



National Institute of Metrology (Thailand)
Ministry of Higher Education, Science, Research and Innovation



NSC-TISI-TIS
Calibration 0144

Certificate of Calibration

Certificate No. : MW-0035-25
Issued by : Flow and Volume of Liquid Laboratory
Mechanical Metrology Department

Page 1 of 3 pages

MEASUREMENT ITEM : Orifice Gas Flow Device

MANUFACTURER : Tisch Environmental, Inc.

MODEL/TYPE : TE-5025A

SERIAL NUMBER : 3905

CUSTOMER : EVM LABORATORY CO., LTD.
10 Soi Phong-Sawatdi 10, Nonthaburi Rd., Tha
Sai, Mueang Nonthaburi, Nonthaburi 11000
Thailand

MEASUREMENT DATE : June 10, 2025

The reported measurement result relates only to the measurand and applies only at the time of measurement.

Reference:
MEC0381-01/25

Date:
June 16, 2025

Approved by:

(Wirun Laopompichayanuwat)

Performed by:

(Terdsak Neadkratoke)

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ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows :

Temperature	: 23.0 ± 2.0	°C
Relative Humidity	: 55 ± 15	%RH

Calibration Condition:

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are 23.0°C and 59 %RH.

MEASUREMENT METHOD:

The Orifice gas flow device was calibrated against NIMT's Standard Gas Meter Model DELTA S-Flow G65. The CP-MW 0009 was used as a calibration guideline.

TABULATION OF RESULTS:

The tables on the next page give the measured values.

UNCERTAINTY OF MEASUREMENT:

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k = 2$. It has been determined in accordance with EA publication EA-4/02 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100 "Evaluation of measurement data - Guide to the Expression of Uncertainty in Measurement". The value of the measurand lies within the assigned range of values with a probability of approximately 95 %.

TRACEABILITY:

This certificate provides a traceability of the measurement to recognized the national standards, and to the realization of the International System of Units (SI).



MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Gas Meter standard. The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1. The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp _Meter mmHg	Δp _Orifice inH ₂ O	Y	Actual Flow [Q_a] m^3/min
1	0.698	750.268	23.02	22.96	58.639	1.762	0.834	0.643
2	0.912	750.188	23.02	22.98	56.793	3.039	1.095	0.843
3	0.997	750.063	23.02	23.01	39.880	3.816	1.227	0.944
4	1.068	750.114	23.04	23.02	32.349	4.496	1.332	1.022
5	1.166	750.107	23.08	23.00	28.076	5.424	1.464	1.123

Slope (m): 1.31479

Intercept (b): -0.01266

Correlation coefficient (r): 0.99992

Uncertainty ($k=2$): 0.014 m^3/min

Table 2. The results of Q standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp _Meter mmHg	Δp _Orifice inH ₂ O	Y	Standard Flow [Q_{std}] m^3/min
1	0.698	750.268	23.02	22.96	58.639	1.762	1.323	0.639
2	0.912	750.188	23.02	22.98	56.793	3.039	1.738	0.838
3	0.997	750.063	23.02	23.01	39.880	3.816	1.947	0.938
4	1.068	750.114	23.04	23.02	32.349	4.496	2.113	1.016
5	1.166	750.107	23.08	23.00	28.076	5.424	2.321	1.115

Slope (m): 2.09919

Intercept (b): -0.02010

Correlation coefficient (r): 0.99992

Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



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โทร 089 7747682, 099 0946209 อีเมล pongsakorn.evmlab@gmail.com

TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-5170X

Serial No: EVM-TSP.03

Approve Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Q_{std} Slope: 0.99990

Model: TE-5025A

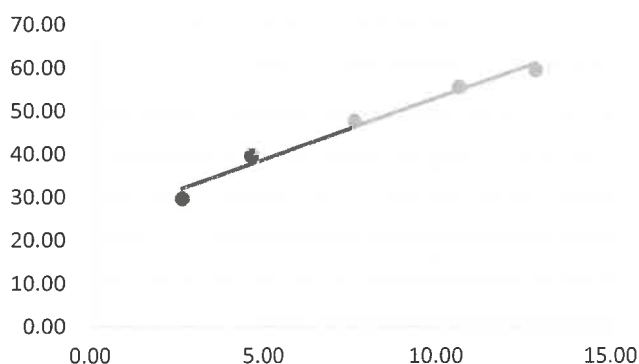
Q_{std} Intercept: -0.00886

Serial#: 3095

Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	12.80	3.562	60.0	59.57	Slope: 15.1076
13	10.60	3.242	56.0	55.60	Intercept: 6.2866
10	7.60	2.746	48.0	47.66	Corr. Coeff: 0.9980
7	4.60	2.139	40.0	39.72	
5	2.60	1.610	30.0	29.79	# of Observations: 5



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-5170X

Serial No: EVM-TSP.07

Approve Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Q_{std} Slope: 0.99990

Model: TE-5025A

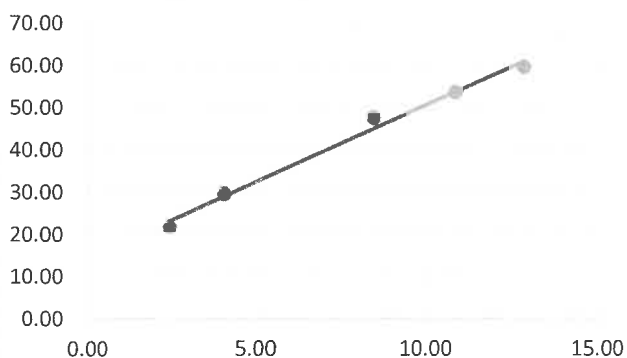
Q_{std} Intercept: -0.00886

Serial#: 3095

Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	Linear Regression Slope: 18.7744 Intercept: -7.3035 Corr. Coeff: 0.9995 # of Observations: 5
18	12.80	3.562	60.0	59.57	
13	10.80	3.272	54.0	53.62	
10	8.40	2.887	48.0	47.66	
7	4.00	1.995	30.0	29.79	
5	2.40	1.547	22.0	21.84	



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-5170X	Serial No: EVM-TSP.06	Approve Montree Padoungkij

Site Conditions

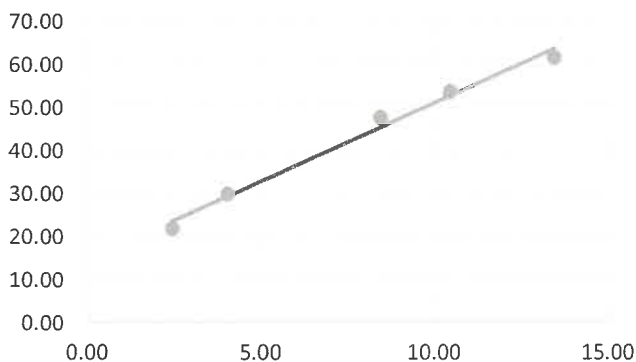
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Q _{std} Slope: 0.99990
Model: TE-5025A	Q _{std} Intercept: -0.00886
Serial#: 3095	Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q _{std} (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.40	3.644	62.0	61.56	Slope: 19.1412
13	10.40	3.211	54.0	53.62	Intercept: -7.9610
10	8.40	2.887	48.0	47.66	Corr. Coeff: 0.9998
7	4.00	1.995	30.0	29.79	
5	2.40	1.547	22.0	21.84	# of Observations: 5



Calibrated by :

Supakit Sakunee
(02/02/25)

Approve by :

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-5170X

Serial No: EVM-TSP.05

Approve Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Q_{std} Slope: 0.99990

Model: TE-5025A

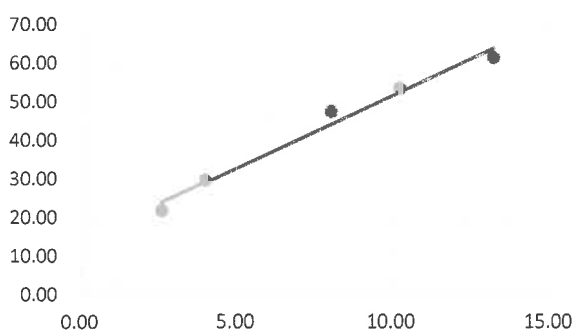
Q_{std} Intercept: -0.00886

Serial#: 3095

Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	<u>Linear Regression</u>
18	13.20	3.617	62.0	61.56	Slope: 19.9719
13	10.20	3.180	54.0	53.62	Intercept: -9.9095
10	8.00	2.818	48.0	47.66	Corr. Coeff: 0.9989
7	4.00	1.995	30.0	29.79	
5	2.60	1.610	22.0	21.84	# of Observations: 5



Calibrated by :

Supakit Sakunee
(02/02/25)

Approve by :

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-5170X	Serial No: EVM-TSP.04	Approve Montree Padoungkij

Site Conditions

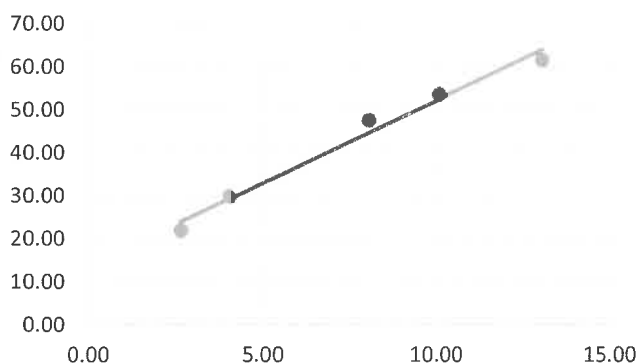
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Q_{std} Slope: 0.99990
Model: TE-5025A	Q_{std} Intercept: -0.00886
Serial#: 3095	Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	<u>Linear Regression</u>
18	13.00	3.589	62.0	61.56	Slope: 20.2970
13	10.00	3.149	54.0	53.62	Intercept: -10.5309
10	8.00	2.818	48.0	47.66	Corr. Coeff: 0.9992
7	4.00	1.995	30.0	29.79	
5	2.60	1.610	22.0	21.84	# of Observations: 5



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-5170X

Serial No: S/N1097

Approve Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Q_{std} Slope: 0.99990

Model: TE-5025A

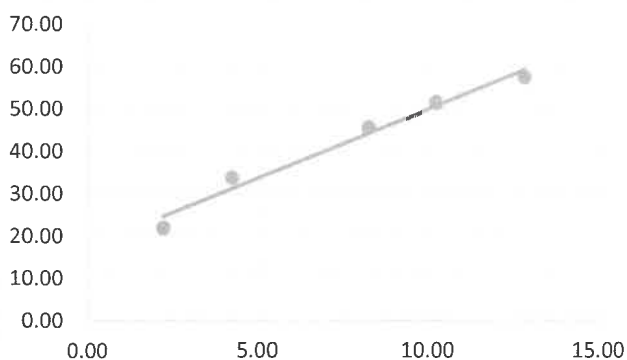
Q_{std} Intercept: -0.00886

Serial#: 3095

Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	<u>Linear Regression</u> Slope: 16.8695 Intercept: -2.1659 Corr. Coeff: 0.9980 # of Observations: 5
18	12.80	3.562	58.0	57.59	
13	10.20	3.180	52.0	51.63	
10	8.20	2.852	46.0	45.67	
7	4.20	2.044	34.0	33.76	
5	2.20	1.482	22.0	21.84	



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)



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TSP High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-5170X

Serial No: S/N1096

Approve Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Q_{std} Slope: 0.99990

Model: TE-5025A

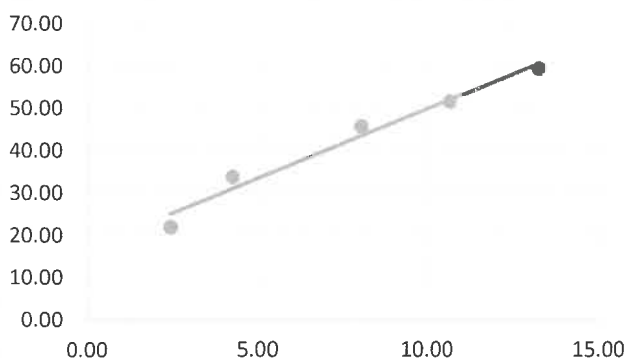
Q_{std} Intercept: -0.00886

Serial#: 3095

Date Certified: 20-Jul-24

Calibration Information

Plate no.	Inch H ₂ O	Q_{std} (m ³ /min)	I (chart)	IC (corrected)	<u>Linear Regression</u> Slope: 17.4432 Intercept: -3.7877 Corr. Coeff: 0.9961 # of Observations: 5
18	13.20	3.617	60.0	59.57	
13	10.60	3.242	52.0	51.63	
10	8.00	2.818	46.0	45.67	
7	4.20	2.044	34.0	33.76	
5	2.40	1.547	22.0	21.84	



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)



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PM10 High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-6070X	Serial No: EVM-PM10.05	Approve: Montree Padoungkij

Site Conditions

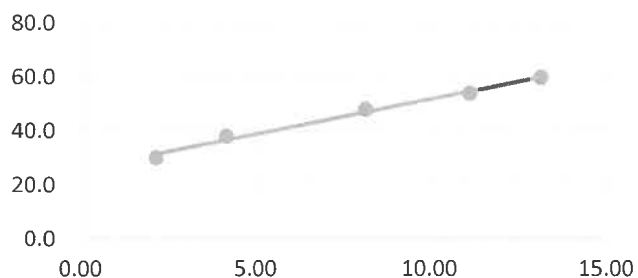
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Slope: 0.99990
Model: TE-5025A	Intercept: -0.00886
Serial#: 3905	Date Certified: 20-Jul-24

Calibration Data

Plate no.	Inch H ₂ O	Q _a (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.10	2.292	60.0	37.84	Slope = 13.3189
13	11.10	2.110	54.0	34.06	Intercept = 6.5955
10	8.10	1.804	48.0	30.27	Corr. Coeff = 0.9976
7	4.10	1.286	38.0	23.96	SFR 1.130
5	2.10	0.923	30.0	18.92	SSP 34.32
# of Observations:					5



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)

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PM10 High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-6070X	Serial No: EVM-PM10.04	Approve: Montree Padoungkij

