ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือวิเคราะห์

เอกสารการสอบเทียบเครื่องมือตรวจวัด
บริษัท เอ็นไวรอนเมนท์ รีเสริช แอนด์ เทคโนโลยี จำกัด

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TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

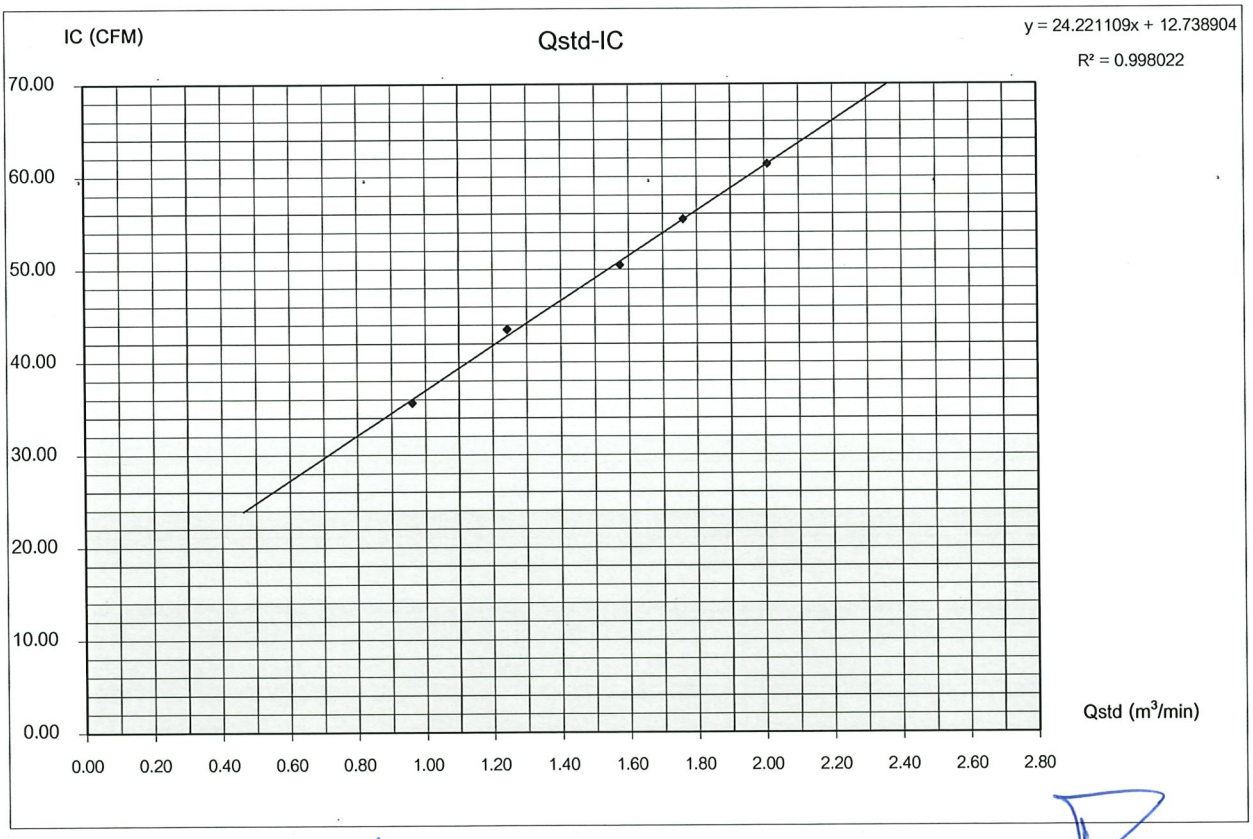
Quotation	2024-01738			*Date*	December 2, 2024
Sampler Location	วัดเขาโพธิ์			*Start Time*	12:50 PM
Sampler Number	TSP No.A3	Transfer Standard Type	Orifice	*Stop Time*	1:00 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	704	Calibrator Serial Number	2915		
Recorder Serial Number	4651				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m^3/min)	(I) ample Flow Rate Indicatio (ft^3/min)	(Y) IC = I$[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O								
5	1.5	1.5	3.0	1.71431	0.96077	36.0	35.63	303.0	757.0		
7	2.5	2.5	5.0	2.21316	1.24252	44.0	43.55	303.0	757.0		
10	4.0	4.0	8.0	2.79945	1.57365	51.0	50.48	303.0	757.0		
13	5.0	5.0	10.0	3.12988	1.76027	56.0	55.43	303.0	757.0		
18	6.5	6.5	13.0	3.56861	2.00806	62.0	61.36	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.998022	Pstd(mmHg) 760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.9990105	T_{NTP}	298.0
3	Correlation Coefficient (r)	0.99974	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

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PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

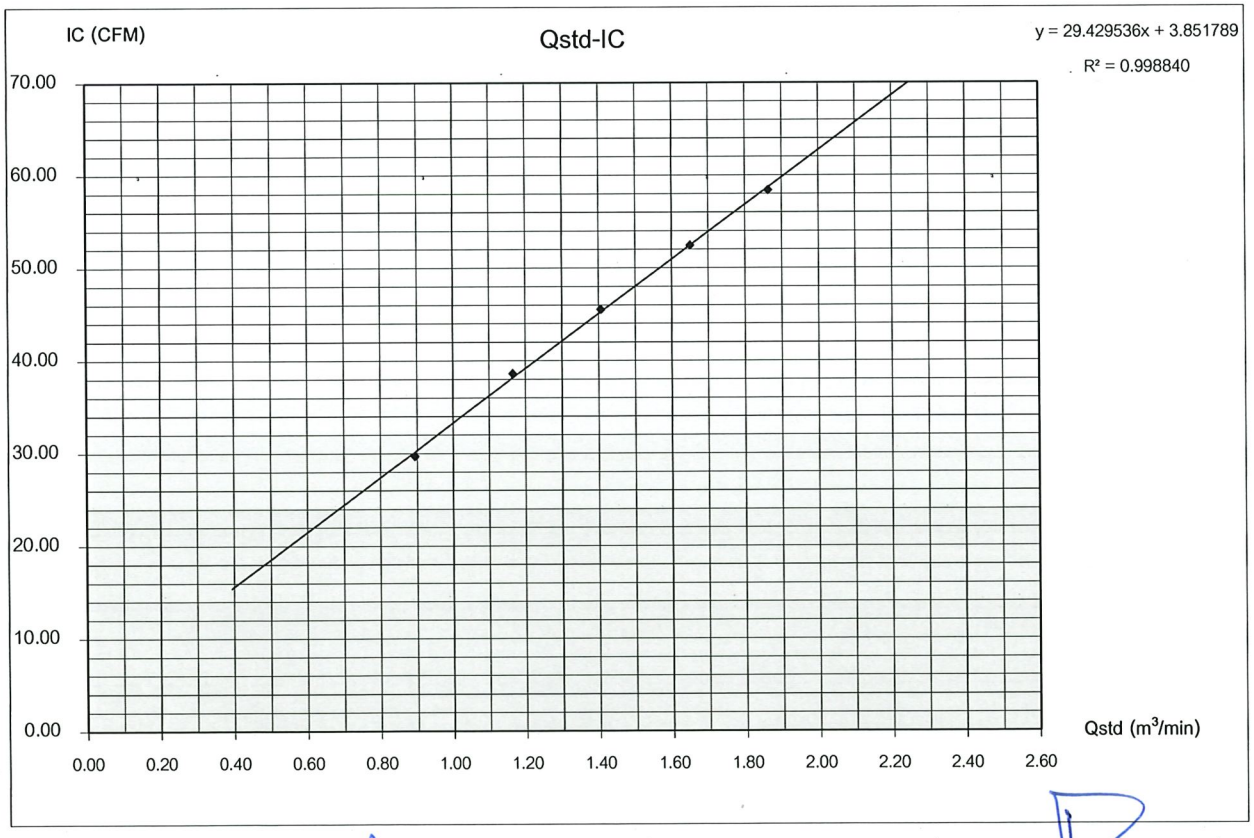
Quotation	2024-01738			*Date*	December 2, 2024
Sampler Location	วัดเขาโพธิ์			*Start Time*	12:39 PM
Sampler Number	PM-10 No.19	Transfer Standard Type	Orifice	*Stop Time*	12:49 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	2133	Calibrator Serial Number	2915		
Recorder Serial Number	2396				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m^3/min)	(I) ample Flow Rate Indicatio (ft^3/min)	(Y) $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O								
5	1.3	1.3	2.6	1.59593	0.89392	30.0	29.69	303.0	757.0		
7	2.2	2.2	4.4	2.07613	1.16513	39.0	38.60	303.0	757.0		
10	3.2	3.2	6.4	2.50391	1.40673	46.0	45.53	303.0	757.0		
13	4.4	4.4	8.8	2.93609	1.65082	53.0	52.46	303.0	757.0		
18	5.6	5.6	11.2	3.31236	1.86333	59.0	58.40	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.99884	Pstd(mmHg) 760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)		1.133	r	0.9994198	T_{NTP} 298.0
3	Correlation Coefficient (r)	0.99974	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

