

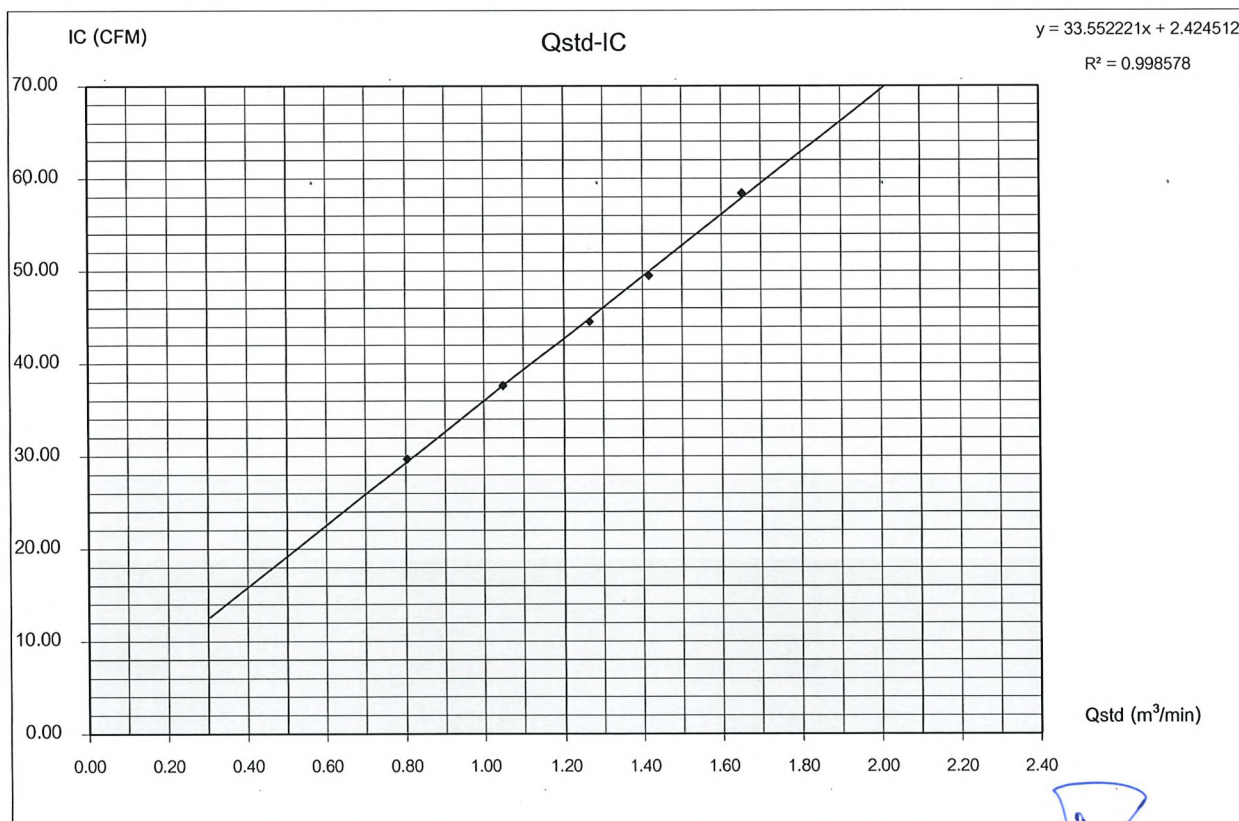
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104			Date	June 4, 2025
Sampler Location	A1 : บ้านเลขที่ 32/2 บ้านหนองยาง			Start Time	1:05 PM
Sampler Number	TSP No.A3	Transfer Standard Type	Orifice	Stop Time	1:15 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Somprasong Thetsakun
Motor Serial Number	704	Calibrator Serial Number	2912		
Recorder Serial Number	4651				

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)			[ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)] (m ³ /min)	ample Flow Rate Indicato (ft ³ /min)	IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	(^°K = ^°C+273)	Pressure (mmHg)	Meter	Meter
	Positive	Negative	ΔH ₂ O								
5	1.4	1.4	2.8	1.65618	0.80399	30.0	29.69	303.0	757.0		
7	2.4	2.4	4.8	2.16845	1.04926	38.0	37.61	303.0	757.0		
10	3.5	3.5	7.0	2.61865	1.26481	45.0	44.54	303.0	757.0		
13	4.4	4.4	8.8	2.93609	1.41679	50.0	49.49	303.0	757.0		
18	6.0	6.0	12.0	3.42861	1.65261	59.0	58.40	303.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0		
1	Slope (m)			2.08863	Linear Equation			r ²	0.998578	Pstd(mmHg)	760.0
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9992887	T _{NTP}	298.15
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98975586	

COMMENT

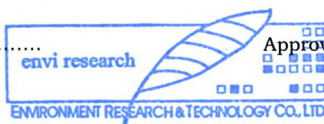
Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)

Technician



Approved By

(Mr. Panupon Podang)

Environmental Scientist

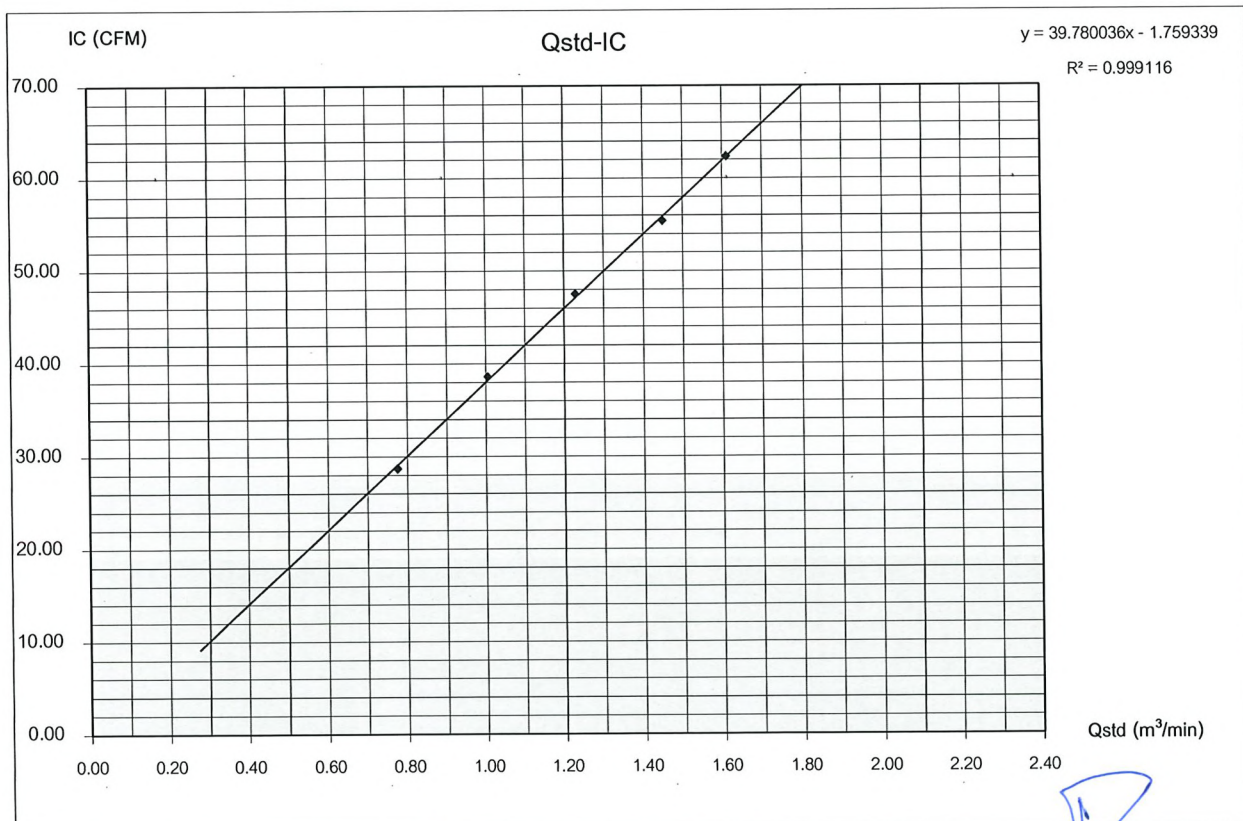
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104	Date	June 4, 2025
Sampler Location	A1 : บ้านเลขที่ 32/2 บ้านหนองยาง	Start Time	12:54 PM
Sampler Number	PM-10 No.13	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	B2012-01	Calibrator Serial Number	2912
Recorder Serial Number	4650	Calibrated By	Mr.Somprasong Thetsakun

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(ft ³ /min)					
5	1.3	1.3	2.6	1.59593	0.77515	29.0	28.70	303.0	757.0		
7	2.2	2.2	4.4	2.07613	1.00506	39.0	38.60	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.22846	48.0	47.51	303.0	757.0		
13	4.6	4.6	9.2	3.00208	1.44839	56.0	55.43	303.0	757.0		
18	5.7	5.7	11.4	3.34180	1.61104	63.0	62.35	303.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0		
1	Slope (m)			2.08863	Linear Equation			r^2	0.999116	Pstd(mmHg)	760.0
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9995579	T _{NTP}	298.0
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.989755586	

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician

Approved By

(Mr. Panupon Podang)
Environmental Scientist

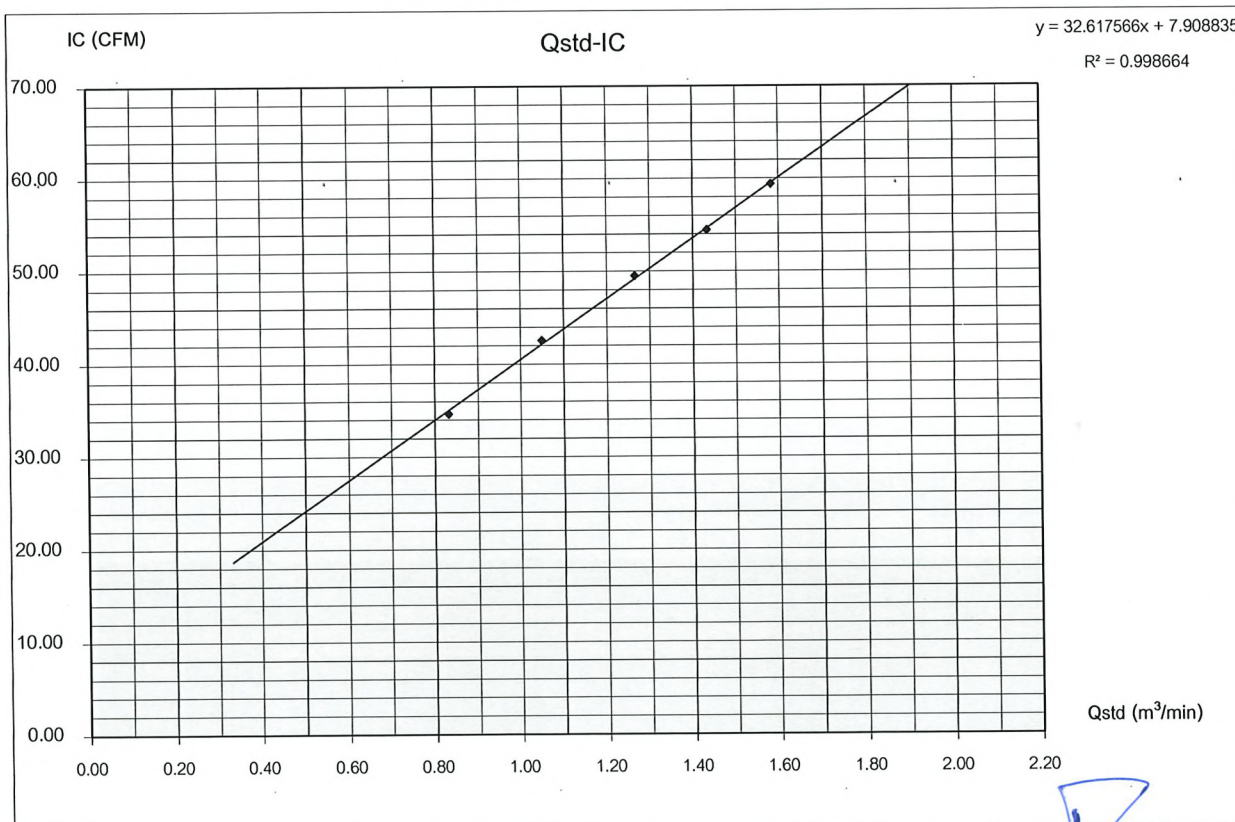
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104	Date	June 4, 2025
Sampler Location	A2 : บ้านห้วยไผ่หน้า หมู่ที่ 4	Start Time	4:39 PM
Sampler Number	TSP No.A25	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	2152	Calibrator Serial Number	2912
Recorder Serial Number	2411	Calibrated By	Mr.Somprasong Thetsakun

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (inH ₂ O)			[ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)]	ample Flow Rate Indicato	IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	("K = °C+273)	Pressure (mmHg)	Meter	Meter	
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(ft ³ /min)						
5	1.5	1.5	3.0	1.71431	0.83183	35.0	34.64	303.0	757.0			
7	2.4	2.4	4.8	2.16845	1.04926	43.0	42.56	303.0	757.0			
10	3.5	3.5	7.0	2.61865	1.26481	50.0	49.49	303.0	757.0			
13	4.5	4.5	9.0	2.96927	1.43268	55.0	54.44	303.0	757.0			
18	5.5	5.5	11.0	3.28265	1.58272	60.0	59.39	303.0	757.0			
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0			
1	Slope (m)			2.08863	Linear Equation			r ²	0.998664	Pstd(mmHg)	760.	
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9993318	T _{NTP}	298.	
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.989755586	

COMMENT

Andersen Instruments, Inc.



