

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, 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. : 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 Phanangkaew (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.

06Jun-2019

FM-FCS-040

Continuation of Calibration Report

Certificate No. : 66S1031-25 Job No. : 66S1031

Page : 2 of 2

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. : 66S1031-24 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
Manufacturer : ACO
Model : 6236
Serial No. : 222129
Identity No. : NS-03-014
Range : See to Data

Ambient temperature : $(20 \pm 2) ^\circ\text{C}$
Relative humidity : $(50 \pm 15) \%$
Atmospheric pressure : -
Date of received : 26-Oct-2023
Date of calibration : 30-Oct-2023
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
Reviewed By : [] Mr. Sompong Srisert
 [] Ms. Natthaparakarn Thanmaphan
Approved By : [] Ms. Bhacharin Phanangkaew (MD)
 [] Mr. Boonyarit Auejirakarn

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.

06Jun-2019

FM-FCS-040

Continuation of Calibration Report

Certificate No. : 66S1031-24 Job No. : 66S1031 Page : 2 of 2

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. : 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
Reviewed By : [] Mr. Sompong Srisert
[] Ms. Natthaprakarn Thammaphan
Approved By : [] Ms. Bhacharin Phanangkaew (MD)
[] 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	94.5	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. : 66S0330-7 Job No. : 66S0330 Page : 1 of 2

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

Address : 31/9 Moo 13, Raikhing, Samphran,

Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter

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

Manufacturer : Scarlet Tech

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

Model : ST-11D

Atmospheric pressure : -

Serial No. : 820388

Date of received : 08-Mar-2023

Identity No. : NS-12-001

Date of calibration : 10-Mar-2023

Range : See to Data

Date of issued : 13-Mar-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	EELBP.31/0664	15-Jun-2023

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 Phangkaew (MD)

Reviewed By : Mr. Sompong Srisert

Mr. Boonyarit Auejirakarn

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.

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	94.3	0.3	0.20
	104	104.3	0.3	0.20
	114	114.2	0.2	0.20
B	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20
Z	94	94.3	0.3	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20

UUC* = Unit Under Calibration

- The End -

CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-6 Job No. : 66S0330 Page : 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.
Address : 31/9 Moo 13, Raikhing, Samphran,
Nakhornpathom 73210
Location : Laboratory

Equipment : Sound Level Meter Ambient temperature : $(20 \pm 2) ^\circ\text{C}$
Manufacturer : Scarlet Tech Relative humidity : $(50 \pm 15) \%$
Model : ST-11D Atmospheric pressure : -
Serial No. : 820891 Date of received : 08-Mar-2023
Identity No. : NS-12-002 Date of calibration : 10-Mar-2023
Range : See to Data Date of issued : 13-Mar-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	EELBP.31/0664	15-Jun-2023

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 Phannangkaew (MD)

Reviewed By : Mr. Sompong Srisert

Mr. Boonyarit Auejirakarn

Ms. Natthaprakarn 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.

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
B	94	94.4	0.4	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20


UUC* = Unit Under Calibration

- The End -

Certificate of Calibration

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

CALIBRATED BY : 
CALIBRATION DATE : 9-May-23

APPROVED BY : 
ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
ID No. : CEM-SL-01
RECEIVED DATE : 4-May-23
AMBIENT TEMPERATURE : 22 °C ± 3°C
RELATIVE HUMIDITY : 50%RH ± 20%RH
SERIAL NUMBER : 060209
CALIBRATION DATE : 9-May-23

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.55/0974 12-Jan-24
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. : 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 : 
 CALIBRATION DATE : 9-May-23

APPROVED BY : 
 ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER
 MANUFACTURER : ACO
 MODEL : TYPE 6226
 ID No. : CEM-SI-02
 RECEIVED DATE : 4-May-23
 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 SOUND CALIBRATOR.	1986	01827	EEL BP 55/0974	12-Jan-24

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. : 150006
ID No. : CEM-SI-06
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
 219/43 MOO 12, PETCHKASEM RD., OMNOI,
 KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
CALIBRATION DATE : 9-May-23

APPROVED BY : 
ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
ID No. : CEM-SI-06
RECEIVED DATE : 4-May-23
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 : 1) MULTIFUNCTION
MODEL : 1986
SERIAL No. : 01827
CERTIFICATE No. : EEL BP 55/0974
DUE DATE : 12-Jan-24

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. : 150007
ID No. : CEM-SI-07
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.
 219/43 MOO 12, PETCHKASEM RD., OMNOI,
 KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY : 
CALIBRATION DATE : 9-May-23

APPROVED BY : 
ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER
MANUFACTURER : ACO
MODEL : TYPE 6226
ID No. : CEM-SI-07
RECEIVED DATE : 4-May-23
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 : 1) MULTIFUNCTION
MODEL : 1986
SERIAL No. : 01827
CERTIFICATE No. : EEL BP 55/0974
DUE DATE : 12-Jan-24

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 Analyzer Performance Testing

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

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

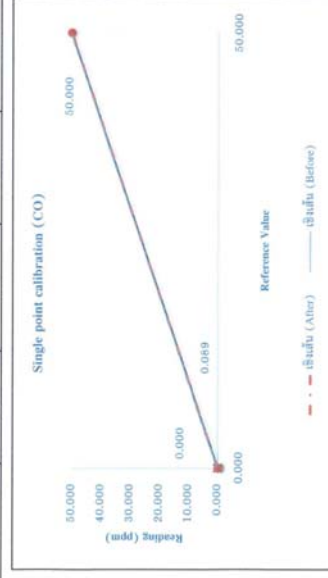
Environmental
 Temperature : 24.2 °C
 Humidity : 55.0 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental Zero Air Generator : API
 Model : 146C Model : 701
 Serial No. : 514811438 Serial No. : 179

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	Before					
	0.089	0.000	0.09	50.2	50.000	0.40
CO	After					
	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by : 
 (Mr. Tong Pima)

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ

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

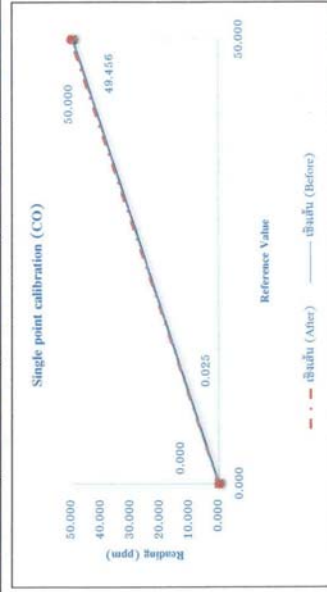
Environmental
 Temperature : 25.2 °C
 Humidity : 52.3 %RH

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	0.025	0.000	0.03	49.456	50.000	-1.09
	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

Thong
(Mr. Thong 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

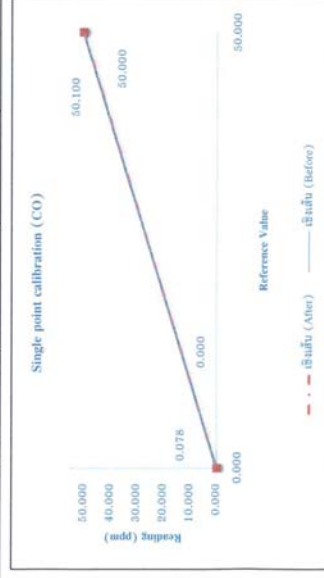
Environmental
 Temperature : 25.6 °C
 Humidity : 53.7 %RH

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	0.076	0.000	0.08	50.1	50.000	0.20
	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :

Thong
(Mr. Thong Pima)

Certificate of Analyzer Performance Testing

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

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

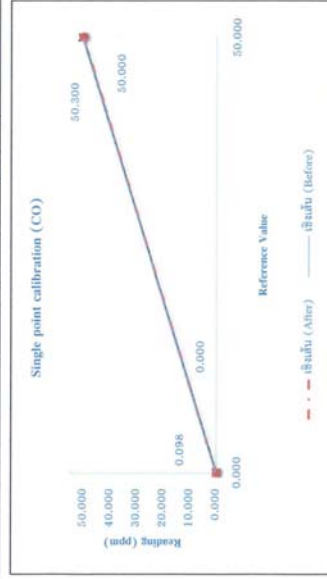
Environmental
 Temperature : 24.9 °C
 Humidity : 41.3 %RH


Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental Zero Air Generator : API
 Model : 146C Model : 701
 Serial No. : 514811438 Serial No. : 179

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.098	0.000	0.10	50.3	50.000	0.60
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 : 10-Jun-23 Certificate No. : 0023-001 Page : 1/1

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

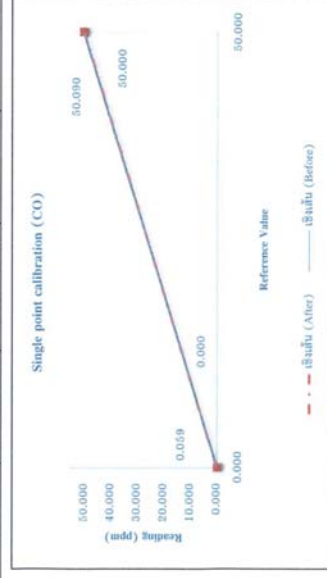
Environmental
 Temperature : 25.2 °C
 Humidity : 51.3 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental Zero Air Generator : API
 Model : 146C Model : 701
 Serial No. : 514811438 Serial No. : 179

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before			After		
	0.059	0.000	0.06	50.1	50.000	0.18
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 : 26-Aug-23 Certificate No. : 0823-001 Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 66193-351