Site Conditions

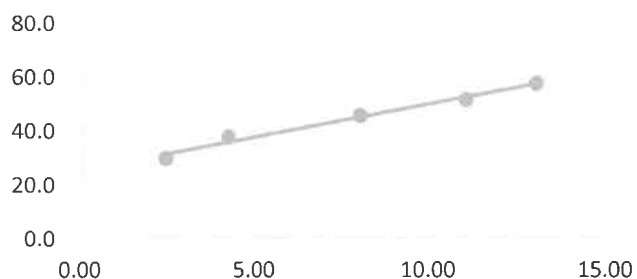
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Slope: 0.99990
Model: TE-5025A	Intercept: -0.00886
Serial#: 3905	Date Certified: 20-Jul-24

Calibration Data

Plate no.	Inch H ₂ O	Q _a (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.00	2.283	58.0	36.58	Slope = 12.8383
13	11.00	2.101	52.0	32.79	Intercept = 6.5209
10	8.00	1.793	46.0	29.01	Corr. Coeff = 0.9951
7	4.20	1.301	38.0	23.96	SFR 1.130
5	2.40	0.986	30.0	18.92	SSP 33.34
# of Observations:					5



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)

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เลขที่ 10 ซอยพงษ์สวัสดิ์ 10 ตำบลท่าทราย อำเภอเมืองนนทบุรี จังหวัดนนทบุรี 11000
โทร 089 7747682, 099 0946209 อีเมล pongsakorn.evmlab@gmail.com

PM10 High Volume Sampler Calibration

☒ PM ☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-6070X	Serial No: EVM-PM10.03	Approve: Montree Padoungkij

Site Conditions

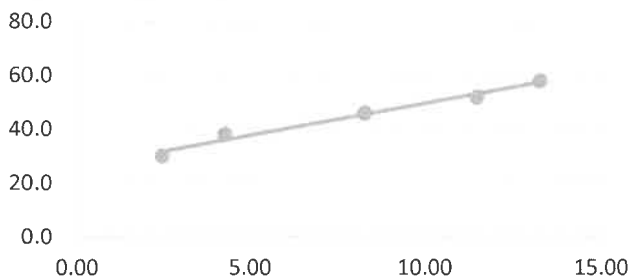
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Slope: 0.99990
Model: TE-5025A	Intercept: -0.00886
Serial#: 3905	Date Certified: 20-Jul-24

Calibration Data

Plate no.	Inch H ₂ O	Q _a (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.20	2.300	58.0	36.58	Slope = 12.5175
13	11.40	2.138	52.0	32.79	Intercept = 6.8705
10	8.20	1.815	46.0	29.01	Corr. Coeff = 0.9933
7	4.20	1.301	38.0	23.96	SFR 1.130
5	2.40	0.986	30.0	18.92	SSP 33.32
# of Observations:					5



Calibrated by :

Supakit Sakunee
(02/02/25)

Approve by :

Montree Padoungkij
(02/02/25)

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 โทร 089 7747682, 099 0946209 อีเมล pongsakorn.evmlab@gmail.com

PM10 High Volume Sampler Calibration

☒ PM ☐ Onsite

Location: office EVM lab	Date: 2-Feb-25	Tech: Supakit Sakunee
Sampler: TE-6070X	Serial No: 1094	Approve: Montree Padoungkij

Site Conditions

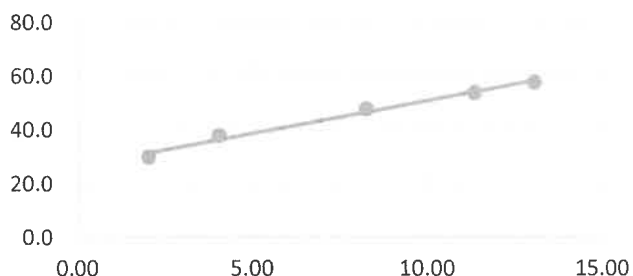
Barometric Pressure (mBar): 1009.00	Corrected Pressure (mm Hg): 757
Temperature (deg C): 28	Temperature (deg K): 301
Average Press. (mBar): 1009.00	Corrected Average (mm Hg): 757
Average Temp. (deg C): 28	Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.	Slope: 0.99990
Model: TE-5025A	Intercept: -0.00886
Serial#: 3905	Date Certified: 20-Jul-24

Calibration Data

Plate no.	Inch H ₂ O	Q _a (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.00	2.283	58.0	36.58	Slope = 12.4617
13	11.30	2.129	54.0	34.06	Intercept = 7.8269
10	8.20	1.815	48.0	30.27	Corr. Coeff = 0.9992
7	4.00	1.270	38.0	23.96	SFR 1.130
5	2.00	0.901	30.0	18.92	SSP 34.74
# of Observations:					5



Calibrated by :

Supakit

Supakit Sakunee
(02/02/25)

Approve by :

Montree

Montree Padoungkij
(02/02/25)

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บริษัท อีวีเอ็ม แล็บอราทอรี แอนด์ รีเสิร์ช จำกัด

EVM LABORATORY AND RESEARCH CO., LTD.

เลขที่ 10 ซอยพงษ์สวัสดิ์ 10 ตำบลท่าทราย อำเภอเมืองนนทบุรี จังหวัดนนทบุรี 11000

โทร 089 7747682, 099 0946209 อีเมล pongsakorn.evmlab@gmail.com

PM10 High Volume Sampler Calibration

☒ PM

☐ Onsite

Location: office EVM lab

Date: 2-Feb-25

Tech: Supakit Sakunee

Sampler: TE-6070X

Serial No: 1093

Approve: Montree Padoungkij

Site Conditions

Barometric Pressure (mBar): 1009.00

Corrected Pressure (mm Hg): 757

Temperature (deg C): 28

Temperature (deg K): 301

Average Press. (mBar): 1009.00

Corrected Average (mm Hg): 757

Average Temp. (deg C): 28

Average Temp. (deg K): 301

Calibration Orifice

Make: Tisch Environmental, Inc.

Slope: 0.99990

Model: TE-5025A

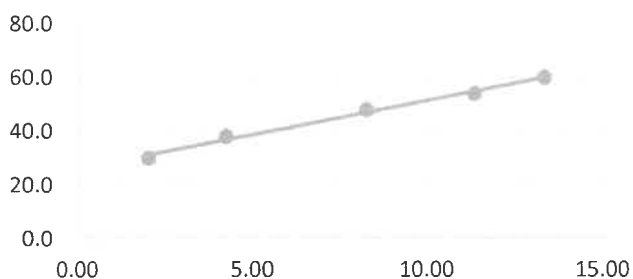
Intercept: -0.00886

Serial#: 3905

Date Certified: 20-Jul-24

Calibration Data

Plate no.	Inch H ₂ O	Q _a (m ³ /min)	I (chart)	IC (corrected)	Linear Regression
18	13.30	2.309	60.0	37.84	Slope = 13.0090
13	11.30	2.129	54.0	34.06	Intercept = 7.0110
10	8.20	1.815	48.0	30.27	Corr. Coeff = 0.9974
7	4.20	1.301	38.0	23.96	SFR 1.130
5	2.00	0.901	30.0	18.92	SSP 34.43
# of Observations:					5



Calibrated by :

Supakit Sakunee
(02/02/25)

Approve by :

Montree Padoungkij
(02/02/25)

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www.accl-calibration.com
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www.88uifitunin8803a.com

ADVANTAGE CENTER CO., LTD.

59/494 M.6, Frakham Road, T.Kukhot, Lumlookkar, Pathumthani 12130 Thailand.

Tel. (66-2) 9873248-50 Fax: (66-2) 9873252 E-mail: info.accl2662@gmail.com

pornsak2008@yahoo.co.th



CALIBRATION LABORATORY

Certificate No. RA-2504016-2

Job No.: RA-2504016

Certificate of Calibration

FOR

Equipment Name : Electronic Balance

Manufacturer : Ohaus

Model : AX224

Serial Number : C112372703

Customer Code : B2021002

Calibration Procedure : CPM-04-03

Received Date : Apr 10, 2025

Calibration Date : Apr 25, 2025

Recommended Due Date : N/A

Location of Calibration : On Site

Customer Name : EVM LABORATORY AND RESEARCH CO., LTD

10 Soi Phongsawat 10, Nonthaburi Road, Tha Sai , Mueang Nonthaburi, Nonthaburi 11000

Environmental Conditions

Ambient Temperature : $(25 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \% \text{RH}$

Atmospheric Pressure : 950 mbar – 1050 mbar

Result : No Adjustment (See data attached in page 3 to the end of certificate)

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

Calibrated by : P. Noppadon

Approved by :

(Pornsak Suksawaeng)

Date of Issue : May 3, 2025

Laboratory Management

Certificate No.: RA-2504016-2

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Standard Weight Set (Class E2)	31930466	C02242138	Nov 21, 2026	SPC

Traceability

This calibration is traceable to the International System of Unit via :

- SPC : SPC Calibration Center

Certificate No. : RA-2504016-2

Result of Calibration

Range capacity : 0 to 220 g

Resolution: 0.0001 g

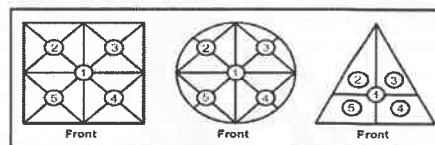
1. Repeatability. (n = 10, n = Number of Measurement)

Load (g)	Standard deviation of reading. (g)	Maximum difference between successive reading. (g)
100	0.000032	0.0001
200	0.000042	0.0001

2. Effect of off center loading.

A mass of 50 g was placed to various positions on the pan.

The weighing machine reading error obtained is given in table.



Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference
50.0000	50.0000	50.0000	50.0000	50.0000	0.0000

3. Linearity

Nominal value (g)	UUC Reading (g)	Correction (g)	Uncertainty of Measurement (± g)
No Load	0.0000	0.0000	0.00018
0.01	0.0100	0.0000	0.00019
0.1	0.1000	0.0000	0.00019
1.0	1.0000	0.0000	0.00019
5.0	5.0000	0.0000	0.00019
20.0	20.0000	0.0000	0.00019
100.0	100.0000	0.0000	0.00020

4. Hysteresis

Load (g)	Hysteresis (g)
100	0.0000

UUC = Unit Under Calibration

- End of Certificate -



Analyzer Performance Test

Calibrated Date: 01 November 2024

Instruments Information

Analyzer Type : CO Analyzer
Model : 48C

Manufacturer : Thermo Environmental
Serial Number : 48C-74290-376

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

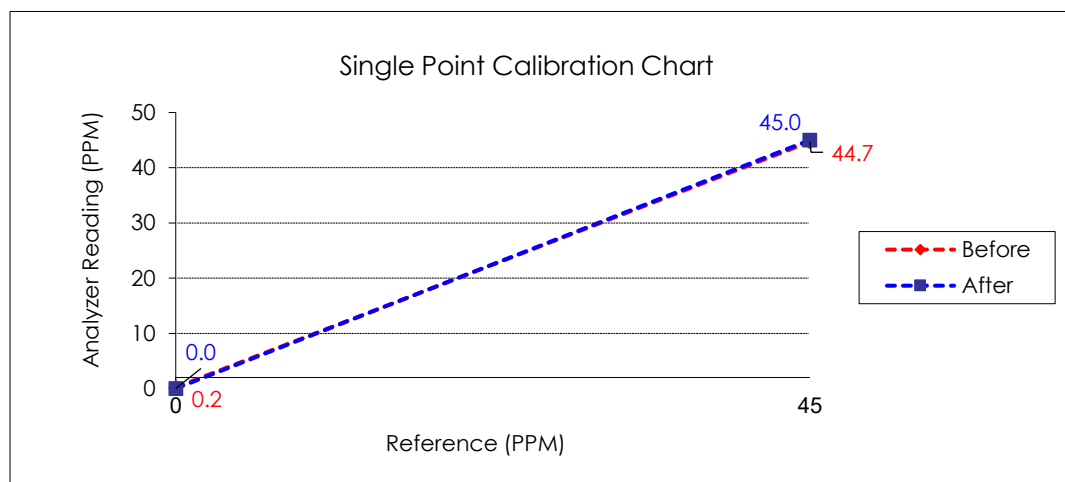
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.7	-0.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 01 November 2024

Instruments Information

Analyzer Type : CO Analyzer
Model : 48C

Manufacturer : Thermo Environmental
Serial Number : 48C-75798-381

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

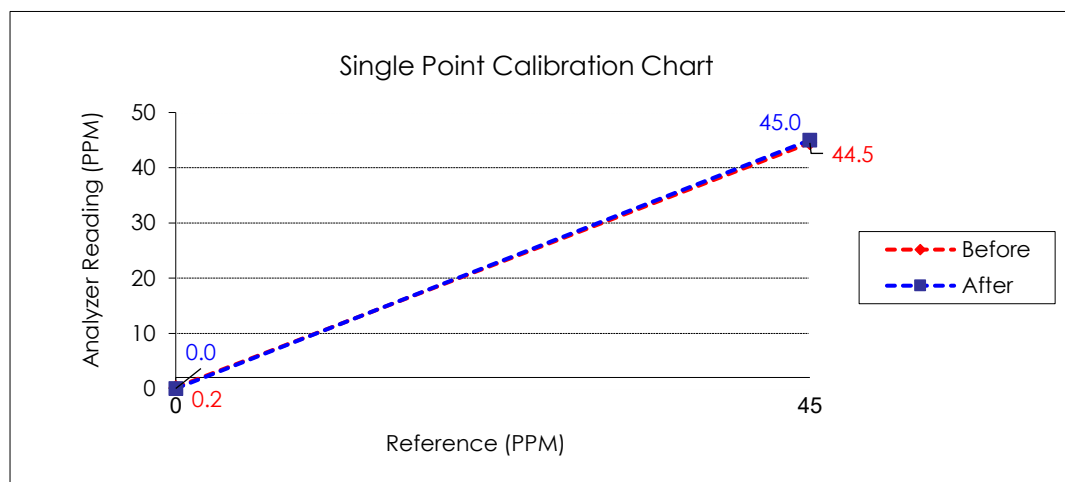
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.5	-1.1
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 18 October 2024