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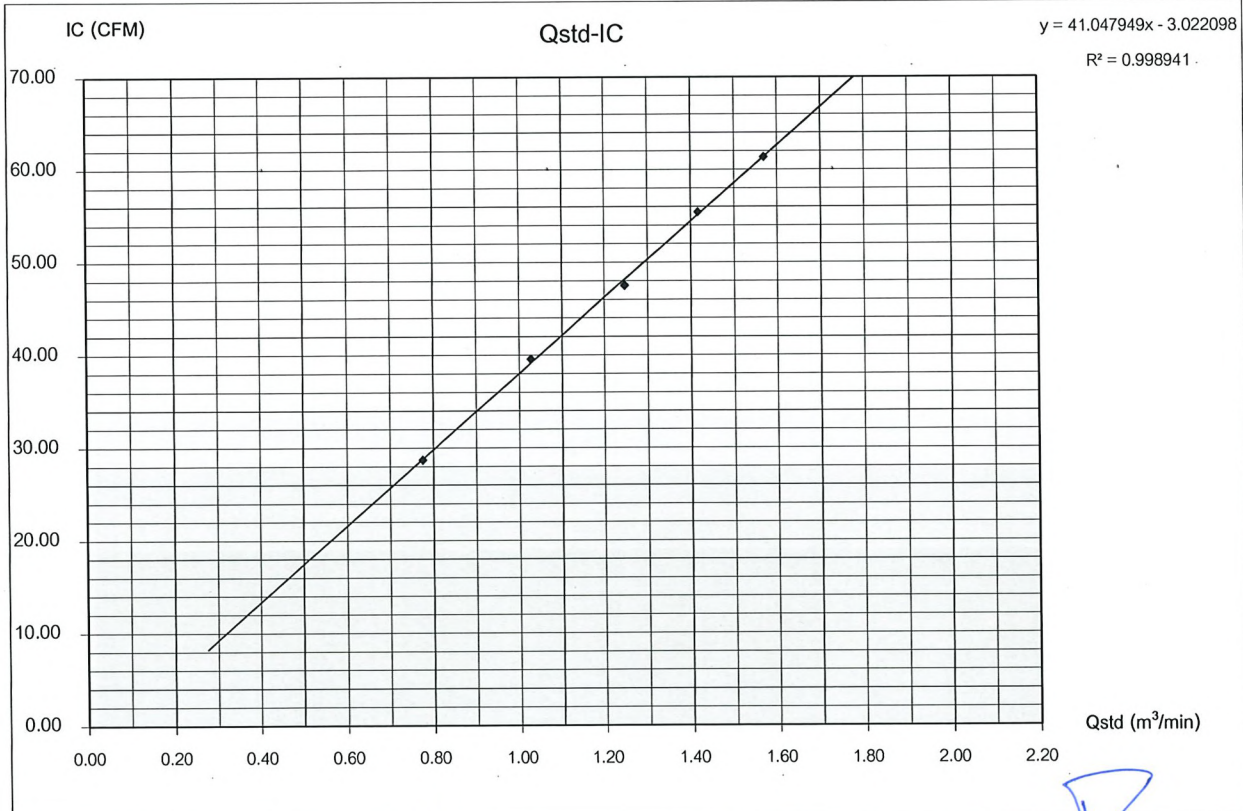
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104			Date	June 4, 2025
Sampler Location	A2 : บ้านห้วยไผ่เก่า หมู่ที่ 4			Start Time	4:50 PM
Sampler Number	PM-10 No.23	Transfer Standard Type	Orifice	Stop Time	5:00 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Somprasong Thetsakun
Motor Serial Number	2135	Calibrator Serial Number	2912		
Recorder Serial Number	2391				

Plate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (inH ₂ O)			[ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)] (m ³ /min)	Sample Flow Rate Indication (ft ³ /min)	IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	(°K = °C+273)	Pressure (mmHg)	Meter	Meter	
	Positive	Negative	ΔH ₂ O									
5	1.3	1.3	2.6	1.59593	0.77515	29.0	28.70	303.0	757.0			
7	2.3	2.3	4.6	2.12279	1.02740	40.0	39.59	303.0	757.0			
10	3.4	3.4	6.8	2.58097	1.24677	48.0	47.51	303.0	757.0			
13	4.4	4.4	8.8	2.93609	1.41679	56.0	55.43	303.0	757.0			
18	5.4	5.4	10.8	3.25267	1.56837	62.0	61.36	303.0	757.0			
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0			
1	Slope (m)			2.08863	Linear Equation			r ²	0.998941	Pstd(mmHg)	760.0	
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9994704	T _{NTP}	298.0	
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.989755586	

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician

Approved By

(Mr. Panupon Podang)
Environmental Scientist

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104			Date	June 4, 2025
Sampler Location	A3 : ศูนย์อนุรักษ์พันธุกรรม			Start Time	2:55 PM
Sampler Number	TSP No.A2	Transfer Standard Type	Orifice	Stop Time	3:05 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Somprasong Thetsakun
Motor Serial Number	6215-462	Calibrator Serial Number	2912		
Recorder Serial Number	4642				

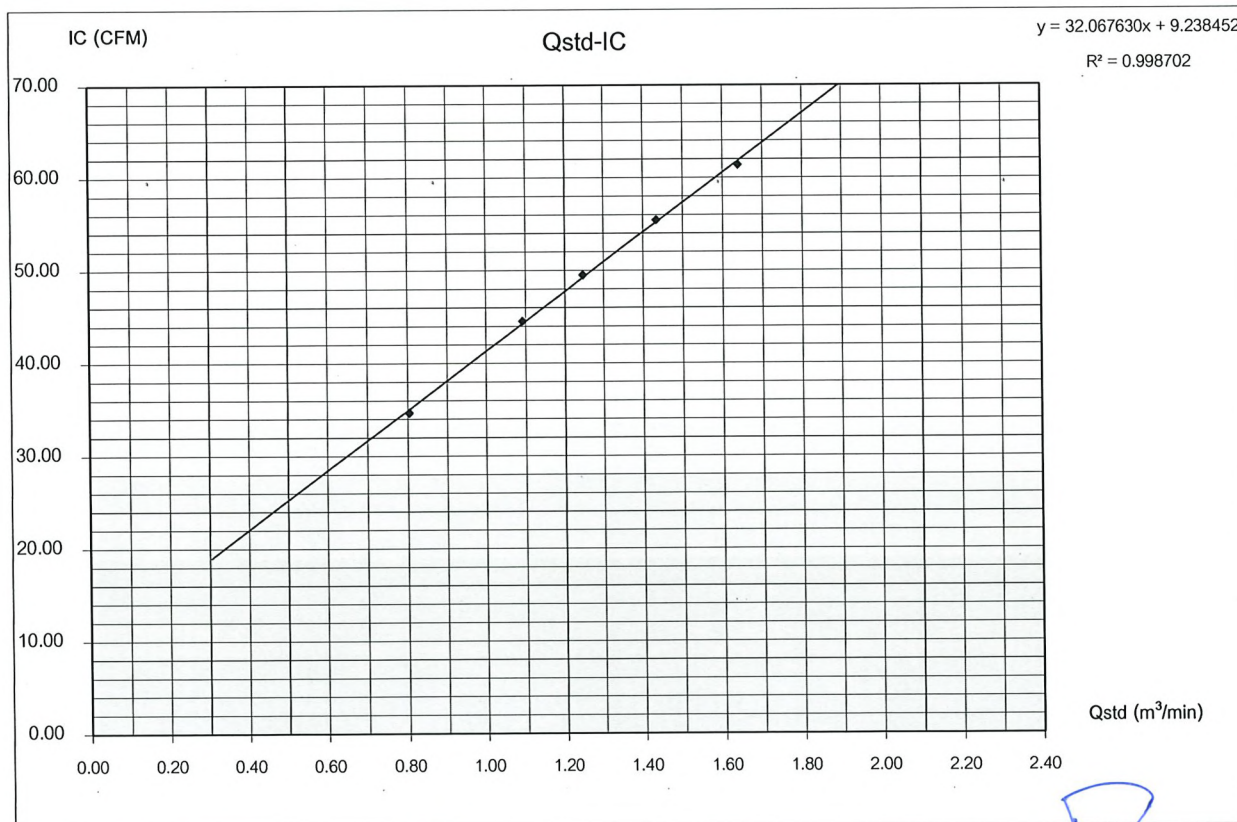
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (ft ³ /min)	$IC = \{[(Pa/P_{std})(T_{std}/Ta)]^{1/2}\}$ (°K = °C+273)		(mmHg)		
	Positive	Negative	ΔH ₂ O								
5	1.4	1.4	2.8	1.65618	0.80399	35.0	34.64	303.0	757.0		
7	2.6	2.6	5.2	2.25699	1.09165	45.0	44.54	303.0	757.0		
10	3.4	3.4	6.8	2.58097	1.24677	50.0	49.49	303.0	757.0		
13	4.5	4.5	9.0	2.96927	1.43268	56.0	55.43	303.0	757.0		
18	5.9	5.9	11.8	3.39992	1.63887	62.0	61.36	303.0	757.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	2.08863	Linear Equation		Average	303.0	757.0		
2	Intercept (b)	-0.02307	Set Point Flow Rate (X) (m ³ /min)	1.133	r ²	0.998702	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99990	Final Set Flow Rate = (I)	0	r	0.9993508	T _{HTP}	298.0	
Result							(Pa/Pstd)*(Tstd/Ta)	0.97961612	
							C=(Pa/Pstd)*(Tstd/Ta)^0.5	0.989755586	

COMMENT

Andersen Instruments, Inc.



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Technician



Approved By

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Environmental Scientist

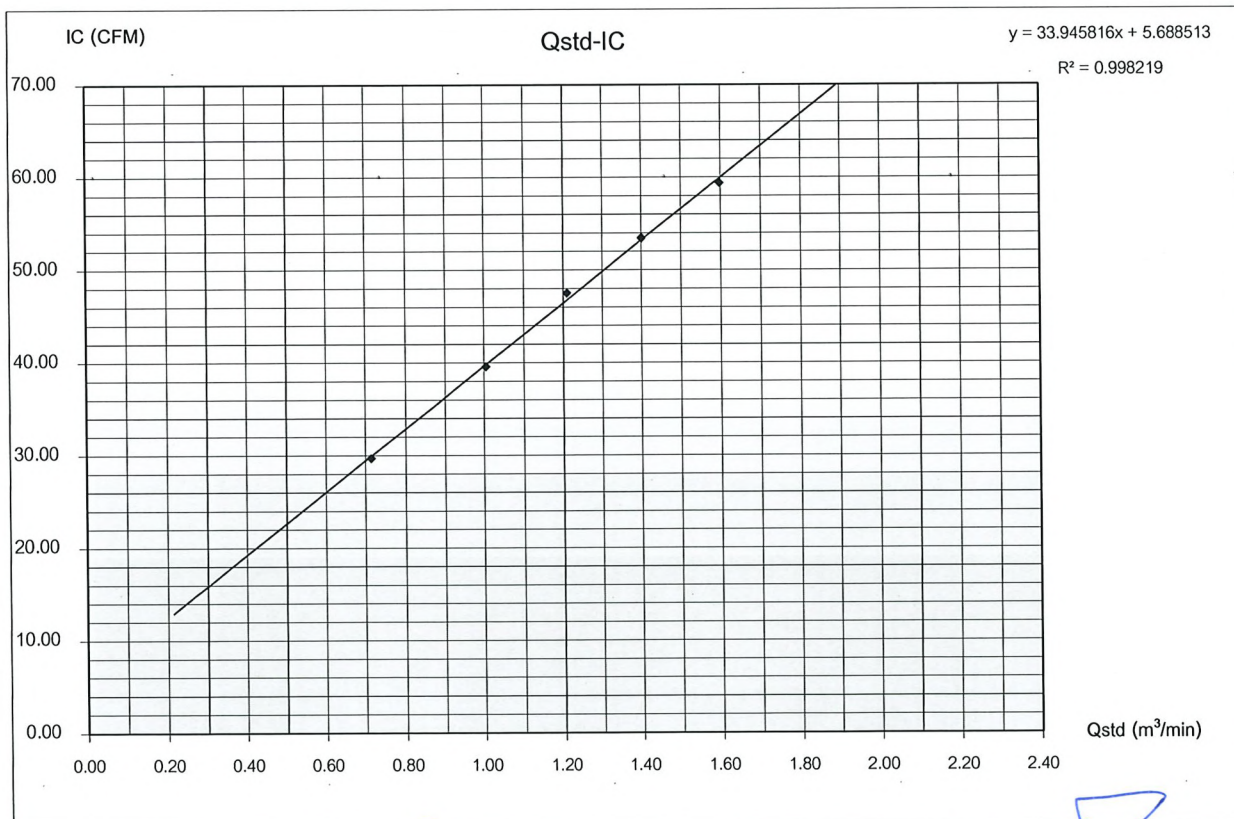
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104	Date	June 4, 2025
Sampler Location	A3 : ศูนย์อนุรักษ์พันธุ์ช้าง	Start Time	3:06 PM
Sampler Number	PM-10 No.12	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	B2012-10	Calibrator Serial Number	2912
Recorder Serial Number	4650	Calibrated By	Mr.Somprasong Thetsakun

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			[ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)] (m ³ /min)	ample Flow Rate Indicator (ft ³ /min)	IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	(^°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O								
5	1.1	1.1	2.2	1.46804	0.71392	30.0	29.69	303.0	757.0		
7	2.2	2.2	4.4	2.07613	1.00506	40.0	39.59	303.0	757.0		
10	3.2	3.2	6.4	2.50391	1.20987	48.0	47.51	303.0	757.0		
13	4.3	4.3	8.6	2.90253	1.40073	54.0	53.45	303.0	757.0		
18	5.6	5.6	11.2	3.31236	1.59694	60.0	59.39	303.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0		
1	Slope (m)			2.08863	Linear Equation			r ²	0.998219	Pstd(mmHg)	760.
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9991091	T _{NTP}	298.
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.989755586	

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician



Approved By

(Mr. Panupon Podang)
Environmental Scientist

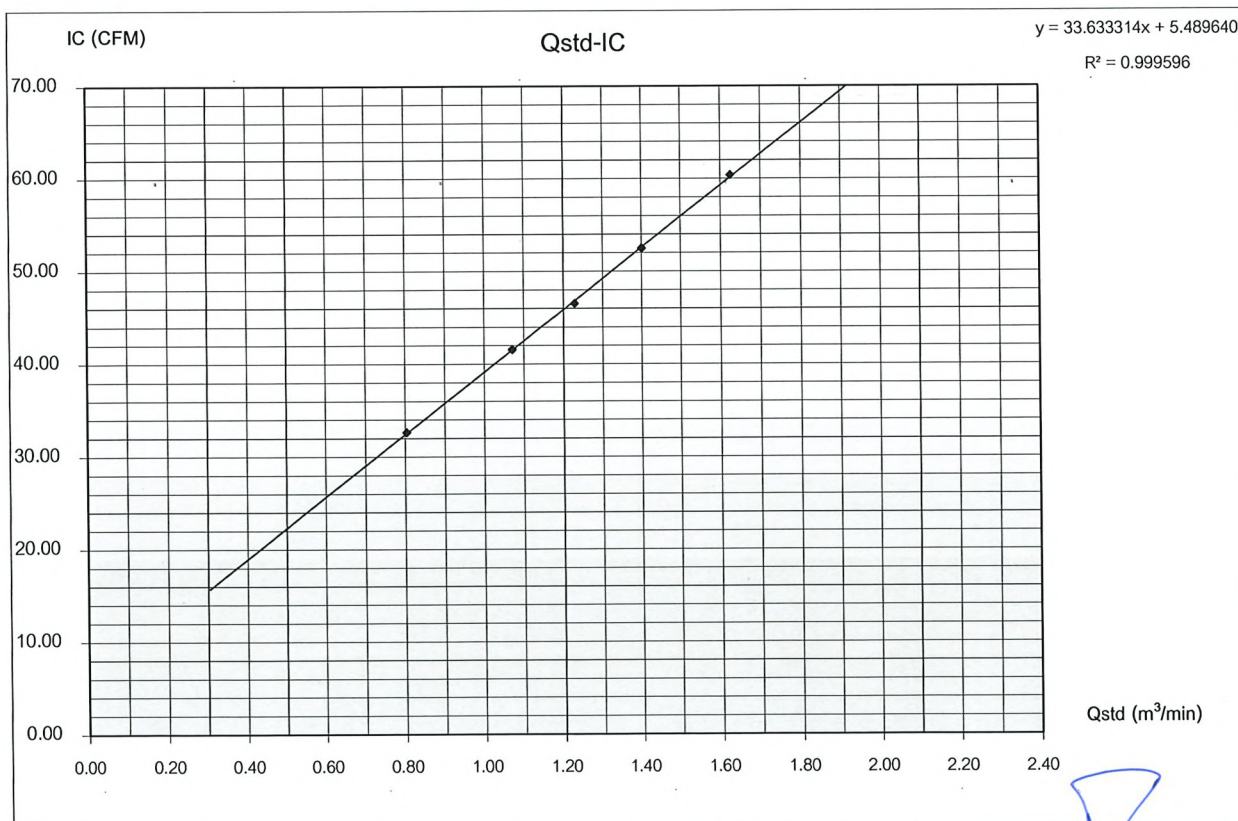
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104			Date	June 4, 2025
Sampler Location	A4 : โรงแรม Links Valley Golf&Hotel Pattaya			Start Time	4:00 PM
Sampler Number	TSP No.A23	Transfer Standard Type	Orifice	Stop Time	4:10 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Somprasong Thetsakun
Motor Serial Number	2055	Calibrator Serial Number	2912		
Recorder Serial Number	2186				