Environmental

Temperature : 25.3 °C
Humidity : 40.2 %RH

Calibration System

Calibrator Units

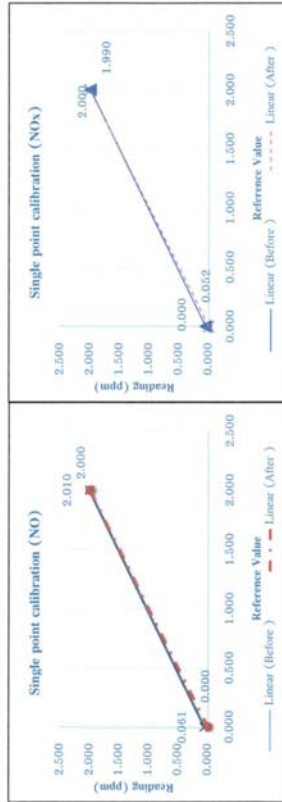
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.061	0.000	0.06	2.01	2.00	0.50
NO _x	0.052	0.000	0.05	1.99	2.00	-0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :
(Mr. Yong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 4-Jul-23 Certificate No. : 0723-001 Page : 1/1

Analyzer Instruments

Analyzer Type : NO/NO_x Analyzer Manufacturer : Thermo Environmental
Model : 42C Serial No. : 63470-339

Environmental

Temperature : 25.1 °C
Humidity : 40.4 %RH

Calibration System

Calibrator Units

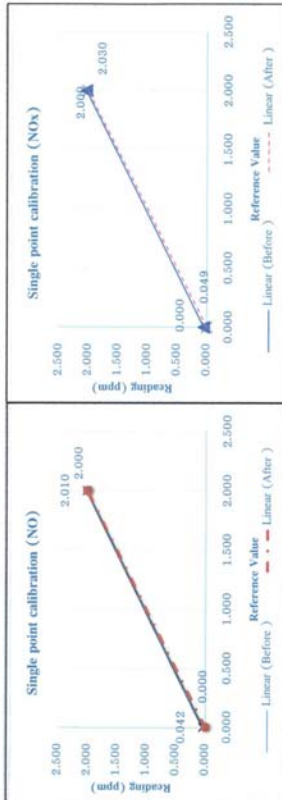
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

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

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.042	0.000	0.04	2.01	2.00	0.50
NO _x	0.049	0.000	0.05	2.03	2.00	1.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO _x	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :
(Mr. Yong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 5-Aug-23 Certificate No. : 0823-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : SO2 Analyzer
 Model : 43C
 Manufacturer : Thermo Environmental
 Serial No. : 43C-62201-334

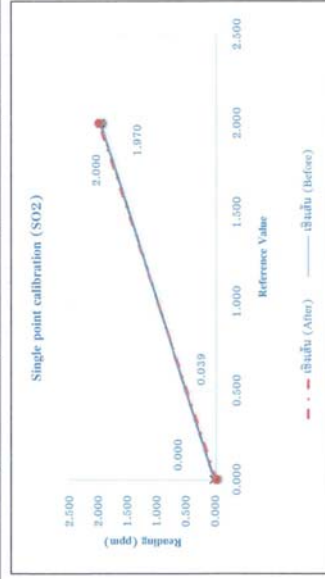
Environmental
 Temperature : 25.0 °C
 Humidity : 51.9 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811438
 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 (%)	
SO2	Before							
	0.039	0.000	0.04		1.97	2.000	-1.50	
SO2	After							
	0.000	0.000	0.00		2.00	2.000	0.00	



Calibrated by :  (Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-002 Page : 1/1

Analyzer Instruments
 Analyzer Type : SO2 Analyzer
 Model : 43C
 Manufacturer : Thermo Environmental
 Serial No. : 43C-70853-367

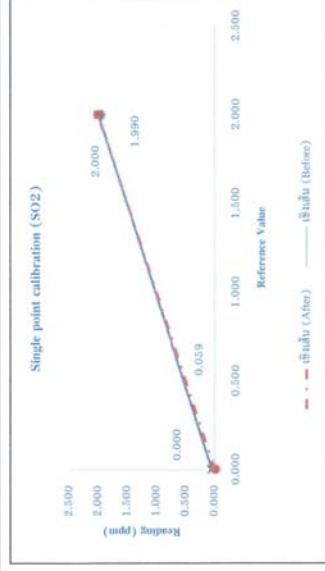
Environmental
 Temperature : 25.1 °C
 Humidity : 47.9 %RH

Calibration System
Calibrator Units
 Gas Calibration : Thermo Environmental
 Model : 146C
 Serial No. : 514811438
 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 (%)	
SO2	Before							
	0.039	0.000	0.06		1.99	2.000	-0.50	
SO2	After							
	0.000	0.000	0.00		2.00	2.000	0.00	



Calibrated by :  (Mr. Tong Pima)



Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-004 Page : 1/1

Analyzer Instruments
Analyzer Type : SO2 Analyzer
Model : 43C
Manufacturer : Thermo Environmental
Serial No. : 43C-77419-385

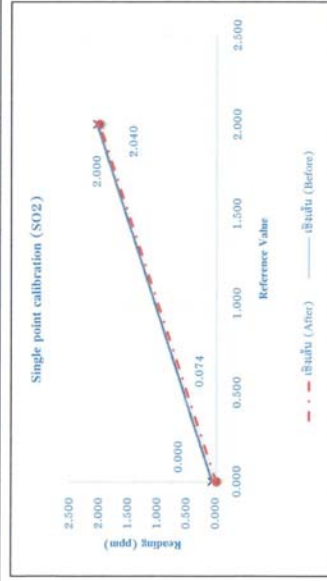
Environmental
Temperature : 25.1 °C
Humidity : 46.2 %RH

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

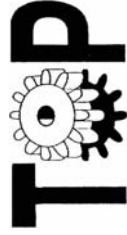
Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
SO2	0.074	0.000	0.074	Before		
				0.074	0.000	0.074
SO2	0.000	0.000	0.000	After		
				0.000	0.000	0.000



Calibrated by :

Tong P.
(Mr. Tong Pina)



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 Office

Make: Tisch Environmental, Inc.
Model: TE-5028A Qstd Slope: 1.58304
Serial#: 1179 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
1	9.45	1.287	60.5	39.80	Slope 36.1461
2	7.75	1.167	55.3	36.38	Intercept -6.1754
3	6.50	1.069	50.7	33.36	Corr. Coeff 0.9935
4	5.75	1.006	45.3	29.80	SFR 1.115
5	4.60	0.901	39.6	26.05	SSP 51.87

of Observations: 5

Calculations

$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)})-b$
 $IC = I(\sqrt{(Ta/Pa)})$

$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m*SFR+b)(\sqrt{(Pa/Ta)})$

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

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): 50.3
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 office has been certified within 12 months of



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. 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)	IC (corrected)	Linear Regression Slope
1	9.35	1.269	60.0	39.12	36.6800
2	7.65	1.149	55.4	36.12	Intercept -6.6541
3	6.55	1.064	50.9	33.19	Corr. Coeff 0.9908
4	5.70	0.993	45.5	29.67	SFR 1.086
5	4.65	0.898	39.4	25.69	SSP 50.91

of Observations: 5

Calculations

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

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

Tav = daily average temperature
Pav = daily average pressure

Qa = actual flow rate
IC = corrected chart response
m = calibrator slope

b = calibrator intercept

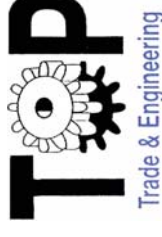
Ta = actual temperature (deg K)
Pa = actual pressure (mm Hg)

For subsequent calculation of sampler flow:
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

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

Total flow over sample (CFM) 55500.52903



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 3310 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.70 Corrected Pressure (mm Hg): 678.2
Temperature (deg F): 75.1 Temperature (deg K): 296.9
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1
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)	IC (corrected)	Linear Regression Slope
1	9.80	1.318	60.7	40.17	34.0987
2	7.40	1.147	55.6	36.79	Intercept -3.7000
3	6.60	1.083	50.8	33.61	Corr. Coeff 0.9779
4	5.35	0.976	45.7	30.24	SFR 1.119
5	4.60	0.906	39.1	25.87	SSP 52.08

of Observations: 5

Calculations

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

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

Tav = daily average temperature
Pav = daily average pressure

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:
Ts = Average temperature (deg K)
Ps = Average pressure (mm Hg)

Average I (chart): 50.4
Average Flow over Sample (m3/min) 1.091243428
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min) 1571.390536

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

Total flow over sample (CFM) 55485.79984



PM10 High Volume Sampler Verification

Site Information

Location: - Site ID: - Date: 2 October 2023
Sampler: TE-6070 PM10 Serial No: 3482 Tech: Tong P.