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TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

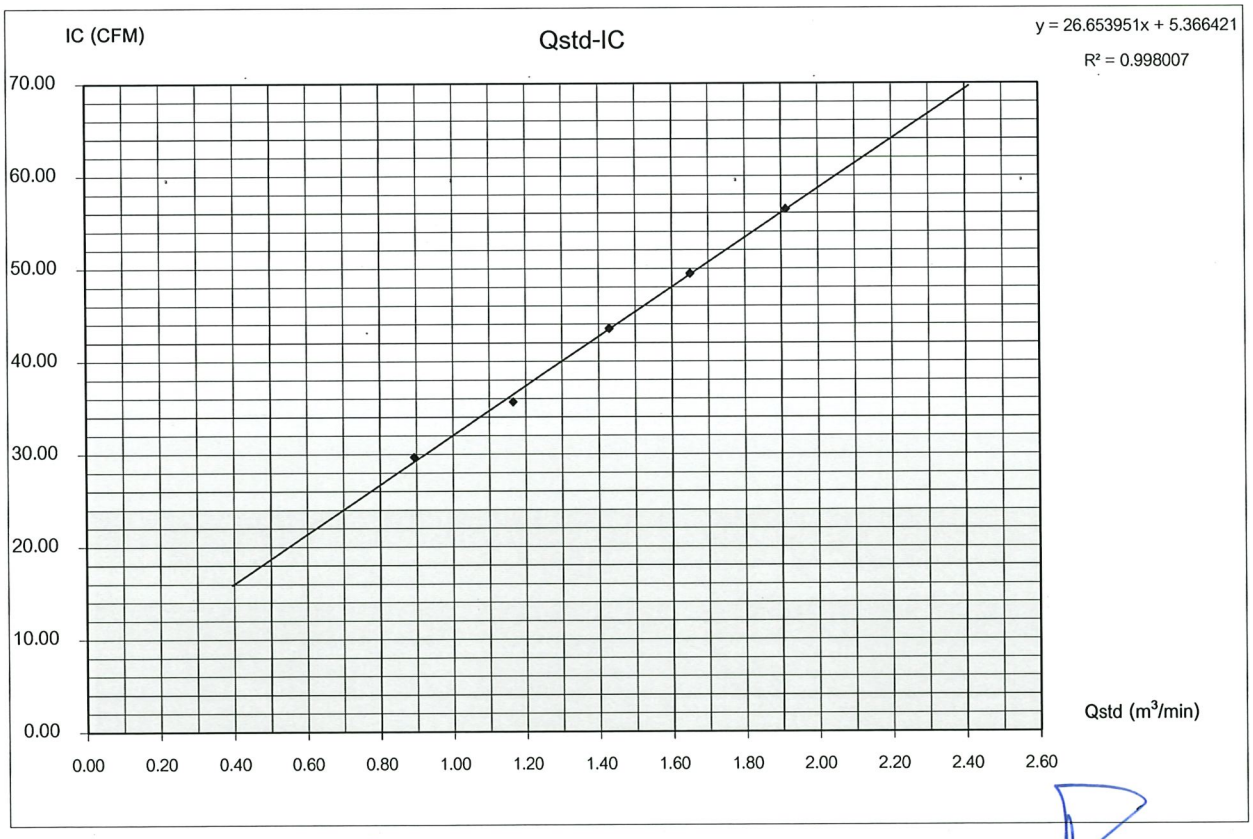
Quotation	2024-01738			*Date*	December 2, 2024
Sampler Location	วัดมาบตอง			*Start Time*	12:09 PM
Sampler Number	TSP No.A28	Transfer Standard Type	Orifice	*Stop Time*	12:19 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	2217	Calibrator Serial Number	2915		
Recorder Serial Number	2134				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m^3/min)	(I) ample Flow Rate Indicatio (ft^3/min)	(Y) IC = I$[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O								
5	1.3	1.3	2.6	1.59593	0.89392	30.0	29.69	303.0	757.0		
7	2.2	2.2	4.4	2.07613	1.16513	36.0	35.63	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.42865	44.0	43.55	303.0	757.0		
13	4.4	4.4	8.8	2.93609	1.65082	50.0	49.49	303.0	757.0		
18	5.9	5.9	11.8	3.39992	1.91278	57.0	56.42	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation		r^2	0.998007	Pstd(mmHg)	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.999003	T_{NTP}	298.0
3	Correlation Coefficient (r)	0.99974	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

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PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

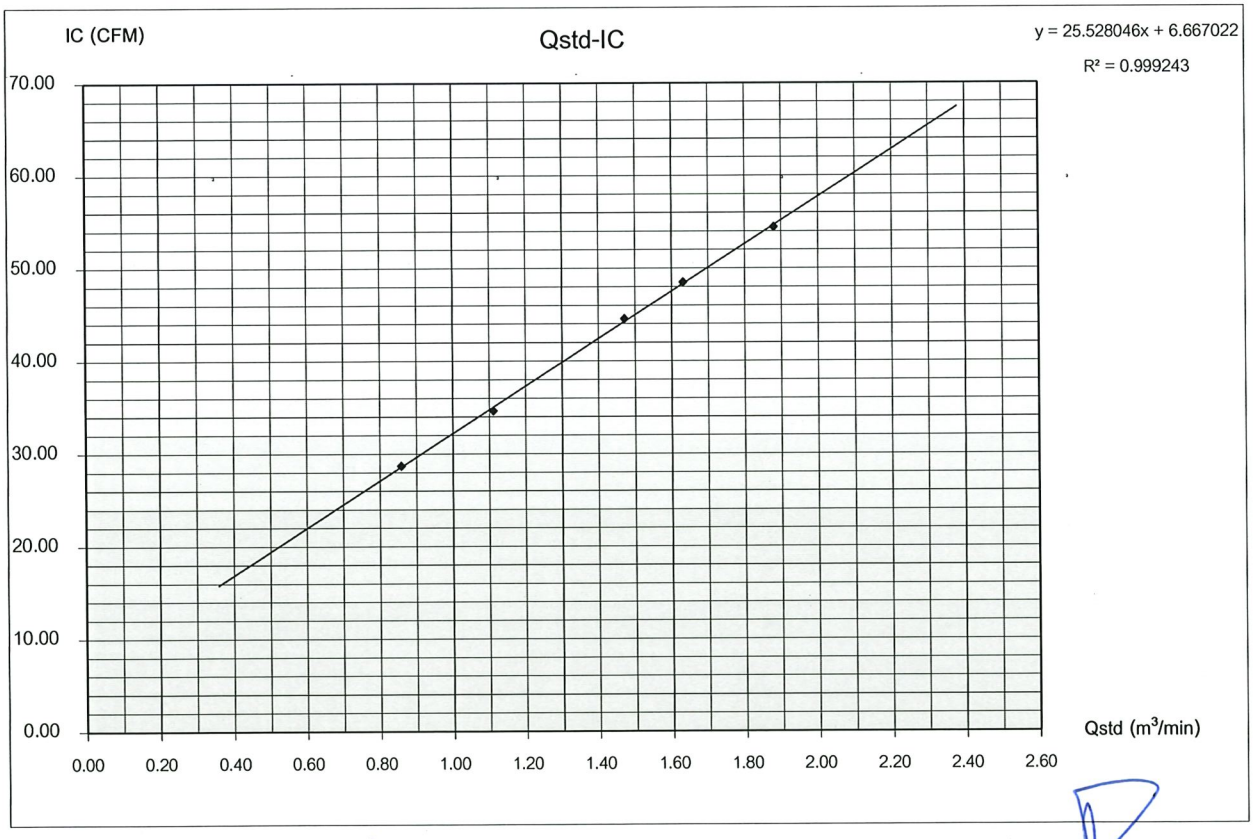
Quotation	2024-01738			*Date*	December 2, 2024
Sampler Location	วัดมาบตอง			*Start Time*	11:58 AM
Sampler Number	PM-10 No.25	Transfer Standard Type	Orifice	*Stop Time*	12:08 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	2150	Calibrator Serial Number	2915		
Recorder Serial Number	2409				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m^3/min)	(I) ample Flow Rate Indicatio (ft^3/min)	(Y) IC = I[(Pa/P_{std})(T_{std}/Ta)]$^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O								
5	1.2	1.2	2.4	1.53332	0.85856	29.0	28.70	303.0	757.0		
7	2.0	2.0	4.0	1.97951	1.11056	35.0	34.64	303.0	757.0		
10	3.5	3.5	7.0	2.61865	1.47153	45.0	44.54	303.0	757.0		
13	4.3	4.3	8.6	2.90253	1.63186	49.0	48.50	303.0	757.0		
18	5.7	5.7	11.4	3.34180	1.87995	55.0	54.44	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation		r^2	0.999243	Pstd(mmHg)	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.9996214	T_{NTP}	298.0
3	Correlation Coefficient (r)	0.99974	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