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indicator (ft ³ /min)	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O								
5	1.4	1.4	2.8	1.65618	0.80399	33.0	32.66	303.0	757.0		
7	2.5	2.5	5.0	2.21316	1.07067	42.0	41.57	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.22846	47.0	46.52	303.0	757.0		
13	4.3	4.3	8.6	2.90253	1.40073	53.0	52.46	303.0	757.0		
18	5.8	5.8	11.6	3.37099	1.62502	61.0	60.38	303.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0		
1	Slope (m)			2.08863	Linear Equation			r ²	0.999596	Pstd(mmHg)	760.0
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.999798	T _{NTP}	298.15
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.989755586	

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)

Technician ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By

(Mr. Panupon Podang)

Environmental Scientist

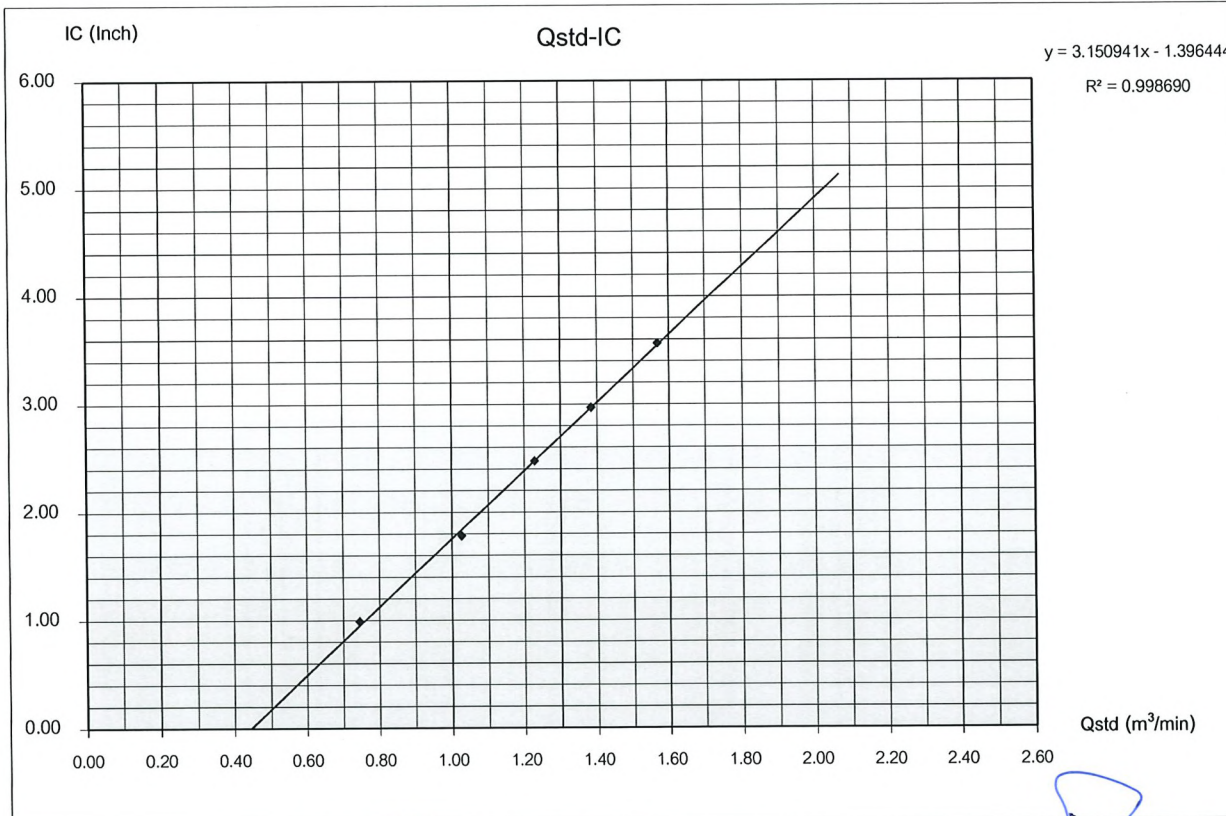
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-02104			Date	June 4, 2025
Sampler Location	A4 : โหนด Links Valley Golf&Hotel Pattaya			Start Time	3:49 PM
Sampler Number	PM-10 No.C33	Transfer Standard Type	Orifice	Stop Time	3:59 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Somprasong Thetsakun
Motor Serial Number	2024-33	Calibrator Serial Number	2912		
Recorder Serial Number					

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indicator (inch/min)	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	Pressure (mmHg)	Meter	Meter
	Positive	Negative	ΔH ₂ O								
5	1.2	1.2	2.4	1.53332	0.74517	1.0	0.99	303.0	757.0		
7	2.3	2.3	4.6	2.12279	1.02740	1.8	1.78	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.22846	2.5	2.47	303.0	757.0		
13	4.2	4.2	8.4	2.86858	1.38447	3.0	2.97	303.0	757.0		
18	5.4	5.4	10.8	3.25267	1.56837	3.6	3.56	303.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	757.0		
1	Slope (m)			2.08863	Linear Equation			r^2	0.99869	Pstd(mmHg)	760.0
2	Intercept (b)			-0.02307	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9993448	T _{NTP}	298.0
3	Correlation Coefficient (r)			0.99990	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.97961612	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98975586	

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician



Approved By

(Mr. Panupon Podang)
Environmental Scientist



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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-021-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 2912
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Environment Research & Technology Co., Ltd.
25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210

RECEIVED DATE : 26 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 27 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.2 °C and 52.0 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). 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 Standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.705	751.990	23.18	22.54	54.902	1.808	1.341	0.652
2	1.003	751.892	23.34	22.78	59.350	3.618	1.897	0.921
3	1.124	751.798	23.56	23.02	42.179	4.788	2.182	1.057
4	1.167	751.706	23.67	23.23	30.570	5.346	2.305	1.114
5	1.409	751.685	23.75	23.28	29.576	7.845	2.791	1.346

Slope (m): 2.08863
Intercept (b): -0.02307
Correlation coefficient (r): 0.99990
Uncertainty ($k=2$): 0.015 m^3/min

Table 2: 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	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_a] m^3/min
1	0.705	751.990	23.18	22.54	54.902	1.808	0.844	0.655
2	1.003	751.892	23.34	22.78	59.350	3.618	1.194	0.926
3	1.124	751.798	23.56	23.02	42.179	4.788	1.375	1.063
4	1.167	751.706	23.67	23.23	30.570	5.346	1.453	1.122
5	1.409	751.685	23.75	23.28	29.576	7.845	1.760	1.356

Slope (m): 1.30815
Intercept (b): -0.01449
Correlation coefficient (r): 0.99990
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Laksale Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH-ServicesSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: Environment Research & Technology Co., Ltd.
Address: 25/114 Moo 6, Soi Chinakhet 1, Ngamwongwan Rd., Toongsongkhong
City: Lakshmi
Zip / Postal: 10210
State / Province: Bangkok
Order Number: 00000000000000000000

Weighing Device

Manufacturer: Mettler Toledo
Model: AB204-S
Serial No.: 1123103723
Building: N/A
Floor: 4
Room: 406
Instrument Type: Weighing Instrument
Asset Number: ERTC-L-IN-0048
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
CIPW002/20
METTLER TOLEDO Work Instruction:
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature	Humidity
	Start: 23.1 °C End: 23.3 °C	Start: 35.7 % End: 35.2 %

As Found Calibration Date: 16-Jan-2025
As Left Calibration Date: N/A
Issue Date: 18-Jan-2025
Calibrator: Nithit Jongkrod
Approved Signatory: Naruephon C.

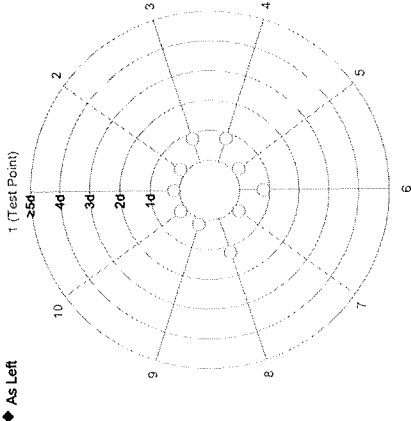
Technical Manager / Head of Calibration Center

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0001 g	N/A
5	100.0000 g	N/A
6	100.0001 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A

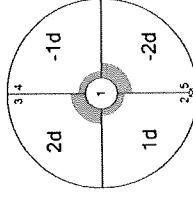


The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0002 g	N/A
4	99.9999 g	N/A
5	99.9998 g	N/A
Maximum Deviation	0.0002 g	N/A

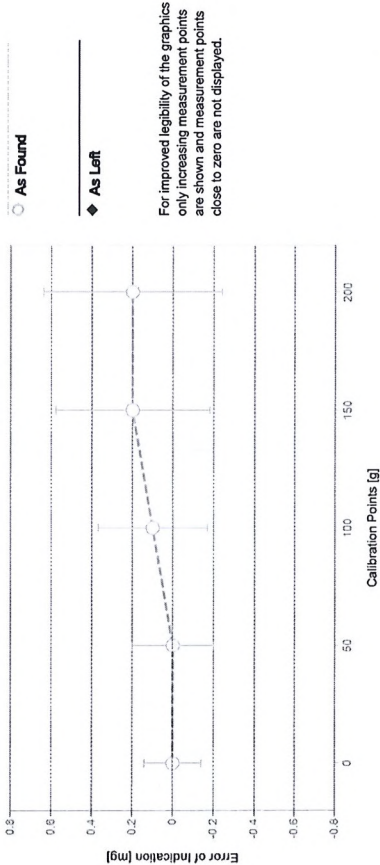


As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.14 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.15 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.15 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.16 mg	2
8	50.0001 g	50.0001 g	0.0000 g	0.20 mg	2
9	99.9999 g	100.0000 g	0.0001 g	0.27 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.38 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.44 mg	2



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS52	Date of Issue:	17-Apr-2024
Certificate Number:	191753	Calibration Due Date:	15-Oct-2025

Weight Set 2: OIML E2

Weight Set No.:	WS52-1	Date of Issue:	17-May-2024
Certificate Number:	C420107128	Calibration Due Date:	17-Oct-2025

Weight Set 3: OIML E2

Weight Set No.:	WS52-2	Date of Issue:	17-May-2024
Certificate Number:	C420107129	Calibration Due Date:	28-Oct-2025

Thermo Hygrometer

Equipment No.:	IN302	Date of Issue:	31-Oct-2024
Certificate Number:	SC-H-00908/67	Calibration Due Date:	17-Oct-2025

Remarks

Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 3.0 · 10⁻⁴ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

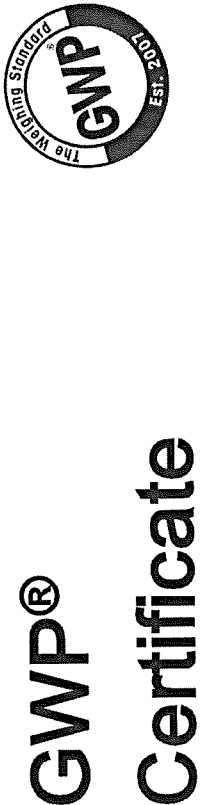
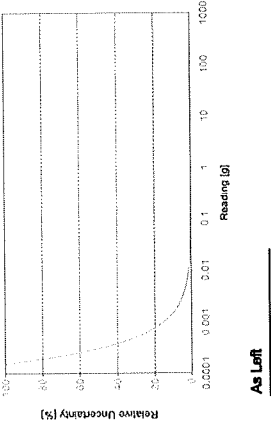
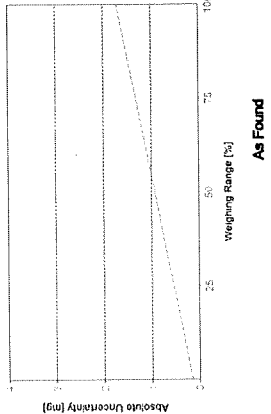
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.17 mg	0.0075%	N/A	N/A
22.0000 g	0.31 mg	0.0014%	N/A	N/A
220.0000 g	1.7 mg	0.00078%	N/A	N/A



As Found ✓ As Left ✓

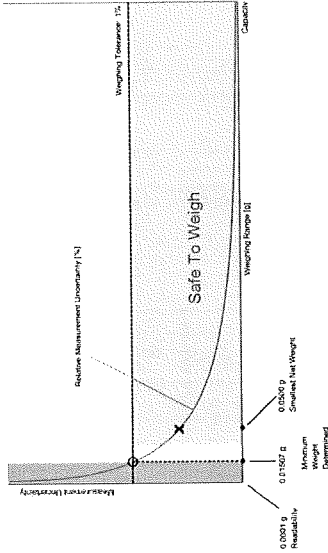
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.0500 g | Safety Factor: 2

Safe Weighing Range



While the value in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
	1	2	3	5	10
Tolerance					
0.1%	0.15163 g	0.30546 g	0.46152 g	0.78056 g	1.62097 g
0.2%	0.07555 g	0.15163 g	0.22827 g	0.38321 g	0.78056 g
0.5%	0.03015 g	0.06039 g	0.09072 g	0.15163 g	0.30546 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07555 g	0.15163 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03771 g	0.07555 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
	1	2	3	5	10
Tolerance					
0.1%	0.15163 g	0.30546 g	0.46152 g	0.78056 g	1.62097 g
0.2%	0.07555 g	0.15163 g	0.22827 g	0.38321 g	0.78056 g
0.5%	0.03015 g	0.06039 g	0.09072 g	0.15163 g	0.30546 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07555 g	0.15163 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03771 g	0.07555 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

- 1. If "N/A" is shown above, no appropriate value could be calculated.
- 2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

Repeatability				Eccentricity		Error of Indication	
As Found	✓			✓		✓	
As Left	✓			✓		✓	

- ✓ = Passed
- ✗ = Failed
- A = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
				Std. Deviation	Result	Std. Deviation	Result
0.1%		N/A			N/A		N/A
0.2%		0.00005 g			✗		✗
0.5%		0.00013 g			✓		✓
1%		0.00025 g		0.00006 g*		0.00006 g*	
2%		0.00050 g			✓		✓
5%		0.00125 g			✓		✓

*The calculated standard deviation value is below the rounding error of the balance. The 0.41*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
				Deviation	Result	Deviation	Result
0.1%		0.0500 g			✓		✓
0.2%		0.1000 g			✓		✓
0.5%		0.2500 g		0.0002 g		0.0002 g	
1%		0.5000 g			✓		✓
2%		1.0000 g			✓		✓
5%		2.5000 g			✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

As Found

Reference Value		Error	Control limits for various weighing tolerances						
			0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0001 g	0.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
99.9999 g	0.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
150.0000 g	0.0002 g	0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0001 g	0.0002 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result			✓	✓	✓	✓	✓	✓	

As Left

Reference Value		Error	Control limits for various weighing tolerances						
			0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0001 g	0.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
99.9999 g	0.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
150.0000 g	0.0002 g	0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0001 g	0.0002 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result			✓	✓	✓	✓	✓	✓	

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.



