signature	
Customer : <u>Y. Iram</u> (<u>นางสาว ยี่ อีราม นาม</u>)	Date : 18/06/67
Service Engineer : <u>Nirat S.</u> (<u>Mr. NIWAT SUPATANIT</u>)	Maintenance Date : 18/06/2024

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm \pm 0.2 nm	324.68 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	Cs 852.10 nm \pm 0.2 nm	852.10 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm \pm 0.02 nm	324.56, 44 / 324.79, 44	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.211 nm
	0.5 nm \pm 0.05 nm	324.42, 45 / 324.95, 45	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.50 nm
	1.0 nm \pm 0.10 nm	324.17, 45 / 325.19, 43	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.02 nm
3. EHT	<350V	336 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
4. Absorbance accuracy (absorbance calibration check). ➢ Gauze 0.49 A.U.	Reading \pm 10% of calibrated value.	0.4897 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: -0.0017 Abs BC on without gauze: -0.0004 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.7650 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	<0.5% RSD	0.39 % RSD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A

Note:

Signature	
Customer : ✓ ธีรณ (นพรัตน์ ธีรณ)	Date : 18 / 06 / 67
Service Engineer : Niwat S. (Mr. NIWAT SUPATANIT)	Maintenance Date : 18 / Jun / 2024

Results File K:\PM AAS\2567\Cu 5ppm_Service.res
 Analysis
 Filename C:\Users\Administrator\Documents\Analysis1.anl
 Date Tue Jun 18 11:30:11 2024
 Method

Instrument Parameters

System Type Flame
 Element Cu
 Matrix
 Lamp Current 4.00 mA
 Wavelength 324.70 nm
 Slit Width 0.50 nm
 Slit Height Normal
 Instrument Mode Abs. BC Off

Sample Measurement Parameters

Measurement Mode Integration
 Sample Introduction Manual
 Read Time 3.00 s
 Time Constant 0.00
 Replicates 10

Calibration Parameters

Calibration Mode Conc Least Squares
 Overrange Sample Action None
 Conc. Units μ g/ml
 Conc. Decimal Places 3
 Calibration Failure On None
 Calibration Failure Action Stop
 Measure Sample Blank After Cal. Yes
 Auto Save Method After Cal. No

Quality Parameters

Second Fail Action	Stop
Range Checking	Off
Check Sample Conc	1.0000 µg/ml
Check Sample Lower Range	80.00 %
Check Sample Upper Range	120.00 %
Check Sample Fail Action	Stop
Check Sample Flag	*

Flame Control Parameters

Flame Type	Air-Acetylene
Fuel Flow	2.000 l/min
Oxidant Flow	10.00 l/min
Burner Angle	0.00°
Workhead Height	15.00 mm

Full Calibration

Calibration Mode	Conc Least Squares	Max Error : 0.0000	R ² : 1.0000	R : 1.0000
------------------	--------------------	--------------------	-------------------------	------------

Error Calibration has zero gradient

Sample	Conc.	%RSD	Mean	Replicates		
Label	(µg/ml)		Abs.			
Table Blank	-----	-----	0.0000			
Standard 1	5.000	-----	0.0000			
STD Gauze 0.49	-----	0.09	0.4897	0.4897	0.4905	0.4897
				0.4898	0.4902	0.4892
				0.4896	0.4894	0.4890
				0.4897		

Analysis

Filename	C:\Users\Administrator\Documents\Analysis1.anl
Date	Tue Jun 18 11:34:16 2024

Method

Instrument Parameters

System Type	Flame
Element	Cu
Matrix	
Lamp Current	4.00 mA
Wavelength	324.70 nm
Slit Width	0.50 nm
Slit Height	Normal
Instrument Mode	Abs. BC On

Sample Measurement Parameters

Measurement Mode	Integration
Sample Introduction	Manual
Read Time	3.00 s
Time Constant	0.00
Replicates	10

Calibration Parameters

Calibration Mode	Conc Least Squares
Overrange Sample Action	None
Conc. Units	µg/ml
Conc. Decimal Places	3
Calibration Failure On	None
Calibration Failure Action	Stop
Measure Sample Blank After Cal.	Yes
Auto Save Method After Cal.	No

Quality Parameters

Second Fail Action	Stop
Range Checking	Off
Check Sample Conc	1.0000 µg/ml

Quality Parameters

Check Sample Lower Range 80.00 %
Check Sample Upper Range 120.00 %
Check Sample Fail Action Stop
Check Sample Flag *

Flame Control Parameters

Flame Type Air-Acetylene
Fuel Flow 2.000 l/min
Oxidant Flow 10.00 l/min
Burner Angle 0.00°
Workhead Height 15.00 mm

Full Calibration

Calibration Mode Conc Least Squares Max Error : 0.0000 R² : 1.0000 R : 1.0000

Error Calibration has zero gradient

Sample	Conc.	%RSD	Mean	Replicates		
Label	(µg/ml)		Abs.			
Table Blank	----	----	0.0000			
Standard 1	5.000	----	0.0000			
BC on with Gauze	----	HIGH	-0.0017	-0.0016	-0.0010	-0.0020
				-0.0019	-0.0026	-0.0034
				-0.0013	-0.0008	-0.0017
				-0.0011		
BC on without Gauze	----	HIGH	-0.0007	0.0000	-0.0013	-0.0012
				-0.0011	-0.0004	-0.0007
				-0.0008	-0.0009	-0.0007
				-0.0000		

Analysis

Filename C:\Users\Administrator\Documents\Analysis1.anl

Analysis

Date Tue Jun 18 11:51:31 2024

Method

Instrument Parameters

System Type Flame
Element Cu
Matrix
Lamp Current 3.00 mA
Wavelength 324.70 nm
Slit Width 0.50 nm
Slit Height Normal
Instrument Mode Abs. BC Off

Sample Measurement Parameters

Measurement Mode Integration
Sample Introduction Manual
Read Time 3.00 s
Time Constant 0.00
Replicates 10

Calibration Parameters

Calibration Mode Conc Least Squares
Overrange Sample Action None
Conc. Units µg/ml
Conc. Decimal Places 3
Calibration Failure On None
Calibration Failure Action Stop
Measure Sample Blank After Cal. No
Auto Save Method After Cal. Yes

Quality Parameters

Second Fail Action Stop

Quality Parameters

Range Checking	Off
Check Sample Conc	1.0000 µg/ml
Check Sample Lower Range	80.00 %
Check Sample Upper Range	120.00 %
Check Sample Fail Action	Stop
Check Sample Flag	*

Flame Control Parameters

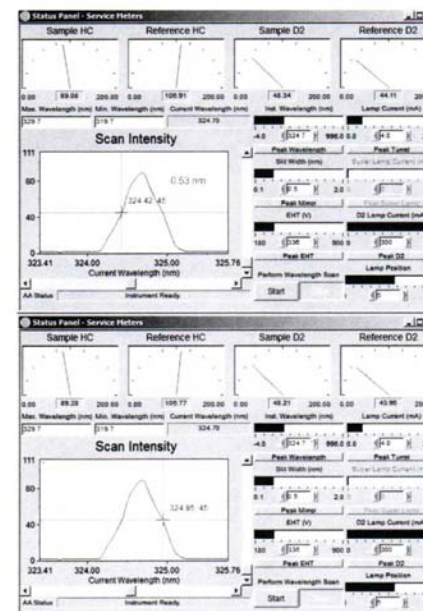
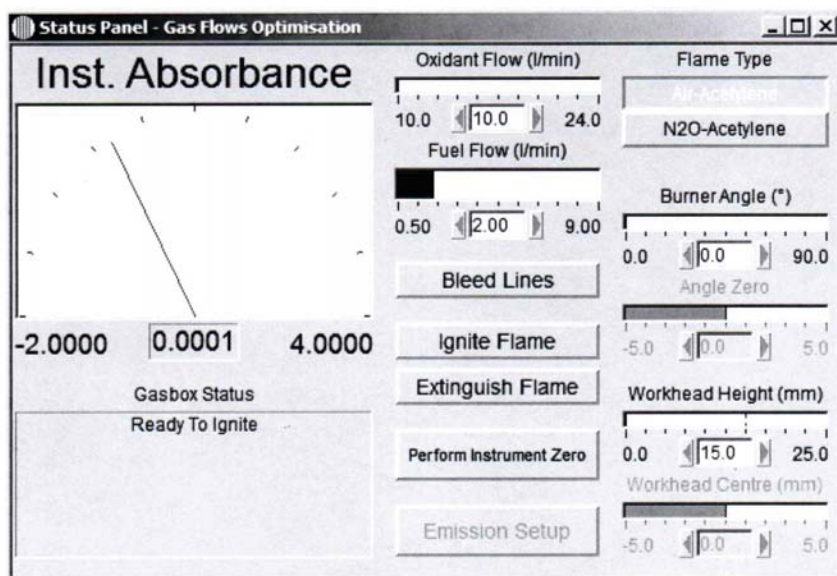
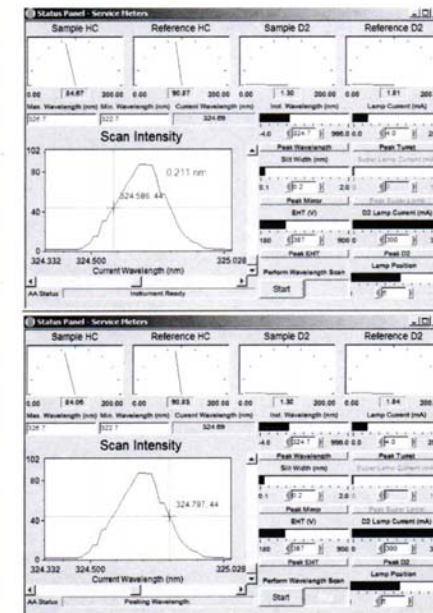
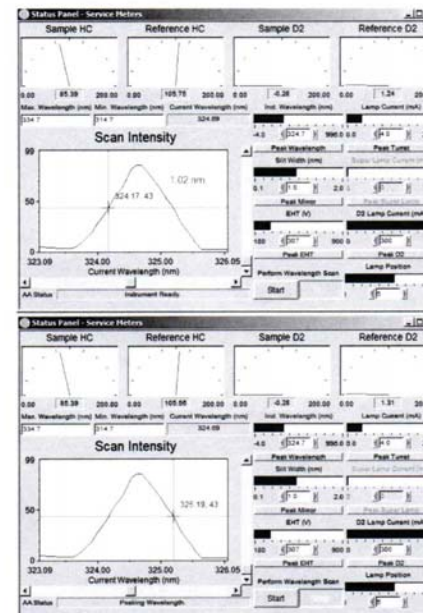
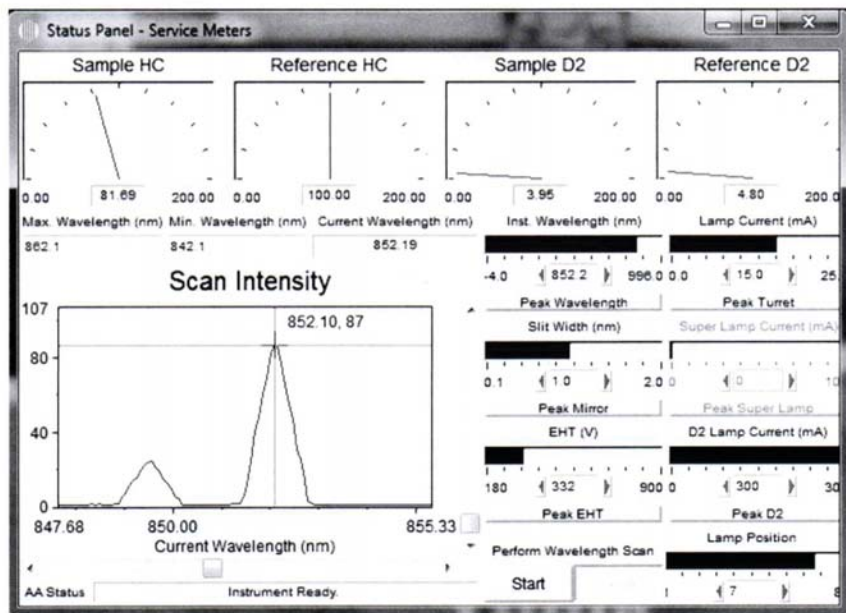
Flame Type	Air-Acetylene
Fuel Flow	2.000 l/min
Oxidant Flow	10.00 l/min
Burner Angle	0.00°
Workhead Height	15.00 mm