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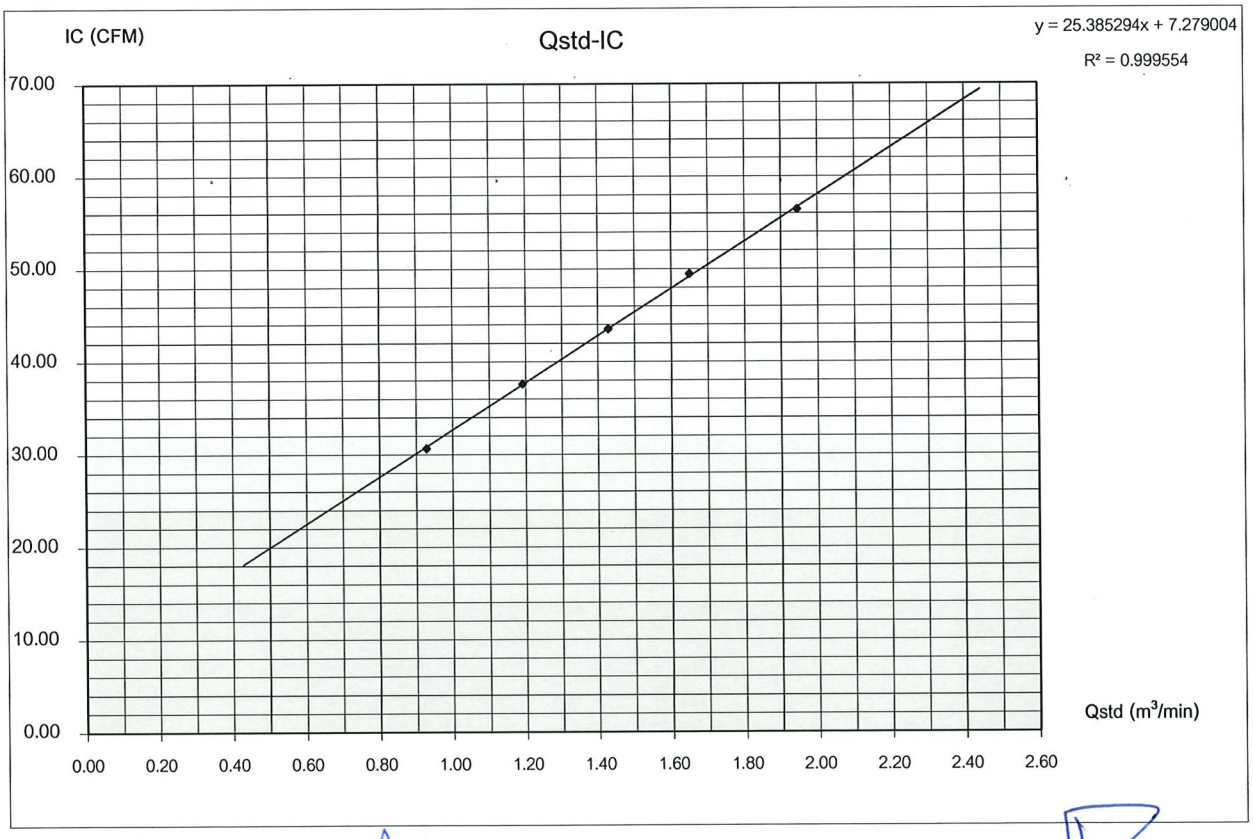
Quotation	2024-01738			*Date*	December 2, 2024
Sampler Location	วัดมาบข่า			*Start Time*	9:50 AM
Sampler Number	TSP No.A22	Transfer Standard Type	Orifice	*Stop Time*	10:00 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	2054	Calibrator Serial Number	2915		
Recorder Serial Number	2187				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)]	(I) ample Flow Rate Indicatio	(Y) $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O		(m^3/min)	(ft^3/min)		(°K = °C+273)	(mmHg)		
5	1.4	1.4	2.8	1.65618	0.92794	31.0	30.68	303.0	757.0		
7	2.3	2.3	4.6	2.12279	1.19148	38.0	37.61	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.42865	44.0	43.55	303.0	757.0		
13	4.4	4.4	8.8	2.93609	1.65082	50.0	49.49	303.0	757.0		
18	6.1	6.1	12.2	3.45707	1.94506	57.0	56.42	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.999554	Pstd(mmHg)	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.999777	T_{NTP}	298.0	
3	Correlation Coefficient (r)	0.99974	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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Technician

Approved By ..... (Mr.Panupon Podang)
Environmental Scientist

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PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

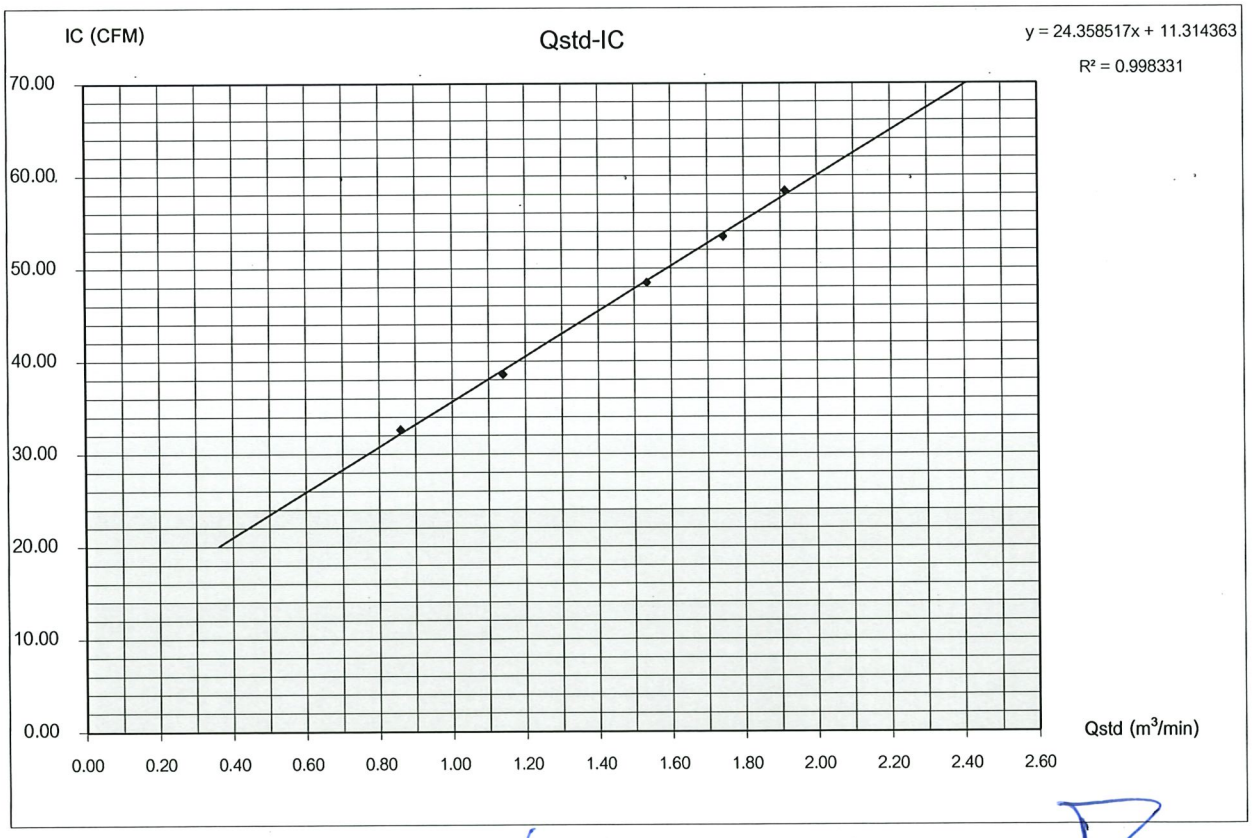
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Sampler Location	วัดมาบข่า			*Start Time*	9:39 AM
Sampler Number	PM-10 No.13	Transfer Standard Type	Orifice	*Stop Time*	9:49 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	B2012-01	Calibrator Serial Number	2915		
Recorder Serial Number	4654				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m^3/min)	(I) ample Flow Rate Indicatio (ft^3/min)	(Y) IC = I$[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O								
5	1.2	1.2	2.4	1.53332	0.85856	33.0	32.66	303.0	757.0		
7	2.1	2.1	4.2	2.02840	1.13817	39.0	38.60	303.0	757.0		
10	3.8	3.8	7.6	2.72857	1.53361	49.0	48.50	303.0	757.0		
13	4.9	4.9	9.8	3.09843	1.74250	54.0	53.45	303.0	757.0		
18	5.9	5.9	11.8	3.39992	1.91278	59.0	58.40	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.998331	Pstd(mmHg) 760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)		1.133	r	0.9991652	T_{NTP} 298.0
3	Correlation Coefficient (r)	0.99974	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 ..... Approved By .....