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 12 December, 2024

Certification No. 444/24

Page : 1 of 2

Object : เครื่องมือตรวจวัดอุณหภูมิมหาวิทยาลัย

Manufacturer : Davis Instruments

Type : Vantage Pro2 ID No. : No.31

Mfg Code : Display A80409D18N

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL

: 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

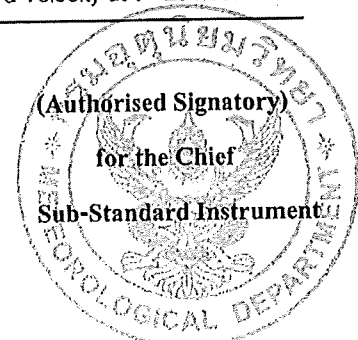
Calibrated by :

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. 444/24

12 December, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacumm inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	9.0	0.02
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

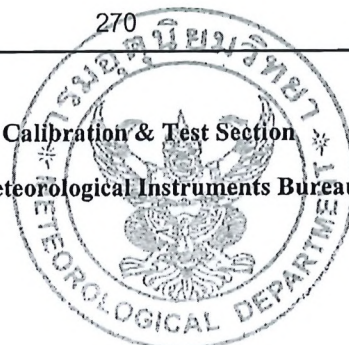
Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





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 12 December, 2024

Certification No. 441/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WE91016A07 ID No. : No.9

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.9 hPa

NATIONAL STANDARD WIND TUNNEL :

: 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

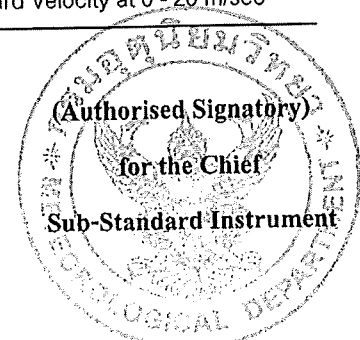
Calibrated by :

Watcharapol

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. 441/24

12 December, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.8	0.22

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer





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 15 January, 2025

Certification No. 041/25

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC40922A02 ID No. : No.32

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1014.7 hPa

NATIONAL STANDARD WIND TUNNEL :

: 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 :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Pisood Promsut
Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 041/25

15 January, 2025

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer





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 28 August, 2024

Certification No. 322/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WE91016A19 ID No. : No.7

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: 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 :

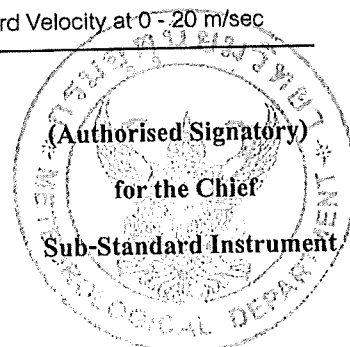
Watchapol

Mr. Watchapol 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. 322/24

28 August, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.7	0.31
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.7	0.32

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

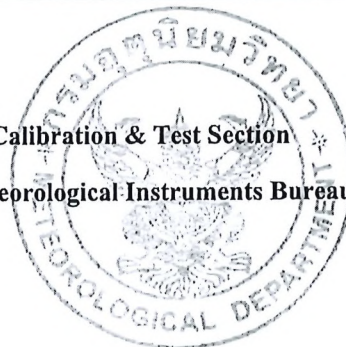
Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	BSWA Technology
Model	:	CA114
Serial No.	:	470160
Range of Calibrator		
- Support Equipment Type	:	94.2
- Frequency	:	1,000 Hz.
Calibrated By	:	Mr.Akarawat Kochabog
Calibration Date	:	June 4, 2025
Customer Name	:	บริษัท ไฟร์เทียร์ คอนซัลแตนท์ จำกัด : โครงการนิคมอุตสาหกรรมเฮอร์มียส์ ของบริษัท เฮอร์มียส์ โคออปอเรชั่น จำกัด

[illegible]

Checked By

Mr. Prayun Detkla
Technician



Approved By

Ms.Sutatip Im-noi
Environmental Scientist

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	BSWA Technology
Model	:	CA114
Serial No.	:	470160
Range of Calibrator		
- Support Equipment Type	:	94.2
- Frequency	:	1,000 Hz.
Calibrated By	:	Mr.Akarawat Kochabog
Calibration Date	:	June 5, 2025
Customer Name	:	บริษัท ไฟร์เทียร์ คอนซัลแตนต์ จำกัด : โครงการนิคมอุตสาหกรรมเฮอร์มียัส ของบริษัท เฮอร์มียัส โคออปเปอเรชั่น จำกัด

[illegible]

Checked By

.....
Mr.Pravun Detkla

Technician



Approved By

.....
Ms.Sutatip Im-noi

Environmental Scientist



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0032

MTC No. EEL. BP. 59/1067

CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co.,Ltd.

Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.

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

Manufacturer : BSWA TECH

Model : CA114

Serial No. : 470160

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer 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 generated by sound calibrator under test shall be 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 : 18 Oct. 2024

Date of Calibration : 24 Oct. 2024

1 / 2
W

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0032

MTC No. EEL. BP. 59/1067

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 °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 Brüel&Kjær 4180	94.19	0.19	± 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 Brüel&Kjær 4180	1002.5	2.5	± 1.5	$\pm 2.0\%$

3. Total Distortion


Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	1.80	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluiyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24 Oct. 2024

Date of Issue : 25 Oct. 2024

Ref : 2011267101803782002

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827



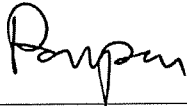
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 25CHO4

Page.: 1 of 3

Equipment :	UV-VIS Spectrophotometer
Manufacturer :	Perkin Elmer
Model :	Lambda 365+
Serial No. :	365PK22072603
ID No. :	ERTC-L-In-180
Condition As-Received:	Used Item
Received Date :	06 January 2025
Calibration Date :	07 January 2025
Reference :	2501-0004ON-15
Submitted by :	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
Calibration Place :	ห้องปฏิบัติการวิเคราะห์ Spectrophotometer
Ambient Temperature :	(23.6 to 25.0) °C (On-Site)
Relative Humidity :	(48 to 44) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-08
Calibrated by :	Uthen Kankawi  Approved Signatory
Approved by :	<input type="checkbox"/> Pornthippa Tameyakul <input checked="" type="checkbox"/> Ponpan Paipim <input type="checkbox"/> Saithip Meangmai
Issue Date :	22 January 2025

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. : 25CHO4

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	43532	119613	22 Feb 2026
2. Absorbance Standard set	44487	122584	31 May 2026
3. Wavelength Standard set	36730	118120	15 Jan 2026
4. Wavelength Standard set	36730	118121	15 Jan 2026
5. Stray Light Standard set	8419	108963	01 Feb 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 : 1 nm

Scan Speed : 30 nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
360.89	360.96	0.12	2.00
459.99	459.90	0.12	2.00
536.52	536.31	0.12	2.00
638.00	637.81	0.12	2.00
879.41	879.32	0.12	2.00



Cert. No. : 25CHO4

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>
350.0	Zero	0.0000	0.0046	2.00
	0.4271	0.4261	0.0046	2.00
	0.6391	0.6377	0.0050	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5234	0.5230	0.0028	2.00
	0.7007	0.6993	0.0028	2.00
	0.9992	0.9975	0.0028	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5648	0.5648	0.0028	2.00
	0.7654	0.7641	0.0028	2.00
	1.0961	1.0948	0.0028	2.00

Stray Light

* Straylight at 260.74 \pm 0.11 nm	Reading at 260.74 \pm 0.11 nm
Abs	2.2527
%T	0.5562

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- Cut-off wavelength of stray light reference material (Potassium Iodide) at Wavelength 260.74 \pm 0.11 nm
- Result = Pass, If Absorbance > 2.00 Abs and Transmission < 1.0 %T at Wavelength 260.74 \pm 0.11 nm
- * : Not NSC-ONSC Accredited
- 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 %.

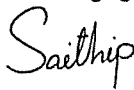


TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484

Certificate of Calibration

Cert.No.: 25CH218

Page.: 1 of 2

Equipment :	pH Meter
Manufacturer :	Waterproof
Model :	pHTestr 30
Serial No. :	3195382
ID No. :	-
Condition As-Received:	Used Item
Received Date :	18 February 2025
Calibration Date :	19 February 2025
Reference :	2502-0526DN-3
Submitted by :	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with reference material (RM)
Calibrated by :	Warakorn Lerngagtrakul 
Approved by :	<hr/> Approved Signatory
() Pornthippa Tameyakul	
() Ponpan Paipim	
(✓) Saithip Meangmai	
Issue Date :	19 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH218

Page.: 2 of 2

Condition of this calibration result

1. Certified Reference Materials : Standard buffer solution (Traceable to NIST, U.S.A.)

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.01	Thermo Scientific	403/03	06 Oct 2026
pH 7.00	Thermo Scientific	402/01	07 Oct 2025
pH 10.01	Thermo Scientific	363/03	08 Sep 2026

2. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

<u>Unit Under Calibration</u>	<u>Standard pH Buffer Solution</u>	<u>Actual pH Reading</u>	<u>Actual mV Reading (mV)</u>	<u>Uncertainty of pH Measurement (\pm)</u>	<u>Coverage factor k</u>
pH Electrode S/N.: 3195382	4.01	4.01	N/A	0.012	2.00
	7.00	7.00	N/A	0.013	2.00
	10.01	10.01	N/A	0.016	2.00

Remark - pH meter does not have voltage mode.
- Can not connect the BNC because the plug does not match with the socket.
- N/A = Not Available

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Certificate of Testing

Cert.No.: 25TW8

Page.: 1 of 2

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	DO210
Serial No. :	HE3C0028
ID No. :	-
Received Date :	14 January 2025
Test Date :	15 January 2025
Reference :	2501-0443DN-12
Submitted by :	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean
Approved by :	<div style="text-align: center;"> _____ Approved Signatory</div>
() Pornthippa Tameyakul () Ponpan Paipim (✓) Saitip Meangmai	
Issue Date :	17 January 2025



Cert.No.: 25TW8

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K2M0006

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.21	0.0071

This report was certified only for the instrument we tested. It is allowable to use for study
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other in full, without written approval of the laboratory

-o0o-



Inctech Metrological Center Co.Ltd.

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,

Saimai, Bangkok 10220, Thailand

Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT24-9500

Page : 1 of 2

Customer : Environment research & Technogy Co.,Ltd.

Address : 25/114 Moo6 Soi Chinaket1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Description : Incubator

Manufacturer : Hotpack

Model : 352601

Serial No. : 78633

Identification No. : ERTC-L-In-133

Calibration Place : Customer Laboratory

Order No. : 4090/24

Received date : Nov 29, 2024

Calibration date : Nov 29, 2024

Environment Condition :

Temperature : (25+/-10) °C

Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Data Acquisition System with Sensor	DAQ970A	MY58003374	MT24-1056	Jan 05, 2025

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%



Calibrated by : Mr.Yuttakorn Jamneansri

Approved by : (Mr.Panuwat Phuklan)

Issue date : Dec 06, 2024

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Certificate No. : MT24-9500

Page : 2 of 2

Function : Temperature measurement

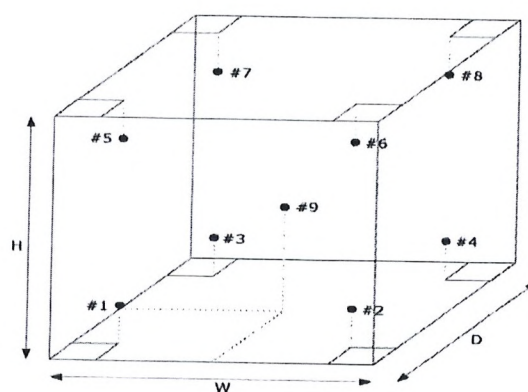
Calibration point : 20 °C

Result : Without adjustment

Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
20	20.276	20.230	20.142	20.019	19.785	20.414	20.187	20.072	20.426	0.41

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20.0	0.27	0.97	1.1



- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

Front view**UUC*** = Unit under calibration**Uniformity** = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.**Overall Variation** = Difference of temperature value between the maximum and minimum any time.**Stability** = One half of the maximum difference of measured temperatures at any one probe.



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

Certificate of Testing

Cert.No.: 24TW185

Page.: 1 of 2

Equipment :	DO Meter
Manufacturer :	YSI
Model :	5000-115V
Serial No. :	03C1280 AC
ID No. :	ERTC-L-In-164
Received Date :	03 September 2024
Test Date :	04 September 2024
Reference :	2409-0126DN-1
Submitted by :	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean 
Approved by :	<hr/> Approved Signatory
() Unnopphol Harachai () Ponpan Paipim (✓) Saithip Meangmai	
Issue Date :	6 September 2024



Cert.No.: 24TW185

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	N03679	140RC001	23MM537	14 Sep 2024

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15K100353

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.18	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
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-o0o-



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



Certificate of Calibration

Cert. No.: 25TM35

Page : 1 of 3

Equipment : Incubator

Manufacturer : Memmert

Model : IF 160

Serial No. : D522.0070

ID No. : ERTC-L-In-181

Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6 Soi Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
Bangkok 10210

Location : 408/2 ห้องปฏิบัติการบ่มอาหารเลี้ยงเชื้อ

Received Order : 06 January 2025

Calibration Date : 06 - 07 January 2025

Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \%$

AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Khit Ruttanaprapachai


Approved by :
☐ Ponpan Paipim
☐ Suwit Imjai
☒ Kunchit Promprat

Issue Date : 18 January 2025

Approved Signatory

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.