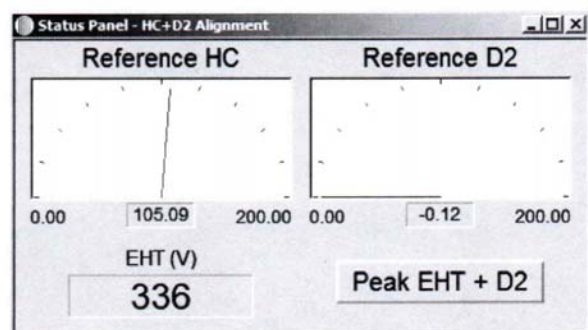
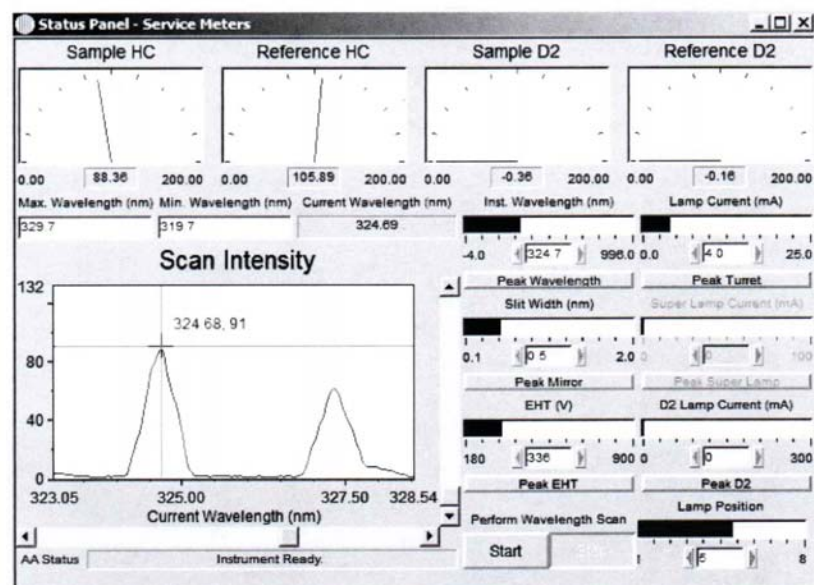
Full Calibration

Calibration Mode	Conc Least Squares	Max Error : 0.0000	R ² : 1.0000	R : 1.0000
	Conc = Abs / (0.1530 + 0.0000 * Abs)			

Sample Label	Conc. (µg/ml)	%RSD	Mean Abs.	Replicates		
Cal Blank	-----	HIGH	-0.0007	-0.0003	-0.0005	-0.0011
				-0.0007	-0.0007	-0.0011
				-0.0003	-0.0010	-0.0004
				-0.0005		
Standard 1	5.000	0.39	0.7650	0.7626	0.7674	0.7625
				0.7674	0.7684	0.7661
				0.7585	0.7657	0.7648
				0.7668		

Sample Label	Conc. (µg/ml)	%RSD	Mean Abs.	Replicates		
Cu1	5.007	0.35	0.7661	0.7630	0.7673	0.7683
				0.7617	0.7651	0.7635
				0.7693	0.7674	0.7665
				0.7691		
Cu2	5.009	0.43	0.7664	0.7670	0.7640	0.7671
				0.7736	0.7644	0.7683
				0.7650	0.7626	0.7634
				0.7689		
Cu3	5.010	0.33	0.7666	0.7668	0.7681	0.7677
				0.7670	0.7622	0.7714
				0.7649	0.7652	0.7683
				0.7648		





GBC Scientific Equipment Pty Ltd

Certificate of Conformance

This is to certify that the gauze membrane serial number: F104
 Reads a value of: 0.49 A.U. at a wavelength of 440 nm, using a
 GBC Cintra serial number V 4331 referenced to a NIST neutral
 density filter: 8661/SRM 930D (1210).

Valid for 12 months from date of issue.

Date: 22/03/2024

Operator: NIWAT SUPATANIT

GBC Scientific
 Equipment Pty Ltd
 A/C/H, 005 472 686
 A/B N, 33 005 472 686

4 Lakewood Boulevard
 PO Box 1135
 Brinsford VIC 3195
 Australia

Telephone
 (03) 9588 6666
 International
 +61 3 9588 6666

Website & Technical Support
www.gbcscl.com
gbc@gbcscl.com



This is to certify that
Niwat Supatanit

From

**DKSH Technology Limited
Thailand**

has successfully completed GBC Service
Training including hardware and software training,
installation and repair on the following instruments:

AAS Instruments and Accessories
UV-Vis Instruments and Accessories
ICP-OES Quantima and Accessories

Introduction to:

ICP-TOFMS OptiMass
High Performance Liquid Chromatography
X-ray Equipment Emma

Training conducted in Penang, Malaysia
From 22 July to 2 August 2019


Geoff Condict
CEO



Supelco®

www.sigmaaldrich.com

**Certified Reference Material
Reference material certificate**

Copper Standard for AAS

TraceCERT®
Traceable Certified Reference Material

Product no.: 38996
Lot no.: BCCH9264
Description of CRM: Copper metal (pure material) in 2% HNO₃ (prepared with HNO₃ suitable for trace analysis and high-purity water, 18.2 MΩ·cm, 0.22 µm filtered).
Expiry date: JUN 2025
Storage: Store at 5°C-25°C
Density (certified) at 20°C: 1011.3 kg m⁻³ ± 0.5 kg m⁻³

Constituent Certified values at 20°C and expanded uncertainties, $U = k \cdot u$ ($k = 2$) ^{[1][2]}

Constituent	Certified values at 20°C and expanded uncertainties, $U = k \cdot u$ ($k = 2$) ^{[1][2]}
Copper	989 mg kg⁻¹ ± 4 mg kg⁻¹ 1000 mg L⁻¹ ± 4 mg L⁻¹

Metrological traceability: Certified values are traceable to the International System of units (SI) through a metrologically valid weighing process. Details see "Details on metrological traceability".^[3]

Measurement method: The certified value is determined by high-precision weighing of thoroughly characterized starting materials and verified by measurement against NIST SRMs or similar CRMs in accordance with ISO/IEC 17025.^[4]

Intended use: Calibration of AAS, ICP, spectrophotometry or any other analytical technique.

Instructions for handling and correct use: The bottle's temperature must be 20°C. Shake well before every use. If storage of a partially used bottle is necessary (at the user's risk), the cap should be tightly sealed and the bottle should be stored at reduced temperature (e.g. refrigerator) to minimize transpiration rate.

Health and safety information: Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.

Packaging: 250 mL HDPE bottle

Accreditation: Sigma-Aldrich Production GmbH is accredited by the Swiss Accreditation Service SAS as reference material producer under no. SRMS 0001 in accordance with international standard ISO 17034^[5]

Certificate issue date: 29 JUL 2022



ISO 17034
SRMS 0001


S. Matt – CRM Operations


Dr. P. Zell – Approving Officer

Sigma-Aldrich Production GmbH, Industriestrasse 25, 9471 Buchs, Switzerland;
Tel +41-81-755-2511; Fax +41-81-756-5449; www.sigmaaldrich.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.