Site Conditions

Barometric Pressure (in Hg): 26.65 Corrected Pressure (mm Hg): 676.9
Temperature (deg F): 75.3 Temperature (deg K): 297.1
Average Press. (in Hg): 26.50 Corrected Average (mm Hg): 673.1
Average Temp. (deg F): 76.3 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)	IC (corrected)	Linear Regression	# of Observations:
1	9.65	1.310	60.5	40.08	Slope 34.0516	5
2	7.50	1.156	55.5	36.77	Intercept -3.5657	
3	6.45	1.072	50.6	33.52	Corr. Coeff 0.9827	
4	5.35	0.978	45.8	30.34	SFR 1.122	
5	4.60	0.907	39.4	26.10	SSP 52.27	

Calculations

$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)})-b$
 $IC = I(\sqrt{(Ta/Pa)})$

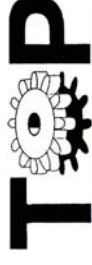
$SFR = 1.13(Ps/Pa)(Ta/Ts)$
 $SSP = (m*SFR+b)(\sqrt{(Pa/Ta)})$

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): 50.4
Average Flow over Sample (m3/min): 1.08858164
Enter Total Time (Hrs): 24.0
Total flow over sample (m3/min): 1567.955756
Total flow over sample (CFM): 55364.51773

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



TSP High Volume Sampler TE-5000 TSP Sampler Verification

Site Information

Location: - Site ID: - Date: 16 Oct 23
Sampler: TE-5000 TSP Serial No: 3269 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 27.80 Corrected Pressure (mm Hg): 706.1
Temperature (deg F): 76.1 Temperature (deg K): 297.7
Average Press. (in Hg): 27.30 Corrected Average (mm Hg): 693.4
Average Temp (Deg F): 75.0 Average Temp: (Deg K): 297.0

Calibration Orifice

Make: Tisch Qstd Slope: 1.58304
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	# of Observations:
1	7.50	1.678	59.7	57.58	Slope: 35.4041	5
2	6.30	1.539	55.4	53.43	Intercept: -2.1709	
3	5.20	1.399	47.9	46.20	Corr. Coeff: 0.9834	
4	4.50	1.302	43.7	42.15		
5	3.10	1.112	40.1	38.68		

Calculations

$Qstd = 1/m(\sqrt{(H2O)(Pa/Pstd)(Tstd/Ta)})-b$
 $IC = I(\sqrt{(Pa/Pstd)(Tstd/Ta)})$

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:
 $1/m(I)(\sqrt{(298/Tav)(Pav/760)})-b$

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

Enter Average I (chart): 49.4
Average Flow Calculation m3/min: 1.395189676
Average Flow Calculation in cfm: 49.26517152
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min: 2009.073133
Total flow in 24 hours cfm: 70941.84699

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



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 Slope
1	7.80	1.705	60.1	57.76	28.1557
2	6.00	1.497	57.2	54.97	11.0629
3	5.30	1.407	53.4	51.32	0.9717
4	4.50	1.297	49.7	47.77	
5	3.90	1.209	45.6	43.83	
					# of Observations: 5

Calculations

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

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:

$$1/m[(I)[\sqrt{Pa/Pstd}(Tstd/Ta))-b]$$

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

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com



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: 3272	Tech: Tong, P

Site Conditions

Barometric Pressure (in Hg): 27.00	Corrected Pressure (mm Hg): 685.8
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): 75.0	Average Temp: (Deg K): 297.0

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 Slope
1	6.80	1.575	62.1	59.03	39.9337
2	5.50	1.418	58.4	55.51	-2.7031
3	4.40	1.269	50.6	48.10	0.9857
4	4.00	1.211	48.7	46.29	
5	3.50	1.133	43.5	41.35	
					# of Observations: 5

Calculations

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

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:

$$1/m[(I)[\sqrt{Pa/Pstd}(Tstd/Ta))-b]$$

Enter Average 1 (chart): 52.7
Average Flow Calculation m3/min 1.322373774
Average Flow Calculation in cfm 46.69398859
Sample Time (Hrs): 24.0
Total flow in 24 hours m3/min 1904.218235
Total flow in 24 hours cfm 67239.34358

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

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com

Certificate of Calibration

Calibrated Date : 5-Sep-23 : Certificate No. : 0923-005
Page : 1/1

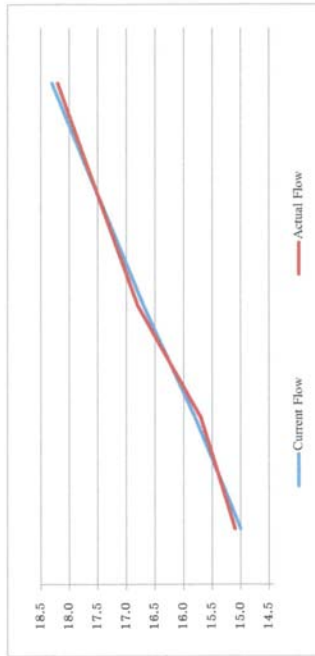
Instruments
Instruments : PM2.5-PM10 Air Sampler : Thermo Scientific PartisollPRM 2000- H
Model : 2000- H : Serial No. : 200FA201109704

Environmental
Temperature : 24.9 °C
Humidity : 46.9 %RH

Calibration System
Instruments : Dycal : Manufacturer : Bios
Model : DCL-H : Serial No. : 102591
Calibration due date : 20-Oct-22

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.8	16.7	16.8
	17.6	17.5	17.5
	15.6	15.8	15.7
	18.1	18.3	18.2
	14.9	15.0	15.1



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

Certificate of Calibration

Calibrated Date : 2-Sep-23 : Certificate No. : 0223-002
Page : 1/1

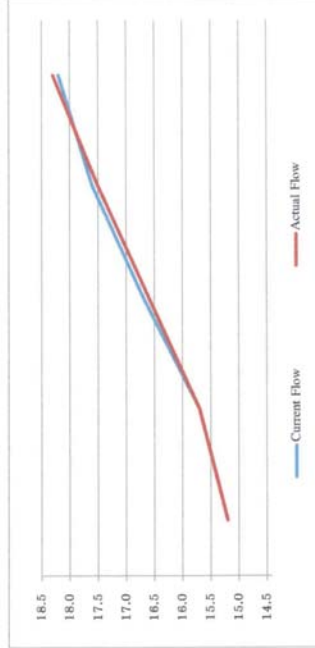
Instruments
Instruments : PM2.5-PM10 Air Sampler : Thermo Scientific
Model : 2000- D : Serial No. : 200DA200310704

Environmental
Temperature : 24.7 °C
Humidity : 52.8 %RH

Calibration System
Instruments : Dycal : Manufacturer : Bios
Model : DCL-H : Serial No. : 102591
Calibration due date : 24-Oct-23

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.7	16.6
	17.5	17.6	17.5
	15.8	15.7	15.7
	18.3	18.2	18.3
	15.0	15.2	15.2



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

Certificate of Calibration

Calibrated Date : 1-Apr-23 Certificate No. : 0423-002 Page : 1/1

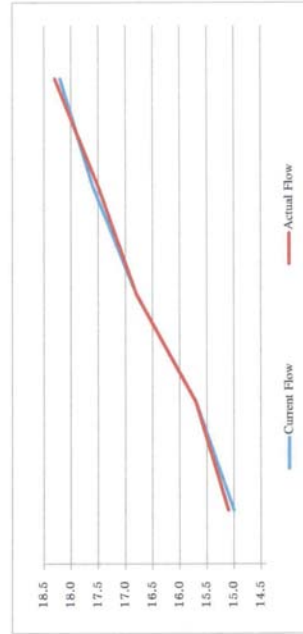
Instruments
Instruments : PM2.5-PM10 Air Sampler
Model : 2000-H Manufacturer : Thermo Scientific
Serial No. : 200FA201309703

Environmental
Temperature : 25.2 °C
Humidity : 52.3 %RH

Calibration System
Instruments : Drycal Manufacturer : Bios
Model : DCL-H Serial No. : 102591
Calibration due date : 24-Oct-23

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.7	16.8	16.8
	17.5	17.6	17.5
	15.8	15.7	15.7
	18.3	18.2	18.3
	15.0	15.0	15.1



Calibrated by : *Tarph*
(Mr. Todd Pina)

Certificate of Calibration

Calibrated Date : 5-Sep-23 Certificate No. : 0923-003 Page : 1/1

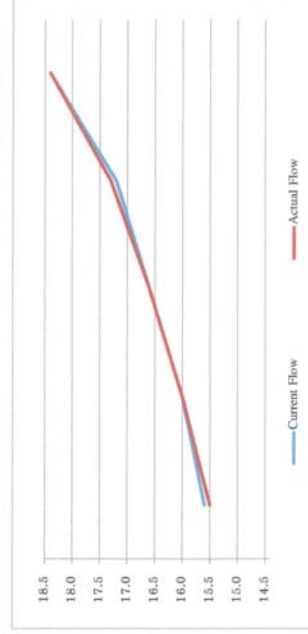
Instruments
Instruments : PM2.5-PM10 Air Sampler
Model : 1400a Manufacturer : TEOM Control Unit (RP)
Serial No. : 140A0254490411

Environmental
Temperature : 26.2 °C
Humidity : 44.1 %RH

Calibration System
Instruments : Drycal Manufacturer : Bios
Model : DCL-H Serial No. : 102591
Calibration due date : 20-Oct-22

Flow Testing

Filter	Set Flow Instrument (L/min)	Current Flow Instrument reading (L/min)	Actual Flow Reference Standard (L/min)
47 mm.	16.5	16.6	16.6
	17.3	17.2	17.3
	15.9	16.0	16.0
	18.4	18.4	18.4
	15.5	15.6	15.5



Calibrated by : *Tarph*
(Mr. Yong Pina)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23 Certificate No. : 0123-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : THC Analyzer Manufacturer : Thermo Environmental
 Model : 51 Serial No. : 51HT-73244-373