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2501-0004ON-5

Cert. No.: 25TM35

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

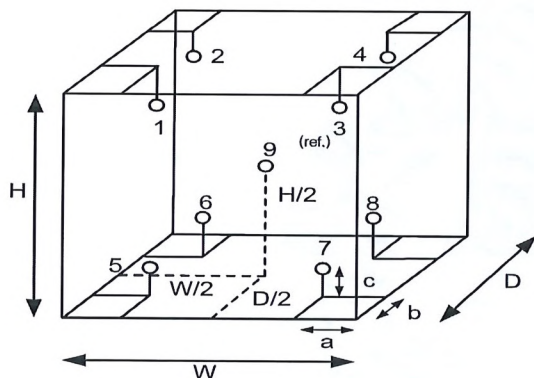
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	51	55
AC Supply (Volt)	221	222



Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

Probe Installation Details :

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm

Dimension of Chamber :

D = 0.40 m
 W = 0.56 m
 H = 0.73 m
 Capacity = 0.16 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2501-0004ON-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 25TM35

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.022	0.22	0.38	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.860	34.762	34.658	34.926	34.791	34.970	34.621	34.837	34.767	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25TM36

Page : 1 of 3

Equipment : Incubator

Manufacturer : Ehret

Model : BK 4106

Serial No. : 22162

ID No. : ERTC-L-In-022

Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6 Soi Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
Bangkok 10210

Location : 408/2 ห้องปฏิบัติการบ่มอาหารเลี้ยงเชื้อ

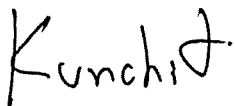
Received Order : 06 January 2025

Calibration Date : 07 - 08 January 2025

Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \%$

AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Khit Ruttanaprapachai


Approved by :
☐ Ponpan Paipim
☐ Suwit Imjai
☒ Kunchit Promprat

Issue Date : 18 January 2025

Approved Signatory

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.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2501-0004ON-6

Cert. No.: 25TM36

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

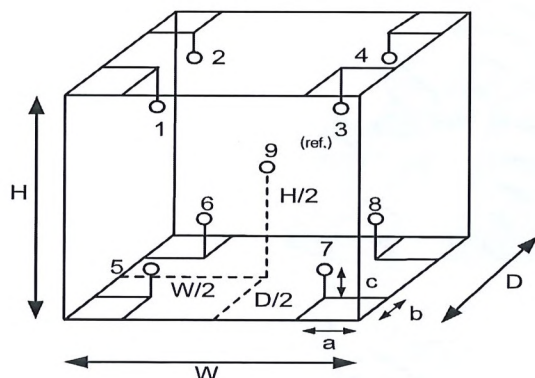
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	28
REL.Humid. (%)	53	50
AC Supply (Volt)	222	221



Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.60 m
H = 0.50 m
Capacity = 0.15 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2501-0004ON-6
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 25TM36

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
44.5	44.5	44.5	0.16	0.64	1.4	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
44.5	44.542	44.705	44.204	44.943	43.855	44.307	44.130	44.630	44.330	0.67

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

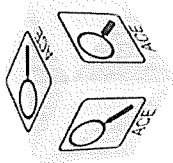
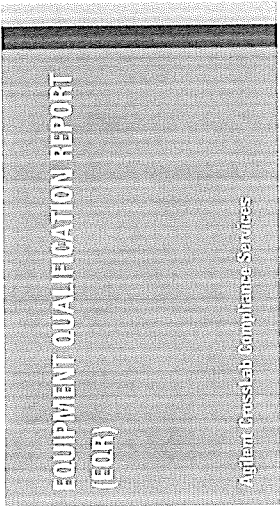
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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Agilent
CrossLab

Agilent CrossLab Compliance

Qualification Type: ES-OQ
System ID: MY15330001
EQP Name: AgilentRecommended
EQP Revision: ES.02.50
EQP Publish Date: March 2020

Date: November 25, 2024 4:27:06 PM
Report Type: Report

Org. Name: Environment Research & Technology Co.,Ltd.

Org. Location: 25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

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Test Summary

Purpose

This section includes the Overall Qualification Status and details for each test that meets at least one of the following criteria: (1) was not scheduled; (2) was scheduled but not run; (3) was processed more than once; (4) passed recommended limits only when dual limits were selected; (5) required deviation(s) or comment(s); (6) required integration event change(s). Tests that pass and do not meet any criteria above are not included.

For a complete list of scheduled tests, see the table of contents. For supporting documentation, refer to the Attachments section.

NOTE: A Pass for the Overall Qualification Status indicates that all scheduled tests were run and passed; R, I, D, and C are blank if not applicable for that specific test.

- R: runs
- I: integration event changes
- D: number of deviations submitted
- C: number of comments submitted
- Status: NS (not scheduled); NR (scheduled but not run); NC (unlocked but not completed)

Details

Test

Status
R I D C

There were no repeated or re-integrated tests. All test resulted in a pass status.

Overall Qualification Status

Pass

Service Details

Purpose

This section includes local contact and delivery details for this service.

General Details

- Service Order No./Request: 6007379887
- EQP Name: AgilentRecommended
- EQP Revision: ES.02.50
- Report Type: Report
- Organization Details
 - Name: Environment Research & Technology Co., Ltd.
 - Location: 25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd., Bangkok 10210

Local Contact Details

- Name: K. Raiwin Posit
- Job Title: Supervisor Scientist
- Qualification Location: ICPOES Room

Operator Details

- Name: Burin Ngamvijit
- Job Title: Field Service Engineer

Data Acquisition Details

- Acquisition Software Name: ICP Expert
- Acquisition Software Revision: 7.1.0.6821

Customer Data System (CDS):

Es: ICP Expert

Instrument Details

Purpose

This section describes the as found system configuration.

Details

Spectrometer 1	
Manufacturer	Agilent Technologies
Name	5100 VDV
Model Number	G8011A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY15330001
Firmware Revision	2994

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G8481A
Serial Number	1A1560387

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15220240

Vapor Generator 1

Manufacturer	Agilent Technologies
Name	VGA77P
Model Number	G8475A
Serial Number	MY15330002

Protocol Details

Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

Preparation

Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

Configuration Details

Model/Serial No.:

G8011A

MY15330001

Results

Criteria

Observed Result

Expected Result

Status

Does the plasma ignite successfully in the first three attempts?

Yes

Yes

Pass

Was the detector calibration performed and completed successfully?

Yes

Yes

Pass

Was the instrument calibration performed and completed successfully?

Yes

Yes

Pass

Test Evidence

Image Details:

Was the detector calibration performed and completed successfully?

Date and Time:

November 25, 2024 4:03:36 PM

Host Name:

AG-5CG3251QJK

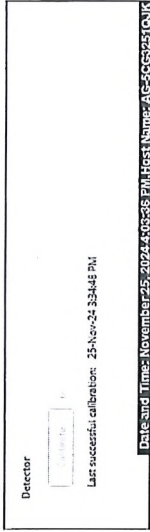


Image Details:

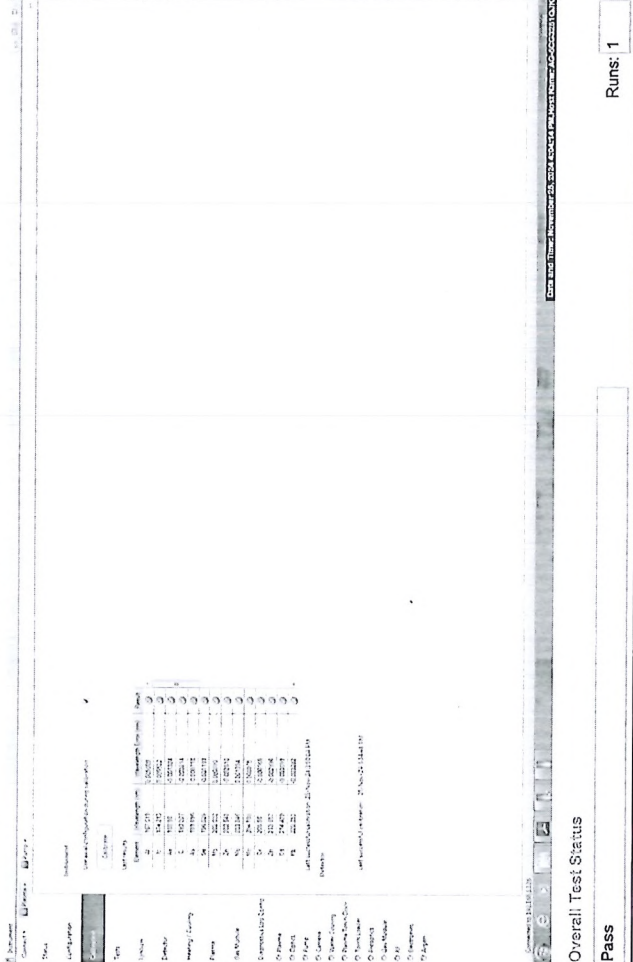
Was the instrument calibration performed and completed successfully?

Date and Time:

November 25, 2024 4:04:14 PM

Host Name:

AG-5CG3251QJK



Instrument Tests

Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details			
Model/Serial No.:	G8011A	MY15330001	
Results	Observed Result	Expected Result	Status

Are the Functional Tests results within acceptance criteria?

Subsystem Communications			
Air Flow	Yes	Yes	Pass
Water Flow	Yes	Yes	Pass
Gas Flows	Yes	Yes	Pass
RF Generator	Yes	Yes	Pass
Camera	Yes	Yes	Pass
Optics	Yes	Yes	Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	Yes	Yes	Pass
Sensitivity	Yes	Yes	Pass
Precision	Yes	Yes	Pass

Overall Test Status	Runs: 1		
Pass			

Autosampler Operation

Purpose

This test verifies that the autosampler operates properly.

Configuration Details			
Model/Serial No.:	G8410A	AU15220240	
Results	Observed Result	Expected Result	Status

Does the autosampler successfully move to the specified location(s)?

Yes	Yes	Pass
Overall Test Status		
Pass	Runs: 1	

Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status.

The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified.

A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results.

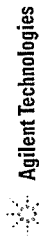
Note: Hardware/software configuration management is the customer's responsibility.

Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	Material	Wavelength calibration solution	13
EQR	General	Certificate of Qualification for ACE	14
EQR	General	Operator's training certificate and qualifications	15
EQR	General	Instrument's Test Report	16
EQR	General	Instrument's Test Report	19
EQR	General	Instrument's Test Report	20
EQR	General	Instrument's Test Report	21
EQR	General	Instrument's Test Report	22
EQR	General	Instrument's Test Report	23
EQR	General	Instrument's Test Report	24

Document Name: Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

Date: November 25, 2024 3:39:18 PM
Drive Serial #: BC1A62DC Platform Revision: ACE 3.13.31

Test	Result
Preparation : 5100 SVDV	Conforms
Instrument Tests : 5100 SVDV	Conforms
Autosampler Operation : Autosampler 1 - SP33	Conforms

Overall Qualification Status
Conforms

This section lists details for materials added with the ACE Attachments tool.

Name:	Wavelength calibration solution
Specification:	Agilent Technologies
Part/Lot No.:	6610030100 1483766
Expiration Date:	July 9, 2026

Document Name:


Instrument's Test Report

Report Summary			
Instrument Model	Agilent 5100 VDV/ICP-OES		
Instrument ID	G8011A		
Instrument Serial Number	MY15330001		
Software Version	7.1.0.6821		
Firmware Version	2994		
Tested By	OO 2024_Burin Ngamvijit		
Test Completed On	25-Nov-24 3:53:45 PM		
Result Summary			
Resolution Test	Pass		
Sensitivity Test	Pass		
Precision Test	Pass		
Resolution Test			
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.38	
As (188.980 nm)	≤ 8.20	6.53	
C (133.027 nm)	≤ 11.50	7.95	
Mo (202.032 nm)	≤ 8.20	6.99	
Cr (206.158 nm)	≤ 13.40	10.06	
Zn (213.857 nm)	≤ 8.70	7.31	
Pb (220.353 nm)	≤ 9.50	7.80	
Co (228.615 nm)	≤ 17.20	10.63	
Ba (230.424 nm)	≤ 9.40	7.92	
Mn (257.610 nm)	≤ 13.30	9.30	
Mn (280.568 nm)	≤ 20.30	15.69	
Cr (267.716 nm)	≤ 11.00	9.11	
Cu (324.754 nm)	≤ 25.00	17.68	
Cu (327.395 nm)	≤ 14.20	12.81	
Sr (338.071 nm)	≤ 33.50	27.14	
Ba (455.403 nm)	≤ 44.00	31.65	
Sr (460.733 nm)	≤ 36.00	20.40	
Ba (493.408 nm)	≤ 36.00	29.54	
Ba (614.171 nm)	≤ 42.00	29.50	
Ar (675.283 nm)	≤ 74.00	65.70	
K (766.491 nm)	≤ 80.00	61.36	

Page 1 of 3

Document Name:

Operator's training certificate and qualifications



Certificate of Completion

Learner Name:

Burin Ngamvijit

Title Of Course:

ANV-CE-ICPOES-2-007-C: ACE ICPOES Specific Training

Completion Date:

March 25, 2024

Certified By Company:

Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service technician for Agilent or Agilent's Safety Alerts, Service Notes, Internal technical updates, update training, current documentation, technical support, current parts, and parts upgrades. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Document Name:

Instrument's Test Report

Report Summary			
Instrument Model	Agilent 5100 VDV/ICP-OES		
Instrument ID	G8011A		
Instrument Serial Number	MY15330001		
Software Version	7.1.0.6821		
Firmware Version	2994		
Tested By	OO 2024_Burin Ngamvijit		
Test Completed On	25-Nov-24 3:53:45 PM		
Result Summary			
Resolution Test	Pass		
Sensitivity Test	Pass		
Precision Test	Pass		
Resolution Test			
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.38	
As (188.980 nm)	≤ 8.20	6.53	
C (133.027 nm)	≤ 11.50	7.95	
Mo (202.032 nm)	≤ 8.20	6.99	
Cr (206.158 nm)	≤ 13.40	10.06	
Zn (213.857 nm)	≤ 8.70	7.31	
Pb (220.353 nm)	≤ 9.50	7.80	
Co (228.615 nm)	≤ 17.20	10.63	
Ba (230.424 nm)	≤ 9.40	7.92	
Mn (257.610 nm)	≤ 13.30	9.30	
Mn (280.568 nm)	≤ 20.30	15.69	
Cr (267.716 nm)	≤ 11.00	9.11	
Cu (324.754 nm)	≤ 25.00	17.68	
Cu (327.395 nm)	≤ 14.20	12.81	
Sr (338.071 nm)	≤ 33.50	27.14	
Ba (455.403 nm)	≤ 44.00	31.65	
Sr (460.733 nm)	≤ 36.00	20.40	
Ba (493.408 nm)	≤ 36.00	29.54	
Ba (614.171 nm)	≤ 42.00	29.50	
Ar (675.283 nm)	≤ 74.00	65.70	
K (766.491 nm)	≤ 80.00	61.36	