(Mr. Prayun Detkla)
Technician

(Mr.Panupon Podang)
Environmental Scientist

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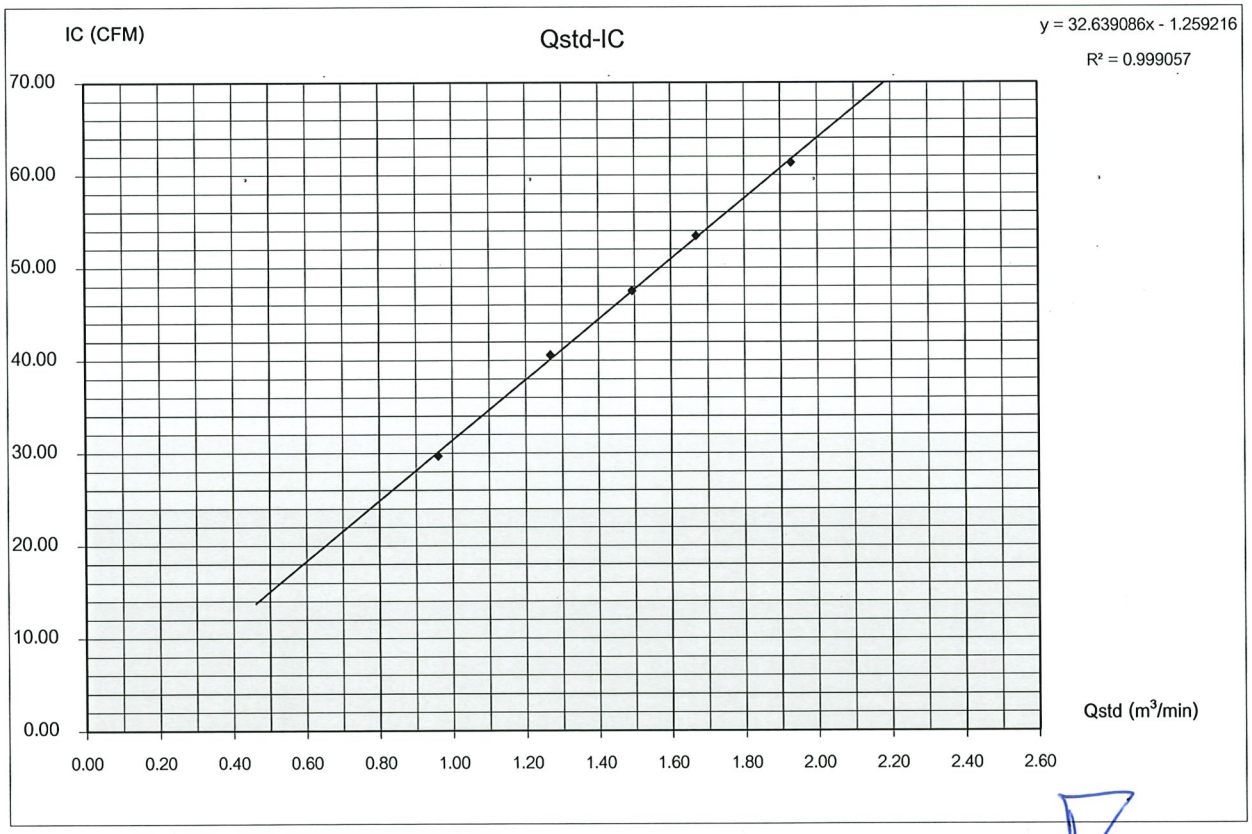
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Sampler Location	วัดหนองผักหนาม			*Start Time*	10:42 AM
Sampler Number	TSP No.A2	Transfer Standard Type	Orifice	*Stop Time*	10:52 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	6215-462	Calibrator Serial Number	2915		
Recorder Serial Number	4642				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)]	(I) ample Flow Rate Indicatio	(Y) IC = I$[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O		(m^3/min)	(ft^3/min)		(°K = °C+273)	(mmHg)		
5	1.5	1.5	3.0	1.71431	0.96077	30.0	29.69	303.0	757.0		
7	2.6	2.6	5.2	2.25699	1.26727	41.0	40.58	303.0	757.0		
10	3.6	3.6	7.2	2.65579	1.49251	48.0	47.51	303.0	757.0		
13	4.5	4.5	9.0	2.96927	1.66955	54.0	53.45	303.0	757.0		
18	6.0	6.0	12.0	3.42861	1.92899	62.0	61.36	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.999057	Pstd(mmHg) 760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)		1.133	r	0.9995284	T_{NTP} 298.0
3	Correlation Coefficient (r)	0.99974	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

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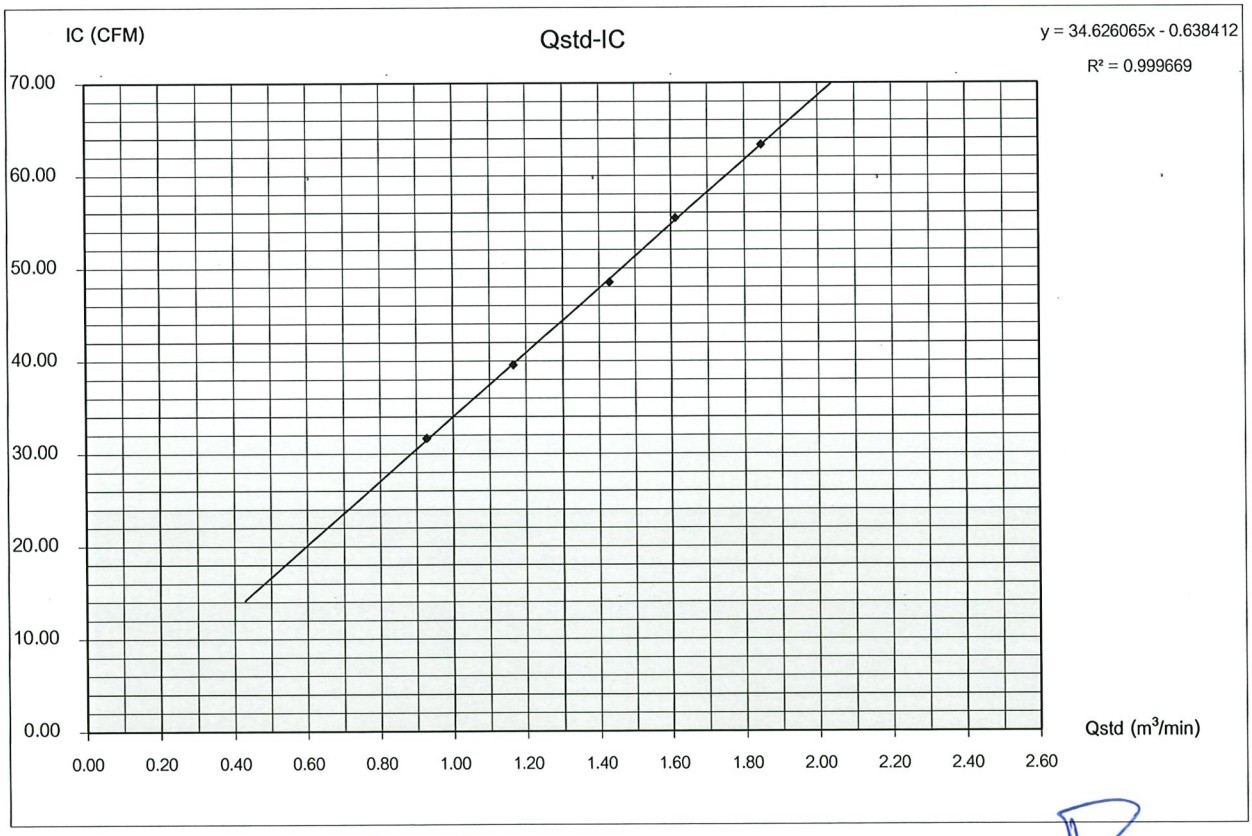
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Sampler Location	วัดหนองผักหนาม			*Start Time*	10:53 AM
Sampler Number	PM-10 No.30	Transfer Standard Type	Orifice	*Stop Time*	11:03 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	*Calibrated By*	Mr.Somprasong Thetsakun
Motor Serial Number	2208	Calibrator Serial Number	2915		
Recorder Serial Number	2616				

Plate No.	(Delta H) Pressure Drop Across Orifice (inH_2O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(X) Qstd = (1/m)[(A-b)]	(I) ample Flow Rate Indicatio	(Y) $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Temparature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O		(m^3/min)	(ft^3/min)		(°K = °C+273)	(mmHg)		
5	1.4	1.4	2.8	1.65618	0.92794	32.0	31.67	303.0	757.0		
7	2.2	2.2	4.4	2.07613	1.16513	40.0	39.59	303.0	757.0		
10	3.3	3.3	6.6	2.54273	1.42865	49.0	48.50	303.0	757.0		
13	4.2	4.2	8.4	2.86858	1.61269	56.0	55.43	303.0	757.0		
18	5.5	5.5	11.0	3.28265	1.84655	64.0	63.34	303.0	757.0		
Linear Regresstion Y ON X : Y= mX + b							Average	303.0	757.0		

1	Slope (m)	1.77059	Linear Equation			r^2	0.999669	Pstd(mmHg) 760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m^3/min)		1.133	r	0.9998345	T_{NTP} 298.0
3	Correlation Coefficient (r)	0.99974	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

envi research ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By .....
(Mr.Panupon Podang)
Environmental Scientist

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
63/14-15, 67/35-36
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Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
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Web site: www.jiranatee.com

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

Flow measurement laboratory
Calibration services department.

NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : **COF-001-67**

MEASUREMENT ITEM	: Top Load Orifice
MANUFACTURER	: TISCH
MODEL/TYPE	: TE-5025A
SERIAL NUMBER	: 2915
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	: 04 Jan 2024
MEASUREMENT DATE	: 29 Jan 2024
ISSUE DATE	: 30 Jan 2024

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'

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 23.9 °C and 63.8 %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.

Calibrated by:

☐ Mr. Sorawit Thachalad
☑ Miss Jittraporn Lertsomphol

JIRANATEE ASSOCIATES CO.,LTD.

Approved signatory: .....
Mr. Parinya Booncharoen
Calibration Department Manager

Jiranatee Associates Co.,Ltd.

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number COF-001-67

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	Δp_Orifice inH_2O	Y	Standard Flow [Q_s] m^3/min
1	0.696	761.303	23.97	23.42	53.502	1.358	1.169	0.652
2	1.001	761.260	23.59	23.04	58.300	2.755	1.665	0.932
3	1.111	761.216	23.70	23.27	39.578	3.557	1.892	1.062
4	1.165	761.175	23.82	23.34	28.812	4.010	2.008	1.129
5	1.416	761.184	23.58	23.16	27.005	5.983	2.454	1.377

Slope (m): **1.77059**

Intercept (b): **0.01317**

Correlation coefficient (r): **0.99974**

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	Δp_Orifice inH_2O	Y	Standard Flow [Q_a] m^3/min
1	0.696	761.303	23.97	23.42	53.502	1.358	0.728	0.649
2	1.001	761.260	23.59	23.04	58.300	2.755	1.036	0.926
3	1.111	761.216	23.70	23.27	39.578	3.557	1.178	1.055
4	1.165	761.175	23.82	23.34	28.812	4.010	1.251	1.123
5	1.416	761.184	23.58	23.16	27.005	5.983	1.527	1.368

Slope (m): **1.10898**

Intercept (b): **0.00822**

Correlation coefficient (r): **0.99973**

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

*****End of Certificate of Calibration*****

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co., Ltd.

Calibration Certificate ID
TH3067-067-011524-ACC-TH

METTLER TOLEDO

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

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	Environment Research & Technology Co., Ltd.		
Address:	25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong		
City:	Laksi	**Contact:**	Ramita Taengthai
Zip / Postal:	10210		
State / Province:	Bangkok		
Order Number:	0332963611		

Weighing Device

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

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

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations 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: 25.4 °C	End: 25.3 °C	Start: 36.4 %	End: 34.9 %
As Left	Start: 25.3 °C	End: 25.2 °C	Start: 34.9 %	End: 34.1 %

As Found Calibration Date:	15-Jan-2024	**Calibrator:**	Nithit Jongkrod
As Left Calibration Date:	15-Jan-2024		
Issue Date:	15-Jan-2024	**Approved Signatory:**	Technical Manager / Head of Calibration Center

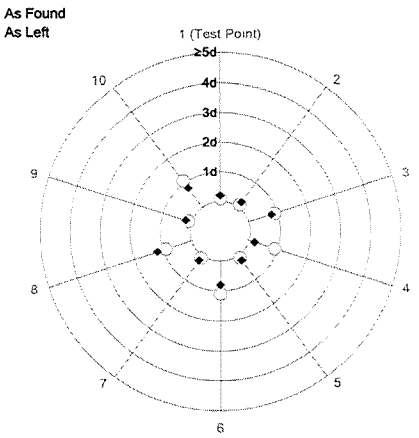
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Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9993 g	100.0002 g
2	99.9993 g	100.0002 g
3	99.9992 g	100.0003 g
4	99.9992 g	100.0002 g
5	99.9993 g	100.0002 g
6	99.9994 g	100.0003 g
7	99.9993 g	100.0002 g
8	99.9992 g	100.0001 g
9	99.9993 g	100.0002 g
10	99.9994 g	100.0003 g
Standard Deviation	**0.00007 g**	**0.00006 g**



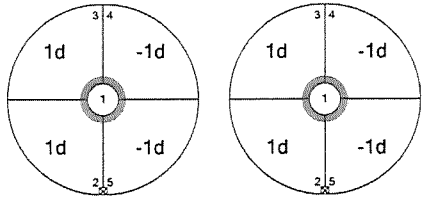
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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	99.9993 g	100.0002 g
2	99.9994 g	100.0003 g
3	99.9994 g	100.0003 g
4	99.9992 g	100.0001 g
5	99.9992 g	100.0001 g
Maximum Deviation	**0.0001 g**	**0.0001 g**



As Found **As Left**

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

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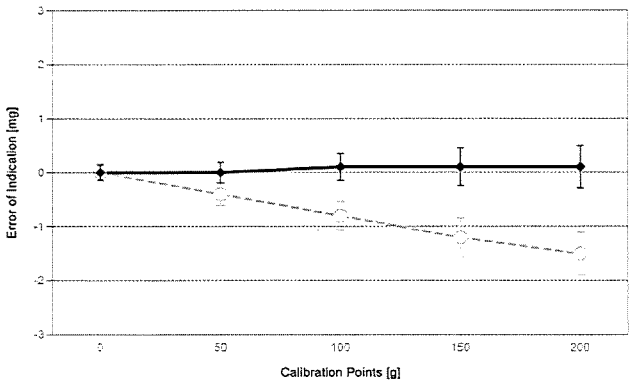
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 mg	2
2	0.0500 g	0.0501 g	0.0001 g	0.17 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.17 mg	2
4	0.5000 g	0.5001 g	0.0001 g	0.17 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.17 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.17 mg	2
7	10.0000 g	9.9998 g	-0.0002 g	0.18 mg	2
8	50.0000 g	49.9996 g	-0.0004 g	0.21 mg	2
9	100.0001 g	99.9993 g	-0.0008 g	0.26 mg	2
10	150.0001 g	149.9989 g	-0.0012 g	0.36 mg	2
11	200.0000 g	199.9985 g	-0.0015 g	0.40 mg	2

As Left

	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	50.0000 g	50.0000 g	0.0000 g	0.19 mg	2
9	100.0001 g	100.0002 g	0.0001 g	0.25 mg	2
10	150.0001 g	150.0002 g	0.0001 g	0.35 mg	2
11	200.0000 g	200.0001 g	0.0001 g	0.39 mg	2



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor *k* – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of 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.

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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:	22-Nov-2022
Certificate Number:	182272	Calibration Due Date:	21-May-2024

Thermo Hygrometer

Equipment No.:	IN302	Date of Issue:	11-Oct-2023
Certificate Number:	SG-H-00656/66	Calibration Due Date:	08-Oct-2024

Remarks

Value of the built-in weight adjusted

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.

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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: $3.0 \cdot 10^{-6}$ / K

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

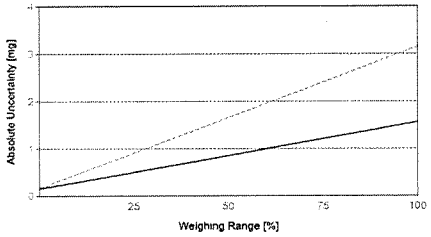
Linearization of Uncertainty Equation

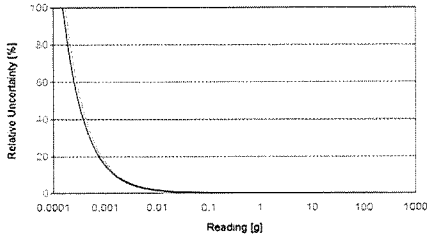
	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.17\ mg + 0.0136\ mg/g \cdot R$	$U_1 = 0.15\ mg + 0.00644\ mg/g \cdot R$

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	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.079%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.16 mg	0.0075%
22.0000 g	0.47 mg	0.0021%	0.29 mg	0.0013%
220.0000 g	3.2 mg	0.0014%	1.6 mg	0.00071%





As Found | As Left

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GWP® Certificate

As Found ✓

The weighing device meets the given process requirements.