Certificate Page 1 of 3

Certificate version 01



Certification process details:

To guarantee top reliability of the values for this **TraceCERT®** certified reference material, three independent procedures were followed. The values have to agree in the range of their uncertainties, but the value from the gravimetric preparation has been chosen as certified value [1]:

1. Gravimetric preparation using pure materials is a practical realization of concentration units, through conversion of mass to amount of substance [3]. If the purity of the materials is demonstrated and if contamination and loss of material is strictly prevented this approach allows highest accuracy and small uncertainties. The certified value of this **TraceCERT®** reference material is based on this approach and directly traceable to the SI unit kilogram. Therefore comprehensively characterized materials of high purity are used. All balances are calibrated annually by an ISO/IEC 17025 accredited laboratory and certified according to DKD guidelines. Calibration is checked daily with OIML Class E2 or F2 weights.
2. The starting material is measured against a certified reference material (i.e. NIST or BAM) followed by gravimetric preparation using balances calibrated with SI-traceable weights. Consequently the value calculated by this unbroken chain of comparisons is traceable to the reference to which the starting material is compared.
3. Whenever applicable the bottled **TraceCERT®** calibration solution is compared to a second reference which is independent from the first reference.

Details on metrological traceability:

Only internationally accepted reference materials e.g. from NIST (USA) or BAM (Germany) have been carefully selected to provide the basis for traceability to the SI unit mole. When no such reference is available, an elemental metal or an adequate salt of highest available purity is used to confirm traceability to this pure material (and therefore to the SI unit kg).

To underpin the certified gravimetric value all traceability measurements are performed with the most accurate and precise analytical technique available. Therefore titrimetry measurement series are applied whenever possible (corrected for trace impurities). When no titrimetric technique is available, the traceability measurements are performed with another analytical technique, e.g. ICP-OES or AAS.

Reference and applied technique used for traceability measurements of the

starting material: NIST SRM 728 / complexometric titration

bottled solution: BAM 365 / complexometric titration

Details on starting materials:

For high purity materials ($P > 99.9\%$) the most appropriate way of purity determination is to quantify the impurities (w_i) and to subtract the sum from 100%. Impurities below the detection limit are considered with a contribution of half of the detection limit (DL_i).

$$P = 100\% - \sum_i w_i - \sum_j \left(\frac{DL_j}{2}\right)$$

Water containing materials were dried to absolute dryness by individual drying conditions (up to 600°C). When drying is impossible due to decomposition water was determined by high-precision KF-titration.

Homogeneity assessment:

Due to the production process, a homogeneous solution derives. Nevertheless a small homogeneity contribution is included into the calculation of content uncertainty of this CRM.

Density Measurement:

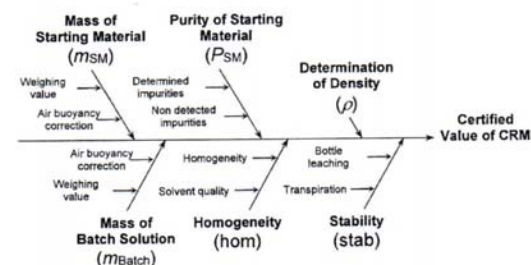
The density measurement is carried out in accordance with ISO/IEC 17025[4] and ISO 15212-1 [6] using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty at the 95% confidence level, using a coverage factor of $k = 2$.

Uncertainty evaluation:

The uncertainty contributions are illustrated by the following cause-effect diagram [7]:

Typical relative contributions are:

$U(m_{SM})$	< 0.01 %
$U(m_{Batch})$	< 0.01 %
$U(P_{SM})$	< 0.05 %
U_{hom}	< 0.03 %
U_{stab}	< 0.17 %
$U(\rho)$	< 0.05 %



The combined standard uncertainty is calculated by combination of the standard uncertainties of the input estimates according to Eurachem/CITAC Guide "Quantifying Uncertainty in Analytical Measurement" and ISO 17034.[2][5]

Expanded uncertainty is then calculated to a confidence level of 95%, typically by multiplying with a confidence level factor of $k=2$.

References:

- [1] ISO Guide 35:2017, "Reference materials - Guidance for characterization and assessment of homogeneity and stability"
- [2] Eurachem/CITAC Guide, 3rd Ed. (2012), "Quantifying uncertainty in analytical measurement"
- [3] Eurachem/CITAC Guide, 2nd Ed. (2019), "Metrological Traceability in chemical measurement"
- [4] The accredited testing laboratory STS 0490 performs the measurements and weighing steps for the certification of this CRM under ISO/IEC 17025:2017, "General requirements for the competence of testing and calibration laboratories"
- [5] ISO 17034:2016, "General requirements for the competence of reference material producers"
- [6] DIN EN ISO 15212-1:1998, Oscillation-type density meters - Part 1: Laboratory instruments
- [7] Reichmuth, A., Wunderli, S., Weber, M., Meyer, V. R. (2004), "The uncertainty of weighing data obtained with electronic analytical balances", Microchimica Acta 148: 133-141.

Certificate of analysis revision history:

Certificate version	Certificate issue date	Reason for version
01	29 JUL 2022	Initial version

Disclaimer:

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Certificate of Calibration

Aqion RFIC: Anion (ID#1084)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

Aqion S/N: 221280114

AS-DV S/N: 22005880126

For

C.E.M Technology (Thailand) CDo., Ltd.



Operator Signature: Nutdanai

Date: Jul 25 ,2024

(Mr.Nutdanai Laekhwan)

Applications Chemist

Qualification Report

PM Check list, CM_OQ and PQ

Aqion RFIC: Anion (ID#1084)

(1st Warranty Year 2) For

For C.E.M Technology (Thailand) Co., Ltd.

PM

Preventive Maintenance Check List



Checklist ICS Preventive Maintenance

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
C.E.M Technology (Thailand) Co., Ltd.	-
Engineer	Date
Nutdanai Laekhwan	25-Jul-24

Instrument Detail

Instrument Model	Application
Aqion RFIC: Anion (ID#1084)	Anion
Instrument components	Serial Number
Aqion	221280114
AS-DV	2205880126

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS600	-	CR-ATC
				EGC KOH
Remark:				

Perform By Archemica



Archemica

Date

Customer

Date



General ICS Maintenance Checklist

No.	Description		Result			
Power on & Connection			Checked	Cleaned	Replaced	N.A.
1	Instrument power on		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2	Instrument connection		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Injection Valve Rebuild			Checked	Cleaned	Replaced	N.A.
3	Rebuilt injection valve 6 port		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	-	Rotor seal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	-	Stator face	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) Auxiliary Valve Rebuild			Checked	Cleaned	Replaced	N.A.
6	Rebuilt auxiliary valve - port		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	-	Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	-	Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Check Valve Cartridge			Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Outlet check valve assembly		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Verified correct flow orientation		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Pump Piston Rinse Seal, Piston Seal and Piston			Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in <i>primary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Piston seal in <i>primary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Piston in <i>primary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Piston rinse seal in <i>secondary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Piston seal in <i>secondary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in <i>secondary</i> pump head		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste Valve and Priming Valve			Checked	Cleaned	Replaced	N.A.
18	Waste valve		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Priming valve		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cell Detector			Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Check electrochemical cell		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	-	Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	-	Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	-	Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	-	Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other			Checked	Cleaned	Replaced	N.A.
26	Sample Loop	Size 25 ul	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	End-line filter		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>
28	Leak sensor		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Lubricate pump mechanic		<input type="checkbox"/>	<input checked="" type="checkbox"/> Lubricated	-	<input type="checkbox"/>
30	Reconnected liquid lines to the valve		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
31	Reconnected liquid lines to pump heads		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
32	Primed pump		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
33	Checked pump for leaks		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
34	Checked gas for leaks		<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>



AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	2205880126	1.6.0

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1.	AS-DV power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2.	AS-DV connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Sampling Tip		Checked	Cleaned	Replaced	N.A.
3.	Sampling needle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Sampling tubing (Transfer line)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Reconnect sampling needle & tubing	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Other		Checked	Cleaned	Replaced	N.A.
6.	Check carousel movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
7.	Check needle movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
8.	Lubricate needle drive	<input checked="" type="checkbox"/>	<input type="checkbox"/> Lubricated	-	<input type="checkbox"/>
9.	AS-DV cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) High Pressure Valve		Checked	Cleaned	Replaced	N.A.
10.	High pressure valve Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11.	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12.	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13.	- Reconnected liquid line to the valve	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Others / comments

CM OQ

Chromeleon Operation Qualification

Seq: ChromeleonLocal\Archemica\Warranty\2024\1st Warranty Year 2 PMPQ 25-Jul-2024\Station Qual 2024-07-25
Page 1 of 12

ThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification

General Information

	Computer Name	Version Number:
Instrument Controller:	DESKTOP-32T6H3B	7.3.1 Build 6535
Client:	DESKTOP-32T6H3B	7.3.1.6535
Operator:	Mr.Nutdanai Laekhwan	

Overall Test Result: *Passed*

Comparison Format:

All Parameters:	Significant Digits:	10
-----------------	---------------------	----

Reviewer's Signature // Date


ARCHEMICA
บริษัท อาร์เคมีกา อินเตอร์เนชั่นแนล จำกัด
ARCHEMICA INTERNATIONAL CO.,LTD.
Nutdanai 25/7/24

Operator's Signature // Date



Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Detection Algorithm: Cobra
Calibration Type: Lin, WithOffset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeffl.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok



Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok



Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

Test Result: Passed



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra
Calibration Type: Lin, WithOffset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
	ProcessingMethod		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Acetanilide	ok
	Asymmetry(AIA)	Acetophenone	ok
	Asymmetry(AIA)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates (JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok
	Rel.Max at	Propiophenone	ok

Test Result: Passed



Chromeleon Operational Qualification, Part 3
System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Inj. Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
System Suitability Test Case Result	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok
		ok

Test Result: Passed

SOFTWARE OQ



Chromeleon

Part 1 - Verification of Selected Results	PASS
Part 2 - Most Frequently Used Parameters: Comparison with Expected Results	PASS
Part 3 - System Suitability Test: comparison with Expected Results	PASS