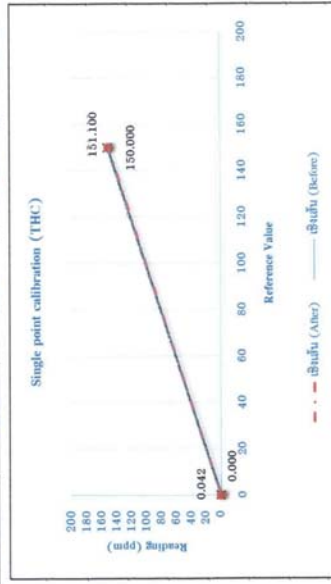
Environmental
 Temperature : 24.7 °C
 Humidity : 54.4 %RH

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

Standard Gas
 Propane Conc. : 150 ppm Cylinder No. : 21W281046
 Expire Date : 26-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.042	0.000	0.042	151	150	0.733
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24 Certificate No. : 0124-001 Page : 1/1

Analyzer Instruments
 Analyzer Type : THC Analyzer Manufacturer : Thermo Environmental
 Model : 51 Serial No. : 51HT-73244-373

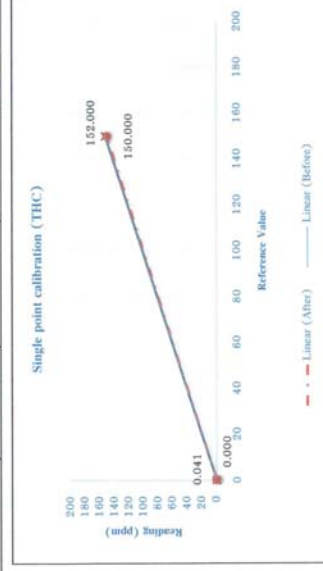
Environmental
 Temperature : 25.1 °C
 Humidity : 40.4 %RH

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

Standard Gas
 Propane Conc. : 150 ppm Cylinder No. : 21W281046
 Expire Date : 26-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
THC	0.041	0.000	0.041	152	150	1.333
After						
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by :

Tong
(Mr. Tong Piima)

Certificate of Analyzer Performance Testing

Calibrated Date : 15-Jan-24 Certificate No. : 0124-002 Page : 1/1

Analyzer Instruments

Analyzer Type : THC Analyzer Manufacturer : Baseline
Model : Series 8800 Serial No. : 584

Environmental

Temperature : 24.6 °C
Humidity : 45.1 %RH

Calibration System

Calibrator Units

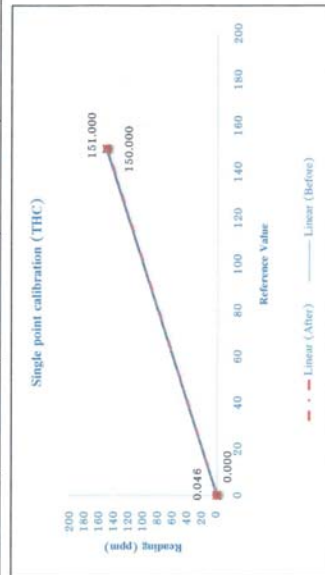
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

Propane Conc. : 150 ppm Cylinder No. : 21W281046
Expire Date : 26-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
THC	Before					
	0.046	0.000	0.046	151	150	0.667
THC	After					
	0.000	0.000	0.000	150	150	0.000



Calibrated by : *Taylor*
(Mr. Tong Pima)

Certificate of Analyzer Performance Testing

Calibrated Date : 30-Jan-23 Certificate No. : 0123-002 Page : 1/1

Analyzer Instruments

Analyzer Type : THC Analyzer Manufacturer : Baseline
Model : Series 8800 Serial No. : 584

Environmental

Temperature : 24.5 °C
Humidity : 56.3 %RH

Calibration System

Calibrator Units

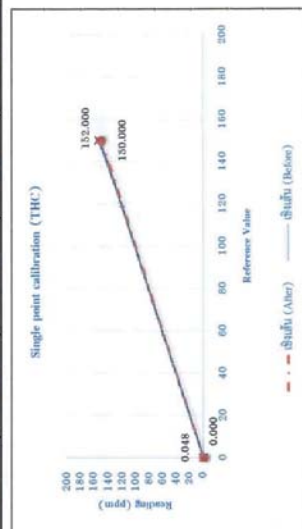
Gas Calibration : Thermo Environmental Zero Air Generator : API
Model : 146C Model : 701
Serial No. : 514811458 Serial No. : 179

Standard Gas

Propane Conc. : 150 ppm Cylinder No. : 21W281046
Expire Date : 26-Sep-25

Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
THC	Before					
	0.048	0.000	0.048	152	150	1.333
THC	After					
	0.000	0.000	0.000	150	150	0.000



Calibrated by : *Taylor*
(Mr. Tong Pima)

เอกสารการสอบเทียบเครื่องมือตรวจวัดความถี่เสียง



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

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

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230379EA

Calibration Report

Equipment: Vibration Meter
Manufacturer: Instantel
Model: Micromate
Serial No.: UM14163
ID No.: VB-01-001
Ambient Temperature: $(23 \pm 5)^{\circ}\text{C}$
Relative Humidity: $(50 \pm 15)\%$

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
8305	2708237	AV-0001-23	20-Jul-2024
2525	2685967	AV-0044-23	20-Jul-2024
3560-C	2705645	CQ20230003EA	25-Dec-2023
HMT331	K3810009	CD20230166EA	14-Jun-2024

Transmitter

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

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 \pm (%)	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	10.000	10.003	0.097	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	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	
63.0	10.000	10.013	10.696	0.683	1.50	
80.0	10.000	9.991	11.098	1.107	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	
	10.000	9.997	9.726	-0.271	1.50	
25.0	10.000	10.000	10.057	0.057	1.50	
31.5	10.000	9.996	10.168	0.172	1.50	
40.0	10.000	9.996	10.199	0.203	1.50	
50.0	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 --

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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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 (\pm 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 (\pm 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%

- o(0) -



Approved by :

(Surachai Promthong)
Laboratory Manager

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 $^{\circ}$ C Resolution : 0.1 $^{\circ}$ C

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

Thermistor probe

Model : N/A

Diameter : 6.5 mm.

Sheath Material : Stainless

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) $^{\circ}$ 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 :

Permpoon 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)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 22E569 22 Feb 2024

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



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

Remarks

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-




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. : 2110009213

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 : Permpon Chantpu

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 :

(Surchai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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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 (\pm 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 (\pm 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%

- 0(0) -



Approved by :

(Surachai Promthong)

Laboratory Manager



CAL-F0031-03

Certificate of Calibration

Certificate No. : 67-400074-2

Page : 1 of 2

Submitted by :

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

21943 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 $^{\circ}$ C Resolution : 0.1 $^{\circ}$ C

Serial No. : PC910X1220811001 ID No. : WW-03-002

Thermistor probe

Model : N/A

Diameter : 4.8 mm.

Serial No. : N/A ID No. : WW-03-002

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

Environment :

Ambient Temperature : (23.0 to 24.0) $^{\circ}$ 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)

2. Standard Digital Thermometer

ID No. Cert.No. Due Date Traceability

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

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Certificate of Calibration

Certificate No. : 67-400074-2

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

Remarks

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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Certificate of Calibration

Equipment: Cooled Incubator
Model: KB 240
Serial No.(or ID): 20180000012164(VWV-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, Tambom 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 Sakthon 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 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.

ผู้รับบริการและผู้เกี่ยวข้อง
 DKSH Technology Limited
 2533 คู่มือ/ที่รับรองระบบงาน/คู่มือการปฏิบัติงาน 10220
 2533 คู่มือ/ที่รับรองระบบงาน/คู่มือการปฏิบัติงาน 10220
 Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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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

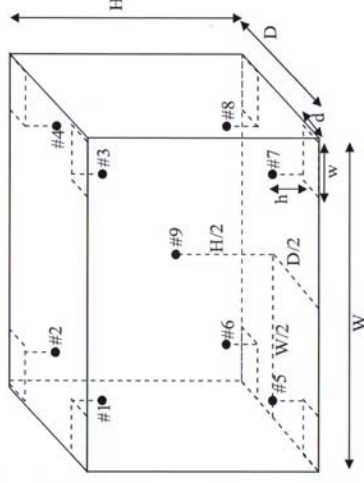
Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

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



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

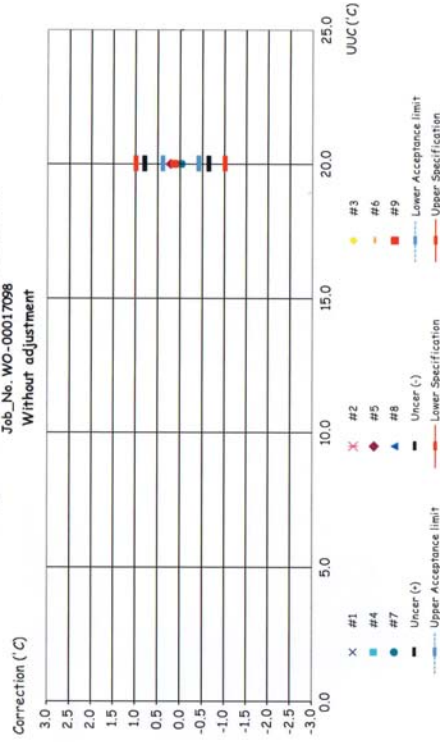
Chamber Characterization

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

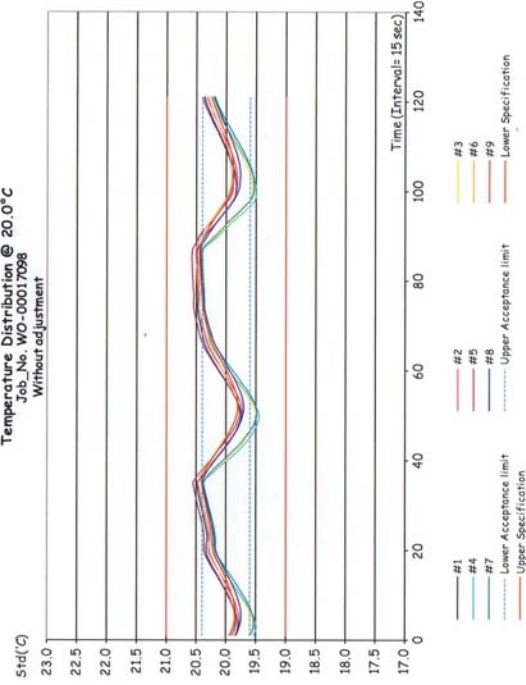
Note: * Maximum uncertainty of the each position