As Left ✓

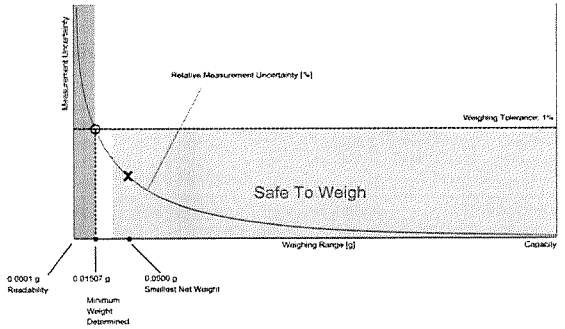
The weighing device meets the given process requirements.

Tests Performed: ☑ As Found ☑ As Left

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.

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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%	0.17097 g	0.34671 g	0.52742 g	0.90460 g	1.95110 g
0.2%	0.08490 g	0.17097 g	0.25823 g	0.43643 g	0.90460 g
0.5%	0.03382 g	0.06783 g	0.10202 g	0.17097 g	0.34671 g
1%	0.01689 g	0.03382 g	0.05080 g	0.08490 g	0.17097 g
2%	0.00844 g	0.01689 g	0.02535 g	0.04231 g	0.08490 g
5%	0.00337 g	0.00675 g	0.01013 g	0.01689 g	0.03382 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%	0.15153 g	0.30504 g	0.46056 g	0.77780 g	1.60910 g
0.2%	0.07552 g	0.15153 g	0.22803 g	0.38254 g	0.77780 g
0.5%	0.03015 g	0.06038 g	0.09068 g	0.15153 g	0.30504 g
1%	0.01507 g	0.03015 g	0.04525 g	0.07552 g	0.15153 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07552 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.

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Attachment to Calibration Certificate:
TH3067-067-011524-ACC-TH
GWP® Certificate

METTLER TOLEDO Service

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

		As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0.00007 g*	N/A	0.00006 g*	N/A
0.2%	0.00005 g		✗		✗
0.5%	0.00013 g		✓		✓
1%	0.00025 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

		As Found		As Left	
Tolerance	Control Limit	Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 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.

Software Version: 1.23.2.187
Report Version: 2.17.16
Form Number: F103C

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Error of Indication

As Found

		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	-0.0004 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	-0.0008 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	-0.0012 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0015 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
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 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.

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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 13 August, 2024 Certification No. 289/24

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WE91016A20 ID No. : No.10

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 1006.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NO 1425 Pitot Tube Thedoor 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

(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. 289/24

13 August, 2024

Standard	HOOK GAGE NO. 1425			**TESTED ANEMOMETER**	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	**Velocity**	**Correction**
m/sec	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	-	-	-	19.8	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 :

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 25 December, 2023 Certification No. 456/23

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC20214A68 ID No. : No.3

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 1018.1 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

(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. 456/23

25 December, 2023

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	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	-	-	-	12.9	0.11
15.01	-	-	-	14.5	0.51
17.02	-	-	-	16.9	0.12
20.02	-	-	-	19.5	0.52

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 : 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 17 April, 2024 Certification No. 184/24

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC60110A03 ID No. : No.11

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 1009.1 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 : Signed :

Mr. Watcharapol Subwat Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

METEOROLOGICAL DEPARTMENT

THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 184/24

17 April, 2024

Standard	HOOK GAGE NO. 1425			**TESTED ANEMOMETER**	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	**Velocity**	**Correction**
m/sec	inches H2O	inches H2O	m/sec	**m/sec**	**m/sec**
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.2	0.82
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.3	0.74
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.5	0.52
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 :

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 28 August, 2024 Certification No. 322/24

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 : Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

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. 322/24

28 August, 2024

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	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 :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

envi research
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Environment Research & Technology Company Limited
25/114 Mu 6 Soi Chinnakhet 1, Ngam Wong Wan Road,
Thung Song Hong, Lak Si, Bangkok 10210
Tel 0-2954-7745-6 Fax 0-2954-7747
E-mail : envi@enviresearch.co.th
www.enviresearch.co.th
Head Office/Tax ID 0105 542 064 981

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 : December 2, 2024
Customer Name : บริษัท โฟร์เทียร์ คอนซัลแตนต์ จำกัด : โครงการนิคมอุตสาหกรรม ซีพีจีซี
บริษัท ซีจี คอร์เปอเรชั่น จำกัด

Item	Equipment			Actual Reading (dB(A))		Status
	Brand	Model	Serial Number	Before Adjustment	After Adjustment	
1	Scarlet Tech	ST-11D	820965	93.8	94.2	Pass
2	Scarlet Tech	ST-11D	820868	94.6	94.2	Pass

Checked By ..... Mr.Prayun Detkla
Technician

envi research ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By ..... Ms.Sutatip Im-noi
Environmental Scientist

envi research
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Environment Research & Technology Company Limited
25/114 Mu 6 Soi Chinnakhet 1, Ngam Wong Wan Road,
Thung Song Hong, Lak Si, Bangkok 10210
Tel 0-2954-7745-6 Fax 0-2954-7747
E-mail : envi@enviresearch.co.th
www.enviresearch.co.th
Head Office/Tax ID 0105 542 064 981

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 : December 6, 2024
Customer Name : บริษัท โฟร์เทียร์ คอนซัลแตนต์ จำกัด : โครงการนิคมอุตสาหกรรม ซีพีจีซี
บริษัท ซีจี คอร์เปอเรชั่น จำกัด

Item	Equipment			Actual Reading (dB(A))		Status
	Brand	Model	Serial Number	Before Adjustment	After Adjustment	
1	RION	NL-42	00484663	94.4	94.2	Pass

Checked By
Mr.Prayun 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 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) 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

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.

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 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 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 Bruel&Kjaer 4180	1002.5	2.5	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	±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 Kluaypa)

Director

สวทช.TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24 Oct. 2024

Date of Issue : 25 Oct. 2024

Ref : 20112671018037820O2

End of Certificate

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.

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

เอกสารการสอบเทียบเครื่องมือตรวจวัด
บริษัท เทสท์ เทค จำกัด

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ใบรับรองการสอบเทียบ “เทอร์โมมิเตอร์”

(Calibration Certificate of Liquid in Glass Thermometer)

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 24T680

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 :	Digital Thermometer With Sensor
Manufacturer:	Testo
Model :	926
Serial No.:	5609260110250914
ID No.:	EQL-058
Condition As-Received:	Used Item
Received Date:	04 April 2024
Calibration Date:	11 April 2024 to 22 April 2024
Reference:	2404-0204DN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

Submitted by: TEST TECH CO.,LTD. (Head Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Black Stack Thermometer	1560	8C454	23I600	30 May 2024
2) PRT Scanner Module	2562	A01303	23I600	30 May 2024
3) Industrial Platinum Resistance Thermometer	5627	739433	23I600	30 May 2024
4) Industrial PRT Probe	5627A	979442	23I600	30 May 2024

2.The 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 maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Anuchit Pangchata
Issue Date : 24 April 2024

Approved Signatory : _____

[ ] Phalinee Prabpaipal
[ ] Chatchawan Khunpiluek
[ ] Wanlop Larpkern

B 0339284

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23T475

Equipment :	Digital Thermometer With Sensor
Manufacturer:	Testo
Model :	926
Serial No.:	33824123/004
ID No.:	EQL-138
Condition As-Received:	Used Item
Received Date:	09 March 2023
Calibration Date:	20 March 2023 to 22 March 2023
Reference:	2303-0314DN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

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.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A609	22I1274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571970	22I1274	17 Oct 2023
3) Industrial Platinum Resistance Thermometer	5627	824304	22I1274	17 Oct 2023

2.The 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 maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Sataporn Mulkammee
Issue Date : 23 March 2023

Approved Signatory : _____

[ ] Phallnee Prabpaipal
[ ] Chatchawan Khunpiluek
[✓] Wanlop Larpkurn

B 0310381

Result of Calibration:- Without Adjustment

Function: Temperature measurement

This equipment was connected with Thermocouple Type T ID No. EQL-138

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
150	2.9962	2.6	-0.3962	0.24
150	35.0051	34.8	-0.2051	0.24
150	36.0061	35.8	-0.2061	0.24
150	36.9974	36.8	-0.1974	0.24
150	41.5051	41.4	-0.1051	0.24
150	43.9973	43.9	-0.0973	0.24
150	55.0047	55.0	-0.0047	0.25
150	169.9960	170.4	0.4040	0.55

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

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QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIST 7023
CALIBRATION 0049

CERTIFICATE No : 23T7717
REFERENCE No : 70152-1

Certificate of Calibration

EQUIPMENT	:	LIQUID IN GLASS THERMOMETER
MANUFACTURER	:	PRECISION
MODEL	:	N/A
SERIAL No	:	8925
ID No	:	EQL-103
RESOLUTION	:	0.1 °C
TYPE	:	TOTAL IMMERSION
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHARUKIT L.
CALIBRATION DATE	:	15-Aug-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Aug-23
RECEIVED DATE	:	08-Aug-23