OVERALL TEST RESULT: PASS
ARCHÉMICA INTERNATIONAL CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>Nutdorn</i>	
Date: 25 Jul 2024	Date:

OQ REVIEW AND COMPLETION



These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification PASSED the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



Field Service Representative Signature:	Customer Signature:
Nutana	
Date: 25/7/24	Date:

OQ EXCEPTIONS AND COMMENTS



N/A

Remainder of Page Intentionally Blank



Field Service Representative Signature:	Customer Signature:
Nutana	
Date: 25/7/24	Date:

PQ

Performance Qualification

TEST EQUIPMENT AND STANDARDS

ThermoFisher
SCIENTIFIC

Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
IC Qualification	Thermo Scientific	Test Box II	21379153	N/A	N/A
Multimeter	FLUKE	289	20920144	N/A	N/A
Thermocouple	FLUKE	K Type	20920144	N/A	N/A
Balance	Ohaus	SPX2202	C327437137	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

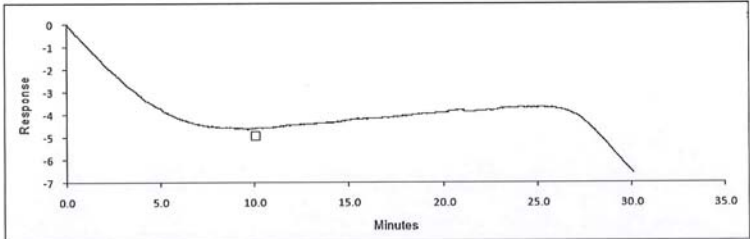
Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	231226	N/A
Nitrate	Thermo Scientific	10 ppm	060254	231226	N/A
Nitrate	Thermo Scientific	25 ppm	060254	231226	N/A
Nitrate	Thermo Scientific	50 ppm	060254	231226	N/A
Nitrate	Thermo Scientific	100 ppm	060254	231226	N/A
Nitrate	Thermo Scientific	1000 ppm	060254	231226	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Field Service Representative Signature:	Customer Signature:
<i>Nutdam</i>	
Date: 25/7/24	Date:

NOISE AND DRIFT (CD)



Information

System Name	Aqion RFIC
Detector SN	221260053
Data Path	chrom://desktop-3216h3b/ChromeleonLocal/Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ.seq/273.smp/ECD_1.channel/ECD_1.chm

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	1.1 nS	≤ 2.0 nS	PASS	1000
Drift	0.7 nS/hr	≤ 20.0 nS/hr	PASS	1000



OVERALL TEST RESULT: **PASS**

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ARCHEMICA INTERNATIONAL CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>Nutana</i>	
Date: 25/7/24	Date:

REPEATABILITY (CD)



Information

System Name	Aqion RFIC
Detector SN	221260053
Data Path	ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 1	25	0.3583	2.654
Repeatability 2	25	0.36	2.659
Repeatability 3	25	0.3583	2.665
Repeatability 4	25	0.3583	2.67
Repeatability 5	25	0.3567	2.673
Repeatability 6	25	0.3567	2.68

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.3	≤ 5.0	PASS
Area	0.4	≤ 1.0	PASS



OVERALL TEST RESULT: **PASS**

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ARCHEMICA INTERNATIONAL CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>Nutana</i>	
Date: 25/7/24	Date:

CARRYOVER (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aqion RFIC
Detector SN	221260053
Data Path	ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.3583	0.01
High Standard	25	0.3583	47.06
Carryover	25	0.3533	0.022

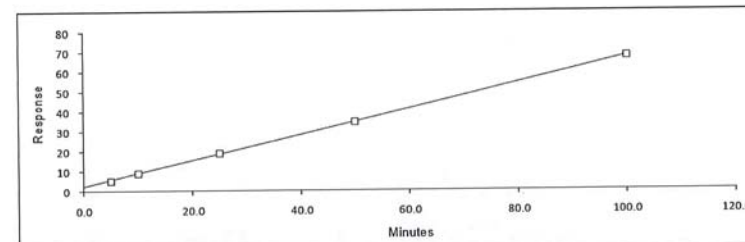
Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.03	≤ 0.10	PASS

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ARCHEMICA INTERNATIONAL CO., LTD.
OVERALL TEST RESULT: **PASS**

Field Service Representative Signature:	Customer Signature:
<i>Nyikana</i>	
Date: 25/7/24	Date:

DETECTOR LINEARITY (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aqion RFIC
Detector SN	221260053
Data Path	ChromeleonLocal://Archemica/Warranty/2024/1st Warranty Year 2 PMPQ 25-Jul-024/IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.014	4.11
Detector Linearity 02	10	9.227	10.57
Detector Linearity 03	25	19.042	25.63
Detector Linearity 04	50	34.755	49.73
Detector Linearity 05	100	67.512	99.97

Linearity

Test	Observed	OQ Limit	Result
r ²	1.000	≥ 0.999	PASS

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OVERALL TEST RESULT: **PASS**

Field Service Representative Signature:	Customer Signature:
<i>Nyikana</i>	
Date: 25/7/24	Date:

ELUENT GENERATOR TEST



EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.611	0.00	± 0.01	PASS
5.00	8.041	8.047	0.01	± 0.05	PASS
10.00	16.082	16.104	0.02	± 0.10	PASS
50.00	80.41	80.46	0.05	± 0.50	PASS
100.00	160.82	161.05	0.23	± 1.00	PASS

OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
Nydamai	
Date: 25/7/24	Date:

IC PUMP FLOW RATE ACCURACY



IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4974	0.520	± 2.0	PASS
1.0	0.9914	0.86	± 2.0	PASS

OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
Nydamai	
Date: 25/7/24	Date:

TEMPERATURE ACCURACY




Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.4	0.4	± 2.0	PASS



OVERALL TEST RESULT: **PASS**

Field Service Representative Signature:	Customer Signature:
	
Date: 25/7/24	Date:

Certificate

Certificate of Standards and Instruments for Qualification

Thermo
SCIENTIFIC

CERTIFICATE OF CONFORMITY

IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number: 21379153
Instrument Part Number: 22000-60001

TEST BOX LOADS AND FUNCTIONS

<input checked="" type="checkbox"/> AES	100Ω	+/- 5%	<input checked="" type="checkbox"/> CR-TC 3-pin ANA INT	1.3KΩ	+/- 5%
<input checked="" type="checkbox"/> EGC CAP KOH	100Ω	+/- 5%	<input checked="" type="checkbox"/> CR-TC 3-pin CAP INT	13.05kΩ	+/- 1%
<input checked="" type="checkbox"/> EGC CAP MSA	100Ω	+/- 5%	<input checked="" type="checkbox"/> CR-TC 4-pin ANA INT	1.3KΩ	+/- 5%
<input checked="" type="checkbox"/> EGC ANA KOH	100Ω	+/- 5%	<input checked="" type="checkbox"/> CR-TC 4-pin CAP INT	13.05kΩ	+/- 1%
<input checked="" type="checkbox"/> EGC ANA MSA	100Ω	+/- 5%	<input checked="" type="checkbox"/> EGC - Memory Test		
<input checked="" type="checkbox"/> ERS (CC)	12Ω	+/- 5%	<input checked="" type="checkbox"/> ERS - Memory Test		
<input checked="" type="checkbox"/> ERC (CV)	250Ω	+/- 5%	<input checked="" type="checkbox"/> CR-TC - Memory Test		

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Tester: Leonardo Alvarez

Notam
25/6/24

Date: 8-SEP-2021

P/N 22000-97001 C

ThermoFisher
SCIENTIFIC

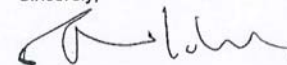
The world leader
in serving science

May 15, 2018

To whom it may concern,

Be advised that the IC Qualification Test Box II (P/N 22000-60001) no longer comes with a sticker labelled "Periodic Calibration Required". An IC Qualification Test Box II can be used without any re-calibration after shipment.

Sincerely,



Thomas Wu
ICSP Product Manager
Thermo Fisher Scientific

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ARCHIMECA INTERNATIONAL CO., LTD.
Notam
25/6/24



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CALIBRATION CERTIFICATE

Certificate No. : EL231988
Job No. : 23110140
Page : 1 of 5

Customer Name. : Archemica Lab Co., Ltd.
Customer Address. : 39 Soi Sukhumvit 63 (Ekamai)
: Sukhumvit Rd., North Klongton,
: Wattana, Bangkok 10110
Instrument Description. : TRUE RMS MULTIMETER
Manufacturer. : FLUKE
Model No. : 289
Serial Number. : 20920144

Received Date : 30 Nov 2023
Calibrated Date : 04 Dec 2023
Issued Date : 04 Dec 2023
Tag No. : -
Service : -
Condition As Received : Used

Calibration Procedure.

Calibration were conducted using in-house calibration procedure according to direct measurement with reference standard.

Procedure No.

CP-EL-01, 02, 03, 04, 05, 06, 07, 10.

Comment.

Reference Standards Instrument.

Instrument Name	Model	Serial No.	Cert. No.	Due Date.
Multi-Function Calibrator	Fluke 5522A	2177901	EE-0033-23	03 Apr 2024
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Traceability Information.

- Traceable to the International System of Units (SI) through the National Institute of Metrology (Thailand), NIMT.

Environmental Conditions.

Temperature : (23 +/- 3) °C Relative Humidity : (50 +/- 15) %

Calibration Information.

- The result of calibration was found accurate as show on date and place of calibration only.
- The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor $k = 2$, providing confidence level of approximately 95%.