Instruments Information

Analyzer Type : CO Analyzer
Model : 300

Manufacturer : API
Serial Number : 531

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

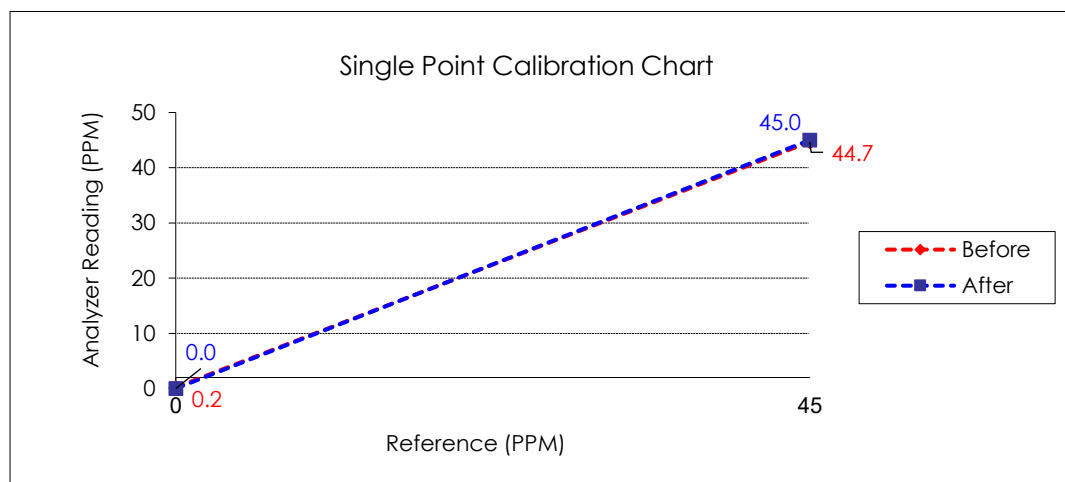
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.7	-0.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 18 October 2024

Instruments Information

Analyzer Type : CO Analyzer
Model : 300

Manufacturer : API
Serial Number : 1531-S

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

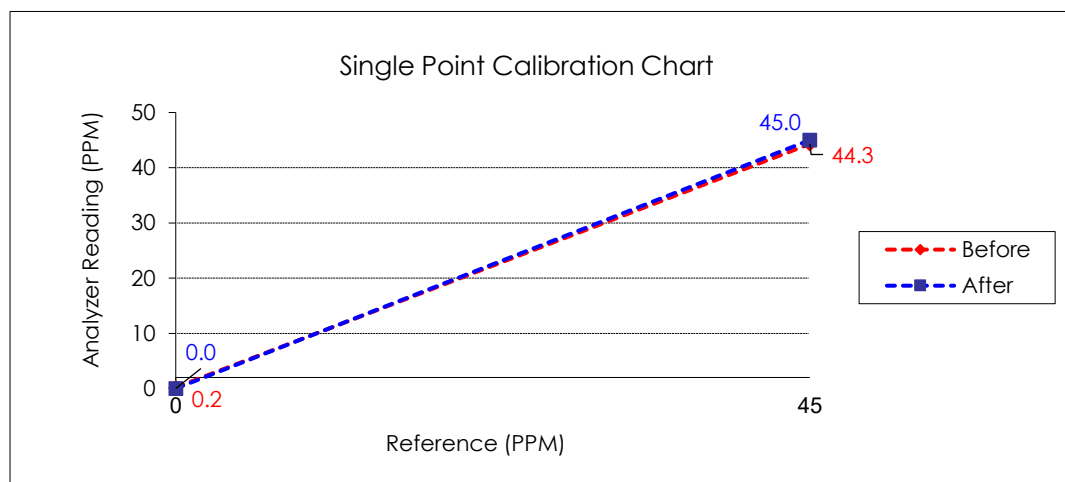
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 16 October 2024

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 42C-60871-328

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

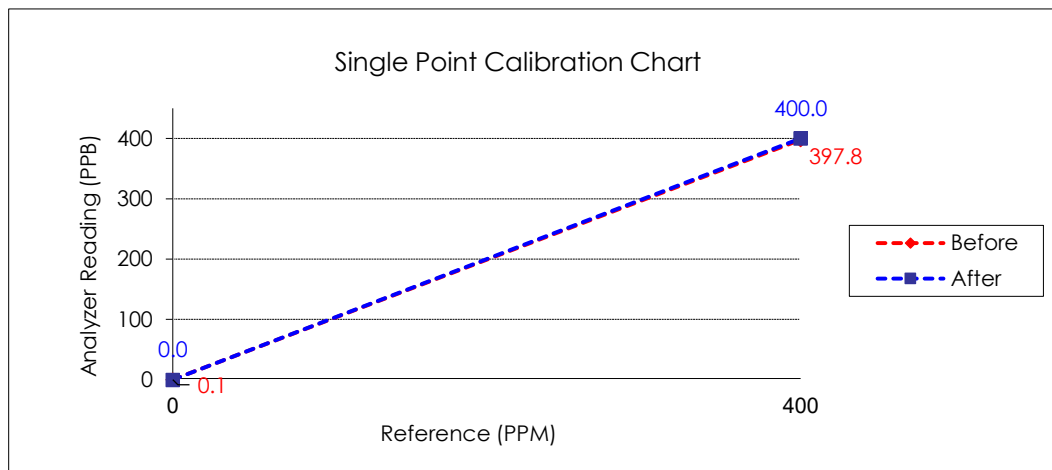
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	397.8	-0.5
NO _x	0.0	0.0	0.0	400.0	397.4	-0.7

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : 
MR. KITTISAK JANSANGWATTANA

Approve by : 
MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 16 October 2024

Instruments Information

Analyzer Type : NO-NO2-NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 42C-65112-346

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

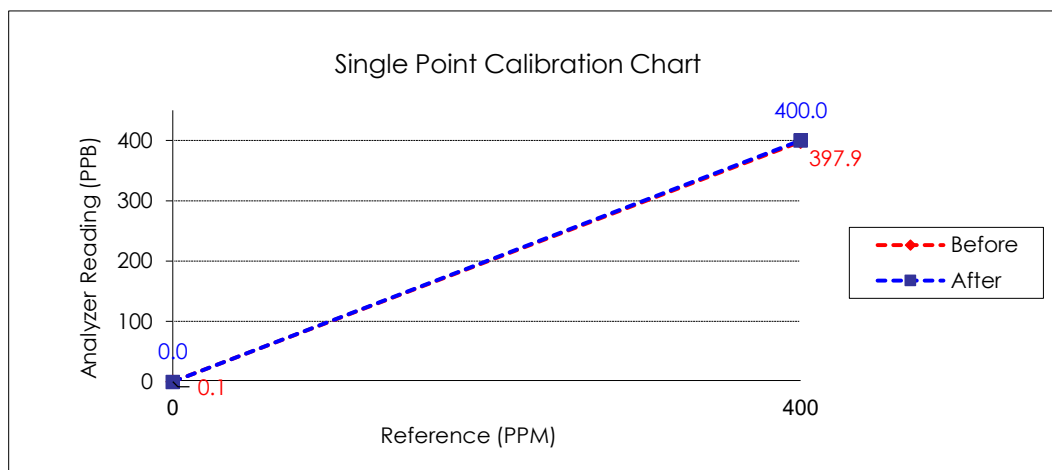
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	397.9	-0.5
NOx	0.0	0.0	0.0	400.0	398.0	-0.5

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทน์วงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 05 November 2024

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0335903951

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

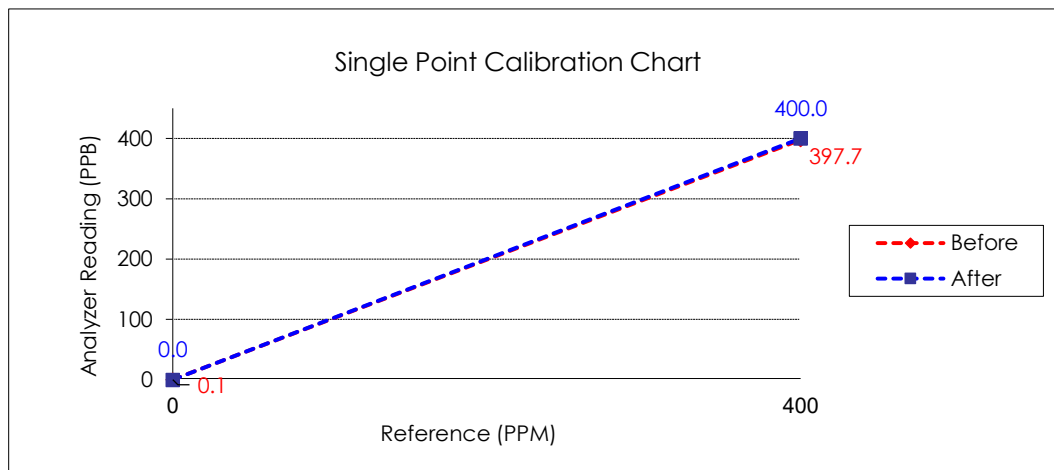
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	397.7	-0.6
NO _x	0.0	0.0	0.0	400.0	397.4	-0.7

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : 
MR. KITTISAK JANSANGWATTANA

Approve by : 
MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 05 November 2024

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0507010761

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

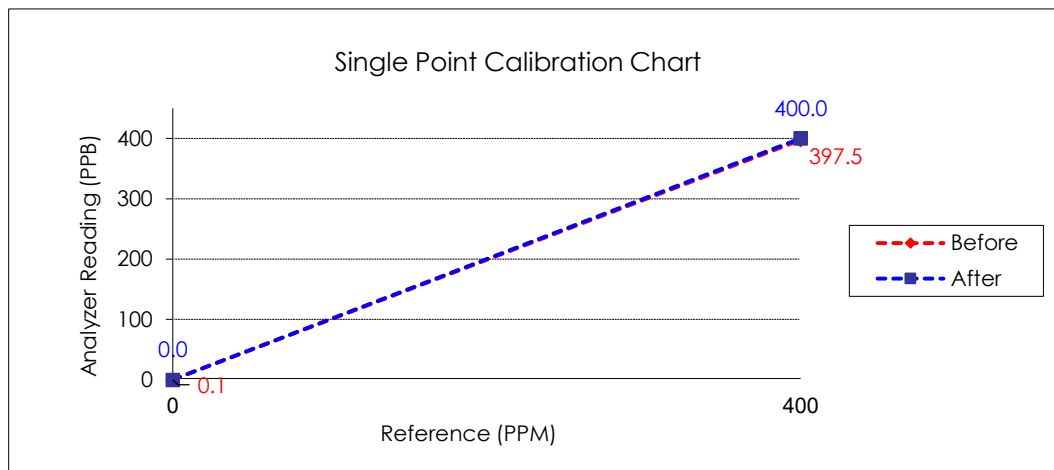
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	397.5	-0.6
NO _x	0.0	0.0	0.0	400.0	397.6	-0.6

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : 
MR. KITTISAK JANSANGWATTANA

Approve by : 
MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 06 November 2024

Instruments Information

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial Number : 43C-71076-367

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

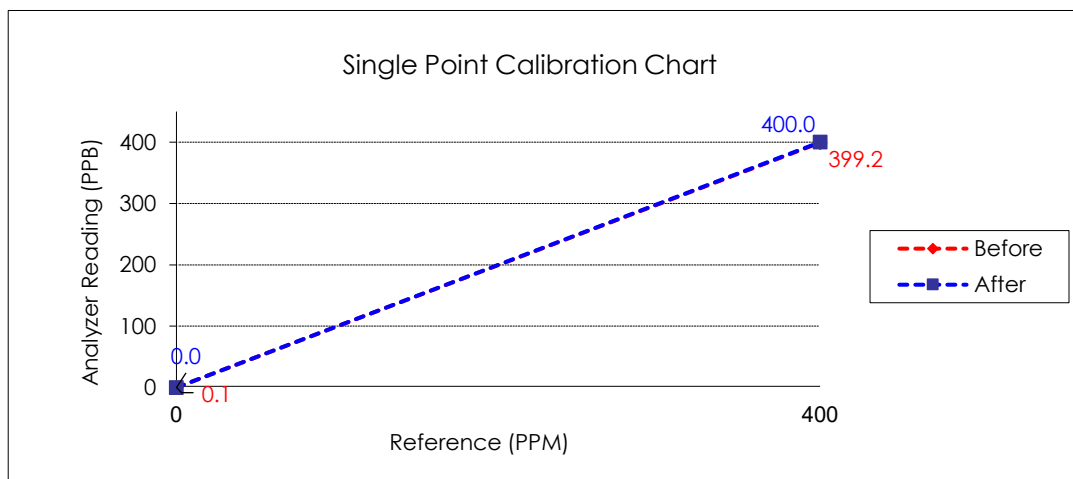
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	399.2	-0.2
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 06 November 2024

Instruments Information

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial Number : 43CTL-74200-376

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

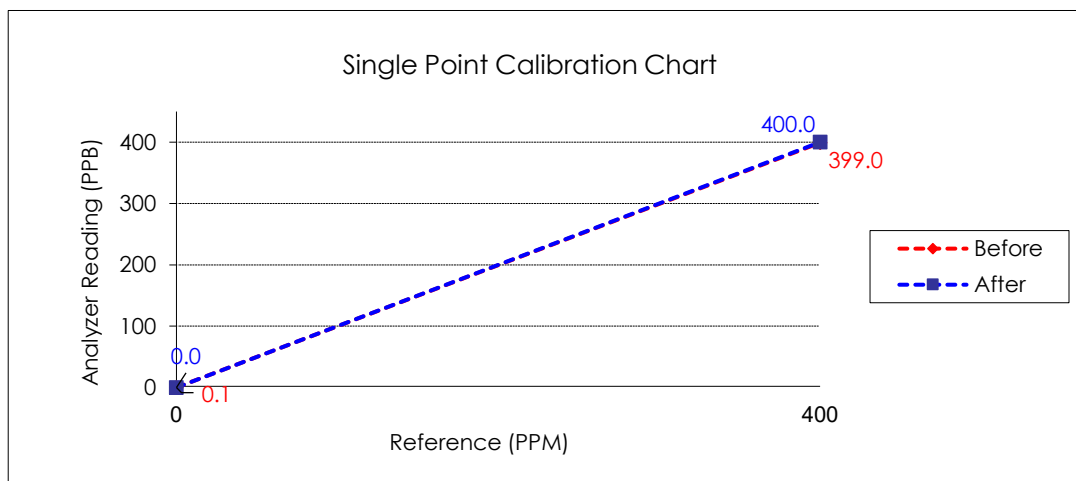
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	399.0	-0.3
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 October 2024