Page 1 of 3

Document Name:

Instrument's Test Report

Document Name:

Instrument's Test Report

Sensitivity Test						Pass	
Radial							
Element Wavelength	Specification	Method	Ratio	Standard	Blank		
As (188.980 nm)	≥ 46.0	SRBR	93.8	902.6	77.4		
Se (196.026 nm)	≥ 41.0	SRBR	59.0	654.6	91.3		
Zn (213.857 nm)	≥ 1421.0	SRBR	3082.0	37899.3	149.6		
Pb (220.353 nm)	≥ 46.0	SRBR	154.5	2137.0	163.3		
Mn (257.610 nm)	≥ 3516.0	SRBR	9444.2	205931.0	472.8		
Al (396.152 nm)	≥ 3.4	SBR	6.5	29251.8	3891.4		
Ba (493.408 nm)	≥ 34.0	SBR	76.6	855031.1	11021.3		
K (766.491 nm)	≥ 1.8	SBR	2.4	82716.8	24314.0		
Axial							
Element Wavelength	Specification	Method	Ratio	Standard	Blank		
As (188.980 nm)	≥ 208.0	SRBR	243.9	2566.7	102.1		
Se (196.026 nm)	≥ 159.0	SRBR	172.0	2078.5	128.5		
Zn (213.857 nm)	≥ 234.0	SRBR	1297.3	13097.8	100.4		
Pb (220.353 nm)	≥ 1743.0	SRBR	8534.0	139946.6	267.9		
Cd (214.439 nm)	≥ 4227.0	SRBR	7800.0	111649.9	204.1		
Pb (220.353 nm)	≥ 320.0	SRBR	684.3	11776.3	296.6		
Mn (257.610 nm)	≥ 10625.0	SRBR	38072.2	1148733.3	906.9		
Cr (267.716 nm)	≥ 1048.0	SRBR	4466.9	120000.5	713.1		
Cu (324.754 nm)	≥ 19.0	SBR	79.4	187702.0	2335.2		
Al (396.152 nm)	≥ 6.0	SBR	27.9	184566.8	6380.2		
Ba (493.408 nm)	≥ 60.0	SBR	303.2	5510982.4	18113.9		
K (766.491 nm)	≥ 24.0	SBR	78.5	2564858.7	32264.7		

Precision Test				Pass	
Radial					
Element Wavelength	Specification	Measured Value % RSD			
As (188.980 nm)	≤ 2.60	1.15			
Se (196.026 nm)	≤ 2.60	1.11			
Zn (213.857 nm)	≤ 1.50	0.48			
Pb (220.353 nm)	≤ 2.60	0.52			
Mn (257.610 nm)	≤ 1.50	0.55			
Al (396.152 nm)	≤ 1.50	0.46			
Ba (493.408 nm)	≤ 1.50	0.72			
K (766.491 nm)	≤ 1.50	0.35			
Axial					
Element Wavelength	Specification	Measured Value % RSD			
As (188.980 nm)	≤ 1.50	0.87			
Se (196.026 nm)	≤ 1.50	0.91			
Zn (213.857 nm)	≤ 1.50	0.42			
Pb (220.353 nm)	≤ 1.50	0.52			
Cd (214.439 nm)	≤ 1.50	0.54			
Pb (220.353 nm)	≤ 1.50	0.54			
Mn (257.610 nm)	≤ 1.50	0.42			
Cr (267.716 nm)	≤ 1.50	0.67			
Cu (324.754 nm)	≤ 1.50	0.85			
Al (396.152 nm)	≤ 1.50	0.60			
Ba (493.408 nm)	≤ 1.50	1.00			
K (766.491 nm)	≤ 1.50	0.56			

Page 3 of 3

Document Name: Instrument's Test Report

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Document Name:

[illegible]

Document Name:

Instrument's Test Report

Item	Spec	Unit	Price
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Document Name:

Instrument's Test Report

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Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer: Burin Ngamvijit
Logged On User Name: Burin_ngamvijit@agilent.com
Signature Creation Date: November 25, 2024
Reason for Signature: Published this original version of document

ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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User Name: burin_ngamvijit
Report Generated by Hostname: AG-SCG3251QJK
Print Date: November 25, 2024 4:27:15 PM
OO HW 5100CPOES ERTC Nov2024 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 25, 2024 3:43:20 PM	Audit	SessionCreated	Session	Host Name: AG-SCG3251QJK Drive Serial Number: 2AF11C98
November 25, 2024 3:43:20 PM	start	Configuration	Session	None
November 25, 2024 3:43:20 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 25, 2024 3:45:57 PM	Audit	ExpLoaded	Session	EQP details for primary technique [Es] - File path: [ProtocolPeder\Es\Configurat on\02.50\Es.02.50.asp], EQP File Name: [Es.02.50.asp], EQP Name: [AgilentRecommended], Photo col Revision [Es.02.50]
November 25, 2024 3:46:05 PM	End	Configuration	Session	None
November 25, 2024 3:46:07 PM	start	Qualification	Session	OQ
November 25, 2024 3:46:07 PM	start	Execution	Preparation : \$100 VDV: Qualitative Test - No setpoints associated	None
November 25, 2024 4:04:19 PM	End	Execution	Preparation : \$100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 25, 2024 4:04:21 PM	start	Execution	Instrument Test : \$100 VDV: Qualitative Test - No setpoints associated	None
November 25, 2024 4:05:07 PM	End	Execution	Instrument Test : \$100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

User Name: burin_nganvijit
Report Generated by Hostname: AG-5CG3251QJK
System ID: MY15330001
Print Date: November 25, 2024 4:27:15 PM

QQ HW 5100ICPOES ERTC Nov2024 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 25, 2024 4:07:02 PM	start	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	None
November 25, 2024 4:07:09 PM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	Run Count : 1
November 25, 2024 4:11:21 PM	Audit	AppRestarted	Session	Host Name: AG-5CG3251QJK_Drive Serial Number: 2AF11C98
November 25, 2024 4:11:22 PM	Audit	SessionReloaded	Session	None
November 25, 2024 4:11:23 PM	start	Qualification	Session	OQ
November 25, 2024 4:12:29 PM	End	Qualification	Session	OQ
November 25, 2024 4:12:29 PM	start	Reporting	Session	None
November 25, 2024 4:26:02 PM	Audit	Reporting	Session	Report Generated : Certificate
November 25, 2024 4:26:22 PM	Audit	Reporting	Session	Report Generated : Report

User Name: burin_nganvijit
Report Generated by Hostname: AG-5CG3251QJK
System ID: MY15330001
Print Date: November 25, 2024 4:27:15 PM

QQ HW 5100ICPOES ERTC Nov2024 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 25, 2024 4:27:05 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: OQ HW 5100ICPOES ERTC Nov2024_20241125_Certifica te_1.pdf User Name: Burin_nganvijit@agilent.com Full Name of Signer: Burin Nganvijit Reason for signature: Published this original version of document



PinAAcle 900Z Preventive Maintenance Report

Company Name: ENVIRONMENT RESEARCH
Instrument Location: 25/114 M.6, THANON NGAMWONGWAN
THUNGSONGHONG, LAKSI, BANGKOK, 10210
Instrument Serial No.: PZAS19031401
Date: 23-Jul-2024

PinAAcle 900Z Preventive Maintenance (PM)			
Company Name:		ENVIRONMENT RESEARCH	
Address (Instrument Location):		25/114 M.6, THANON NGAMWONGWAN, THUNGSONGHONG, LAKSI, BANGKOK, 10210	
Serial Number:		PZAS19031401	PM Number: 1/2
Customer Name (if applicable):		K. RAIWIN	Telephone Number: 099-182-9241
Customer Support Engineer Name:		Khwanhai	Service Order Number: WO-02879967
Date PM Performed: (DD-MMM-YYYY)		23-Jul-2024	Next PM Due Date: (DD-MMM-YYYY) 23-Jan-2025
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370144 Rev.9	A	January 2018	

Scope
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The customer should save their method before the PM begins.

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

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	60-004CRY1	Feb-2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	
B3100652 Or N9307029	Electronic Flow Meter	1	NA	
B0505495	Test Jig	1	NA	
03030997	System 2 EDL Driver	1	03030997	
N3050605	As System 2 EDL	1	16148	
N3050121	Cu Lumina HCL	1	092216-010130	
N3050109	Ba Lumina HCL	1	102416-040160	
N3050139	K Lumina HCL	1	110716-010060	
N3050152	Ni Lumina HCL	1	100516-030190	
N3050119	Cr Lumina HCL	1	091911-020150	

Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's 80501018 & 80501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSV008.STN
- ☒ Perform Cooling System maintenance if needed per SDB# COSV005.STN.
- ☒ Check auto sampler operation.
- ☐ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect and clean the furnace windows, if needed.
- ☒ Inspect and clean the GFTV camera lens, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☒ Verify that the air filter element is dry. Replace if necessary.

7. After PM Performance tests [THGA]:

7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min \pm 25 mL/min	208	Passed
External Flow Rate	100 mL/min \pm 10 mL/min	101	Passed

7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	\leq 0.005 Abs.	-0.0002	Passed
Standard Deviation	\leq 0.005	0.0001	Passed

7.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	\leq 7.0 pg/0.0044 A-s	5.6	Passed
Precision	\leq 2.0 %	1.68	Passed

7.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	16.3	Passed
Zeeman Ratio	0.52 ± 0.04	0.53	Passed

8. Review:

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

Additional Comments

Additional Comments Regarding the PM	
$\text{Zeeman Ratio} = \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$	
	$= \frac{0.1375}{0.1375 + 0.1198}$
	$= 0.53$

Review


The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.	
This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 23-Jul-2024 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 23-Jul-2024 (DD-MM-YYYY)

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: Environment Research & Technology
Address: 25/114 Moo 6, Soi Chinakhet 1, Ngamwongwan Rd., Toongsongthong
City: Laksi
Zip / Postal: 10210
State / Province: Bangkok
Order Number: 

Contact: Ramita Taengthai

Weighing Device

Manufacturer: Mettler Toledo
Model: MS204TS/00
Serial No.: B547728937
Building: N/A
Floor: 5
Room: 504
Weighing Instrument: ERTC-L-IN-114
Asset Number: N/A
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

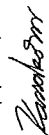
Range	Max. Capacity	Readability (g)
1	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0/CENAM-ema.2015
METTLER TOLEDO Work Instruction: CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 21.1 °C	End: 20.3 °C	Start: 37.8 %	End: 42.2 %

As Found Calibration Date: 15-Jan-2025
As Left Calibration Date: N/A
Issue Date: 17-Jan-2025
Calibrator: Supat Kruapoo
Approved Signatory: 

Technical Manager / Head of Calibration Center

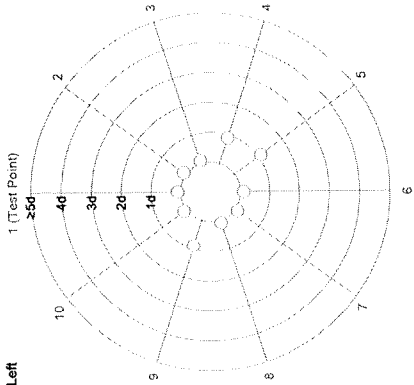
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	99.9999 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0000 g	N/A
6	99.9999 g	N/A
7	99.9999 g	N/A
8	99.9999 g	N/A
9	99.9998 g	N/A
10	99.9999 g	N/A
Standard Deviation	0.00008 g	N/A

○ As Found
◆ As Left

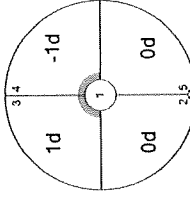


The "σ" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

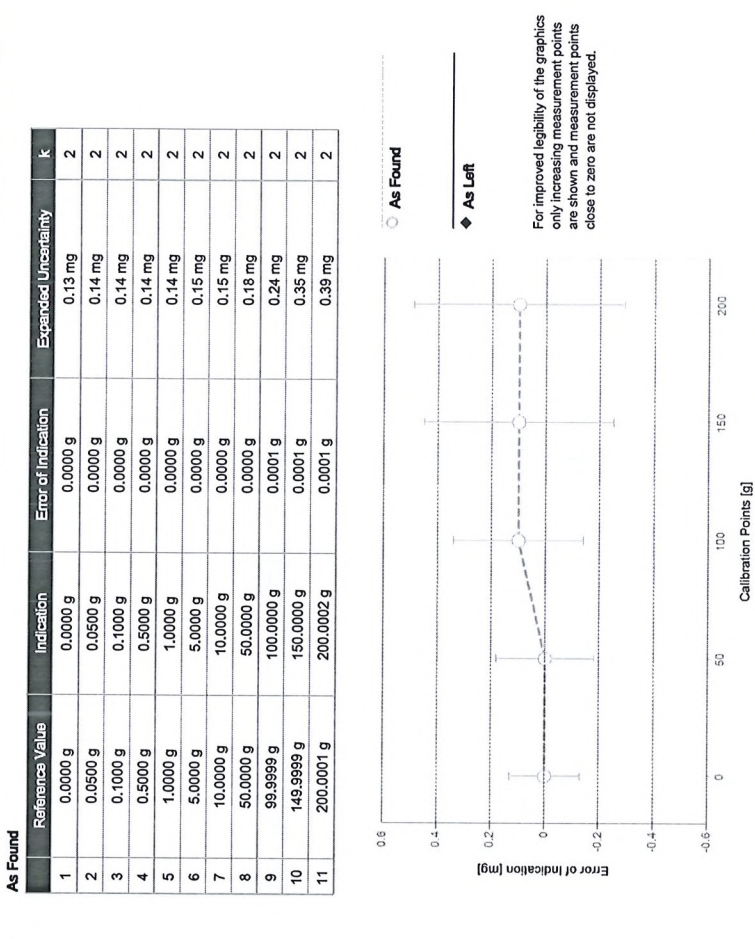
Position	As Found	As Left
1	99.9999 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	99.9998 g	N/A
5	99.9999 g	N/A
Maximum Deviation	0.0001 g	N/A



As Found

The "σ" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS38	Date of Issue:	15-Dec-2023
Certificate Number:	189517	Calibration Due Date:	15-Jun-2025

Weight Set 2: OIML E2

Weight Set No.:	WS38-1	Date of Issue:	22-Feb-2024
Certificate Number:	C411772496	Calibration Due Date:	22-Aug-2025

Weight Set 4: OIML E2

Weight Set No.:	WS38-3	Date of Issue:	27-Feb-2024
Certificate Number:	C411772498	Calibration Due Date:	27-Aug-2025

Thermo Hygrometer

Equipment No.:	IN256	Date of Issue:	19-Jul-2024
Certificate Number:	SG-H-00636/67	Calibration Due Date:	18-Jul-2025

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 3.0 · 10⁻⁶ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

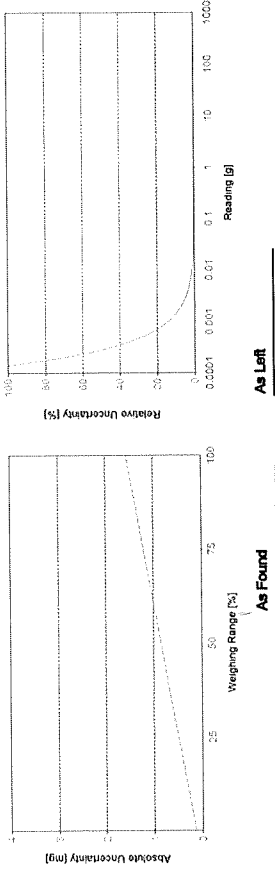
Uncertainty of Uncertainty Equation

Range		As Found		As Left	
d	Max				
1	0.0001 g	220 g	U ₁ = 0.14 mg + 0.00647 mg/g · R		N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.14 mg	0.64%	N/A	N/A
0.2200 g	0.14 mg	0.064%	N/A	N/A
2.2000 g	0.15 mg	0.0070%	N/A	N/A
22.0000 g	0.28 mg	0.0013%	N/A	N/A
220.0000 g	1.6 mg	0.00071%	N/A	N/A



GWP® Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results correspond to As Found.