Calibrated by : Mr.Suputthana Prapasal

Approved by :
Approved Signatory
() Mr.Phitsanu Wangchai
() Mr.Tanawat Siripakdee

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CALIBRATION CERTIFICATE

Certificate No. : EL231988
Page. : 2 of 5

Range	Standard Value	UUC* Reading	Error	(±) Uncertainty
-------	----------------	--------------	-------	-----------------

Function : DC Voltage Measurement (Without Adjustment)

50 mV	0.0000 mV	0.000 mV	0.000 mV	0.0016 mV
50 mV	5.0000 mV	5.003 mV	0.003 mV	0.0016 mV
50 mV	45.0000 mV	45.002 mV	0.002 mV	0.0021 mV
50 mV	-45.0000 mV	-44.999 mV	0.001 mV	0.0021 mV
500 mV	50.0000 mV	50.00 mV	0.00 mV	0.0061 mV
500 mV	450.000 mV	450.00 mV	0.00 mV	0.0080 mV
500 mV	-450.000 mV	-450.01 mV	-0.01 mV	0.0080 mV
5 V	0.500000 V	0.5001 V	0.0001 V	0.000059 V
5 V	4.50000 V	4.5003 V	0.0003 V	0.000082 V
5 V	-4.50000 V	-4.5002 V	-0.0002 V	0.000082 V
50 V	5.00000 V	5.000 V	0.000 V	0.00059 V
50 V	45.0000 V	45.002 V	0.002 V	0.00095 V
50 V	-45.0000 V	-45.001 V	-0.001 V	0.00095 V
500 V	50.0000 V	50.00 V	0.00 V	0.0059 V
500 V	450.000 V	450.03 V	0.03 V	0.0095 V
500 V	-450.000 V	-450.02 V	-0.02 V	0.0095 V
1000 V	100.0000 V	100.0 V	0.0 V	0.058 V
1000 V	900.000 V	899.9 V	-0.1 V	0.060 V
1000 V	-900.000 V	-899.9 V	0.1 V	0.060 V

Function : DC Voltage Measurement LoZ (Without Adjustment)

1000 V	0.0000000 V	0.0 V	0.0 V	0.058 V
1000 V	100.0000 V	100.0 V	0.0 V	0.058 V
1000 V	900.000 V	900.5 V	0.5 V	0.060 V
1000 V	-900.000 V	-900.5 V	-0.5 V	0.060 V

Function : AC Voltage Measurement (Without Adjustment)

50 mV	5.000 mV	50 Hz	5.007 mV	0.007 mV	0.0053 mV
50 mV	45.000 mV	50 Hz	45.015 mV	0.015 mV	0.013 mV
500 mV	50.000 mV	50 Hz	50.02 mV	0.02 mV	0.014 mV
500 mV	450.00 mV	50 Hz	450.22 mV	0.22 mV	0.11 mV
5 V	0.50000 V	50 Hz	0.5000 V	0.0000 V	0.00012 V
5 V	4.5000 V	50 Hz	4.5057 V	0.0057 V	0.0011 V
50 V	5.0000 V	50 Hz	5.003 V	0.003 V	0.0012 V
50 V	45.000 V	50 Hz	45.045 V	0.045 V	0.0085 V
500 V	50.000 V	50 Hz	50.00 V	0.00 V	0.011 V
500 V	450.00 V	50 Hz	450.39 V	0.39 V	0.12 V
1000 V	100.000 V	50 Hz	100.1 V	0.1 V	0.060 V
1000 V	900.00 V	50 Hz	900.6 V	0.6 V	0.23 V

Remark : (*) UUC : Unit Under Calibration

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CALIBRATION CERTIFICATE

Certificate No. EL231988
Page. 3 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : AC Voltage Measurement LoZ (Without Adjustment)				
1000 V	100.000 V	50 Hz	100.4 V	0.060 V
1000 V	900.00 V	50 Hz	904.1 V	0.23 V
Function : DC Current Measurement (Without Adjustment)				
500 uA	0.000 uA		0.00 uA	0.017 uA
500 uA	50.000 uA		50.02 uA	0.023 uA
500 uA	450.00 uA		450.07 uA	0.078 uA
5000 uA	500.00 uA		500.1 uA	0.097 uA
5000 uA	4500.0 uA		4501.1 uA	0.57 uA
50 mA	5.0000 mA		5.001 mA	0.00082 mA
50 mA	45.000 mA		45.002 mA	0.0058 mA
400 mA	40.000 mA		40.00 mA	0.0077 mA
400 mA	360.00 mA		359.99 mA	-0.01 mA
5 A	0.50000 A		0.5011 A	0.00013 A
5 A	4.5000 A		4.5007 A	0.0002 A
10 A	1.00000 A		1.002 A	0.00061 A
10 A	9.0000 A		9.021 A	0.0040 A
Function : AC Current Measurement (Without Adjustment)				
500 uA	50.00 uA	50 Hz	49.92 uA	-0.08 uA
500 uA	450.00 uA	50 Hz	449.89 uA	-0.11 uA
5000 uA	500.00 uA	50 Hz	499.8 uA	-0.2 uA
5000 uA	4500.0 uA	50 Hz	4502.0 uA	2.0 uA
50 mA	5.0000 mA	50 Hz	4.991 mA	-0.009 mA
50 mA	45.000 mA	50 Hz	44.987 mA	-0.013 mA
400 mA	40.000 mA	50 Hz	40.00 mA	0.00 mA
400 mA	360.00 mA	50 Hz	360.14 mA	0.14 mA
5 A	0.50000 mA	50 Hz	0.4995 mA	-0.0005 mA
5 A	4.5000 mA	50 Hz	4.4976 mA	-0.0024 mA
10 A	1.00000 mA	50 Hz	0.992 mA	-0.008 mA
10 A	9.0000 mA	50 Hz	8.998 mA	-0.002 mA

Remark : (*) UUC : Unit Under Calibration

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CALIBRATION CERTIFICATE

Certificate No. EL231988
Page. 4 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : Resistance Measurement (Without Adjustment)				
500 Ω	0.0000 Ω		0.00 Ω	0.0075 Ω
500 Ω	50.0000 Ω		50.00 Ω	0.0084 Ω
500 Ω	450.000 Ω		449.87 Ω	-0.13 Ω
5 kΩ	0.500000 kΩ		0.5000 kΩ	0.00060 kΩ
5 kΩ	4.50000 kΩ		4.4997 kΩ	-0.0003 kΩ
50 kΩ	5.00000 kΩ		4.999 kΩ	-0.001 kΩ
50 kΩ	45.0000 kΩ		44.990 kΩ	-0.010 kΩ
500 kΩ	50.0000 kΩ		50.00 kΩ	0.00 kΩ
500 kΩ	450.000 kΩ		449.88 kΩ	-0.12 kΩ
5 MΩ	0.500000 MΩ		0.5000 MΩ	0.000070 MΩ
5 MΩ	4.50000 MΩ		4.4989 MΩ	-0.0011 MΩ
30 MΩ	3.000000 MΩ		3.000 MΩ	0.00061 MΩ
30 MΩ	27.00000 MΩ		26.988 MΩ	-0.012 MΩ
50 MΩ	5.00000 MΩ		5.00 MΩ	0.0059 MΩ
50 MΩ	45.0000 MΩ		44.95 MΩ	-0.05 MΩ
100 MΩ	10.00000 MΩ		10.0 MΩ	0.0 MΩ
100 MΩ	90.0000 MΩ		89.9 MΩ	-0.1 MΩ
500 MΩ	250.0000 MΩ		249.5 MΩ	-0.5 MΩ
500 MΩ	450.00 MΩ		447.0 MΩ	-3.0 MΩ
Function : Resistance Measurement LoΩ (Without Adjustment)				
50 Ω	0.0000 Ω		0.000 Ω	0.0050 Ω
50 Ω	5.0000 Ω		5.008 Ω	0.008 Ω
50 Ω	25.0000 Ω		25.015 Ω	0.015 Ω
50 Ω	45.0000 Ω		45.008 Ω	0.008 Ω
Function : Capacitance Measurement (Without Adjustment)				
1 nF	0.0000 nF		0.000 nF	0.0078 nF
1 nF	0.5000 nF		0.499 nF	-0.001 nF
1 nF	0.9000 nF		0.898 nF	-0.002 nF
10 nF	1.0000 nF		1.00 nF	0.00 nF
10 nF	9.0000 nF		9.01 nF	0.01 nF
100 nF	10.0000 nF		10.0 nF	0.0 nF
100 nF	90.000 nF		90.0 nF	0.0 nF
1 uF	0.100000 uF		0.100 uF	0.000 uF
1 uF	0.90000 uF		0.900 uF	0.000 uF
10 uF	1.00000 uF		1.00 uF	0.00 uF
10 uF	9.0000 uF		9.01 uF	0.01 uF
100 uF	10.0000 uF		10.0 uF	0.0 uF
100 uF	90.000 uF		90.0 uF	0.0 uF
1000 uF	100.000 uF		100 uF	0 uF
1000 uF	900.00 uF		900 uF	0 uF
10 mF	1.00000 mF		1.00 mF	0.0072 mF
10 mF	9.0000 mF		8.99 mF	-0.01 mF
100 mF	10.0000 mF		10.0 mF	0.0 mF
100 mF	90.000 mF		89.8 mF	-0.2 mF

Remark : (*) UUC : Unit Under Calibration

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25/7/24



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CALIBRATION CERTIFICATE

Certificate No. EL231988
Page. 5 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
Function : Frequency Measurement (Without Adjustment)				
100 Hz	10.00 Hz @ 1 V	10.000 Hz	0.000 Hz	0.00059 Hz
100 Hz	90.00 Hz @ 1 V	90.000 Hz	0.000 Hz	0.00066 Hz
1000 Hz	100.00 Hz @ 1 V	100.00 Hz	0.00 Hz	0.0058 Hz
1000 Hz	900.0 Hz @ 1 V	900.00 Hz	0.00 Hz	0.0061 Hz
10 kHz	1.0000 kHz @ 1 V	1.0000 kHz	0.0000 kHz	0.000058 kHz
10 kHz	9.000 kHz @ 1 V	9.0000 kHz	0.0000 kHz	0.000061 kHz
100 kHz	10.000 kHz @ 1 V	10.000 kHz	0.000 kHz	0.00058 kHz
100 kHz	90.00 kHz @ 1 V	90.000 kHz	0.000 kHz	0.00061 kHz
1000 kHz	100.00 kHz @ 1 V	100.00 kHz	0.00 kHz	0.0058 kHz
1000 kHz	500.0 kHz @ 1 V	500.00 kHz	0.00 kHz	0.0059 kHz

Range	Standard Value	Required UUC*Reading	UUC*Reading	Error	(±) Uncertainty
Function : Thermocouple Measurement K Type (Without Adjustment)					
-200 to 1350 °C	-5.550 mV	-180.0 °C	-178.6 °C	1.4 °C	0.37 °C
-200 to 1350 °C	0.000 mV	0.0 °C	0.7 °C	0.7 °C	0.24 °C
-200 to 1350 °C	4.096 mV	100.0 °C	100.7 °C	0.7 °C	0.22 °C
-200 to 1350 °C	24.905 mV	600.0 °C	600.8 °C	0.8 °C	0.22 °C
-200 to 1350 °C	37.326 mV	900.0 °C	900.8 °C	0.8 °C	0.22 °C
-200 to 1350 °C	48.838 mV	1200.0 °C	1200.9 °C	0.9 °C	0.23 °C

Remark : (*) UUC : Unit Under Calibration

END OF CALIBRATION

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ARCHIMICA INTERNATIONAL CO., LTD.