The End of Certificate

Corr. Distribution & Max. Measurement Uncertainty
Job No. WO-00017098
Without adjustment



Temperature Distribution @ 20.0 °C
Job No. WO-00017098
Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่อง: Cooled Incubator

ยี่ห้อ: KB 240

หมายเลขเครื่อง: 2018000012164(WW-16-001)

ตรวจสอบ (เป็น)		รายการ (เป็น)	ผลการตรวจสอบ (เป็น)	หมายเหตุ
14 Feb 2024	14 Feb 2024			
ปกติ	ไม่ปกติ	General	ปกติ	ไม่ปกติ
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<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 ฟลิท	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	6. การทำงาน Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การทำงาน Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. การทำงาน Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานระบบความปลอดภัย Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานระบบบันทึกอุณหภูมิ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานระบบบันทึกการขึ้น	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. การบันทึกเสียง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. การตรวจสอบ ภาชนะที่บรรจุ	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ผู้ตรวจ:

Mr. Ampol Srisumphan
Service Engineer

บริษัท ดีเคเอส อี.พี.
DKSH Technology Limited
2533 ถนนสุขุมวิท กรุงเทพมหานคร 10260
โทรศัพท์: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

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Certificate of Calibration

Equipment: Hot Air Oven

Model: UF 55

Serial No.(or ID): B219.0142 (WW-05-002)

Manufacturer: Memmert

Condition: In Condition

Shelves(pc.): 2

Customer:

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

31/8 Moo 13, Tamborn 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

Signature of the Engineer

(Mr. Ampol Srisumphan)

Person in charge

This certificate is issued in 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 laboratories.

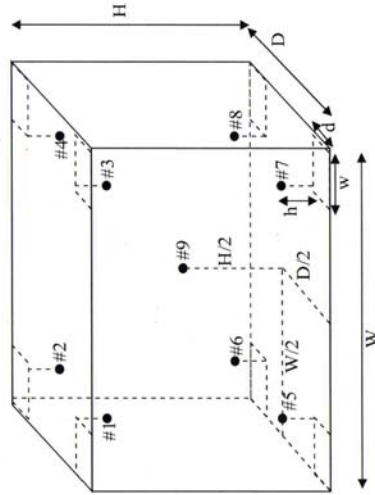
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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

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DKSH Technology Limited
2533 ถนนสุขุมวิท กรุงเทพมหานคร 10260
โทรศัพท์: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-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.

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)*
180.0	180.0	180.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	0.56
			180.34	179.98	180.46	180.34	180.63	180.33	179.22	179.80	180.74	

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)*
110.0	110.0	110.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	0.46
			110.40	110.15	110.45	110.37	110.42	110.29	109.86	110.12	110.51	

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



Refer to Certificate No.: C31240372 Page: 1 of 2

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

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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



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

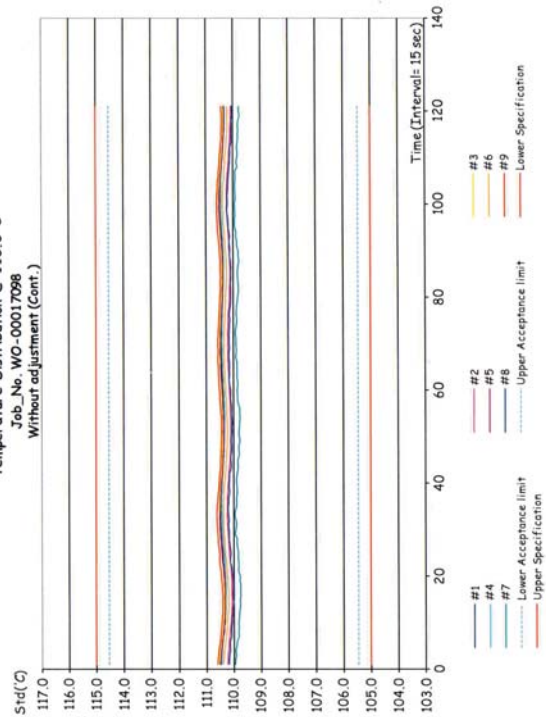
The End of Statements of Conformity

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

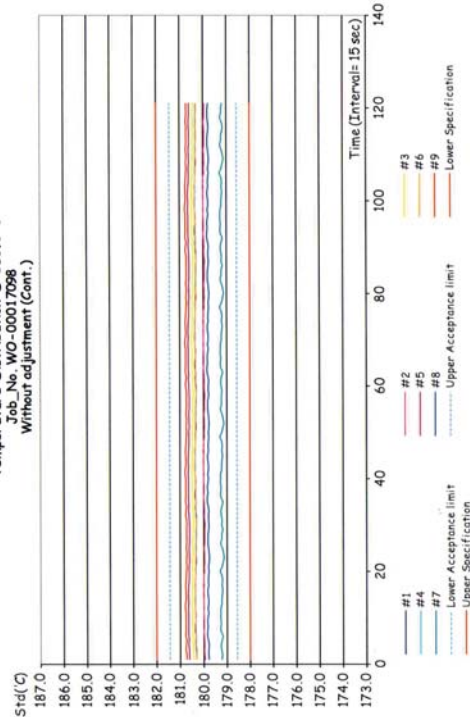
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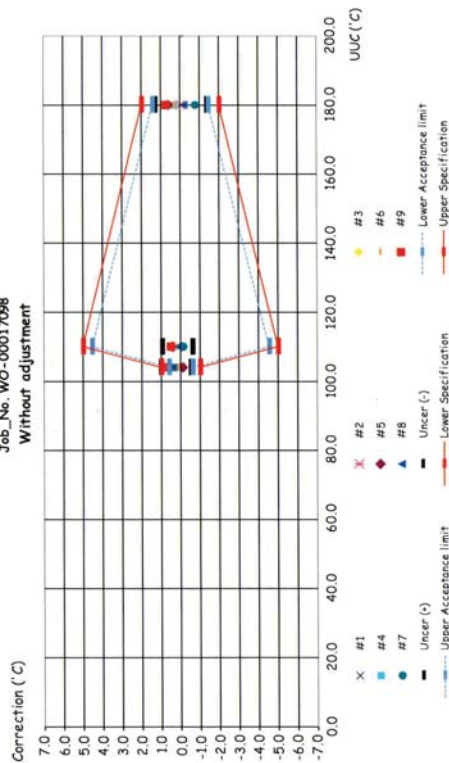
Temperature Distribution @ 110.0°C
Job_No. WO-00017098
Without adjustment (Cont.)



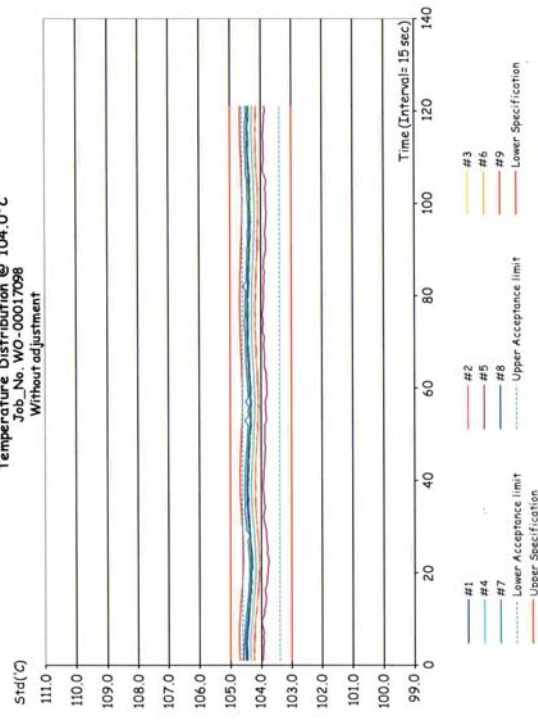
Temperature Distribution @ 180.0°C
Job_No. WO-00017098
Without adjustment (Cont.)