Original

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 23T7717

Calibration Report

EQUIPMENT	:	LIQUID IN GLASS THERMOMETER			
MANUFACTURER	:	PRECISION			
MODEL	:	N/A			
ID No	:	EQL-103	SERIAL NUMBER	:	8925
RESOLUTION	:	0.1 °C	TYPE	:	TOTAL IMMERSION
RECEIVED DATE	:	08-Aug-23	CALIBRATION DATE	:	15-Aug-23
AMBIENT TEMPERATURE	:	23 °C ± 3 °C	RELATIVE HUMIDITY	:	50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	23T3927	08-Mar-24
2) SPRT PROBE	5614	636626	23T3927	08-Mar-24
3) PRECISION BATH	7320	A21105	22T13199	14-Dec-23
4) PRECISION BATH	CTR-40	A68155	22T13198	09-Dec-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
20.013	20.0	140	0.013	N/A	0.10
25.010	25.0	160	0.010	N/A	0.10
41.508	41.5	230	0.008	N/A	0.10
44.505	44.5	240	0.005	N/A	0.10
45.003	45.0	245	0.003	N/A	0.10
49.999	50.0	265	-0.001	N/A	0.10

UUC* : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

Specimen

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23H2216

Equipment :	Dial Thermo-Hygrometer
Manufacturer:	Barigo
Model :	-
Serial No.:	-
ID No.:	EQL-064
Condition As-Received:	Used Item
Received Date:	12 October 2023
Calibration Date:	17 October 2023 to 20 October 2023
Reference:	2310-0447DN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

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.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1523	3240076	23I305	15 Mar 2024
2) Dew Point Hygrometer	Optidew 401	164756	TH-0158-22	13 Dec 2023

2.The 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 maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Surasit Phansudnoi
Issue Date : 26 October 2023

Approved Signatory : Viporn

[ ] Chakrit Waewwanjua
[ ] Pornthippa Tameyakul
[✓] Viporn Tantiyawutti

B 0327545

Result of Calibration:- Without Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	30.1	30.0	-0.1	1.5
25.0	40.1	39.0	-1.1	1.5
25.0	50.1	49.0	-1.1	1.7
25.0	60.0	59.0	-1.0	1.7
25.0	75.2	75.5	0.3	1.8

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.046	15.0	-0.046	0.72
19.975	20.0	0.025	0.72
25.022	25.0	-0.022	0.72
30.000	30.0	0.000	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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Vipada

a 1185882

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T7718
REFERENCE No : 70152-2

Certificate of Calibration

EQUIPMENT	:	LIQUID IN GLASS THERMOMETER
MANUFACTURER	:	PRECISION
MODEL	:	G13004
SERIAL No	:	N/A
No	:	EQL-111
RESOLUTION	:	1 °C
TYPE	:	TOTAL IMMERSION
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHARUKIT L.
CALIBRATION DATE	:	15-Aug-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Aug-23
RECEIVED DATE	:	08-Aug-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	LIQUID IN GLASS THERMOMETER			
MANUFACTURER	:	PRECISION			
MODEL	:	G13004			
ID No	:	EQL-111	**SERIAL NUMBER**	:	N/A
RESOLUTION	:	1 °C	**TYPE**	:	TOTAL IMMERSION
RECEIVED DATE	:	08-Aug-23	**CALIBRATION DATE**	:	15-Aug-23
AMBIENT TEMPERATURE	:	23 °C ± 3 °C	**RELATIVE HUMIDITY**	:	50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	23T3927	08-Mar-24
2) SPRT PROBE	5614	636626	23T3927	08-Mar-24
3) PRECISION BATH	7320	A21105	22T13199	14-Dec-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
115.013	115.0	120	0.013	N/A	0.15
120.998	121.0	124	-0.002	N/A	0.15

UUC* : UNIT UNDER CALIBRATION

REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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ใบรับรองการสอบเทียบ "เครื่องวัดความนำไฟฟ้า"

(Calibration Certificate of Conductivity Meter)

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

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Conductivity Meter
Manufacturer :	TOA
Model :	CM-41X
Serial No. :	842572
ID No. :	EQL-211
Condition As-Received:	Used Item
Received Date :	11 January 2024
Calibration Date :	15 January 2024
Reference :	2401-0300DN-1
Submitted by :	TEST TECH CO.,LTD. (HEAD Office) 30, 32 Rama II Soi 63, Rama II Rd., Samaedam, Bangkhunthian, Bangkok 10150
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure:	In -house method : - CP-CH6 by direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Saithip

Approved Signatory

(✓) Saithip Meangmai
( ) Warakorn Lerngagtrakul
( ) Ponpan Paipim

Issue Date : 17 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	23I1051	05 Sep 2024
2) Ref. Std.Thermometer	4982054	110RC044	23I908	26 Jul 2024

- This Certification is traceable to SI Throught Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 µS/cm	CPA Chem	913595	14 July 2024
1.413 mS/cm	CPA Chem	931955	30 Sep 2024
12.880 mS/cm	CPA Chem	913597	14 July 2024

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 147.0, 1413.0, 12880 µS/cm

Conductivity Electrode Serial No.: 806F0005

Standard Conductivity Solution	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
147.0 µS/cm	147.1 µS/cm	0.99 µS/cm	2.00
1.413 mS/cm	1.413 mS/cm	0.0092 mS/cm	2.00
12.880 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

- Adjustment Cell constant = 147.0 µS/cm 96.8 m^{-1} ,1.413 mS/cm = 98.0 m^{1} ,12.880 mS/cm = 99.4 m^{-1}

Sailip

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : CT-58101B
- Serial No. : 806F0005

Dimension of probe;

- Length : 114 mm
- Diameter : 12 mm
- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)	Coverage factor *k*
25.0	25.003	25.0	-0.003	0.13	2.00

Remark : - 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 %.

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Saithip

a 1197671

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ใบรับรองการสอบเทียบ "ตุ้มน้ำหนักมาตรฐาน"

(Calibration Certificate of Standard Weights)

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 24M150

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 :	Standard Weight
Manufacturer:	LS
Model :	-
Serial No.:	-
ID No.:	EQL-121
Condition As-Received:	Used Item
Received Date:	18 January 2024
Calibration Date:	26 January 2024
Reference:	2401-0593DN
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 10) %
Atmospheric Pressure:	1017.0 hPa

Submitted by: TEST TECH CO.,LTD. (Head Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using calibration procedure CP-M06 according to OIML R111-1 Edition 2004 (E).

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwat Wutthicharoenmongkol
Issue Date : 29 January 2024

Approved Signatory : _____

[ ] Phalinee Prabpaipal
[✓] Sura Suwannasri
[ ] Sorapong Koomkainam

B 0333471

Result of calibration Without adjustment

Nominal Value	Marking	Conventional mass	Uncertainty of Measurement (±)	Maximum Permissible error (±)
50 g	None	50.00001 g	0.10 mg	0.30 mg

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 24M151

Equipment :	Standard Weight
Manufacturer:	-
Model :	-
Serial No.:	-
ID No.:	EQL-258
Condition As-Received:	Used Item
Received Date:	18 January 2024
Calibration Date:	26 January 2024
Reference:	2401-0593DN
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 10) %
Atmospheric Pressure:	1016.7 hPa

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.

Submitted by: TEST TECH CO.,LTD. (Head Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using calibration procedure CP-M06 according to OIML R111-1 Edition 2004 (E).

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwat Wutthicharoenmongkol
Issue Date : 29 January 2024

Approved Signatory :

[ ] Phalinee Prabpaipal
[✓] Sura Suwannasri
[ ] Sorapong Koomkainam

B 0333472

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23M1557

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 :	Standard Weight
Manufacturer:	-
Model :	-
Serial No.:	M 0030/11
ID No.:	EQL-139
Condition As-Received:	Used Item
Received Date:	10 August 2023
Calibration Date:	17 August 2023
Reference:	2308-0284DN
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %
Atmospheric Pressure:	1006.2 hPa

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.7 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024

2.This certificate is not certified for any commercial transaction.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thapakorn Thammachai
Issue Date : 17 August 2023

Approved Signatory :

[ ] Phalinee Prabpaipal
[✓] Sura Suwannasri
[ ] Sorapong Koomkainam

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement (±)	Maximum Permissible error (±)
2 g	2.000018 g	0.040 mg	0.12 mg

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23M1558

Equipment :	Standard Weight
Manufacturer:	Mettler Toledo
Model :	-
Serial No.:	11119459
ID No.:	EQL-149
Condition As-Received:	Used Item
Received Date:	10 August 2023
Calibration Date:	17 August 2023
Reference:	2308-0284DN
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %
Atmospheric Pressure:	1005.75 hPa

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.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.7 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024

2.This certificate is not certified for any commercial transaction.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thapakorn Thammachai
Issue Date : 17 August 2023

Approved Signatory : _____

[ ] Phalinee Prabpaipal
[✓] Sura Suwannasri
[ ] Sorapong Koomkalnam

B 0322292

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement (±)	Maximum Permissible error (±)
20 g	20.000008 g	0.080 mg	0.25 mg