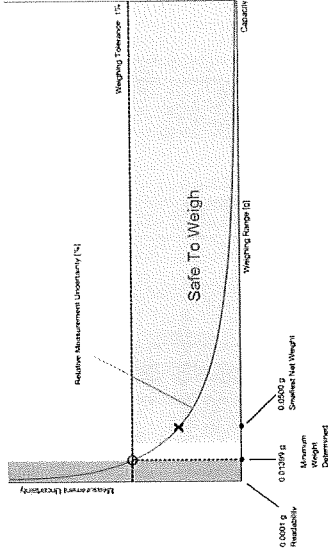
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.14075 g	0.28335 g	0.42783 g	0.72259 g	1.49521 g
0.2%	0.07015 g	0.14075 g	0.21182 g	0.35535 g	0.72259 g
0.5%	0.02800 g	0.05608 g	0.08423 g	0.14075 g	0.28335 g
1%	0.01399 g	0.02800 g	0.04203 g	0.07015 g	0.14075 g
2%	0.00699 g	0.01399 g	0.02100 g	0.03502 g	0.07015 g
5%	0.00280 g	0.00560 g	0.00839 g	0.01399 g	0.02800 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.14075 g	0.28335 g	0.42783 g	0.72259 g	1.49521 g
0.2%	0.07015 g	0.14075 g	0.21182 g	0.35535 g	0.72259 g
0.5%	0.02800 g	0.05608 g	0.08423 g	0.14075 g	0.28335 g
1%	0.01399 g	0.02800 g	0.04203 g	0.07015 g	0.14075 g
2%	0.00699 g	0.01399 g	0.02100 g	0.03502 g	0.07015 g
5%	0.00280 g	0.00560 g	0.00839 g	0.01399 g	0.02800 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

- 1. If "N/A" is shown above, no appropriate value could be calculated.
- 2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

Repeatability			
As Found	As Left	Eccentricity	Error of Indication
✓	✓	✓	✓

- ✓ = Passed
- ✗ = Failed
- ⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance		Control Limit	As Found		As Left	
			Std. Deviation	Result	Std. Deviation	Result
0.1%		N/A		N/A		N/A
0.2%		0.00005 g		✗		✗
0.5%		0.00013 g		✓		✓
1%		0.00025 g	0.00006 g*	✓	0.00006 g*	✓
2%		0.00050 g		✓		✓
5%		0.00125 g		✓		✓

*The calculated standard deviation value is below the rounding error of the balance. The 0.41*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance		Control Limit	As Found		As Left	
			Deviation	Result	Deviation	Result
0.1%		0.0500 g		✓		✓
0.2%		0.1000 g		✓		✓
0.5%		0.2500 g	0.0001 g	✓	0.0001 g	✓
1%		0.5000 g		✓		✓
2%		1.0000 g		✓		✓
5%		2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

Error of Indication

As Found

Reference Value		Error	Control limits for various weighing tolerances						
			0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g		0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0000 g		0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
99.99999 g		0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
149.9999 g		0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0001 g		0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result			✓	✓	✓	✓	✓	✓	

As Left

Control limits for various weighing tolerances								
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
99.9999 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
149.9999 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g	
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g	
Result		✓	✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25TM33

Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 110

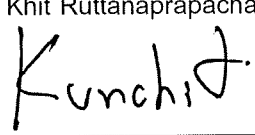
Serial No. : B414.0652

ID No. : ERTC-L-In-098

Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi,
Bangkok 10210

Location : หน้าห้อง 510

Received Order : 06 January 2025
Calibration Date : 06 January 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Khit Ruttanaprapachai


Approved by : _____
Approved Signatory

() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 18 January 2025

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.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2501-0004ON-3

Cert. No.: 25TM33

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025
2) Data Acquisition	MY49001451	24LM79	TPA	29 May 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

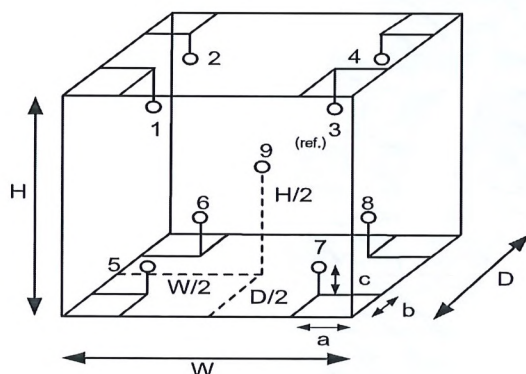
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	55	58
AC Supply (Volt)	222	221

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	19RTD-2/1	24-19TC-01
2	19RTD-2/2	24-19TC-02
3	19RTD-2/3	24-19TC-03
4	19RTD-2/4	24-19TC-04
5	19RTD-2/5	24-19TC-05
6	24-19RTD-2/6	24-19TC-06
7	19RTD-2/7	24-19TC-07
8	19RTD-2/8	24-19TC-08
9 (ref.)	19RTD-2/9	24-19TC-09

Probe Installation Details :

Dimension of Chamber :

a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
			Capacity =	0.11	m ³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2501-0004ON-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 25TM33

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
104.0	104.0	104.0	0.13	1.2	1.8	2
180.0	180.0	180.0	0.54	3.6	4.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.884	103.140	103.191	103.508	104.382	103.829	104.340	103.742	104.282	0.42
180.0	181.068	177.733	178.025	179.100	181.089	180.099	181.795	180.145	181.130	1.4

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

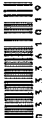
-o0o-

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Laksale Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: Environment Research & Technology
Address: 25/114 Moo 6, Soi Chirakret 1, Ngamwongwan Rd., Toongsoenghong
City: Laksi
Zip / Postal: 10210
State / Province: Bangkok
Order Number: 

Contact: Ramita Taengthai

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS204S/01	Asset Number:	ERTC-L-IN-088
Serial No.:	B334691537	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	5	Terminal Asset No.:	N/A
Room:	504		

Range	Max Capacity	Readability (g)
1	220 g	0.0001 g

Procedure

Calibration Guidelines: EURAMET cg-18 v. 4.0/CENAM-ema:2015
CPIW002/20
METTLER TOLEDO Work Instruction:
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 19.7 °C End: 19.6 °C	Start: 40.0 % End: 45.0 %

As Found Calibration Date: 15-Jan-2025
As Left Calibration Date: N/A
Issue Date: 17-Jan-2025
Calibrator: Supt.
Supapit Kruapoo
Approved Signatory: 

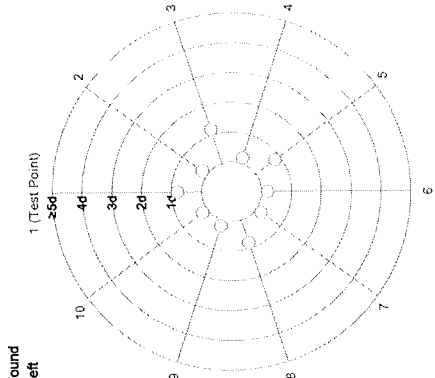
Technical Manager / Head of Calibration Center

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0002 g	N/A
4	100.0001 g	N/A
5	100.0000 g	N/A
6	100.0001 g	N/A
7	100.0001 g	N/A
8	100.0000 g	N/A
9	100.0001 g	N/A
10	100.0001 g	N/A
Standard Deviation	0.00006 g	N/A

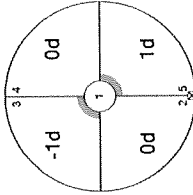


The "g" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0001 g	N/A

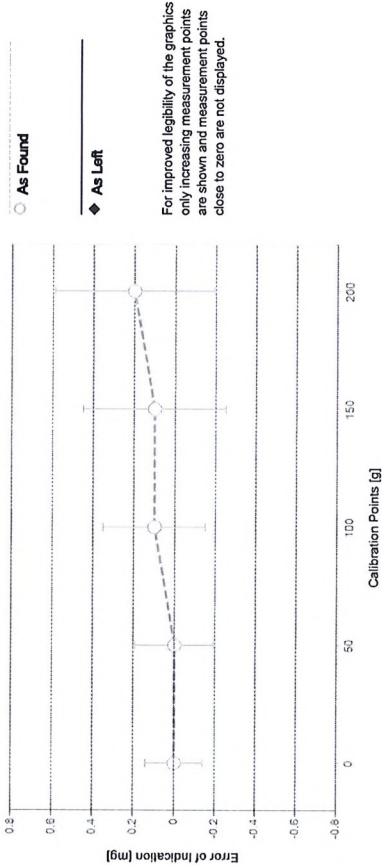


As Found

The "g" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found				
	Reference Value	Indication	Error of Indication	Expanded Uncertainty
1	0.0000 g	0.0000 g	0.0000 g	0.14 mg
2	0.0500 g	0.0500 g	0.0000 g	0.15 mg
3	0.1000 g	0.1000 g	0.0000 g	0.15 mg
4	0.5000 g	0.5000 g	0.0000 g	0.15 mg
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg
6	5.0000 g	5.0000 g	0.0000 g	0.16 mg
7	10.0000 g	10.0001 g	0.0001 g	0.16 mg
8	50.0000 g	50.0000 g	0.0000 g	0.19 mg
9	99.9999 g	100.0000 g	0.0001 g	0.25 mg
10	149.9999 g	150.0000 g	0.0001 g	0.35 mg
11	200.0001 g	200.0003 g	0.0002 g	0.39 mg



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS38	Date of Issue:	15-Dec-2023
Certificate Number:	189517	Calibration Due Date:	15-Jun-2025

Weight Set 2: OIML E2

Weight Set No.:	WS38-1	Date of Issue:	22-Feb-2024
Certificate Number:	C411772496	Calibration Due Date:	22-Aug-2025

Weight Set 3: OIML E2

Weight Set No.:	WS38-3	Date of Issue:	27-Feb-2024
Certificate Number:	C411772496	Calibration Due Date:	27-Aug-2025

Thermo Hygrometer

Equipment No.:	IN256	Date of Issue:	19-Jul-2024
Certificate Number:	SC-H-00636/67	Calibration Due Date:	18-Jul-2025

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-4} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

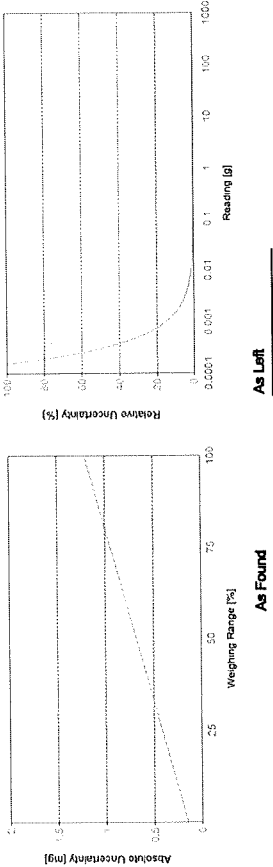
Uncertainty of Uncertainty Equation

Range		As Found		As Left	
d	Max				
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00482 \text{ mg/g} \cdot R$	N/A	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Example)

Net Indication	As Found		As Left	
0.0220 g	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.16 mg	0.0073%	N/A	N/A
22.0000 g	0.26 mg	0.0012%	N/A	N/A
220.0000 g	1.2 mg	0.00055%	N/A	N/A



GWP® Certificate

As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results correspond to As Found.

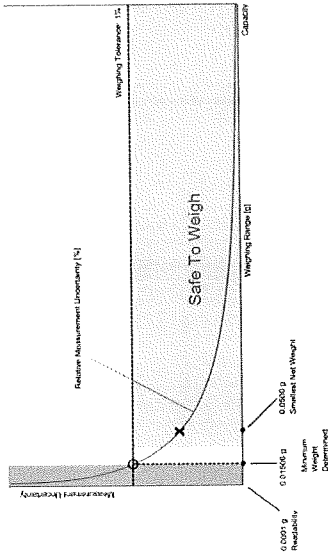
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.15128 g	0.30404 g	0.45829 g	0.77136 g	1.58179 g
0.2%	0.07546 g	0.15128 g	0.22748 g	0.38098 g	0.77136 g
0.5%	0.03014 g	0.06034 g	0.09059 g	0.15128 g	0.30404 g
1%	0.01506 g	0.03014 g	0.04523 g	0.07546 g	0.15128 g
2%	0.00753 g	0.01506 g	0.02260 g	0.03768 g	0.07546 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01506 g	0.03014 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.15128 g	0.30404 g	0.45829 g	0.77136 g	1.58179 g
0.2%	0.07546 g	0.15128 g	0.22748 g	0.38098 g	0.77136 g
0.5%	0.03014 g	0.06034 g	0.09059 g	0.15128 g	0.30404 g
1%	0.01506 g	0.03014 g	0.04523 g	0.07546 g	0.15128 g
2%	0.00753 g	0.01506 g	0.02260 g	0.03768 g	0.07546 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01506 g	0.03014 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

- 1. If "N/A" is shown above, no appropriate value could be calculated.
- 2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

Repeatability			
As Found	As Left	Eccentricity	Error of Indication
✓	✓	✓	✓

- ✓ = Passed
- ✗ = Failed
- ⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance		Control Limit	As Found		As Left	
			Std. Deviation	Result	Std. Deviation	Result
0.1%		N/A		N/A		N/A
0.2%		0.00005 g		✗		✗
0.5%		0.00013 g		✓		✓
1%		0.00025 g		✓	0.00006 g*	✓
2%		0.00050 g		✓		✓
5%		0.00125 g		✓		✓

*The calculated standard deviation value is below the rounding error of the balance. The 0.41*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance		Control Limit	As Found		As Left	
			Deviation	Result	Deviation	Result
0.1%		0.0500 g		✓		✓
0.2%		0.1000 g		✓		✓
0.5%		0.2500 g		✓		✓
1%		0.5000 g		✓	0.0001 g	✓
2%		1.0000 g		✓		✓
5%		2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

Error of Indication

As Found

Reference Value		Error	Control limits for various weighing tolerances					
			0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	0.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	0.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0002 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result			✓	✓	✓	✓	✓	✓

As Left

Control limits for various weighing tolerances							
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Agilent CrossLab Start Up Services

Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about *Agilent Technical Support Services*, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the *Agilent YouTube* channel at <https://www.youtube.com/user/agilent>.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID ERTC - L-in - 175 / US2125A011

Instrument System Site and Location Environment Research & Technology Co., Ltd / BE ECD

List System Component Product Numbers

List the Serial Numbers of each Component

1. G55A0A	US2125A011
2. G4513A	CN21195125
3. G4514A	CN21207024

4.
5.
6.
7.
8.
9.
10.