Instruments Information

Analyzer Type : SO2 Analyzer

Manufacturer : API

Model : 100A

Serial Number : 340

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

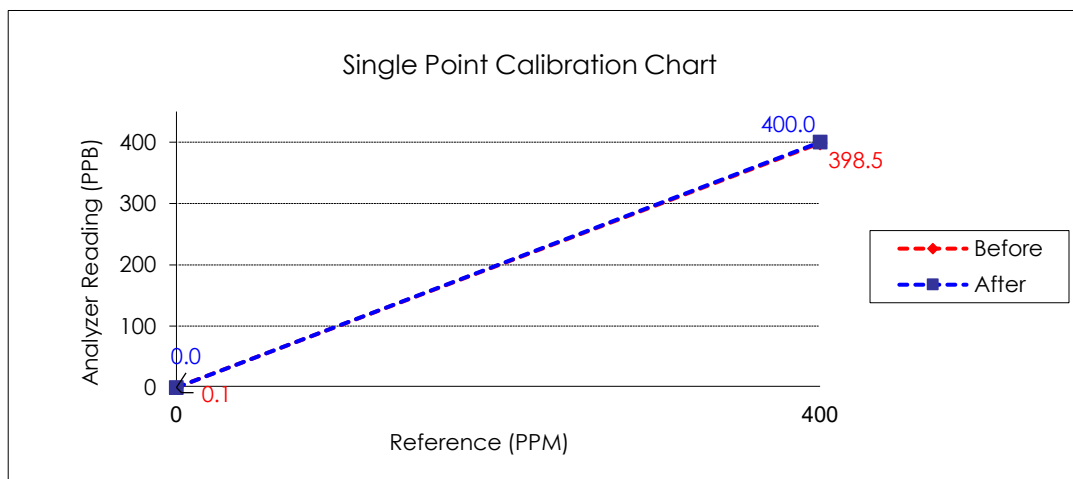
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	398.5	-0.4
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 October 2024

Instruments Information

Analyzer Type : SO2 Analyzer

Manufacturer : API

Model : 100A

Serial Number : 378

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

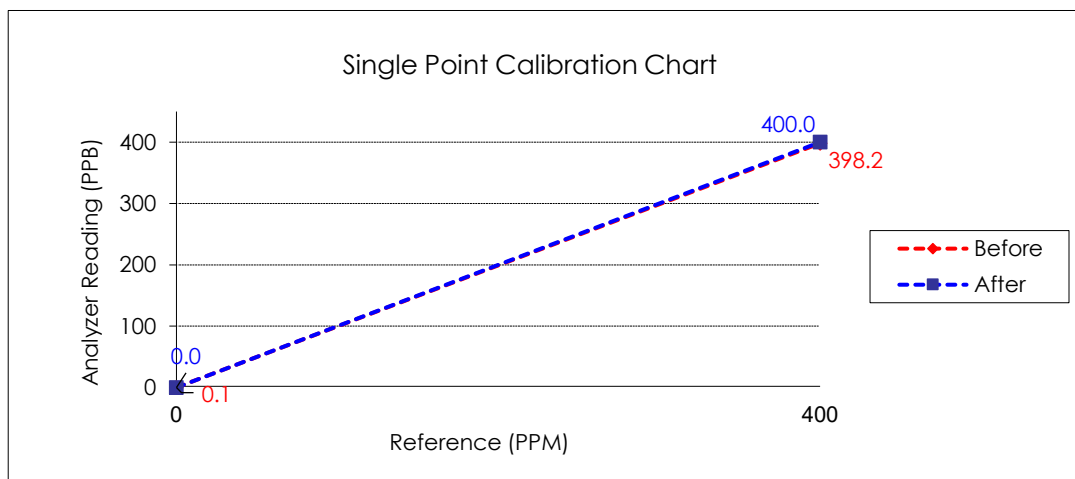
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	398.2	-0.5
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

CALIBRATION LABORATORY

Certificate No. RS-2503011-5

Job No. RS-2503011

Certificate of Calibration

FOR

Equipment Name : Sound Calibrator

Manufacturer : SCARLET TECH

Model : ST-120

Serial Number : ST120C0673E

Customer Code : N/A

Location of Calibration : In Lab

Customer Name : EVM LABORATORY AND RESEARCH CO., LTD.

10, Soi Phong Sawatdi 10, Nonthaburi Rd, Tha Sai, Mueang Nonthaburi, Nonthaburi 11000

Calibration Procedure : CPE-04-01

Received Date : Mar 7, 2025

Calibration Date : Mar 14, 2025

Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \% \text{RH}$

Result : No Adjustment (See data attached in page 3 to the end of certificate)

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

Calibrated by : B. Pradit

Approved by :


(Pornsak Suksawaeng)

Date of Issue : Mar 27, 2025

Laboratory Management

Certificate No.: RS-2503011-5

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP. 32/1167	Nov 14, 2025	TISTR
Digital Sound Level Meter	HF:2556826	RA-2411075-22	Nov 1, 2025	NIMT
6.5 Digit Multimeter	US36127537	E1U2404984	Nov 7, 2025	NA

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research
- ACCL : Advantage Center Co.,Ltd.
- NA : NA Caltechnologies Co.,Ltd.



Certificate No. : RS-2503011-5

Result of Calibration

Sound Pressure Level

UUC Setting (dB)	STD Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94	93.96	0.04	0.12
114	113.95	0.05	0.12

Frequency

UUC Setting (Hz)	STD Reading (Hz)	Correction (Hz)	Uncertainty of Measurement (± Hz)
1000	999.8	0.2	0.58

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





บริษัท อีวีเอ็ม แลบบอราทอรี แอนด์ รีเสิร์ช จำกัด

EVM Laboratory And Research Co., Ltd.

เลขที่ 10 ซอยพงษ์สวัสดิ์ 10 ตำบลท่าทราย อำเภอเมืองนนทบุรี จังหวัดนนทบุรี 11000

โทร 089 7747682 อีเมล pongsakorn.evmlab@gmail.com

Calibration Test Report

Calibration Report NO. 0100

Pages. 1 / 1

Calibrated Date. 23/6/68

Calibrated for company. โชน นวนดร

References Standard	
Sound Calibration Model : Scarlet	S/N : ST120C0673E
Date of Calibration : 2024/07/06	Specification : Class 1

Calibration System	
Equipment Type : Sound Level Meter	Manufacture : <u>SCARLET</u>
Model : <u>ST-11D</u>	

Conditions	
Temperature <u>26</u> °C	Humidity <u>44</u> %
Barametric pressure <u>754.27</u> mmHg	

Result of Test				
Sound Level Meter (S/N or ID NO.)	References Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
<u>820396</u>	94.00	<u>94.0</u>	<u>-</u>	<u>-</u>

Calibrated by : [Signature]

Approved by : [Signature]

Syakit Sakum
(.....)
Date 23 / 6 / 68

(Mr. Montree Padoungkij)
Date 23 / 6 / 68



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2025

Certification No. 186/25

Page : 1 of 2

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21 ID No. : EVM-F.AB.WS&WD.02

Serial No. : Wireless Receiver 2112DR0108

Wind Sensor 2112DT0108

Customer : EVM Laboratory CO.,Ltd.
10 Soi Phongsawat 10, Tha Sai,
Mueang Nonthaburi, Nonthaburi 11000.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.7 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 186/25

31 March, 2025

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112	
Young Meteorological Instruments	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



สอบเทียบเครื่องมือวิเคราะห์ทางห้องปฏิบัติการ
[Calibration Document of Laboratory]



Certificate of Calibration



Equipment: Electronic Balance
Model: BSA224S-CW
Serial No. (or ID.): 26991071 (LAB-BL-001)
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01250142
Issued Date: 16 January 2025
Job No.: WO-00057478
Page: 1 of 2

Customer: Vcare Environment Services Co., Ltd.
1/25 Soi Suphaphong 3 Yek 8 Nongbon,
Pravech, Bangkok 10250

Environment Condition: Temperature 24 °C ± 0.5 °C
Humidity 46 %RH ± 3.6 %RH

Calibration Place: Vcare Environment Services Co., Ltd. (LB301)
1/25 Soi Suphaphong 3 Yek 8 Nongbon,
Pravech, Bangkok 10250

Calibration By: Mr. Preecha Phooarsai
Calibration Date: 15 January 2025

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02241320

(Mr. Preecha Phooarsai)

Person in charge

This certificate is issued for the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Authorized signatory
(Mr. Adisai Maknoi)
Authorized signatory

Person in charge
(Mr. Preecha Phooarsai)

Delivering Growth – in Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022

Calibration Results:
Without Adjustment

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

Nominal Test Value	Reference Points (g)				
	A	B	C	D	E
100	0.0001	0.0001	0.0001	-0.0001	-0.0001

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

Nominal test value (g)	Standard Deviation
20	0.00003
200	0.00004

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

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.001	0.00100	0.0010	0.0000	0.000096	2.02
1	1.00001	1.0000	0.0000	0.000097	2.02
2	2.00001	2.0000	0.0000	0.000098	2.02
5	5.00002	5.0000	0.0000	0.000099	2.02
10	10.00002	10.0000	0.0000	0.00010	2.02
20	20.00001	20.0000	0.0000	0.00011	2.01
50	50.00001	50.0000	0.0000	0.00012	2.01
100	99.99995	100.0000	0.0001	0.00017	2.00
120	119.99996	120.0000	0.0000	0.00020	2.00
150	149.99996	150.0000	0.0000	0.00023	2.00
200	200.00012	200.0001	0.0000	0.00029	2.00

The End of Certificate

Authorized signatory
(Mr. Adisai Maknoi)
Authorized signatory

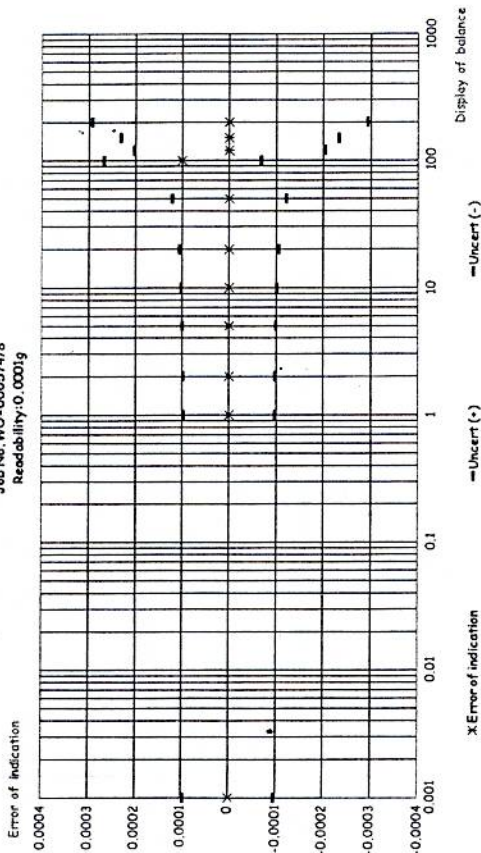
Person in charge
(Mr. Preecha Phooarsai)

Delivering Growth – in Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022



Without Adjustment
Job No. WO-00057478
Readability: 0.0001g



ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00057478

ชนิดเครื่องมือ: Electronic Balance รุ่น: BSA224S-CW

หมายเลขเครื่อง: 26991071

ตรวจสอบ (รับ)	รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
	15 Jan 2025		15 Jan 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☐	1. สายไฟ/Adapter, power supply 220/110V	☒	☐	
☒	☐	2. ความสมบูรณ์ชุดกระถังเก็บ (Cover)	☒	☐	
☒	☐	3. ความสมบูรณ์ชุดของระดับน้ำ	☒	☐	
☒	☐	4. การปรับระดับของขาตั้งเครื่อง	☒	☐	
☒	☐	5. การทดสอบของของหนัก	☒	☐	
☒	☐	6. ความสมบูรณ์ของ Display	☒	☐	
☒	☐	7. การแสดงผลของ Display หลังวางไฟหนัก	☒	☐	
☒	☐	8. ชุดรองงานชั่ง (Stopper) / pan support	☒	☐	
☒	☐	9. การทำงานของ Function Internal / External	☒	☐	
☒	☐	10. ความสะอาดของหัวเครื่องภายนอกและแกน load cell	☒	☐	
☒	☐	11. สภาวะแวดล้อม ณ สถานที่ใช้เครื่อง	☒	☐	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Preecha Phocarsai
Service Engineer

บริษัท ดีเคเอสเอช (ประเทศไทย) จำกัด
DKSH Technology Limited
2533 ถนนพหลโยธิน แขวงสามยุค กรุงเทพมหานคร 10260
2533 Sukhaphat Road, Phrasaengyuek, Bangkok 10260
Phone +66 2633 7000 Email info.ccs@dksh.com Website www.dksh.com/sen/c/thailand

Delivering Growth - in Asia and Beyond.