Corr_Distribution & Max_Measurement Uncertainty
Job_No. WO-00017098
Without adjustment



Temperature Distribution @ 104.0°C
Job_No. WO-00017098
Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00017098

ชนิดเครื่อง: Hot Air Oven

หมายเลขเครื่อง: B219.0142 (WW-05-002)

รุ่น: UF-55

รายการ (It.)	รายการตรวจสอบ		รายการ (It.)		หมายเหตุ
	14 Feb 2024	14 Feb 2024	14 Feb 2024	14 Feb 2024	
1. ส่วนตัว	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	
3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. การแสดง Display	<input checked="" type="checkbox"/>	
5. การทำงาน ฟัดดล	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. การทำงาน Lever of Ventilation valve	<input checked="" type="checkbox"/>	
7. การทำงาน Lever door open / close	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. การทำงาน Door seal	<input checked="" type="checkbox"/>	
9. การทำงานระบบความปลอดภัย Safety	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. การทำงานระบบแจ้งเตือน	<input checked="" type="checkbox"/>	
11. การทำงานระบบบันทึกเวลา	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. การทำงานระบบบันทึกเวลา	<input checked="" type="checkbox"/>	
13. การทำงานระบบบันทึกเวลา	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. การทำงานระบบบันทึกเวลา	<input checked="" type="checkbox"/>	

ผู้ตรวจ:

Mr. Ampol Srisumphan
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ 9 ตำบลบางนา อำเภอบางนา กรุงเทพมหานคร 10260
Phone: +66 2639 7005 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.



Harikul Science Co., Ltd.
694 Soi Ratchaditwit 24, Pracharatbampien,
Samsenok, Hualkhwang, Bangkok 10310
Tel: 0-274-2456 Fax: 0-274-2443
Email: info@harikul.com www.harikul.com

CERT. No.: HS-U059H

Certificate of Calibration

Calibration Date : 28 Aug 23

Submitted by : C.E.M TECHNOLOGY (THAILAND) Co., LTD.

219/43 Moo 12, Peichkasem Road, Omnoi, Krathumban,

Samulsakom 74130

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 : S/N. 11430

Salinity : 0 ppt

Technician : Kittipong M.

Calibration Details

Calibration Point 100% air sat. (status) (status)

(@20 °C, DO = 9.09 mg/l)

Measurement 1 (mg/l)

Measurement 2 (mg/l)

Measurement 3 (mg/l)

Measurement 4 (mg/l)

Measurement 5 (mg/l)

Measurement 6 (mg/l)

Measurement 7 (mg/l)

Measurement 8 (mg/l)

Measurement 9 (mg/l)

Measurement 10 (mg/l)

Mean Measurement

Inaccuracy

Overall Status

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 Sumritam)



Avio200 Preventive Maintenance Report

Company Name: CEM TECHNOLOGY
Instrument Location: 219/43 Krathum Baen District
Samut Sakhon 74130
Instrument Serial No.: M79S2103051
Date: 02-Aug-2023

ICP-OES/Avio200 Preventive Maintenance (PM)					
Company Name:		CEM TECHNOLOGY			
Address (Instrument Location):		219/43 Krathum Baen District Samut Sakhon 74130			
Serial Number:		M79S2103051	PM Number:	4 of 4 Warranty	
Customer Name (if applicable):		K. Wichuda	Telephone Number:	086 9054664	
Service Engineer Name:		K. Chayanan	Service Order Number:	WO-02409475	
Date PM Performed: (DD-MM-YYYY)		02-Aug-2023	Next PM Due Date: (DD-MM-YYYY)	02-Feb-2024	
Standard Labor Hours to Complete PM :				4 hours	

Part Number	Release	Publication Date
09370140 Rev.5	B	January 2018



Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Avio200 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
Avio200	M7952103051	Syngistix V 5.1.0.0293
S23 Autosampler	0121106523	

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	Not Applicable
N077520	Air Filter-RF Generator	Not Applicable
09992731	Axial Window	Not Applicable
B0810377	Radial Window	Not Applicable
N0770438	O-ring kit, injector support adapter	Not Applicable
N0780437	O-ring kit, torch	Not Applicable

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot # Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	57-024CRX1 Oct-2024
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	54-134CRY1 Jun-2024

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ✓ Ask customer about unit's performance since last visit.
- ✓ Check incoming AC line voltage under load for proper levels and grounding.
- ✓ Is the instrument operational?

2. Mechanical:

- ✓ Inspect and clean all fans and filters.
- ✓ Inspect and replace torch components and necessary.
Torch Components Replaced: ☐Yes ☒No
If yes, list components replaced:
- ✓ Inspect all tubing for signs of cracking or leaking and replace as necessary.
Tubing Replaced: ☒Yes ☐No
If yes, list tubing replaced:
- ✓ Inspect the peristaltic pump for proper operation.
- ✓ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ✓ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	35psi

- ✓ Check the shear gas nozzle for blockages and proper, uniform flow.
- ✓ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ✓ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, XY mirror) if problems are found.
- ✓ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ✓ Drain air compressor surge tank.
- ✓ Clean exterior of instrument.

3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
- ☒ Check all RF generator and spectrometer power supply voltages.
- ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

Spectrometer:

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Ensure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☒ Yes ☐ No
Radial Window Replaced: ☒ Yes ☐ No

5. Post PM Performance Tests:

- ☒ Perform View Align.

5.1 Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.007	Passed
Ni 231.604 - Resolution	≤0.011	0.009	Passed
Ni 341.476 - Resolution	≤0.015	0.013	Passed
Ba 455.403 - Resolution	≤0.020	0.017	Passed

5.2 Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD ≤ 1 %	0.46	Passed
Mg 280.856	%RSD ≤ 1 %	0.25	Passed
Mg 285.207	%RSD ≤ 1 %	0.22	Passed
Ba 455.403	%RSD ≤ 1 %	0.15	Passed

5.3 Mn BEC:

- ☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2% HNO_3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC: $\text{BEC} = (\text{IB} * \text{Conc of Std}) / (\text{IS} - \text{IB})$. Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS
Mn 257.610	Radial	1,000 ppb	66993.5	1909809.2
Mn 257.610	Axial	1,000 ppb	152396.8	10817525.8
Mn 257.610	IB* Conc.	IS - IB	BEC	Spec
Radial	66993500	1842815.7	20.25	<30 PPB
Axial	152396800	10665129	13.12	<30 PPB

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Avio200 have been completed.

This ICP-OES/Avio200 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date: 02-Aug-2023 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 02-Aug-2023 (DD-MM-YYYY)

ICP-OES/Avio200 Preventive Maintenance (PM)

Page 6 of 6

CERTIFICATE OF CALIBRATION

Certificate No.: T0-2109034/23 Page 1 of total 4 pages

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

Equipment Thermo Reactor
Manufacturer Spectroquant
Serial No. 23290802
Description Resolution of UUC : 1 °C
Model TR 420
ID No.

Environmental Conditions
Ambient Temperature: (23 ± 3) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: -

Calibration Location Blue Devils Laboratory (TL)
Received Date 21 September 2023
Calibration Date 22 September 2023
Date of Issue 23 September 2023
Condition of Artifacts Used conditions but can be calibrated

Checked by  **Approved by** 

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

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

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.: T0-2109034/23

Page 2 of total 4 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	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY59002120/ MY41211040	10-0302002/23	Feb. 3, 2024	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	150	149.9	150	-0.1	0.22	0.68
# 2	150	149.8	150	-0.2	0.14	
# 3	150	149.5	150	-0.5	0.21	
# 4	150	149.8	150	-0.2	0.20	
# 5	150	149.1	150	-0.9	0.16	
# 6	150	149.6	150	-0.4	0.32	
# 7	150	149.2	150	-0.8	0.14	
# 8	150	149.7	150	-0.3	1.80	
# 9	150	149.5	150	-0.5	0.18	
# 10	150	149.1	150	-0.9	0.16	
# 11	150	149.1	150	-0.9	0.16	
# 12	150	149.2	150	-0.8	0.17	

UUC : Unit Under Calibration

FE-169

Calibrated by Pongsak
REV.02/02/24/21

Certificate No.: T0-2109034/23

Page 3 of total 4 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	150.2	150	0.2	0.25	0.68
# 2	150	150.2	150	0.2	0.29	
# 3	150	150.0	150	0.0	0.29	
# 4	150	149.6	150	-0.4	0.18	
# 5	150	149.1	150	-0.9	0.13	
# 6	150	149.5	150	-0.5	0.25	
# 7	150	149.1	150	-0.9	0.16	
# 8	150	149.1	150	-0.9	0.13	
# 9	150	149.7	150	-0.3	0.20	
# 10	150	149.5	150	-0.5	0.20	
# 11	150	149.2	150	-0.8	0.13	
# 12	150	149.6	150	-0.4	0.23	

UUC : Unit Under Calibration

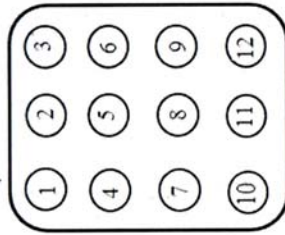
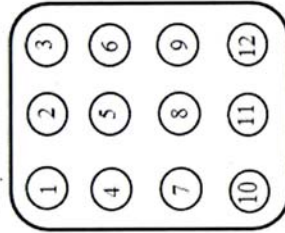
Calibrated by Pongsak
REV.02/02/24/21

FE-169

Certificate No.: T0-2109034/23

Page 4 of total 4 pages

Measurement Results (Cont.):