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

ALS Maintenance

Section NOT applicable

- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values.
- ☒ Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Preventive Maintenance Procedure

Clean and Inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed, off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	8890 GC	1/4 2
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1/4 N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Teflon Guide Ignitor (glow plug) assembly with O-ring	5182-9748	8890 GC	N/A
	19231-60680	8890 GC	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	115.4
Back detector output	N/A	11.5
AUX 1 detector output	N/A	22.0
AUX 2 detector output	N/A	22.0
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Passed
Leak and Restriction Test after back inlet maintenance	Pass	Passed
Leak and Restriction Test after front inlet Split Vent	Pass	Passed
Trap replacement	Pass	Passed
Leak and Restriction Test after back inlet Split Vent	Pass	Passed
Trap replacement	Pass	Passed
Front inlet pressure decay test	Pass	Passed
Back inlet pressure decay test	Pass	Passed

Agilent 8890 GC Preventive Maintenance Checklist

Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Completed, All Result passed.

Service Completion

Service request number 6007597701 Date service completed 05 JUN 2024
Agilent signature [Signature] Customer signature [Signature]

Total number of pages in this document 9

PM REPORT

Service Order No./Request: 6007595663
EQP Revision: GC.02.52
Overall PM Status: Completed

Organization Name: Environment Research & Technology Co., Ltd.
Organization Location: Ngamwongwan Rd., 25/114 Moo 6 Soi Chinnakhet 1
Thungsohong Luksi Bangkok 10210

Operator Name: Saenguthai Tarak
Customer Contact: K.Virat Hamvannanukul

Purpose and Customer Responsibilities

Preventive maintenance (PM) is an Agilent Technologies recommended procedure designed to reduce the likelihood of electro-mechanical failures. Failure to perform a PM may reduce the long-term reliability of certain instruments and systems. As applicable, customers should make the following available: operating supplies; consumables; usage-dependent items such as gases, vials, syringes, solvents; a means for disposing waste (solvents). Before the support provider arrives on site, the customer should save all methods and remove all samples from the autosampler. During the PM, a customer representative should be available.

Instrument Details ID: ERTC-L-In-175_US2125A011

Module	PM Type
Tested Combination1	Not applicable
Tested Combination2	Not applicable
Tested Combination3	Not applicable
Tested Combination4	Not applicable
Sampler 1	Standard
Sampler 2	No PM
Sampler 3	Not applicable
Mainframe 1	Standard
Inlet 1	Standard
Inlet 2	Standard
Detector 1	Standard
Detector 2	Standard

Date: June 11, 2025 8:15:25 PM
System ID: ERTC-L-In-175_US2125A011

Detector 3 Standard
Detector 4 Standard

Manufacturer	Type	Serial # or Location	Firmware
Agilent Technologies	Injection Tower	CN21195125	A.11.06
Agilent Technologies	Tray	CN21207024	A.11.03
Agilent Technologies	Manual Injection		
Agilent Technologies	8890	US2125A011	2.3.3.6
Agilent Technologies	SSL	Front	Not applicable
Agilent Technologies	SSL	Back	Not applicable
Agilent Technologies	FID	Back	
Agilent Technologies	FPD+	Middle	
Agilent Technologies	ECD	U38762	
Agilent Technologies	ECD	U39045	

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Task List		System Inspection - 8890 : - Mainframe		Inlet Maintenance - Front SSL : - Inlet: 8890			
Ask the customer if firmware should be updated now				Replace septa		Completed	
Discuss any problems customer is having with instrument				Replace inlet seal		Completed	
Check logbook/records and exclude maintenance on recently serviced items				Replace washer		Completed	
Record or print operating/method parameters (columns, flows, temperatures, and so on)				Replace liner		Completed	
Perform a general inspection of each system module				Replace O-ring		Completed	
Alert customer to any potential safety issues (waste container(s) full, frayed wiring, and so on)				Replace split vent trap		Completed	
As applicable, check that autosampler waste lines are properly routed and not kinked or obstructed; check that drip trays are properly positioned				Zero all pressure sensors		Completed	
As applicable, check carrier gas line filters for color change and inform customer of any service life issues				Perform leak and restriction test		Completed	
Record obvious problems, external damage, firmware upgrades, other comments				Perform split vent restriction test		Completed	
Process the inspection tasks				Perform pressure decay test		Completed	
Mainframe Maintenance - 8890 : - Mainframe: 8890				Process the inlet tasks		Completed	
Open GC covers and remove any dust or debris				Inlet Maintenance - Back SSL : - Inlet: 8890			
Inspect internal connectors for proper contact and placement				Replace septa		Completed	
Perform the GC initialization test				Replace inlet seal		Completed	
Verify operation of oven motor				Replace washer		Completed	
Verify operation of all cooling fans				Replace liner		Completed	
Verify operation of intake/outlet damper or flapper				Replace O-ring		Completed	
Process the mainframe tasks				Replace split vent trap		Completed	
				Zero all pressure sensors		Completed	
				Perform leak and restriction test		Completed	
				Perform split vent restriction test		Completed	
				Perform pressure decay test		Completed	
				Process the inlet tasks		Completed	

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Detector Maintenance - Back FID : - GC Detector: 8890		Detector Maintenance - Left ECD : - GC Detector: 8890		Detector Maintenance - Back FID : - GC Detector: 8890		Detector Maintenance - Left ECD : - GC Detector: 8890	
Record pre-PM detector offset	Completed	Record pre-PM detector offset	Completed	Record pre-PM detector offset	Completed	Record pre-PM detector offset	Completed
Clean the collector assembly	Completed	Restore the normal operating conditions or customer method	Completed	Clean the collector assembly	Completed	Restore the normal operating conditions or customer method	Completed
Clean or replace ignitor	Completed	Purge the system with carrier flow for 15 minutes	Completed	Clean or replace ignitor	Completed	Purge the system with carrier flow for 15 minutes	Completed
Replace jet	Completed	Bake out the system and restore the normal operating conditions	Completed	Replace jet	Completed	Bake out the system and restore the normal operating conditions	Completed
Restore the normal operating conditions or customer method	Completed	Perform system checkout	Completed	Restore the normal operating conditions or customer method	Completed	Perform system checkout	Completed
Purge the system with carrier flow for 15 minutes	Completed	Record post-PM detector offset	Completed	Purge the system with carrier flow for 15 minutes	Completed	Record post-PM detector offset	Completed
Bake out the system and restore the normal operating conditions	Completed	Process the detector tasks	Completed	Bake out the system and restore the normal operating conditions	Completed	Process the detector tasks	Completed
Perform system checkout	Completed	Sampler Maintenance - Front Injection Tower : - Sampler: 7693A	Completed	Perform system checkout	Completed	Sampler Maintenance - Front Injection Tower : - Sampler: 7693A	Completed
Record post-PM detector offset	Completed	Verify all cables are installed properly	Completed	Record post-PM detector offset	Completed	Verify all cables are installed properly	Completed
Process the detector tasks	Completed	Clean surface of tray arm, gripper jaws, rods, and quadrants	Completed	Process the detector tasks	Completed	Clean surface of tray arm, gripper jaws, rods, and quadrants	Completed
Detector Maintenance - Middle FPD+ : - GC Detector: 8890	Completed	Check tray quadrants for proper fit	Completed	Detector Maintenance - Middle FPD+ : - GC Detector: 8890	Completed	Check tray quadrants for proper fit	Completed
Perform system checkout	Completed	Clean injector needle guide cone/vial stripper, needle support, and nearby surfaces	Completed	Perform system checkout	Completed	Clean injector needle guide cone/vial stripper, needle support, and nearby surfaces	Completed
Record pre-PM detector offset	Completed	Clean injector turret sample vial inserts, if applicable	Completed	Record pre-PM detector offset	Completed	Clean injector turret sample vial inserts, if applicable	Completed
Disassemble the detector	Completed	Clean surface of the injector	Completed	Disassemble the detector	Completed	Clean surface of the injector	Completed
Disassemble the optics assembly	Completed	Remove any dust or debris from the electronics assembly vents	Completed	Disassemble the optics assembly	Completed	Remove any dust or debris from the electronics assembly vents	Completed
Clean/Replace the brazement (as needed)	Completed	Perform a test injection	Completed	Clean/Replace the brazement (as needed)	Completed	Perform a test injection	Completed
Reassemble the optics assembly	Completed	Process the sampler tasks	Completed	Reassemble the optics assembly	Completed	Process the sampler tasks	Completed
Reassemble the detector	Completed	Service Review - 8890 : - Qualitative Test - No setpoints associated	Completed	Reassemble the detector	Completed	Service Review - 8890 : - Qualitative Test - No setpoints associated	Completed
Perform system checkout	Completed	Perform post-PM service review	Completed	Perform system checkout	Completed	Perform post-PM service review	Completed
Record post-PM detector offset	Completed	Smart Alerts	Completed	Record post-PM detector offset	Completed	Smart Alerts	Completed
Process the detector tasks	Completed	Process the service review tasks	Completed	Process the detector tasks	Completed	Process the service review tasks	Completed
Detector Maintenance - Front ECD : - GC Detector: 8890	Completed			Detector Maintenance - Front ECD : - GC Detector: 8890	Completed		
Record pre-PM detector offset	Completed			Record pre-PM detector offset	Completed		
Restore the normal operating conditions or customer method	Completed			Restore the normal operating conditions or customer method	Completed		
Purge the system with carrier flow for 15 minutes	Completed			Purge the system with carrier flow for 15 minutes	Completed		
Bake out the system and restore the normal operating conditions	Completed			Bake out the system and restore the normal operating conditions	Completed		
Perform system checkout	Completed			Perform system checkout	Completed		
Record post-PM detector offset	Completed			Record post-PM detector offset	Completed		
Process the detector tasks	Completed			Process the detector tasks	Completed		

Test Record

GC/GCMS System Inspection

Firmware Update

Was firmware updated (at customer request)?

No

Mainframe

Name/SN:

8890

US2125A011

Initialization

This test verifies that the GC can complete its self-test after turn-on and not report any error. A not-ready status is not considered as an error.

Status:

Pass

Inlet

Type/Loc.:

SSL

Front

Pressure Decay

This test demonstrates the pressure integrity of the GC inlet. A FAIL indicates that leak is present in the GC carrier gas flow path.

P1: 25.3 psi

Pressure Change: P2 - P1

P2: 24.9 psi

Limit:

-0.4 psi

/5 minutes

>= -2.0 psi

<= 0.5 psi

AND

Pass

Status:

Pass

Leak and Restriction

This test demonstrates that the inlet controls at the specified setpoint to verify the basic operation of inlet and flow path.

Status:

Pass

Split Vent Restriction

This test demonstrates that the split vent is operational.

Status:

Pass

Inlet

Type/Loc.:

SSL

Back

Date:

June 11, 2025 8:15:25 PM

System ID:

ERTC-L-In-175_US2125A011

Pressure Decay

This test demonstrates the pressure integrity of the GC inlet. A FAIL indicates that leak is present in the GC carrier gas flow path.

P1: 25.0 psi

Pressure Change: P2 - P1

P2: 24.8 psi

Limit:

-0.2 psi

/5 minutes

>= -2.0 psi

<= 0.5 psi

AND

Pass

Status:

Pass

Leak and Restriction

This test demonstrates that the inlet controls at the specified setpoint to verify the basic operation of inlet and flow path.

Status:

Pass

Split Vent Restriction

This test demonstrates that the split vent is operational.

Status:

Pass

Detector

Type/Loc.:

FID

Back

Offsets (Pre PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Pre PM:

22.4

Offsets (Post PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Post PM:

19.3

System Checkout

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Blank

Status:

Pass

Detector

Type/Loc.:

FPD+

Middle

Date:

June 11, 2025 8:15:25 PM

System ID:

ERTC-L-In-175_US2125A011

System Checkout (Pre PM)

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Status:

Offsets (Pre PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Pre PM:

Offsets (Post PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Post PM:

System Checkout

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Status:

Detector

Type/Loc.:

Offsets (Pre PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Pre PM:

Offsets (Post PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Post PM:

System Checkout

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Status:

Detector

Type/Loc.:

Offsets (Pre PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Pre PM:

Offsets (Post PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Post PM:

System Checkout

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Status:

NOTE: This test's 0 comment(s) and 1 deviation(s) are available in the Attachments section.

Sampler

Type/Loc.:

Sampler Checkout

This test demonstrates that sampler movements and communications operate as expected during an injection cycle. It is not a test of instrument performance.

Status:

GC/GCMS Service Review

Repeated Test Log

Repeated Test Name:

Detector Maintenance - Left ECD:-- GC Detector: 8890-Run 1

Detector

Type/Loc:

ECD

Left

Offsets (Pre PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Pre PM:

246.5

Offsets (Post PM)

This section records the detector offset values. Pre-PM and post-PM results should be similar.

Post PM:

2254.7

System Checkout

This test demonstrates that all instrument modules are correctly installed and connected, and a test injection produces a chromatogram with the expected characteristics. It is not a test of instrument performance.

Standard:

Blank

Status:

Pass

Post-PM Service Review

Record the PM service activity in the customer's instrument records/logbook

Status:

Completed

Update/reset instrument maintenance counters

Status:

Completed

Add PM sticker to system or logbook

Status:

Completed

Review service and all test results with customer

Status:

Completed

Record instrument firmware updates in PM attachments or IQ record

Status:

Not applicable

Supply the customer with a copy of the Smart Alerts flyer

Status:

Not applicable

Describe Smart Alerts to the customer

Status:

Not applicable

Install Smart Alerts if requested

Status:

Not applicable

Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the PM Report. Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	General	Operator's training certificate and qualifications	15
EQR	Deviation	Detector Maintenance - Left EOD: - GC Detector: 8890	16
EQR	Parts Record	Inlet 1	17
EQR	Parts Record	Inlet 2	17
EQR	Parts Record	Sampler 1	17
EQR	Parts Record	Sampler 2	17
EQR	Parts Record	Sampler 3	17
EQR	Parts Record	Detector 1	17
EQR	Parts Record	Detector 2	17
EQR	Parts Record	Detector 3	17
EQR	Parts Record	Detector 4	17

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:	Saenguthai Saeng Tarak
Title Of Course:	AN-CE-GC-IL-113-A: 8890/8860 GC Service Training SPFFPM and Troubleshooting
Completion Date:	November 25, 2021
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	June 11, 2025
Reason for Signature:	Executed protocol and published this original version of document

ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

Regulatory Disclaimer

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