Certificate of Calibration

Represent to Certificate of Calibration No. C13250017
Liquid Bath
Model: LWB-122D
Serial No. (or ID.): 07072020 (LAB-WB-001)
Manufacturer: Lab Tech
Condition: In Condition
Forced Circulation: None

Customer: Vcare Environment Services Co., Ltd.
1/25 Soi Suphaphong 3 Yek 8 Nongbon,
Pravech, Bangkok 10250

Environment Condition: Temperature: 28 °C ± 0.2 °C
Humidity: 59 %RH ± 5.5 %RH
Voltage: 229 VAC ± 1.2 VAC

Calibration Place: Vcare Environment Services Co., Ltd. (LB304)
1/25 Soi Suphaphong 3 Yek 8 Nongbon,
Pravech, Bangkok 10250

Calibration By: Mr. Thanakrit Rakasapol
Calibration Date: 15 January 2025
The Method used: In house method, CAL-WI-17, base on ASTM E715-80
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240023

Signature

(Mr. Udon Srichana)
Authorized signatory

Signature

(Mr. Thanakrit Rakasapol)
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 standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

UKAS Accredited certificate only
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2638 7000 Email: info@calibration.dksh.com Website: www.dksh.com/calibration-thailand

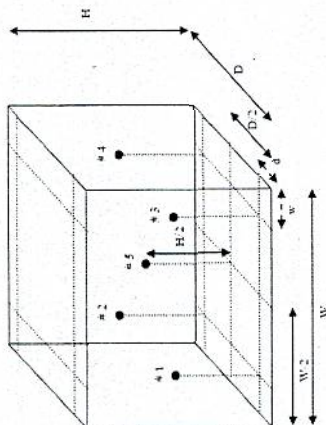
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CAL-FM-C13-13: 12 Sep 2022



Certificate No.: C13250070

Page: 2 of 4



Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 50 (cm) D = 29 (cm) H = 12 (cm) Volume = 17 (Liters)
Standard Locations #1: w = 5 (cm) d = 5 (cm)
Standard Locations #2: w = 5 (cm) d = 5 (cm)
Standard Locations #3: w = 5 (cm) d = 5 (cm)
Standard Locations #4: w = 5 (cm) d = 5 (cm)
Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	101	102	103	104	105

Definitions

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

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

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

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

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

UKAS Accredited certificate only

2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2638 7000 Email: info@calibration.dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C13-13: 12 Sep 2022

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	84.70	-0.30	1.1
#2	84.82	-0.18	1.2
#3	84.71	-0.29	1.2
#4	84.40	-0.60	1.3
#5	85.27	0.27	1.2

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
85.0	85.0	85.0	#1	#2	#3	#4	#5	
			84.70	84.82	84.71	84.40	85.27	1.3

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
85.0	1.42	0.59	2.10

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 95.1 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	94.79	-0.31	0.73
#2	95.02	-0.08	0.73
#3	94.59	-0.51	0.79
#4	94.53	-0.57	0.96
#5	95.32	0.22	0.75

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
95.0	95.0	95.1	#1	#2	#3	#4	#5	
			94.79	95.02	94.59	94.53	95.32	0.96

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
95.1	1.15	0.42	1.55

Note: * Maximum uncertainty of the each position

The End of Certificate



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF 110
Serial No.(or ID): B419.0093 (LAB-OV-002)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Customer: Vcare Environment Services Co.,Ltd.
1/25 Soi Suphaphong 3 Yek 8 Nongbon, Pravach,
Bangkok 10250

Environment Condition: Temperature: 26 °C ± 1.4 °C
Humidity: 59 %RH ± 4.2 %RH
Voltage: 229 VAC ± 1.3 VAC

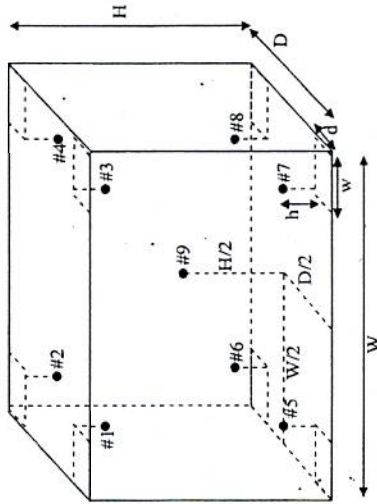
Calibration Place: Vcare Environment Services Co.,Ltd. (LB03)
1/25 Soi Suphaphong 3 Yek 8 Nongbon, Pravach,
Bangkok 10250

Calibration By: Mr. Thanakrit Raksapol
Calibration Date: 15 January 2025
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. C10230022

Thit
(Mr. Thanakrit Raksapol)

Person in charge
(Mr. Pramote Ramrong)
Authorized signatory
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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Unit Address: 2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2639 7000 Email: info@calibration@dksh.com Website: www.dksh.com/calibration-thailand
Delivering Growth - in Asia and Beyond.



Standard Installation Locations

Volume (Calibration Zone)= 34 (Liters)

Inside chamber: W = 56 (cm) D = 40 (cm) H = 48 (cm)
Standard Locations (#1, #2, #3, #4): w = 6 (cm) d = 5 (cm) h = 5 (cm)
Standard Locations (#5, #6, #7, #8): w = 6 (cm) d = 5 (cm) h = 17 (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

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

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

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



Certificate No.: C31250110 Page: 3 of 4

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	104.28	0.28	0.39
#2	104.18	0.18	0.39
#3	104.44	0.44	0.39
#4	103.71	-0.29	0.39
#5	104.13	0.13	0.39
#6	104.19	0.19	0.39
#7	103.66	-0.34	0.39
#8	103.67	-0.33	0.39
#9	103.99	-0.01	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	104.28	104.18	104.44	103.71	104.13	104.19	103.66	103.67	103.99	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.52	0.10	0.95

Note: * Maximum uncertainty of the each position

DKSH Measurement Services (Thailand) Co., Ltd.
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31250110 Page: 4 of 4

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	181.17	1.17	0.47
#2	181.02	1.02	0.47
#3	181.35	1.35	0.47
#4	179.10	-0.90	0.47
#5	180.62	0.62	0.48
#6	180.27	0.27	0.47
#7	178.87	-1.13	0.48
#8	179.06	-0.94	0.47
#9	179.91	-0.09	0.47

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	181.17	181.02	181.35	179.10	180.62	180.27	178.87	179.06	179.91	0.48

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.53	0.11	2.65

Note: * Maximum uncertainty of the each position

The End of Certificate

DKSH Measurement Services (Thailand) Co., Ltd.
2533 Sukhumvit Road, Bangkok, Prachinburi 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

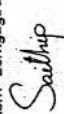
Cert.No.:24CHO499/1
Page: 1 of 3

This Certificate was issued to replace to the Certificate No. 24CHO499

Equipment : Spectrophotometer
Manufacturer : Merck
Model : Pro 100
Serial No. : 2317117261
ID No. : LAB-ST-003

Condition As-Received: Used Item
Received Date : 25 September 2024
Calibration Date : 25 September 2024
Reference : 2409-07900C-1
Submitted by : Vcare Environment Services Co.,Ltd
1/25 Soi Suphaphong 3 Yek 8,
Nongbon, Pravech, Bangkok 10250
IC Room
Calibration Place :
Ambient Temperature : (25.4 to 25.4) °C (On-Site)
Relative Humidity : (56.2 to 48.5) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01

Calibrated by : Warakorn Lemgagrakul

Approved by :

Approved Signatory

() Unnophol Harachai
() Ponpan Palpim
(✓) Sathip Meangmai

Issue Date : 2 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Cert. No. : 24CHO499/1
Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :
- | Material | Serial No. | Certificate No. | Due date |
|----------------------------|------------|-----------------|-------------|
| 1. Absorbance Standard set | 44487 | 122584 | 31 May 2026 |
| 2. Wavelength Standard set | 29829 | 114509 | 11 Sep 2025 |
| 3. Wavelength Standard set | 29829 | 114510 | 11 Sep 2025 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Unit maintained through :
- Starna Scientific Ltd.
4. Spectral Bandwidth : 4 nm
Scan Speed : nm/min

Calibration Results : without adjustment

Wavelength Accuracy of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor k
334.22	334.2	0.13	2.00
418.48	418.1	0.13	2.00
536.90	536.7	0.13	2.00
637.94	637.9	0.14	2.00
740.27	740.2	0.14	2.00



Cert. No.: 24CHO489/1

Page: 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement ($\pm$ Abs)	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5598	0.561	0.0028	2.00
	0.7037	0.705	0.0028	2.00
	1.0013	1.001	0.0029	2.00
485.0	Zero	0.000	0.0028	2.00
	0.5222	0.524	0.0028	2.00
	0.6646	0.666	0.0028	2.00
	0.9444	0.944	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5234	0.524	0.0028	2.00
	0.7007	0.701	0.0028	2.00
	0.9992	0.998	0.0028	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5573	0.558	0.0028	2.00
	0.7760	0.776	0.0028	2.00
	1.1104	1.108	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5648	0.565	0.0028	2.00
	0.7654	0.765	0.0028	2.00
	1.0961	1.094	0.0029	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

- UUC = Unit Under Calibration

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

-o0o-

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : Vcare Environment Services Co., Ltd.

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Tetedyne - API

MODEL : T300

SERIAL NO : 3631

STANDARD GAS CONCENTRATION (PPM) : 808.9

CYLINDER NO : CC739972

CYLINDER PRESSURE (psig) : 900

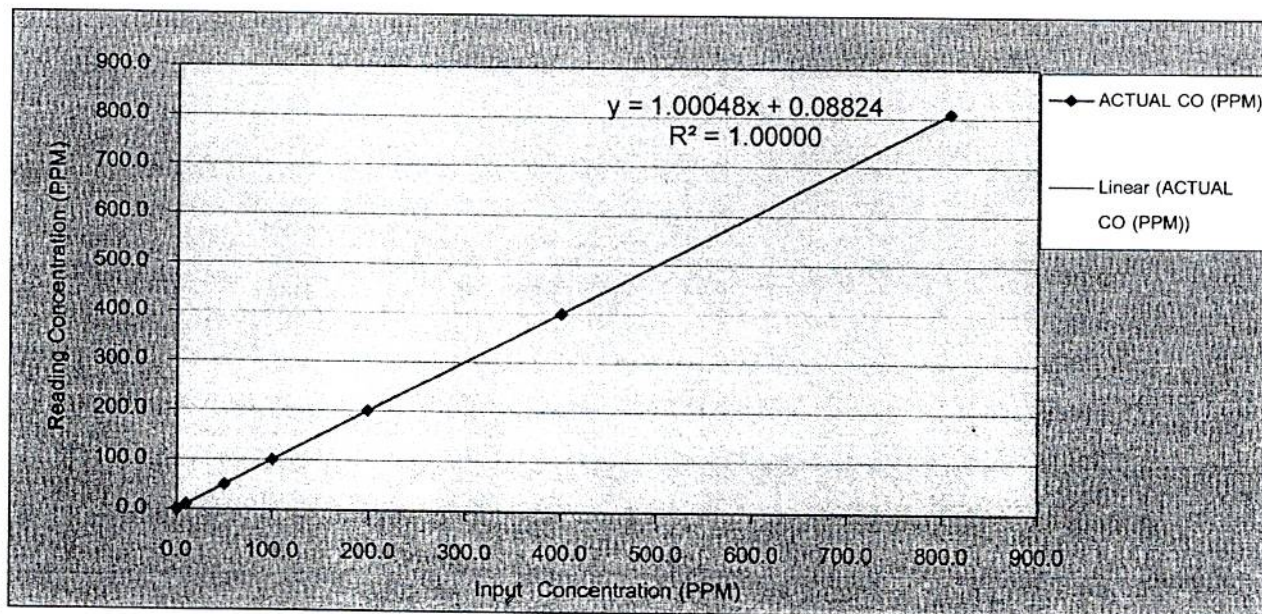
CERTIFIED DATE : Nov 05, 2020

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 05, 2028

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.00	0.00	0.00	-
1	10.00	9.95	-0.05	-0.50
2	50.00	50.10	0.10	0.20
3	100.00	100.15	0.15	0.15
4	199.20	200.21	1.01	0.51
5	400.60	400.10	-0.50	-0.12
6	808.90	809.56	0.66	0.08
AVERAGE (%)				0.26



CALIBRATED BY : คุณ ธนาคม มหาอาจ

DATE : 25 กรกฎาคม 2567

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์: 02-515-8987



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : Vcare Environment Services Co., Ltd.

วันที่ : 25 กรกฎาคม 2567

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 3631

TEST VALUES			
	API MODEL T300	BEFORE	AFTER
1	RANGE 1 - 1000 PPM	50.0	50.0
2	STABILITY ≤ 1 PPM	0.08	0.00
3	CO MEASURE 2500 - 4800 mV	3595.5	3586
4	CO REFERENCE 2000 - 4800 mV	2953.1	2945
5	MR RATION 1.1 ± 1.3	1.227	1.227
6	PRESEEURE 25 - 35 in - Hg-A	28.3	28.2
7	SAMPLE FLOW $800 \pm 10\%$ cc/min	789.3	760
8	SAMPLE TEMP 48 ± 4 °C	46	47.1
9	BENCH TEMP 48 ± 2 °C	48	48
10	WHEEL TEMP 68 ± 2 °C	68	68
11	BOX TEMP AMBIENT ± 5 °C	34	34.5
12	CO SLOPE 1.0 ± 0.3	0.905	0.885
13	CO OFFSET 0.0 ± 0.3	0.014	0.016
14	CO READING (AMBIENT) PPM	-0.48	0.21
15	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.23 / 12.23 / 16.47 / -15.09	5.25 / 12.23 / 16.47 / -15.09
16	ZERO GAS 0.00 PPM	-0.48	0.00
17	SPAN GAS 400.6 PPM	405.51	400.10

หมายเหตุ

- ทำการเปลี่ยน O-ring 2 ชิ้น , Spring 1 ชิ้น , Sintered Filter 1 ชิ้น, Filter 47 mm.1 แผ่น
- ทำการ Calibrate Multi-Point

(คุณธนาคม มหาอาจ)

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณธนาคม มหาอาจ

โทรศัพท์ : 0-2515-8987

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

สอบเทียบเครื่องมือเก็บตัวอย่างอากาศจากปล่องระบาย
[Calibration of Emission from stationary source]

Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #:	XC-572-V
Serial #:	0708053 (No.1)
DGM Model #:	SK25EX
DGM Serial #:	00006301

Calibration Conditions

Bar. Pressure (mm Hg):	758.7
Ambient Temperature (°C):	25.9
Relative Humidity (%):	65
Altitude (m):	1.50
Bar. Pressure Corr. (mm Hg):	758.6