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 -

Calibrated by: Pongsak
REV.02.02/24/21

Performance Verification Certificate

Job No. LSPR2306369

Equipment: AA SPECTROMETER

Serial No.: A7310

Manufacturer: GBC Scientific

Verification Date: 23-Jun-2023

Model Type: SavantAA

Customer: บริษัท ซี.ดี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด

219/43 หมู่12 ถนนพหลโยธิน ตำบลคลองน้อย อำเภอคลองหลวง จังหวัดปทุมธานี 74130

Result of Verification

Test Description	Criteria	Reading	Result
1. EHT Photometric Noise (if >350 V)	< 350 V Std. Dev <0.0002	332 V	PASS
2. Wavelength Accuracy, Cu 324.75 nm	± 0.20 nm	324.65 nm	PASS
3. Wavelength Accuracy, Cs 852.10 nm	± 0.20 nm	852.30 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.22 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.51 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	0.99 nm	PASS
7. Standard Gauze Screen 0.49 Abs* BC mode with gauze BC mode without gauze Difference between With gauze and without gauze	± 0.02 Abs. -0.0001 Abs. -0.0004 Abs. < 0.004 Abs.	0.4888 Abs. -0.0001 Abs. -0.0004 Abs. 0.0003 Abs.	PASS PASS PASS
8. ABS Reading 5ppm Cu	> 0.7 Abs.	0.740 Abs.	PASS
9. %RSD	< 0.5 %	0.48 %	PASS

* Write in the criteria column the Abs reading on the gauze screen calibration label

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ DKSH Technology Limited

Verification By: Mr. NIWAT SUPATANIT

Signatory: [Signature]

Issued Date: 3-Jul-2023

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phraekhanong, Bangkok 10260
Phone +662 639 7000, www.dksh.com

02 639 7000

Delivering growth - in Asia and beyond

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

Geoff Condict
CEO



Supelco

www.sigmaaldrich.com

Certified Reference Material Reference material certificate

Copper Standard for AAS

Product no.: 38996

Lot no.: BCH9264

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

TraceCERT
Reference Material

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

S. Matt - CRM Operations

Dr. P. Zell - Approving Officer

Sigma-Aldrich Production GmbH, Industriestrasse 25, 9471 Buchs, Switzerland;
Tel +41-81-755-2511; Fax +41-81-756-5445; www.sigmaaldrich.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.

Certificate Page 1 of 3

Certificate version 01



CERTIFICATE OF CONFORMANCE

Equipment name	: Gauze membrane
Serial Number	: F104
Procedure Used	: NIST neutral density filter: 8661/SRM 930D (1210)
Reference Standard	: Spectrophotometer, LIBRA S70
Serial Number	: 136821

Result :

Wavelength (nm)	Measured Value (A.U.)
440	0.489

Valid for 12 months from date of issue.

Issue Date : 5 March 2023
Operator by : Mr. Niwat Supatanit

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Phrahanong, Bangkok 10260
Phone +662 639 7000, www.dksh.com

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PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 23/06/23

Customer : บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด

Address : 219/43 หมู่12 ถนนพหลโยธิน ตำบลอินทนนท์
Model : SavantAA

อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130

Contract :

Power on switch and initial status

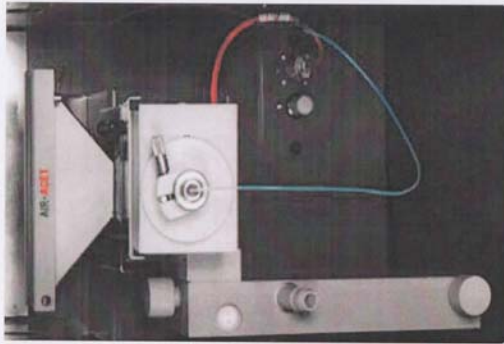
Isobutyl Alcohol 2.400

Preventive Maintenance		Pass	Fail	Remarks
Electrical Voltage				
-	Main voltage (power supply check 220V \pm 10V).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	220.1V
-	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"/>	25.1 C
-	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"/>	400kPa
-	Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.0kPa
-	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
-	Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General 3.0
-	Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

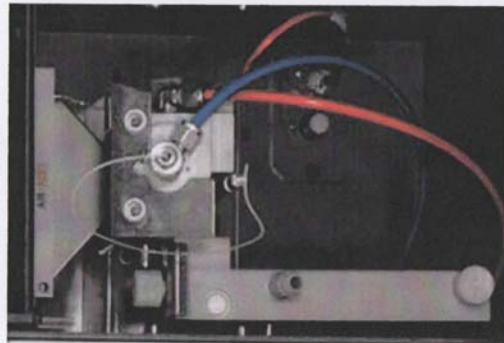
ATOMIC ABSORPTION SPECTROPHOTOMETER

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:

N/A

Signature	
Customer :	Date :
(.....)	
Service Engineer :	Maintenance Date :
(Mr. NIWAT SUPATANIT)	23 / Jun / 2023



บริการลูกค้า

Job No. LSPR2306389
Service contract Basic Plan
Service contract Performance Plan

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm \pm 0.2 nm Cs 852.10 nm \pm 0.2 nm	324.65 nm 852.20 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2. Slit width accuracy (0.2 nm .0.5 nm.1.0 nm)	0.2 nm \pm 0.02 nm 0.5 nm \pm 0.05 nm 1.0 nm \pm 0.10 nm	0.216 nm 0.51 nm 0.99 nm	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
3. EHT	<350V	332 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4. Absorbance accuracy (absorbance calibration check). ➢ Gauze 0.49 A.U.	Reading \pm 10% of calibrated value.	0.4988 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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: -0.0001 Abs BC on without gauze: -0.0004 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6. Sensitivity / noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U. <0.5% RSD	0.7396 Abs 0.48 %	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	

Note: N/A

Signature	Date :
Customer : (.....)	Maintenance Date : 23 / Jun / 2023
Service Engineer : Niwat S. (Mr. NIWAT SUPATANIT)	



Certificate of Calibration

Aquion RFIC: Anion (ID#1084)

This certificate is to verify that instrument below are calibrated
by Archemica International Co., Ltd.

Aquion S/N: 221280114
AS-DV S/N: 2205880126

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



Operator Signature: Date: Jan 25, 2024
(Mr.Itsaraphap Bumrungrjeam)
Applications Chemist

การดูแลบำรุงรักษาเชิงป้องกัน Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: service.tec.th@dksh.com

ฝ่ายขายและการตลาด

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

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

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตรวจซ่อมบำรุงของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุณ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคาไม่รวมถึงค่าบริการซ่อมหรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ใต้ค่าเดินทาง 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

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

รายละเอียดผู้รับบริการ

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

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพร พินพา		
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ		
โทรศัพท์	0869054664	เบอร์โทร	-
E-mail	lab.cemtech1@gmail.com		

รายละเอียดผู้ให้บริการ

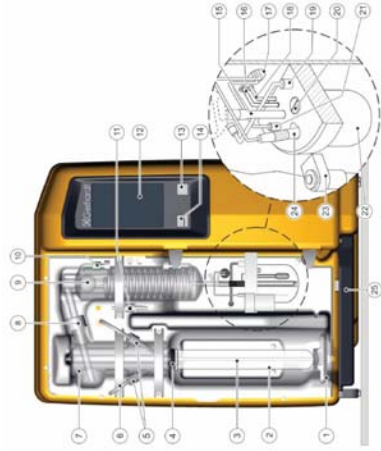
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: support.sk@dksh.com เจ้าหน้าที่ประสานงาน : คุณสุธาวัฒน์ ศรีรัตน์ โทรศัพท์ 090 678 6925			
เจ้าหน้าที่ผู้ให้บริการ	นายวิชาญ สดอาด		
ตำแหน่ง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

ลงนามผู้รับบริการ	ลงนามผู้ให้บริการ
ตัวจริง (.....)	ตัวจริง (นายวิชาญ สดอาด)
ตำแหน่ง	ตำแหน่ง
วันที่ / ประทับตราบริษัท	วันที่ / ประทับตราบริษัท

15/05/2024

JOB:LSPR2403415.....MODEL:VAP.200.....S/N: GER5200180181.
Operational Qualification (OQ)
อุปกรณ์ทดสอบทางชีวภาพ

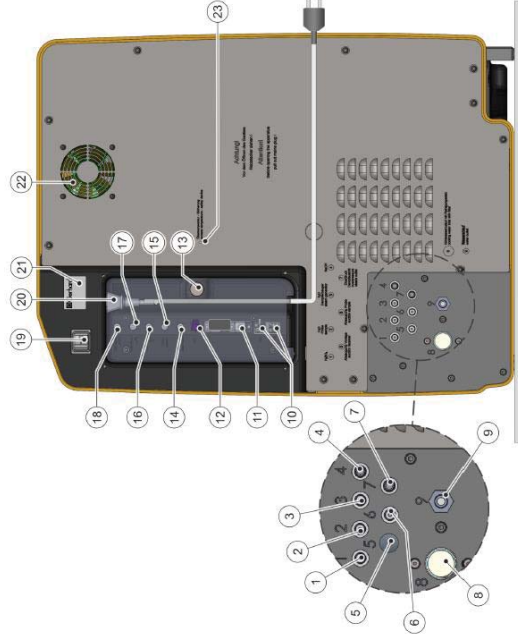
FRONT



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 checked="" 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 checked="" 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"/>

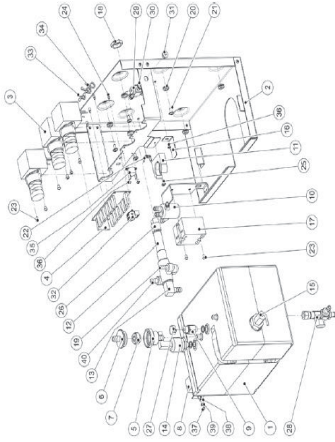
** only VAP 450

REAR



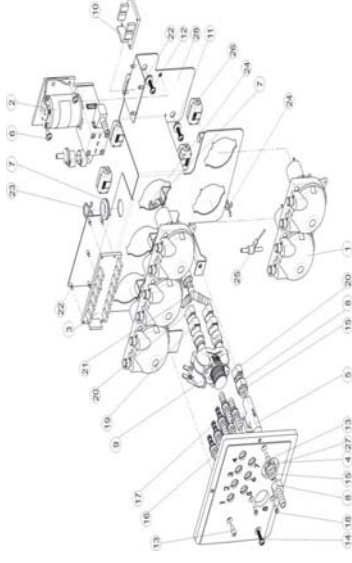
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Tube connection for sample H2O supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	Tube connection for steam generator 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 checked="" type="checkbox"/>
15	Connection (not used)	<input type="checkbox"/>	<input type="checkbox"/>	<input 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