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CALIBRATION CERTIFICATE

Certificate No. TL230236
Job No. 23110140
Page. 1 of 2

Customer Name : Archemica Lab. Co., Ltd.
Customer Address : 39 Sol Sukhumvit 63 (Ekamal),
Sukhumvit Rd., North Klongton, Wattana ,
Bangkok 10110.

Received Date : 30 Dec 2023
Calibrated Date : 01 to 02 Dec 2023
Issued Date : 02 Dec 2023

Instrument Description : Digital Thermometer with sensor
Manufacturer : FLUKE
Model No. : 289
Serial Number : 20920144

Tag No. : -
Service : -
Condition As Received : Used Item

Calibration Procedure.

Calibration were conducted using in-house calibration procedure according to comparison measurement with Platinum Resistance Thermometer (PRT) into temperature source.

Procedure No.
CP-TL-01

Comment.

Reference Standards Instrument.

Instrument Name	Model	Serial No.	Cert No.	Due Date
Platinum Resistance Thermometer	5615	958332	TT-0066-23	21 Jun 2024
Thermometer Readout	1529	829730	22E4124	26 Dec 2023

Traceability Information.

The temperature scale used was based on ITS-90.
This certification is traceable to the International System of Units (SI).

Environmental Conditions

Temperature : (23 ± 3) °C Relative Humidity : (50 ± 15) %RH

Calibration Information.

The result of calibration was found accurate as show on date and place of calibration only.
The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor (k),
providing confidence level of approximately 95%.

Calibrated by : Nuttapon Srisuwan



Approved Signatory
(✓) Mr. Phitsanu Wangchal
() Mr. Tanawat Siripakdee

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CALIBRATION CERTIFICATE

Certificate No. TL230236

Page 2 of 2

Result of Calibration:

(Without Adjustment)

Sensor of UUC*: Thermocouple Wire Type: K Serial No.: ID/Tag No.: 20920144
Dimension: Length: 1000 mm Diameter: 1.5 mm

Immersion Depth	Standard Reading	UUC* Reading	Correction Value	Uncertainty of Measurement (z)	Coverage Factor
mm	°C	°C	°C	°C	k =
150	0.0024	1.1	-1.1	0.50	2.00
150	50.0051	49.7	0.3	0.50	2.00
150	100.0050	99.0	1.0	0.50	2.00

UUC*: Unit Under Calibration

END OF CERTIFICATE

ARCHEMICA
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25/7/24

Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254
Certificate of Analysis

Lot Number 231226

Expiration of Certification
December 2024

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.08 \pm 0.03
2	10.03 \pm 0.14
3	25.16 \pm 0.65
4	50.43 \pm 0.09
5	99.7 \pm 3
6	1014 \pm 17

ARCHEMICA
บริษัท อีเคม จำกัด
ARCHEMICA INTERNATIONAL CO., LTD.

Nutarn
25/7/24

The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01

20-Dec-2011

thermoscientific.com/dionex

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XX21149-EN 02165 031318-10

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Sunnyvale, CA 94088-3603
(408) 737-0700



Thermo Fisher Scientific
Sunnyvale, CA USA is
ISO 9001 Certified.

thermo
scientific

Certificate of Completion

This certifies that

Nutdanai Laekhwan

Has successfully completed

OJT RPG Mentoring: Ion Chromatography System Qualification Service Training

APACHEMICA
บริษัท อีพีเอ็ม อีเอสเอสเอส จำกัด
APACHEMICA INTERNATIONAL CO., LTD.
วันที่: 25/7/24

Valid for 3 years from:

Oct/4/2022

Issued electronically and
approved by:

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System, Training, Mentoring,
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Important note: The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors.



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

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ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : marketing.tec.th@dksh.com

Website : www.dksh.co.th/technology/scientific-thailand

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance



เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุณย์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



www.dksh.com/scientific-thailand



marketing.tec.th@dksh.com



@dkshscientific

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการครั้งต่อปี

ครั้งที่ 1, วันที่ 15/05/2024.....

รายละเอียดผู้รับบริการ


หน่วยงาน	บริษัท จี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพาพร พิมพ์				
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ				
โทรศัพท์	0869054664	เบอร์ต่อ	-	แฟกซ์	-
E-mail	lab.cemtech1@gmail.com				

รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)	
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260	
โทรศัพท์ 0 2 693 7000 Email: sudarat.sk@dksh.com	
เจ้าหน้าที่ประสานงาน : คุณสุภารัตน์ ศิริรัตน์ โทรศัพท์ 090 678 6925	
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุช สลอลาด
ตำแหน่ง	Specialist, Technical Service.
โทรศัพท์	0938138736 แฟกซ์ -
E-mail	Jirayut.js@dksh.com

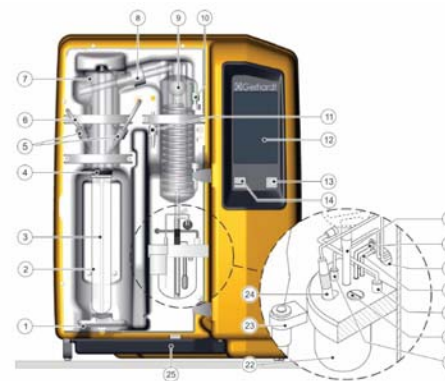
ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวบรรจง	(.....)	ตัวบรรจง	(นาย จิรายุช สลอลาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	15/05/2024

JOB: LSPR2403415.....MODEL: VAP 200.....S/N: GER5200180181

Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

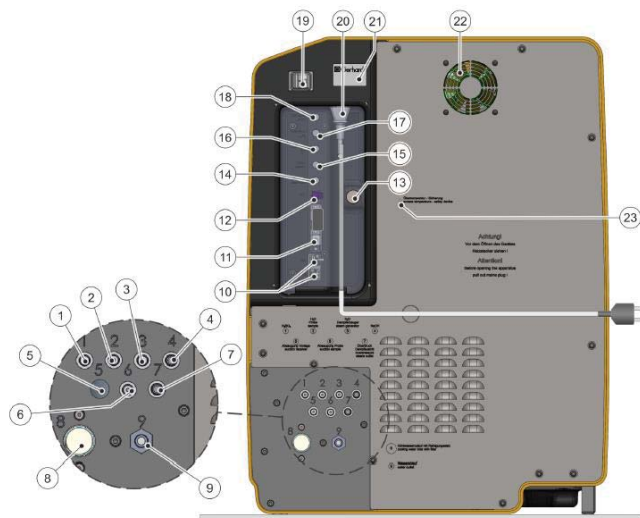
FRONT



No		PASS	FAIL	N/A
1	Quick clamping device with clamping block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Digestion tube 250/300 ml	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	PTFE steam inlet tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Connection stopper, Viton	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Screw cap GL18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	PTFE-inlet tubing NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Distribution head made of glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Screw cap GL32	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Distillation condenser made of glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Screw cap GL14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Control panel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Operating Button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	USB interface (with protective cap)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Silicone tubing 8/10 for distillate discharge **	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
16	Verprene tubing 4/8, receiver suction **	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
17	Cable duct for electrode cable + titration tube**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
18	Silicone tubing 4/7, boric acid inlet**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
19	Sensor for level monitoring including connector**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
20	Agitator motor with propeller**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
21	Titration acid inlet tube **	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	Receiver glass**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	Holder for pH electrode, removable**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	pH electrode (combined electrode)**	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	Drip tray PP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

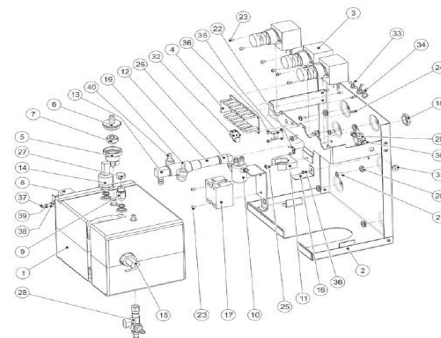
** only VAP 450

REAR



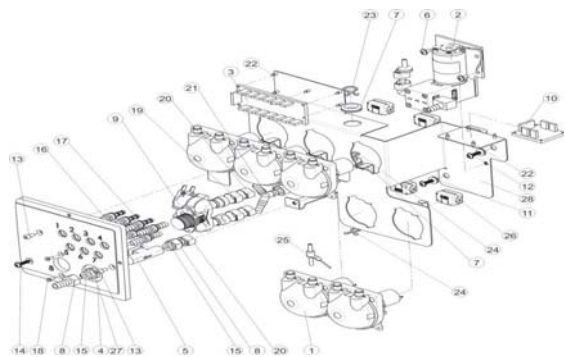
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Tube connection for sample H2O supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Tube connection for steam generator H2O supply	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Tube connection for NaOH supply	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Tube connection for receiver glass extraction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Tube connection for sample waste extraction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Tube connection , overpressure steam outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Connection for cooling water supply (with cleaning sieve)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Tube connection for cooling water outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	4 X USB interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	1 X RS-232 Interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	LAN Interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Screw cap for Perspex cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Connection socket for sample waste tank level monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Connection (not used)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
16	Connection socket for H2O tank level monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Connection socket for H3BO3 tank level monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Connection socket for NaOH tank level monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Overcurrent circuit breaker	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Apparatus socket (mains cable connection)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Rating plate with serial number	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Exhaust air fan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Excess temperature switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Inside Steam generator