Calibration Reference

Work No.:	SVO39297
Calibration No.:	SA2025-001

Reference Equipment

WTM Model:	W-NK-5B
Serial No.:	546321
Cal.Due	21-Mar-25
Thermometer:	FLUKE714
Serial No.:	9038005

Judgment : **Pass** According to note :

Factors/Conversions

Std. Temp. (K):	298.15
Std. Press. (mm Hg):	760
K ₁ (K/mm Hg):	0.3923

UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Volume			Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Reference Meter (WTM)			Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Total	Initial	Final
Θ	P _{m(g)}	V _m	V _{mf}	V _m	t _{mf}	t _{mf}	P _w	V _{mf}	V _{mf}	V _w	t _{wf}	t _{wf}
900	13.00	2343973.6	2344134.8	161.2	25.0	26.0	-1.8	495838.31	495997.68	159.4	26.2	26.1
600	25.00	2344145.3	2344301.9	156.6	26.0	26.0	-2.2	496008.12	496163.28	155.2	26.1	26.0
480	50.00	2344314.8	2344492.2	177.4	26.0	26.0	-3.0	496176.15	496352.61	176.5	26.0	26.0
420	80.00	2344505.2	2344702.4	197.2	26.0	26.0	-4.2	496365.44	496562.20	196.8	26.0	26.0
300	120.00	2344715.0	2344886.5	171.5	26.0	26.0	-5.6	496574.56	496746.75	172.2	26.0	26.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH @	Variance
V _{w(Std)}	Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH @	ΔΔH @
159.46	10.63	160.83	10.6	0.9915	-0.0001	53.3	4.674
155.15	15.51	156.16	15.5	0.9935	0.0019	48.0	-0.624
176.13	22.02	177.33	22.0	0.9932	0.0016	47.6	-1.022
195.80	27.97	197.69	28.0	0.9904	-0.0012	47.1	-1.588
170.76	34.15	172.59	34.2	0.9894	-0.0022	47.2	-1.440
				0.9916	= Y Avg.	48.7	= ΔH @ Avg. (Metric)

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

Note 2 : For ΔH_g, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Calibrator :

VAEROJN RUANGARAM

Signature :

Vaevo

Date :

17/Jan/25

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

Revised : 20230103

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

บริษัท สิทิพอร์นแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

SITHIPHORN
Calibration No.: **SA2025-001**

UUT Meter / Console Information

Model #: XC 572-V Serial number: 0708053 (No.1)
DGM Model #: SK25EX Serial number: 00006301

Check the Diagnosis

Check the system before calibrating.

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

Nomenclature

Pb - Barometric Pressure
DGM - Dry Gas Meter
K₁ - Constant based on standard temp and press
Θ - Run time, in minutes
P_m - ΔH (Meter Pressure, gauge)
V_m - Volume collected by test meter, corrected for STP
Q_{m(std)} - Calculated flow rate of test meter
K' - Critical orifice coefficient
P_w - Measured pressure of reference meter
t_w - Temperature measured in reference meter
t_m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice

Equations

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

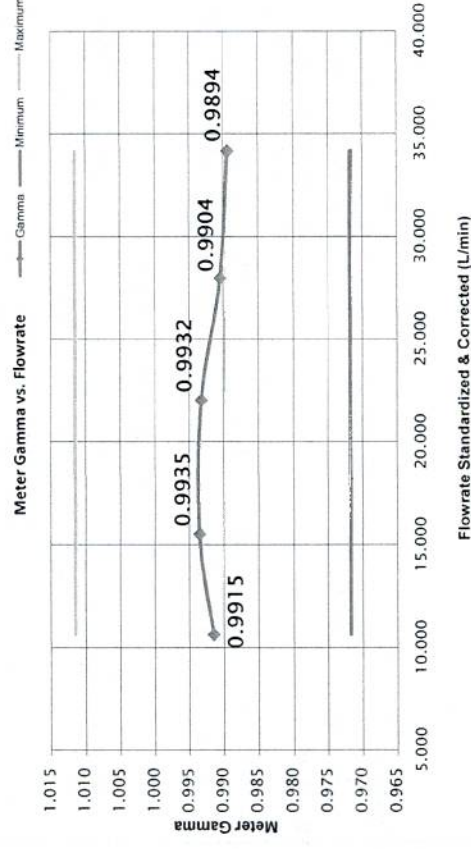
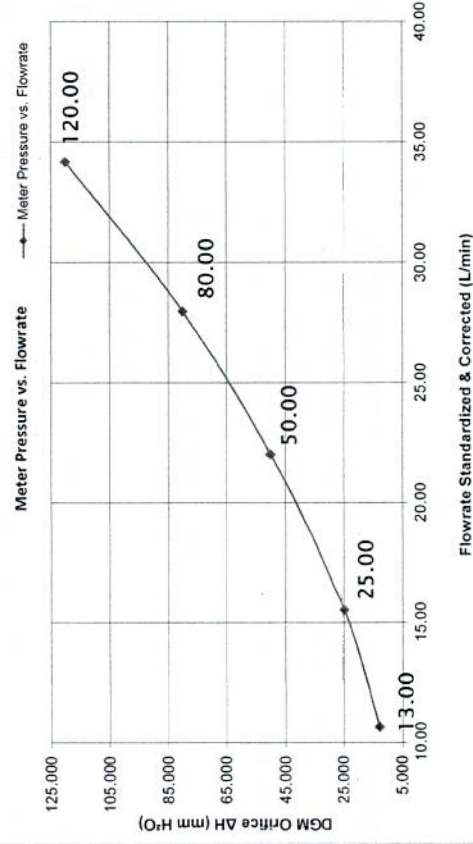
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{w(o)}}{13.6})}{K_1 V_m (P_{bar} + \frac{T_{wH}}{13.6})}$$

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

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

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.0011636 * (P_{bar} + \frac{P_{w(o)}}{13.6}) * (\frac{T_w * \Theta}{V_w * P_{bar}})^2}{T_m}$$

Calibration Graphs



Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

page: 1/1

Console Information

Model #: XC-572-V
Serial #: 0708053 (No.1)
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 758.70
Humidity (%): 65
Tamb (°C): 25.9
Elevation (m): 1.5
Corr. Pbar (mm. Hg): 758.70

Calibration Reference

Calibration No.: SA2025-001
Work No.: SVO39297
Reference Devices
TC Calibrator Model: FLUKE 714
Serial No.: 9038005

Temperature Sensors Calibration Data

Reference Temp. Point	Test Thermocouple Calibrations						Reference Point Status ¹
	Aux	Stack	Probe	Oven	Filler	Exit	
1	-18	-17	-17		°C	°C	Pass/Fail
2	38	38	38	38	°C	°C	PASS
3	93	94	94	94	°C	°C	PASS
4	149	150	150	150	°C	°C	PASS
5	260	261	261	261	°C	°C	PASS
6	371	373			°C	°C	PASS
7	482	487			°C	°C	PASS
8	593	596			°C	°C	PASS
9	816	821			°C	°C	PASS
10	1038	1047			°C	°C	PASS
Overall Audit Status							PASS

DGM Temperature Sensor

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	ΔT _{dev}	Maximum	Reference Status ² (±1%)
#	°C	°C	%	%	Pass/Fail
Ice Water	0.3	0	0.11%	0.11%	PASS
Ambient	25.9	26	0.02%		

Temperature Controller

Heater Controller	Reference Measure (μ)	Deviated to set point	ΔT _{dev}	Temp. Controller Status ³
120 °C	°C	°C	°C	Pass/Fail
Probe	124.3	126	-2	0.43%
Oven	122.7	125	-2	0.58%

Notes

- ¹ Suggested, minimum reference points are 500, 750, 1000, 1500, 1900, 2300, 2700, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500, 7000, 7500, 8000, 8500, 9000, 9500, 10000, 11000, 12000, 13000, 14000, 15000, 16000, 17000, 18000, 19000, 20000, 21000, 22000, 23000, 24000, 25000, 26000, 27000, 28000, 29000, 30000, 31000, 32000, 33000, 34000, 35000, 36000, 37000, 38000, 39000, 40000, 41000, 42000, 43000, 44000, 45000, 46000, 47000, 48000, 49000, 50000, 51000, 52000, 53000, 54000, 55000, 56000, 57000, 58000, 59000, 60000, 61000, 62000, 63000, 64000, 65000, 66000, 67000, 68000, 69000, 70000, 71000, 72000, 73000, 74000, 75000, 76000, 77000, 78000, 79000, 80000, 81000, 82000, 83000, 84000, 85000, 86000, 87000, 88000, 89000, 90000, 91000, 92000, 93000, 94000, 95000, 96000, 97000, 98000, 99000, 100000, 101000, 102000, 103000, 104000, 105000, 106000, 107000, 108000, 109000, 110000, 111000, 112000, 113000, 114000, 115000, 116000, 117000, 118000, 119000, 120000, 121000, 122000, 123000, 124000, 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Nozzle Calibration

Nozzle Information		Calibration Conditions		Calibration Reference	
Manufacturer	Apex	Bar. Pressure (mm Hg):	758.7	Calibration No.:	SA2025-001
Type	Stainless Steel	Ambient Temperature (°C):	25.9	Work No.:	SVO39297
Identification	1	Relative Humidity (%):	65	Units:	Metric

Reference Equipment:
Vernier, 0-250mm 0.01 mm increments model Mitutoyo

Serial No
3038570

Cal No.:
L2023/0355-0001

Cal due:
15/Mar/25

Calibration Method

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

ID No.	Sizes measured every 60° nozzle			(D ₁ + D ₂ + D ₃) / 3		Judgment
	mm.	D ₁	D ₂	D ₃	D _{avg}	
4	3.1	3.23	3.25	3.23	3.237	PASS
6	4.6	4.58	4.59	4.59	4.587	PASS
8	6.2	6.27	6.24	6.25	6.253	PASS
10	7.8	7.77	7.76	7.80	7.777	PASS
12	9.4	9.51	9.51	9.50	9.507	PASS
14	10.9	10.97	11.00	10.99	10.987	PASS
16	12.6	12.61	12.59	12.64	12.613	PASS

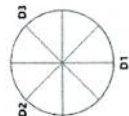
Where :

D₁, D₂, D₃ = There difference nozzle diameters at 60 degrees to each other,

each measured to the nearest 0.025 mm or 0.001 inch

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

D_{avg} = (D₁ + D₂ + D₃) / 3



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Signature: V. Vongh

Date: 17/Jan/25

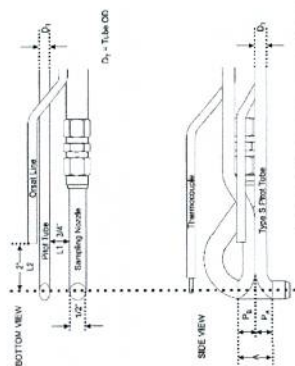
Sampling Probe and Pitot validation

Sampling Probe Information		Calibration Conditions		Calibration Reference	
Manufacturer:	Apex	Bar. Pressure (mm Hg):	758.7	Calibration No.:	SA2025-001
Probe Type:	SS, 3/8	Ambient Temperature (°C):	25.9	Work No.:	SVO39297
Probe No.:	-	Relative Humidity (%):	65	Reference Devices	
Pitot tube Type:	S Type 3/8 Inc.			- Vernier, 0-250mm 0.01 mm increments	
Pitot tube No.:	A9301	Units:	Metric	Model: Mitutoyo ID No. EPD1-VER-57-1-CEN-01	

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

Sampling Probe Validation with Tune up

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



Measured	Acceptance Standard
L ₁ = 15.33 mm	(19.05 mm. or 0.75 in.)
L ₂ = 44.84 mm	(50.8 mm. or 2.0 in.)
D ₁ = 9.52 mm	(9.525 mm., 0.375 in.)
A = 22.12 mm	(2.1 D ₁ ≤ A ≤ 3D ₁)
A/2D ₁ = 1.162 mm	(1.05 P _A / D ₁ ≤ A ≤ 1.5)

Pitot Tube Validations and Engles measurement Result

g: Measure results after maintenance and adjustments.

P _g Size	Acceptance of correctness
α ₁ = 1.50 °	≤ 10°
β ₁ = 2.65 °	≤ 5°
P _A Size	Acceptance of correctness
α ₂ = 1.15 °	≤ 10°
β ₂ = 1.05 °	≤ 5°

Engles measurement	Calculated Result	Acceptance Criteria
W = 1.35 °	0.574 mm	W < 0.0794 mm. (0.03125 in)
Z = 2.15 °	0.830 mm	Z < 3.175 mm. (0.125 in.)

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

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Signature: V. Vongh

Date: 17/Jan/25

UUT Meter Console Information

Model #:	XC-572-V
Serial #:	1209052 (No.2)
DGM Model #:	SK25EX
DGM Serial #:	00003229

Calibration Conditions

Bar. Pressure (mm Hg):	758.7
Ambient Temperature (°C):	25.4
Relative Humidity (%):	65
Altitude (m):	1.50
Bar. Pressure Corr. (mm Hg):	758.6

Calibration Reference

Work No.:	SVO39297
Calibration No.:	SA2025001
Reference Equipment	
WTM Model:	W-NK-5B
Serial No.:	546321
* Cal.Due	21-Mar-25
Thermometer:	FLUKE714
Serial No.:	9038005

Judgment: **Pass** According to note:

Factors/Conversions

Std. Temp. (K):	298.15
Std. Press. (mm Hg):	760
K ₁ (K/mm Hg):	0.3923

UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Volume			Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Reference Meter (WTM)		
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Outlet Temperature (°C)
Θ	P _{mig}	V _m	V _{mf}	V _m	t _{mi}	t _{mf}	P _w	V _{mi}	V _{mf}	t _{wt}
900	13.00	2933438.5	2933602.3	163.8	26.0	27.0	-1.4	485512.02	485677.40	26.1
600	25.00	2933621.3	2933775.8	154.5	27.0	27.0	-2.0	485699.01	485853.99	26.0
480	50.00	2933787.3	2933970.8	183.5	27.0	27.0	-3.2	485865.35	486047.65	26.0
420	80.00	2933981.1	2934186.0	204.9	27.0	28.0	-4.6	486057.91	486260.19	26.0
300	120.00	2934338.3	2934518.4	180.1	28.0	28.0	-5.2	486410.10	486589.97	25.9

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH @	Variance
V _{w(Std)}	Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH @	ΔΔH @
165.69	11.05	162.88	11.0	1.0173	0.0177	49.3	3.521
155.07	15.51	153.55	15.5	1.0099	0.0103	48.0	2.162
181.86	22.73	182.82	22.7	0.9948	-0.0048	44.5	-1.323
201.13	28.73	204.39	28.7	0.9841	-0.0156	44.3	-1.508
178.61	35.72	180.04	35.7	0.9920	-0.0076	43.0	-2.852
				0.9996	= Y Avg.	45.8	= ΔH @ Avg. (Metric)

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

Note2: For ΔH_g, orifice pressure differential that equates to 0.0212 m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H₂O.