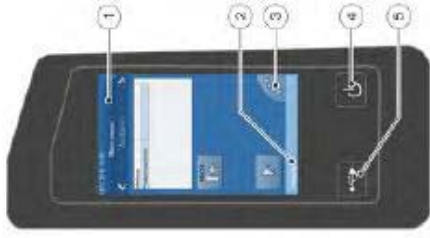
No		PASS	FAIL	N/A
1	Steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Steam generator traverse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Pinch valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<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 Function Test)

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

รายงานผลการปฏิบัติงาน

1. TECHNICAL DATA

Main Supply 220 volt + 10% 50 Hz with ground
Nominal current

1.1 COOLING WATER BATH

Temperature 15-20 °C
Cooling Water Outlet
Control Temperature

1.2 OPTICAL TEST VAP200

Screw cap GL14
Screw cap GL18
Screw cap GL32
Distillation Head
Condensor
Viton Cone
Ventilation Valve BV
Micro Switch Sample
Agitator motor for propeller

2.SYSTEM COOLING WATER INLET

Cooling Water Inlet
Cooling Water Outlet
Flow control valve

3.SYSTEM CONTROL

Display
Program
Adding NaOH
Adding H2O
Adding H3BO3
Suction Sample
Suction Receiver

4.SYSTEM DISTILLATION

Boiler
Level Sensor
Novopren
Solenoid Valve Shut-Off
Solenoid Valve Steam
Solenoid Valve soft steam
Ventilation Valve Premount
Excess Pressure Detector
Heating Element

5. PUMP

Pump H₂O Steam
- Non-Return Valve
Pump H₂O Sample
- Non-Return Valve
Pump NaOH
- Non-Return Valve
Pump H3BO3
- Non-Return Valve
Pump suction
Pump suction receiver

6. The Following Program Run :

Addition H2O 0-999 ml.
Addition NaOH 0-999 ml.
Addition H3BO3 0-999 ml.
Reaction Time 0-108 min
Distillation Time 0-108 min
Steam Capacity 10%-100%
Suction Sample
Suction Receiver

7. Measured pumps

Pump NaOH

Volume : ...13.33.....ml

Remark :

Remark

N/A

Fail

Pass

Remark

N/A

Fail

Pass

Remark

N/A

Fail

Pass

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 crystallizing 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.

Analytical errors

Fault description	Cause	Remedy
Analyte results too high	The chemicals used are contaminated with nitrogen compounds.	■ Detailed checking of the chemicals. ■ Determination of a blank value. ■ Replace the chemicals if necessary.
	Valent reaction in the digestion tube: sodium hydride drops get into the receiver.	■ Increase of the water addition amount.
	Glass bridges of the condenser is broken or worn out, sodium hydride drops get into the receiver.	■ Replacement of the glass condenser.
	Glass cleaning agents in the digestion tube.	■ Clean digestion tube in advance with distilled water.
	Entrainment of ammonia from the previous sample.	■ Increase distillation time. ■ Check whether sample was previously sufficiently alkalized.
	Incomplete distillation; distillation time too short.	■ No quantitative explosion of the ammonia content. ■ The distillation amount should be 100 ml.
Analyte result too low or no result	Ammonia escapes at leaking places.	■ Solid or defective Viton plugs: clean or replace. ■ Check seals (G.L. screw connections) on the condenser and receiver. ■ Check valve at the condenser is gummed up; clean or replace. ■ Digestion tube is damaged at the neck or bottom. ■ Distribution head glass leaks; replace.
	Adding amount of the sodium hydride too little; no ammonia development.	■ Check the content flow rate of the NaOH pump (see technical data).
	Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.	■ Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	■ Increase of the acid amount.
	Formation of stable ammonia compounds with sodium hydroxide destroyed with sodium hydroxide.	■ This problem only occurs with catalysts and reagents. Sodium hydroxide solution destroys these compounds.

General error message

Fault description	Cause	Remedy
'Cooling water flow volume too low'	Cooling water pressure under 1 bar	■ Open water tap. ■ Check coolant pressure. ■ Check coolant tube. Program continues automatically once error has been fixed.
'Sample tube missing'	Sample tube missing.	■ Insert sample tube. Continue program or restart.
'Distillation room protective door open'	Protection door not closed	■ Close protection door. Program continues automatically once error has been fixed.
'Reagent storage/waste'	One or more storage tanks are empty	■ Fill storage tank. ■ Check correct sealing of the universal sensors. The running program can be continued after rectification of the error.
	The sample waste tank is full.	■ Empty sample waste tank. ■ Check correct sealing of the universal sensors. The running program can be continued after rectification of the error.

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

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เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากรัน เวลา ราชการ (วันหยุดเสาร์ – อธิศษ หรือ วันหยุด นักชดถกน) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ ไม่รวมถึงค่าบริการซ่อม 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



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Preventive Maintenance Contract

จำนวนใบการทำสัญญาบริการ ...๑...ครั้งต่อปี
ครั้งที่ ๑..วันที่ 15.05.2024.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด		
ที่อยู่	219/43 หมู่2 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะห้บะนง จังหวัดสมุทรสาคร 74130		
โทรศัพท์	0869054664	แฟกซ์	-

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณศิริพร พิมพ์		
ตำแหน่ง	เจ้าหน้าที่ห้องปฏิบัติการ		
โทรศัพท์	0869054664	เบอร์ดี	แฟกซ์ -
E-mail	lab.centechl@gmail.com		

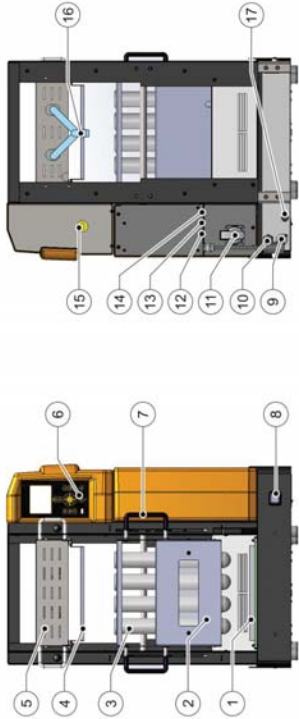
รายละเอียดผู้ให้บริการ

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

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวจริง	(.....)	ตัวจริง	(นาย จิรายุ สดอาด)
ตำแหน่ง		ตำแหน่ง	Specialist, Technical Service.
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	15/05/2024

Part 3: ตรวจสอบสภาพเครื่อง

Front and rear view of KT-L version



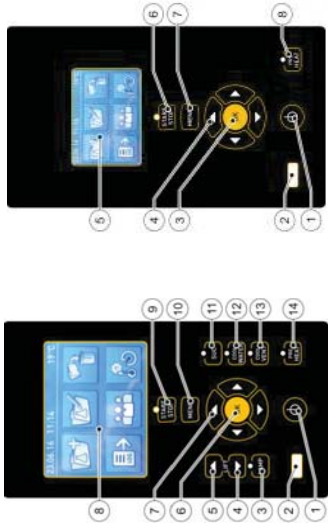
No.		PASS	Fail	N/A	Remark
1	KJELDATHERM digestion block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	เสื่อมสภาพ
2	Insert rack	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Digestion tube	<input checked="" type="checkbox"/>	<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: ฉะเอียดและรายงานผลการให้บริการ Preventive Maintenance

4.1 ตรวจสอบไฟฟ้า

ใช้ไฟ 220 V 50 Hz	Pass	Fail	N/A	Remark
กระแสไฟฟ้าตามพิกัดเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สายไฟของเครื่อง	Pass	Fail	N/A	Remark
ท่อแก้ววามไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สายขมวดึงท่อแก้ววามไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สภาพของ A aluminum block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การขึ้นลงของ Lift	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	เสื่อมสภาพ
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.ตรวจเช็คระบบการทำงาน



☐ KT-L

☒ KT

- Switch controller on or off:
- USB port
- LAMP button
- LIFT down button
- LIFT up button
- OK button
- Navigation buttons
- Display
- START/STOP button
- MENU button
- SUC button
- COOL/WATER button (optional)
- COOL / FENT" button (optional)
- PRE HEAT" button
- การขึ้นของอุณหภูมิมมากกว่า10องศาต่อหน้าที่ที่25องศา
- การทำงานของตัวป้องกันอุณหภูมิสูงเกิน
- การทำงานของระบบควบคุมอุณหภูมิ

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

การบำรุงรักษาทั่วไป (Basic maintenance)

1. การย่อยตัวอย่างเกิดการเค็ดที่รุนแรงอันเนื่องจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการสั่นออกมา
2. เมื่อใช้เสร็จ ไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำเอาคาลองไอการใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงไปที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดลงมาติดอยู่ในหลุม

เพื่อป้องกันไม่ให้เกิดราดังกล่าวก้ไปกับการเผออุณหภูมิ