No		PASS	FAIL	N/A
1	Steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Steam generator traverse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Pinch valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Circuit board distributor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Valve tubing connection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Housing safety valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Safety valve SKT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Excess temperature protection , steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Safety valve G 1/8 0,5 bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Ventilation glass pinch valve VAPODEST	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Hose clamp for ventilation clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Distributor PP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Angle connection PP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Pressure transmitter	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Level switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Fixing bracket steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Relay HT+	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	VA Hexagon nut 1/2"	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Angle connection 1/8"	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Bushing nipple 6-10-14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	VA Lens head screw M5 X 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Grounding connection , 2-pole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	VA Lens head screw M4 X 6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Spacer bolt 5 mm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	VA Lens head screw M4 X 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Tubing connection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Hose clamp 14.5 mm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	Module ball valve with nozzles	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Cross manifold with spout	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	Seal copper G 1/8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	Locking screw 1/8"	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	Pin strip	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Bundle clamp 12 H 4500	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Bundle clamp 12 H 4502	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	Temperature switch 80°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	VA Lens head screw M3 X 6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	VA Hexagon nut M4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	Lins head screw M4 X 8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	VA Spring washer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	Angle connection , reduced , 1/8" PP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Module Pump holder VAP200 - 450 V3



No		PASS	FAIL	N/A
1	Peristaltic pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Diaphragm pump NaOH. with non-return valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Circuit board	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Tubing connection module	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Flow controller	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Lens head screw M5 x 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Bushing nozzle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Screw in socket	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Magnetic valve 2/2 way	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Circuit board distributor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Bushing nozzle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Screw 5 x 25	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Cylinder screw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Screw 5 x 20	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Seal EPDM 15 x 4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Tubing connection piece 51x10x6,5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Tubing connection piece 51x10x10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Screw M4x10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Y-tube connector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Spacer bolt 5 mm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Bundle clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Bundle clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Retrofit earthing pumpv	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Snap ferrite	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Nut G 3/8"	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	Pump holder plate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Control panel



No		PASS	FAIL
1	Title bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Status bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Navigation button	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Smart switch with multiple functions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	USB interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distribution Head
- Condensor
- Steam generator
- Tubing
- Viton cone

ตรวจสอบ Function การทำงาน (The FunctionTest)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H3BO3

รายงานผลการให้บริการ

	Pass	Fail	N/A	Remark
1. TECHNICAL DATA				
Main Supply 220 volt + 10% 50 Hz with ground	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Normal current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>8a.....
1.1 COOLING WATER BATH	Pass	Fail	N/A	Remark
Temperature 15-20 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control Temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2 OPTICAL TEST VAP200	Pass	Fail	N/A	Remark
Screw cap GL14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screw cap GL18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screw cap GL32	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distillation Head	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Viton Cone	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	เสื่อมสภาพ
Ventilation Valve BV	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Micro Switch Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agitator motor for propeller	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. SYSTEM COOLING WATER INLET	Pass	Fail	N/A	Remark
Cooling Water Inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flow control valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.SYSTEM CONTROL	Pass	Fail	N/A	Remark
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding H2O	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Adding H3BO3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Suction Sample	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Suction Reciver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.SYSTEM DISTILLATION	Pass	Fail	N/A	Remark
Boiler	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Level Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Novopren	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve Shut-Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve soft steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation Valve Premount	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excess Pressure Detector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating Element	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. PUMP

	Pass	Fail	N/A	Remark
Pump H ₂ O Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Return Valve	-	-	-
Pump H ₂ O Sample	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
- Non-Return Valve	-	-	-
Pump NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Return Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump H ₃ BO ₃	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
- Non-Return Valve	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pump suction	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pump suction receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

6. The Following Program Run :

	Pass	Fail	N/A	Remark
Addition H ₂ O 0-999 ml.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Addition NaOH 0-999 ml.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Addition H ₃ BO ₃ 0-999 ml.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Reaction Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distillation Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steam Capacity 10%-100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suction Sample	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Suction Receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

7. Measured pumps

	Pass	Fail	N/A	Remark
Pump NaOH			
Volume : ..13.33.....ml			

Remark :

.....

ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning program

Glass parts and tubes must be rinsed daily before starting analysis in order to prevent clogging by crystallising chemicals.

The following settings are recommended for this:

parameters	Value
H ₂ O addition	150 ml
NaOH addition	0 ml
Distillation time	7 min
Steam power	100 %
Reaction time	0 s
Suction sample	30 s

→ Insert a digestion tube (without sample) and start the program.

⚠ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

General error message

Fault description	Cause	Remedy
'Cooling water flow volume too low'	Cooling water pressure under 1 bar	<ul style="list-style-type: none"> Open water tap. Check coolant pressure. Check coolant tube. Program continues automatically once error has been fixed.
'Sample tube missing'	Sample tube missing.	<ul style="list-style-type: none"> Insert sample tube. Continue program or restart.
'Distillation room protective door open'	Protection door not closed	<ul style="list-style-type: none"> Close protection door. Program continues automatically once error has been fixed.
'Reagent storage/waste'	One or more storage tanks are empty	<ul style="list-style-type: none"> Fill storage tank. Check correct seating of the universal sensors. The running program can be continued after rectification of the error.
	The sample waste tank is full.	<ul style="list-style-type: none"> Empty sample waste tank. Check correct seating of the universal sensors. The running program can be continued after rectification of the error.

Analytical errors

Fault description	Cause	Remedy
Analyte results too high	The chemicals used are contaminated with nitrogen compounds.	<ul style="list-style-type: none"> ■ Detailed checking of the chemicals. ■ Determination of a blank value. ■ Replace the chemicals if necessary.
	Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"> ■ Increase of the water addition amount.
	Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"> ■ Replacement of the glass condenser.
	Glass cleaning agents in the digestion tube.	<ul style="list-style-type: none"> ■ Clean digestion tube in advance with distilled water.
	Entrainment of ammonia from the previous sample.	<ul style="list-style-type: none"> ■ Increase distillation time. ■ Check whether the sample was previously sufficiently alkalisied.
Analyte result too low or no result	Incomplete distillation; distillation time too short.	<ul style="list-style-type: none"> ■ No quantitative expulsion of the ammonia content. ■ The distillation amount should be 100 ml.
	Ammonia escapes at leaking places.	<ul style="list-style-type: none"> ■ Soiled or defective Viton plugs; clean or replace. ■ Check seals (GL screw connections) on the distribution head; replace if necessary. ■ Check valve at the condenser is gummed up; clean or replace. ■ Digestion tube is damaged at the neck extension. ■ Distribution head glass leaks; replace.
	Addition amount of the sodium hydroxide too little; no ammonia development.	<ul style="list-style-type: none"> ■ Check the constant flow rate of the NaOH pump (see Technical Data).
	Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.	<ul style="list-style-type: none"> ■ Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	<ul style="list-style-type: none"> ■ Increase of the acid amount.
	Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.	<ul style="list-style-type: none"> ■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

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Website : www.dksh.co.th/technology/scientific-thailand

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักขัตฤกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)

เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260

เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



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@dkshscientific

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี
ครั้งที่ ...1... วันที่ 15/05/2024.....

รายละเอียดผู้รับบริการ


หน่วยงาน	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะทู้ภูเก็ต จังหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริภาพร พิมพ์			
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ			
โทรศัพท์	0869054664	เบอร์ติดต่อ	-	แฟกซ์ -
E-mail	lab.cemtech1@gmail.com			

รายละเอียดผู้ให้บริการ

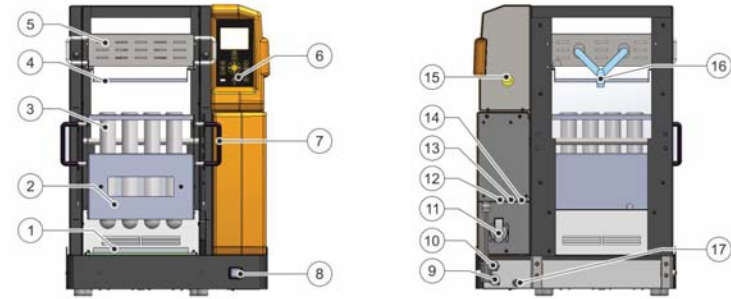
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: sudarat.sk@dksh.com เจ้าหน้าที่ประสานงาน : คุณสุวรรณ์ ศิริรัตน์ โทรศัพท์ 090 678 6925	
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุทธ สลอาด
ตำแหน่ง	Specialist, Technical Service.
โทรศัพท์	0938138736 แฟกซ์ -
E-mail	Jirayut.js@dksh.com

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวบรรจง	(.....)	ตัวบรรจง	(นายจิรายุทธ สลอาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	15/05/2024