Calibrator: VAEROJN RUANGARAM

Date: 17/Jan/25

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SITHIPHORN ASSOCIATES COMPANY LIMITED

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

Revised: 20230103

Sithiporn Associate Co., Ltd

Environmental / Hygiene Department (ENV)

Web site: www.sithiphorn.com

E-mail: service2-env@sithiphorn.com

Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Calibration No.: SA2025001

UUT Meter / Console Information

Model #: XC 572-V Serial number: 1209052 (No.2)
DGM Model #: SK25EX Serial number: 00003229

Check the Diagnosis

Check the system before calibrating.

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

Nomenclature

Pb - Barometric Pressure
DGM - Dry Gas Meter
K₁ - Constant based on standard temp and press
Θ - Run time, in minutes
P_m - ΔH (Meter Pressure, gauge)
V_m - Volume collected by test meter, corrected for STP
Q_{m(test)} - Calculated flow rate of test meter
K' - Critical orifice coefficient
P_w - Measured pressure of reference meter
t_w - Temperature measured in reference meter
t_m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice

Equations

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

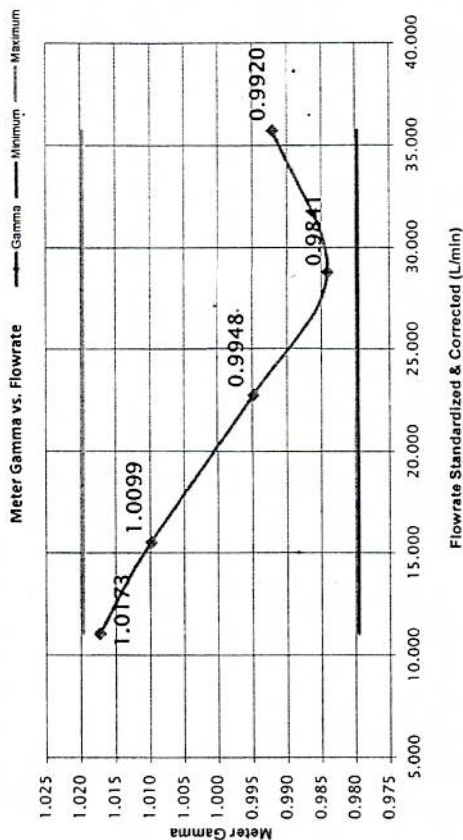
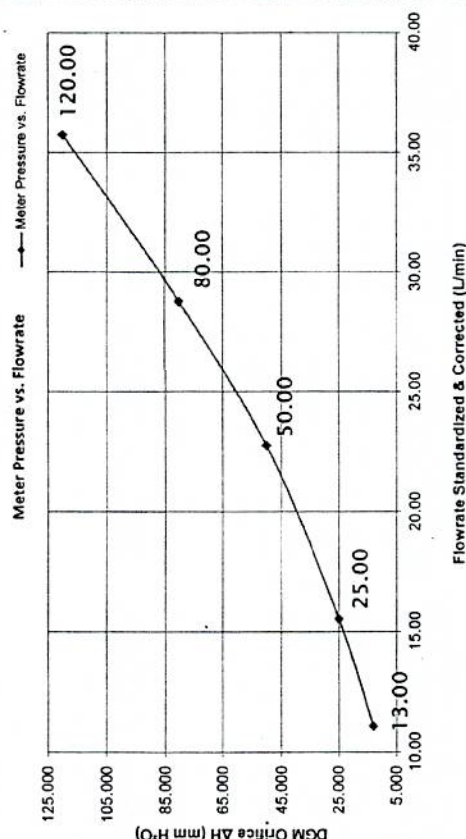
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$$

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

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

$$Metric \Delta H_n = \frac{P_{m(g)} * 0.0011986 * (P_{bar} + \frac{P_{m(g)}}{13.6}) * (\frac{T_w * \Theta}{V_w * P_{bar}})^2}{T_m}$$

Calibration Graphs



Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

page: 1/1

Console Information

Model #: XC-572-V

Serial #: 1209052 (No.2)

Units: Metric

Calibration Conditions

Pbar (mm. Hg): 758.70

Humidity (%): 65

Temp (°C): 25.4

Elevation (m): 1.5

Calibration Reference

Calibration No.: SA2025001

Work No.: SVO39287

Reference Devices

TC Calibrator Model: FLUKE 714

Serial No.: 9038005

Calibration No.: SA2025001

Work No.: SVO39287

Reference Devices

TC Calibrator Model: FLUKE 714

Serial No.: 9038005

Digital Manometer Model: Dwyer DFGA-00

Serial No.: 721

Temperature Sensors Calibration Data

Reference Temp.		Test Thermocouple Calibrations					Reference Point Status ¹	
Point	°C	Aux	Stack	Probe	Oven	Filler	Exit	
1	-18	-17	-17	-17	-17	-17	-17	Pass/Fail
2	38	38	38	38	38	38	38	PASS
3	93	94	94	94	94	94	94	PASS
4	149	150	150	150	150	150	150	PASS
5	260	260	260	260	260	260	260	PASS
6	371		375					PASS
7	482		487					PASS
8	503		508					PASS
9	816		826					PASS
10	1038		1048					PASS
Acceptance criteria: 1.50% 3.0°C/3.4°F 1.0°C/1.8°F								General Audit Status
								PASS

DGM Temperature Sensor

Ref Point	Reference Temp.	°C	DGM Thermocouple Sensor Reading	ΔT _{max}	Maximum	Reference Status ¹ (±1%)
Ice Water	0.3	°C	0	0.11%	%	Pass/Fail
Ambient	25.4	°C	25	0.08%	0.11%	PASS

Temperature Controller

Heater Controller	Reference Measure	XC-572-V Thermometer	Deviated to set point	ΔT _{max} ±3%	Temp. Controller Status ³
Set point	(μ)	°C	°C	°C	Pass/Fail
120 °C		121	1	0.13%	PASS
Probe	121.5	122	-2	0.48%	PASS
Oven	120.2				PASS

Notes

¹ Suggested, minimum reference points are 10, 100, 200, 300, 500, 700, 900, 1100, 1300, 1500 °F, can test for more² For valid test results, the maximum difference between last and reference readings should be temperature from the reference reading and the last thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7 & 6.1.1.8)³ Heater control acceptance limit: Temperature can be maintained at 120 °C ±1 °C, ±0.7% within ±1.5% at a flow rate of 20 gpm.บริษัท สิทธีพรเอโซเซียส จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Signature: V (SVO39287)

Date: 17/Jan/25

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

Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572-V

Serial #: 1209052 (No.2)

Units: Metric

Calibration Conditions

Pbar (mm. Hg): 30.00

Humidity (%): 65%

Amb. Temp. (°C): 25.4

Altitude (m): 100.0

Calibration No.: SA2025001

Work No.: SVO39287

Reference Devices

TC Calibrator Model: FLUKE 714

Serial No.: 9038005

Digital Manometer Model: Dwyer DFGA-00

Serial No.: 721

Audit Data

Reference Point		Console Thermocouple Audit					Reference Point Status ¹	
#	°C	Aux	Stack	Probe	Oven	Filler	Exit	
1	26.5	27	27	27	27	27	27	Pass/Fail
Acceptance criteria: 1.50% 3.0°C/3.4°F 1.0°C/1.8°F								PASS

Reference Thermocouple ID: 90728323

Ref Point	Reference Temp.	°C	DGM Thermocouple Sensor Reading	ΔT _{max}	Maximum	Reference Status ¹ (±1%)
Ice Water	0.3	°C	0	0.11%	%	Pass/Fail
Ambient	25.4	°C	25	0.08%	0.11%	PASS

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

Reference Point		Console Vacuum Audit		Reference Point Status ¹	
#	mm. Hg	Reference Vacuum	Console Vacuum	mm. Hg	Pass/Fail
1	26.42	26.00	26.00	26.00	PASS

Notes

¹ For valid test results, the maximum difference between last and reference readings should be temperature from the reference reading and the last thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7 & 6.1.1.8)² For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (13.3 mm Hg)บริษัท สิทธีพรเอโซเซียส จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Signature: V (SVO39287)

Date: 17/Jan/25

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

Nozzle Calibration

Nozzle Information		Calibration Conditions		Calibration Reference
Manufacturer	Apex	Bar. Pressure (mm Hg):	758.7	Calibration No.: SA2025001
Type	Stainless Steel	Ambient Temperature (°C):	25.4	Work No.: SVC039297
Identification	2	Relative Humidity (%):	65	Units: Metric

Reference Equipment

Vernier 0-250mm 0.01 mm increments model Mitutoyo

Cal No.:

L202310355-0001

Cal due:

15/Mar/25

Calibration Method

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

Calibration Result

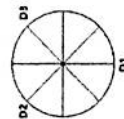
ID No.	Sizes		measured every 60° nozzle		$(D_1 + D_2 + D_3) / 3$		Judgment
	mm.		D_1	D_2	D_3	Davg	
4	3.1	3.14	3.14	3.11	3.130	3.130	PASS
6	4.6	4.58	4.54	4.56	4.560	4.560	PASS
8	6.2	6.27	6.28	6.28	6.277	6.277	PASS
10	7.8	7.80	7.77	7.78	7.783	7.783	PASS
12	9.4	9.49	9.52	9.48	9.487	9.487	PASS
14	10.9	10.97	11.00	10.99	10.987	10.987	PASS
16	12.6	12.63	12.63	12.62	12.627	12.627	PASS

Where:

D_1, D_2, D_3 = Three difference nozzle diameters at 60 degrees to each other, each measured to the nearest 0.025 mm or 0.001 inch

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

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



Signature

Veevoh

Date

17/Jan/25

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SITHIPORN ASSOCIATES COMPANY LIMITED

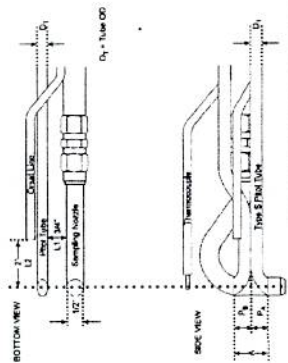
Sampling Probe and Pitot validation

Sampling Probe Information		Calibration Conditions		Calibration Reference
Manufacturer:	Apex	Bar. Pressure (mm Hg):	758.7	Calibration No.: SA2025001
Probe Type:	SS, 3ft	Ambient Temperature (°C):	25.4	Work No.: SVC039297
Probe No.:	S Type 3ft Inc.	Relative Humidity (%):	65	Reference Devices:
Pitot tube Type:	S Type 3ft Inc.			- Vernier 0-250mm 0.01 mm increments
Pitot tube No.:	A11034	Units:	Metric	Model Mitutoyo ID No. EPD1-VER-57-1-CEN-01

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

Sampling Probe Validation with Tune up

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



Measured	Acceptance Standard
$L_1 = 19.43$ mm	(19.05 mm. or 0.75 in.)
$L_2 = 43.67$ mm	(50.8 mm. or 2.0 in.)
$D_1 = 9.57$ mm	(9.525 mm., 0.375 in.)
$A = 21.23$ mm	(2.1 $D_1 \leq A \leq 3D_1$)
$A/2D_1 = 1.109$ mm	(1.05 $P_A / D_1 \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

□ : Measure results after maintenance and adjustments.

P_A Size	Acceptance of correctness
$\alpha_1 = 3.05^\circ$	$\leq 10^\circ$
$\beta_1 = 2.35^\circ$	$\leq 5^\circ$
P_A Size	Acceptance of correctness
$\alpha_2 = 1.55^\circ$	$\leq 10^\circ$
$\beta_2 = 1.20^\circ$	$\leq 5^\circ$

Engles measurement	Calculated Result	Acceptance Criteria
$W = 1.15^\circ$	0.454 mm	$W < 0.0794$ mm. (0.03125 in)
$Z = 1.40^\circ$	0.519 mm	$Z < 3.175$ mm. (0.125 in.)

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

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SITHIPORN ASSOCIATES COMPANY LIMITED

Signature

Veevoh

Date

17/Jan/25

สอบเทียบเครื่องมือตรวจวัดระดับความดังเสียง
[Calibration of Noise measurement]



TISTR

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0016 MTC No. EEL. BP. 34/1067

CALIBRATION CERTIFICATE

Submitted by : V Care Environment Services Co., Ltd.
Address : 1/29 Soi Suphaphong 3 Yek 8, Nongbon, Pravach, Bangkok, 10250.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Calibrator : $(23 \pm 3) ^\circ\text{C}$
Manufacturer : Tenuars : Relative Humidity : $(50 \pm 15) \%$
Model : TM-100 : Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$
Serial No. : 170603266

Standards used : 1. Digital Function Synthesizer NF Electronic DE-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2633526.

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

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

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

Date of Receipt : 10 Oct. 2024
Date of Calibration : 16 Oct. 2024

1/3

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FM.BLMTC.002 Rev.5

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Request No. 21-68/0016 MTC No. EEL. BP. 34/1067

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz
Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ$ C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	94.52	0.52	± 0.10	IEC60942:2003 Class 2 $\pm 0.75 \text{ dB}$

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	996.8	-3.2	± 1.5	IEC60942:2003 Class 2 $\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	2.05	± 0.50	IEC60942:2003 Class 2 $\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Oct. 2024

2/3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0016

MTC No. EEL. BP. 34/1067

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz
Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Briel&Kjaer 4180	114.58	0.58	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Briel&Kjaer 4180	991.5	-8.5	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Briel&Kjaer 4180	2.20	± 0.60	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Mr.
.....
(Mr. Weerachai Dechaiyae)

Approved by :



TISTR
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Oct. 2024

Date of Issue : 17 Oct. 2024

Ref : 2011267100903658001

End of Certificate

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FMBL/MTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL.BP. 51/0867

CALIBRATION CERTIFICATE

Submitted by : V Care Environment Services Co., Ltd.
Address : 1/29 Soi Suphaphong 3 Yek 8, Nongbon, Pravaach, Bangkok, 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Ambient Environment
Manufacturer	: Scarlet Tech	Temperature : $(23 \pm 3) ^\circ\text{C}$
Model	: ST-11D	Relative Humidity : $(50 \pm 15) \%$
Serial No.	: 820895	Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$
Microphone	: 82659	
Preamplifier	: -	

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 16 Aug. 2024

Date of Calibration : 17 Sep. 2024

1 / 9

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FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL.BP. 51/0867

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 17 Sep. 2024

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FM.BLMTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	94.0	94.0	0.0	0.7	0.48	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of -30.6 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32.5	0.10	N/A

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

Frequency Weighing	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	8.7	0.10	N/A
C-Weight	9.5	0.10	N/A
Flat	3.8	0.10	N/A

Date of Calibration : 17 Sep. 2024

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.4	0.6	0.5	±1.0	0.45	0.6
1 000	-0.3	-0.4	-0.4	±0.7	0.45	0.6
8 000	-0.6	-0.4	-0.5	+1.5 ; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	0.0	0.1	±1.0	0.20	0.6
125	-0.1	0.0	0.1	±1.0	0.20	0.6
250	-0.1	0.0	0.1	±1.0	0.20	0.6
500	-0.1	0.0	0.1	±1.0	0.20	0.6
1 000	0.0	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	0.0	±1.0	0.20	0.6
8 000	-0.1	-0.1	0.0	+1.5 ; -2.5	0.20	0.7
16 000	-5.2	-5.2	0.1	+2.5 ; -16.0	0.20	1.0

Date of Calibration : 17 Sep. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL. BP. 51/0867

5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.1	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 17 Sep. 2024

5 / 9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL. BP. 51/0867

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
124	123.9	-0.1	0.8	0.40	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.1	0.1	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.1	0.1	0.8	0.30	0.3
74	74.1	0.1	0.8	0.30	0.3
69	69.1	0.1	0.8	0.30	0.3
64	64.0	0.0	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3

Date of Calibration : 17 Sep. 2024

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Office/Laboratory 668 Mu 2 Tambon Bangpoornai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand Tel. (66) 0 2323 1672-80 ext. 115, 116 E-mail : mtca@tistr.or.th Website : www.tistr.or.th
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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	54.0	0.0	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	44.1	0.1	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	94.0	94.0	0.0	0.8	0.30	0.3
25-120	94.0	94.0	0.0	0.8	0.30	0.3

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	50	50.0	0.0	0.8	0.30	0.3
25-120	30	30.0	0.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tbm (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±0.5	0.20	0.3
	2	119.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	109.8	-0.2	+1.0; -3.0	0.20	0.3
Slow	200	129.6	0.0	±0.5	0.20	0.3
	2	110.0	0.0	+1.0; -3.0	0.20	0.3
	0.25	130.1	0.1	±0.5	0.20	0.3
SEL	2	110.1	0.1	+1.0; -1.5	0.20	0.3
	0.25	101.0	0.0	+1.0; -3.0	0.20	0.3

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Complete cycle	135.4	135.1	-0.3	2.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	1.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 1 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Positive one-half cycle	Negative one-half cycle				
140.8	140.8	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Begin	139.0				
End	139.0	0.0	0.1	0.10	0.1

Calibrated by :

Wittawat Supanich
(Mr. Wittawat Supanich)

Approved by :

Prawate Khuaypa
(Mrs. Prawate Khuaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Sep. 2024

Date of Issue : 20 Sep. 2024

Ref : 2011267081603049002

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL BP. 52/0867

CALIBRATION CERTIFICATE

Submitted by : V Care Environment Services Co., Ltd.
Address : 1/29 Soi Suphaphong 3 Yek 8, Nongbon, Pravach, Bangkok, 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	Ambient Environment
: Sound Level Meter	Temperature : (23 ± 3) °C
: Scarlet Tech	Relative Humidity : (50 ± 15) %
: ST-11ID	Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 16 Aug. 2024

Date of Calibration : 18 Sep. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL BP. 52/0867

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 18 Sep. 2024

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FN.BLMTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	94.0	94.0	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of -29.4 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
35.1	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	20.8	0.10	N/A
C-Weight	19.4	0.10	N/A
Flat	24.2	0.10	N/A

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.5	0.5	±1.0	0.45	0.6
1 000	-0.6	-0.6	±0.7	0.45	0.6
8 000	-0.5	-0.6	+1.5 ; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.1	0.1	±1.0	0.20	0.6
125	-0.1	0.0	±1.0	0.20	0.6
250	-0.1	0.0	±1.0	0.20	0.6
500	-0.1	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	±1.0	0.20	0.6
8 000	-0.1	-0.2	+1.5 ; -2.5	0.20	0.7
16 000	-5.7	-5.7	+2.5 ; -16.0	0.20	1.0

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5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.1	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
139	139.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	113.9	-0.1	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.0	0.0	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.0	0.0	0.8	0.30	0.3
74	74.0	0.0	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	64.0	0.0	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	54.1	0.1	0.8	0.30	0.3
49	49.4	0.4	0.8	0.30	0.3
44	45.2	1.2	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	94.0	94.0	0.0	0.8	0.30	0.3
25-120	94.0	94.0	0.0	0.8	0.30	0.3

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	50	50.0	0.0	0.8	0.30	0.3
25-120	30	30.0	0.0	0.8	0.30	0.3

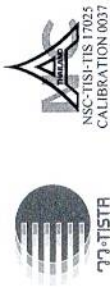
9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±0.5	0.20	0.3
	2	118.9	-0.1	+1.0; -1.5	0.20	0.3
	0.25	109.7	-0.3	+1.0; -3.0	0.20	0.3
Slow	200	129.6	0.0	±0.5	0.20	0.3
	2	110.0	0.0	+1.0; -3.0	0.20	0.3
	0.25	130.1	0.1	±0.5	0.20	0.3
SEL	2	110.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	100.9	-0.1	+1.0; -3.0	0.20	0.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL. BP. 52/0867

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.1	-0.3	2.0	0.20	0.35
Positive half cycle	134.4	134.3	-0.1	1.0	0.20	0.35
Negative half cycle	134.4	134.3	-0.1	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	141.4	0.0	1.5	0.20
141.4	141.4				

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.1	0.10	0.1
End	139.0				

Calibrated by : *Wittawat Supanich*
(Mr. Wittawat Supanich)

Approved by : *Prawate Khuayoo*
(Mr. Prawate Khuayoo)

Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Sep. 2024

Date of Issue : 20 Sep. 2024

Ref : 2011267081603049003

End of Certificate

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FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL. BP. 53/0867

CALIBRATION CERTIFICATE

Submitted by : V Care Environment Services Co., Ltd.
Address : 1/29 Soi Suphaphong 3 Yek 8, Nongbon, Pravach, Bangkok, 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Temperature	: (23 ± 3) °C
Manufacturer	: Scarlett Tech	Relative Humidity	: (50 ± 15) %
Model	: ST-11D	Ambient Pressure	: (101.325 ± 1.5) kPa
Serial No.	: 820897		
Microphone	: 59131		
Preamplifier	: -		

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 16 Aug. 2024

Date of Calibration : 19 Sep. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL. BP. 53/0867

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 19 Sep. 2024

2 / 9

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FM.BLMTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	94.0	94.0	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of -29.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
25.0	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	12.9	0.10	N/A
C-Weight	22.3	0.10	N/A
Flat	24.1	0.10	N/A

Date of Calibration : 19 Sep. 2024

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FM.BL.MTC.002 Rev.5

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.0	0.2	±1.0	0.45	0.6
1 000	0.1	0.0	±0.7	0.45	0.6
8 000	0.2	0.1	+1.5 ; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.0	±1.0	0.20	0.6
125	-0.1	0.0	±1.0	0.20	0.6
250	-0.1	0.0	±1.0	0.20	0.6
500	0.0	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	±1.0	0.20	0.6
8 000	-0.2	-0.2	+1.5 ; -2.5	0.20	0.7
16 000	-5.7	-5.7	+2.5 ; -16.0	0.20	1.0

Date of Calibration : 19 Sep. 2024

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5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.1	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 19 Sep. 2024

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
126	125.2	-0.8	0.8	0.30	0.3
125	124.4	-0.6	0.8	0.30	0.3
124	123.5	-0.5	0.8	0.30	0.3
119	118.9	-0.1	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.0	0.0	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.1	0.1	0.8	0.30	0.3
74	74.0	0.0	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	64.0	0.0	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3

Date of Calibration : 19 Sep. 2024

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	53.9	-0.1	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	44.1	0.1	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	94.0	94.0	0.0	0.8	0.30	0.3
25-120	94.0	94.0	0.0	0.8	0.30	0.3

Date of Calibration : 19 Sep. 2024

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	50	50.0	0.0	0.8	0.30	0.3
25-120	30	30.0	0.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	135.9	-0.1	+0.5	0.20	0.3
	2	118.9	-0.1	+1.0; -1.5	0.20	0.3
	0.25	109.8	-0.2	+1.0; -3.0	0.20	0.3
Slow	200	129.5	-0.1	+0.5	0.20	0.3
	2	110.0	0.0	+1.0; -3.0	0.20	0.3
	200	130.0	0.0	+0.5	0.20	0.3
SEL	2	110.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	100.9	-0.1	+1.0; -3.0	0.20	0.3

Date of Calibration : 19 Sep. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0592

MTC No. EEL BP. 53/0867

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.2	-0.2	2.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	1.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle	0.0	1.5	0.20	0.25
139.7	139.7				

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.1	0.10	0.1
End	139.0				

Calibrated by: *Wittawat Supanich*
(Mr. Wittawat Supanich)

Approved by: *Pravate Klutypa*
(Mr. Pravate Klutypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 19 Sep. 2024

Date of Issue : 23 Sep. 2024

Ref : 2011267081603049004

End of Certificate

9 / 9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0015

MTC No. EEL. BP. 33/1067

CALIBRATION CERTIFICATE

Submitted by

: V Care Environment Services Co., Ltd.

Address

: 1/29 Soi Suphaphong 3 Yek 8, Nongboon, Pravaeh, Bangkok, 10250

Calibrated at

: Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description : Sound Level Meter

: (23 ± 3) °C

Manufacturer : Scarlet Tech

Relative Humidity : (50 ± 15) %

Model : ST-11D

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No.

: 820898

Microphone

: 58918

Preamplifier

: -

Standards used :

1. Band Pass Filter Stamford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ardo AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
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6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt

: 9 Oct. 2024

Date of Calibration

: 11 Nov. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0015

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12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

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

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

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

Date of Calibration

: 11 Nov. 2024

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.99	94.0	94.0	0.0	0.7	0.48	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of -32.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.5	0.10	N/A

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

Frequency (Hz)	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	10.3	0.10	N/A
C-Weight	10.4	0.10	N/A
Flat	16.8	0.10	N/A

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	-0.3	-0.1	-0.1	±1.0	0.45	0.6
1 000	0.0	-0.1	-0.2	±0.7	0.45	0.6
8 000	0.0	0.0	0.1	+1.5 ; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-15.3	0.0	0.0	±1.0	0.20	0.6
125	-0.1	0.0	0.0	±1.0	0.20	0.6
250	-0.1	0.0	0.0	±1.0	0.20	0.6
500	-0.1	0.0	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	0.0	±1.0	0.20	0.6
8 000	-0.1	-0.1	0.0	+1.5 ; -2.5	0.20	0.7
16 000	-5.2	-5.3	0.0	+2.5 ; -16.0	0.20	1.0

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5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.1	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	93.9	-0.1	0.2	0.20	0.2
Flat	93.9	-0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
135	135.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.0	0.0	0.8	0.30	0.3
84	83.9	-0.1	0.8	0.30	0.3
79	79.0	0.0	0.8	0.30	0.3
74	74.0	0.0	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	63.9	-0.1	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	54.0	0.0	0.8	0.30	0.3
49	49.1	0.1	0.8	0.30	0.3
44	44.6	0.6	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	94.0	94.0	0.0	0.8	0.30	0.3
25-120	94.0	94.0	0.0	0.8	0.30	0.3

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
45-140	50	50.0	0.0	0.8	0.30	0.3
25-120	30	30.0	0.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±0.5	0.20	0.3
	2	118.7	-0.3	+1.0; -1.5	0.20	0.3
	0.25	109.9	-0.1	+1.0; -3.0	0.20	0.3
Slow	200	129.5	-0.1	±0.5	0.20	0.3
	2	109.9	-0.1	+1.0; -3.0	0.20	0.3
	0.25	109.9	-0.1	+1.0; -3.0	0.20	0.3
SEL	200	130.0	0.0	±0.5	0.20	0.3
	2	110.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	100.9	-0.1	+1.0; -3.0	0.20	0.3

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Request No. 21-68/0015

MTC No. EEL. BP. 33/1067

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Complete cycle	135.4	135.1	-0.3	2.0	0.20	0.35
Positive half cycle	134.4	134.3	-0.1	1.0	0.20	0.35
Negative half cycle	134.4	134.3	-0.1	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Positive one-half cycle	Negative one-half cycle	0.0	1.5	0.20	0.25
143.2	143.2				

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Begin	139.0	0.0	0.1	0.10	0.1
End	139.0				

Calibrated by :

Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by :



(Mr. Prawate Klunaypa)

Director

Electrical and Electronic Standards Laboratory

Date of Calibration : 11 Nov. 2024

Date of Issue : 11 Nov. 2024

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End of Certificate

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