JOB No: LSPR2403414.....MODEL: KT 20 S/N: GER5720180118

Part 3: ตรวจสอบสภาพเครื่อง

Front and rear view of KT-L version



No.		PASS	Fail	N/A	Remark
1	KJELDATHERM digestion block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	เชื่อมสภาพ
2	Insert rack	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Digestion tube	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Stainless steel drip tray	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Exhaust manifold	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	Controls module, removable	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Handle for insert rack	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	Mains switch with overcurrent protection function	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	Connection for lift unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10	Mains cable with plug	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11	Power supply for TURBOSOG	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12	Connects controller module to block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13	Connection for fan for cooling samples (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
14	Connection for external cooling water valve (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15	Connects controller module to block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16	Connection for Iso-Versinic hose (extraction)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17	Excess temperature fuse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18	Lift	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Part 4: ละเอียดและรายงานผลการให้บริการ Preventive Maintenance

4.1 ตรวจสอบระบบไฟฟ้า

	Pass	Fai	N/A	Remark
ใช้ไฟ 220 V50 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
กระแสไฟฟ้าตามพิกัดเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ท่อแก๊วรวมไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สายยางต่อกับท่อแก๊วรวม ไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สภาพของ Aluminum block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	เสื่อมสภาพ
การขึ้นลงของ Lift	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Light	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Current Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thermostat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.3 ตรวจสอบระบบการทำงาน



	Pass	Fail	N/A	Remark
Switch controller on or off.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
USB port	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LAMP button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
LIFT down button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
LIFT up button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
OK button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Navigation buttons	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
START/STOP button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MENU button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SUC button	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
COOLWATER button (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
COOL VENT button (optional)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRE HEAT button	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การขึ้นของอุณหภูมิมากกว่า10องศาต่อเวลาที่250องศา	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของตัวป้องกันอุณหภูมิสูงเกิน	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของระบบควบคุมอุณหภูมิ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

การบำรุงรักษาทั่วไป (Basic maintenance)

1. การย่อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องจากตัวอย่งนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับขั้น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
2. เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำเอาคองไอรด์ใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอรด์ที่จะหยดลงมาที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดยดลงมาติดอยู่ในหลุม เพื่อป้องกันไม่ให้คราบดังกล่าวไปกั้นการแผ่อุณหภูมิ



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Tel: (662) 971-5800 Fax: (662) 971-5300
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



CERTIFICATE OF CALIBRATION

Certificate No : S2024/180

Page : 1/5

Order No : 243/2024

Customer : C.E.M Technology (Thailand) Co., Ltd
Address : 219/43 Moo 12 Phet Kasem Rd., Omnoi, Krathum Baen, Samut Sakhon 74130
Instrument : UV/VIS spectrophotometer
Manufacture : Merck
Model : Prove 100
Serial Number : 1714112078
Environment : Temperature (26.9 - 27.6) °C
Humidity (74 - 72) %RH
Received Date : September 24, 2024
Calibration Date : September 24, 2024
Issued Date : September 30, 2024
Calibrate Status : No Adjustment
Calibration Area : Customer area
Roomname : Laboratory Room of C.E.M Technology (Thailand) Co., Ltd

Calibrated By : Pacharapol
(Mr. Pacharapol Kwanbang)
Calibration Engineer

Approved By : Wanchai
(Mr. Wanchai Meesiri)
Manager

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Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



Certificate No : S2024/180

Page : 2/5

1. Photometric Accuracy

CRMs: Neutral Density Glass Filters

CRMs Serial Number: 10563

Traceability: Traceable to NIST, U.S.A. through Neutral density filters NIST SRM 930e & 1930, Double Aperture method through Starna certificate report no.113594

Spectral slit width : 4.00 nm

1.1 Reading scale at 420.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.5604	0.559	0.0014	0.0044
1.0723	1.071	0.0013	0.0038
2.1753	2.171	0.0043	0.0064

1.2 Reading scale at 440.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.5503	0.549	0.0013	0.0040
1.0467	1.045	0.0017	0.0040
2.1117	2.111	0.0007	0.0064

1.3 Reading scale at 465.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.4996	0.499	0.0006	0.0034
0.9649	0.964	0.0009	0.0040
1.9646	1.963	0.0016	0.0060

1.4 Reading scale at 546.1 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.5136	0.512	0.0016	0.0028
0.9765	0.976	0.0005	0.0028
1.9848	1.982	0.0028	0.0064



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1.5 Reading scale at 590.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.5424	0.540	0.0024	0.0029
1.0130	1.012	0.0010	0.0029
2.0238	2.019	0.0048	0.0061

1.6 Reading scale at 635.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
0.0000	0.000	0.0000	0.0028
0.5265	0.525	0.0015	0.0030
0.9667	0.964	0.0027	0.0031
1.9145	1.911	0.0035	0.0062

2. Photometric Accuracy

CRMs: Potassium Dichromate in Perchloric acid

CRMs Serial Number: 132023

Blank Serial Number: 128038

Traceability: Traceable to NIST, U.S.A. through crystalline potassium dichromate NIST SRM 935a through Starna certificate report no.120920

Spectral slit width : 4.00 nm

Wavelength (nm)	Certificate (Abs)	Average Measured Value (A)	Correction (A)	Uncertainty ± (A)
235	0.0000	#N/A	#N/A	#N/A
	0.7351	#N/A	#N/A	#N/A
257	0.0000	#N/A	#N/A	#N/A
	0.8564	#N/A	#N/A	#N/A
313	0.0000	#N/A	#N/A	#N/A
	0.2855	#N/A	#N/A	#N/A
350	0.0000	#N/A	#N/A	#N/A
	0.6363	#N/A	#N/A	#N/A



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3. Wavelength Accuracy

Spectral slit width : 4.00 nm

3.1 CRMs: Holmium Glass Filter

CRMs Serial Number: 10763

Traceability Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 113607

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
241.54	#N/A	#N/A	#N/A
279.40	#N/A	#N/A	#N/A
288.70	#N/A	#N/A	#N/A
334.22	333.9	0.32	0.12
361.26	361.1	0.16	0.12
418.48	418.8	-0.32	0.12
453.20	453.3	-0.10	0.12
460.06	460.0	0.06	0.12
536.90	536.4	0.50	0.12
637.94	637.6	0.34	0.12

3.2 CRMs: Didymium Glass Filter

CRMs Serial Number: 10764

Traceability Traceable to NIST Didymium filter NIST SRM 2034, through Starna certificate report no. 113608

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
585.48	585.3	0.18	0.12
684.63	684.6	0.03	0.12
740.27	740.3	-0.03	0.12
748.28	748.7	-0.42	0.12
807.16	807.4	-0.24	0.12
879.70	879.3	0.40	0.12



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4. *Stray Light

CRMs: Potassium Chloride aqueous solution

CRMs Serial Number: 14912

Blank Serial Number: 14958

Traceability Traceable to NIST, U.S.A. potassium chloride NIST SRM2032, through Starna certificate report no.113597

Spectral slit width : 4.00 nm

Wavelength (nm)	Certificate	Average Measured
201.13	>2A	#N/A
201.13	<1%T	#N/A

5. *Spectral Resolution

CRMs: Toluene in Hexane

CRMs Serial Number: 14812

Blank Serial Number: 14803

Traceability Traceable to toluene in hexane NIST SRM2034,through Starna certificate report no. 113598

Spectral slit width (nm)	Abs Ratio
0.5	#N/A
1.0	#N/A
1.5	#N/A
2.0	#N/A
3.0	#N/A

Note : * "Not TISI Accredited" in this certificate have been included for completeness

Remark:

- 1 Calibrate Method
 - 1.1 Photometric and Wavelength accuracy: In-house method W-SER-001 based on ASTM E925-02 and ASTM E275-01
 - 1.2 Stray light: Measuring the CRMs in both absorbance and transmittance unit at wavelength 201.23 nm. Base on European Pharmacopoeia V.6.19.3 1984
 - 1.3 Spectral resolution: Measuring the CRMs. The maximum absorbance values were read at closest to 268.7nm and the minimum absorbance values were read at closest 267.0 nm. Refer to European Pharmacopoeia V.6.19.3 1984
- 2 N/A = not available.
3. Uncertainty of Measurement: The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
4. This result of calibration was found accurate as shown on date and place of calibration only.
5. This report will certify of calibrated equipment only.

- End of Report -



THAI CALIBRATION SERVICES CO., LTD.

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CALIBRATION CERTIFICATE

Certificate No.S2403073S

page 1 of 2

Customer : C.E.M TECHNOLOGY (THAILAND) CO., LTD.

31/8 Moo 13 Raikhing,

Sampran, Nakhornpathom 73210

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius

Order No. : 67S0768-1

Model : BSA224S-CW

Ambient temperature : (22.5 ± 5.0) °C

Accuracy class : -

Relative humidity : (47.0 ± 10.0) %

Capacity : 220 g

Received date : 02-Mar-2024

Resolution : 0.0001 g

Date of calibration : 02-Mar-2024

Serial No. : 3139614148

Date of issue : 04-Mar-2024

ID No. : CI-01-003

Condition of the balance : Good working conditions

Place of calibration : ห้องเครื่อง

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2310001S	7-Oct-2024	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By : Sathaporn Rueangpluppla

Technician

Approved Signatory :

Chonlatee Pongwatvisanon

This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.



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CALIBRATION CERTIFICATE

Certificate No.S2403073S

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The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
200	0.00005	0.0001	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0000
Point 3	99.9999
Point 4	99.9999
Point 5	100.0000
Eccentric Value	0.0001



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	k
Unload	0.0000	0.0000	0.0000	0.00016	2.32
1	1.0000	1.0000	0.0000	0.00016	2.28
2	2.0000	2.0000	0.0000	0.00016	2.28
5	5.0000	5.0000	0.0000	0.00017	2.28
10	10.0000	9.9999	+0.0001	0.00017	2.25
20	20.0000	20.0000	0.0000	0.00017	2.21
50	50.0000	49.9999	+0.0001	0.00017	2.17
100	99.9999	100.0000	-0.0001	0.00020	2.08
120	120.0000	119.9999	+0.0001	0.00023	2.04
150	150.0000	149.9999	+0.0001	0.00025	2.03
200	199.9999	199.9996	+0.0003	0.00028	2.00

Remark : Adjustment, Internal weight

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--