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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ใบรับรองการสอบเทียบ "เครื่องวัดความขุ่น"

(Calibration Certificate of Turbidimeter)

Certificate of Calibration

Equipment:	TURBIDIMETER	Certificate No.:	C08220157
Model:	2100N	Issued Date:	21 September 2022
Serial No. (or ID.):	970400003415 (EQL-024)	Job No.:	KSPR2211615
Manufacturer:	HACH	Page:	1 of 2
Condition:	In Condition		

Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakhanong, Bangkok 10260 Thailand

Calibration By: Mr.Wasan Nuchnabee

Calibration Date: 21 September 2022

The Method used: In house method, CAL-WI-23, base on Hach Manufacturer Method 8195

Traceability: This certificate is traceable to Primary standard Fromazin and StablCal accepted by United States Environmental Protection Agency (EPA) through Hach Company Certificate No. A1075 , A1074 , A1091 , A1074 , A1074

(Mr. Wasan Nuchnabee)
Person in charge

(Mr. Thalerngkeat Poungngam)
Authorized signatory

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

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

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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.048	0.012	0.0004	0.070
20.40	20.1	0.30	0.05	1.0
206.0	204	2.0	0.5	10
1020.0	1013	7.0	1.2	50
4065.0	3875	190.0	1.8	200

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.057	0.003	0.0015	0.070
20.40	20.5	-0.10	0.04	1.0
206.0	206	0.0	0.5	10
1020.0	1018	2.0	0.5	50
4065.0	4064	1.0	0.5	200

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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ใบรับรองการสอบเทียบ "เครื่องวัด pH"

(Calibration Certificate of pH Meter)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24E0681
REFERENCE No : 71961-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	DKK TOA
MODEL	:	HM-25R
SERIAL No	:	760205
ID No	:	EQL-183
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	PRASERT D.
CALIBRATION DATE	:	23-Jan-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	24-Jan-24
RECEIVED DATE	:	23-Jan-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24E0681

Calibration Report

EQUIPMENT	:	pH METER			
MANUFACTURER	:	DKK TOA	MODEL	:	HM-25R
ID No	:	EQL-183	SERIAL NUMBER	:	760205
RECEIVED DATE	:	23-Jan-24	CALIBRATION DATE	:	23-Jan-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	RELATIVE HUMIDITY	:	50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9623	13-Sep-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
   - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
177.48	178	-0.52	0.59	2.0
0.00	1	-1.00	0.59	2.0
-177.48	-177	-0.48	0.59	2.0

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 202F0138MK

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.0061	4.01	-0.004	0.013	2.0
6.9994	7.00	-0.001	0.013	2.0
10.0070	10.01	-0.003	0.014	2.0

3. PERCENT SLOPE 97%
4. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
24.999	25.0	80	-0.001	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

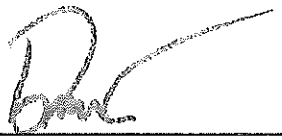
NSC-TISI-TISI7025
CALIBRATION 6049

CERTIFICATE No : 23E3129
REFERENCE No : 68715-2

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	TOA-DKK
MODEL	:	HM-41X
SERIAL No	:	784878
ID No	:	EQL-199
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	PRASERT D.
CALIBRATION DATE	:	29-Mar-23

APPROVED BY	:	 PONGSAK J.
ISSUED DATE	:	30-Mar-23
RECEIVED DATE	:	29-Mar-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23E3129

Calibration Report

EQUIPMENT	:	pH METER			
MANUFACTURER	:	TOA-DKK	**MODEL**	:	HM-41X
ID No	:	EQL-199	**SERIAL NUMBER**	:	784878
RECEIVED DATE	:	29-Mar-23	**CALIBRATION DATE**	:	29-Mar-23
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	49 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
) pH STANDARD SOLUTION	00651-10	CC747845	4882-13159657	02-Mar-24
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
   - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
177.48	177	0.48	0.59	2.0
0.00	0	0.00	0.59	2.0
-177.48	-178	0.52	0.59	2.0

2. DISPLAY UNIT WITH pH ELECTRODE S/N: N/A

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.01	-0.003	0.013	2.0
7.003	7.00	0.003	0.013	2.0
10.003	10.01	-0.007	0.014	2.0

3. PERCENT SLOPE 95%
4. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
25.002	25.0	80	0.002	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

Metrohm
Siam Ltd.

Metrohm Siam Ltd.
979/111-115 S.M. Tower 33rd Floor,
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Phyathai, Bangkok 10400 THAILAND
Phone (+66)0 2298 0864
Fax (+66)0 2298 0865
E-mail : service@metrohm.co.th
www.metrohm.co.th

NSC-TISI-TIS17025
CALIBRATION 0376

Certificate of Calibration

Date of Issue	:	21 August 2023
Certificate No.	:	231872/ME
Customer Company	:	Test Tech Co., Ltd. 30,32 Rama II Soi 63, Rama II Rd.,Samaedam, Bangkhunthian,Bangkok 10150
Instrument Manufacturer	:	Metrohm
Instrument Type	:	pH meter
Model	:	781
Instrument Serial Number	:	1781001011219 (ID : EQL-131)
Calibration Place	:	Laboratory, Test Tech Co., Ltd. 30,32 Rama II Soi 63, Rama II Rd.,Samaedam, Bangkhunthian,Bangkok 10150
Environment Status	:	Temperature : 22.65°C ± 0.15°C Humidity : 63.25% ± 2.75%
Date of Receipt	:	18 August 2023
Date of Calibration	:	18 August 2023
Job Number	:	CAL230577/ME
Condition of Calibration Item	:	Used Item
Result of Calibration	:	[X] Without Adjustment [ ] Adjustment
Calibrated By	:	Mr. Monton Tontun
Approved By	:	Patipon M. Authorized Signatory

[ ] Mr. Kowit Photaeng
[/] Mr. Patipon Musigapala
[ ] Mr. Teerayut Cheepdamrong

The uncertainties are for a confidence probability of approximately 95%

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Metrohm Siam Ltd.
979/111-115 S.M. Tower 33rd Floor,
Phahonyothin Rd., Phayathai,
Phyathai, Bangkok 10400 THAILAND
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E-mail : service@metrohm.co.th
www.metrohm.co.th

NSC-TISI-TIS17025
CALIBRATION 0376

Calibration Report

Certificate No: 231872/ME

1. Reference Standards

Item	Description/Model	Serial No.	Manufacturing	Certificate No.	Due Date
1	Digital Multimeter 34401A	MY41054280	Agilent	E1U231457	25 Mar 2024
2	Multifunction Calibrator MC3	30328644	Beamex	CAL0252-22P0214	15 Nov 2023
3	Temperature and Humidity Logger	62225348	Ebro	L202209318-001	28 Sep 2023

2. The measurement standards are traceable to International system of units (SI) by mean of an unbroken chain of calibration via accredited calibration laboratory, National or International metrology institute.

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

4. The results of test were found accurate as shown on date and place of test only.

5. Procedure Used :

On-site method WI-02 by substitute measurement with digital multimeter (DC Voltage)

On-site method WI-02 based on BS 3145 : 1978 (pH)

On-site method WI-02 based on CEI IEC 751 : 1983 (Temperature)

6. The calibration results apply only accuracy of display unit pH meter. User shall be electrode test and calibrate pH meter with traceability standard buffer.

Metrohm
Siam Ltd.

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NSC-TISI-TIS17025
CALIBRATION 0376

Calibration Report

Certificate No: 231872/ME

1. Input I (DC Voltage)

Range (mV)	[1]STD Setting (mV)	[2]Tolerance (mV)	[3]UUC Reading (mV)	Uncertainty (± mV)
2 V	0.00	-1.0 to 1.0	0.1	0.092
	300.00	299.0 to 301.0	300.0	0.12
	600.00	599.0 to 601.0	599.9	0.14
	900.00	899.0 to 901.0	899.9	0.15
	1900.00	1899.0 to 1901.0	1899.7	0.19
	-1900.00	-1901.0 to -1899.0	-1899.7	0.19

2. Input I (pH)*

[1]STD Setting (mV)	Nominal Value (pH)	[2]Tolerance (pH)	[3]UUC Reading (pH)	Uncertainty (± pH)
414.12	0	-0.017 to 0.017	0.001	0.0019
354.96	1	0.983 to 1.017	1.001	0.0018
295.80	2	1.983 to 2.017	2.000	0.0015
236.64	3	2.983 to 3.017	3.000	0.0013
177.48	4	3.983 to 4.017	4.000	0.0011
118.32	5	4.983 to 5.017	5.000	0.0009
59.16	6	5.983 to 6.017	5.999	0.0008
0.00	7	6.983 to 7.017	7.000	0.0010
-59.16	8	7.983 to 8.017	7.999	0.0008
-118.32	9	8.983 to 9.017	8.999	0.0009
-177.48	10	9.983 to 10.017	9.999	0.0011
-236.64	11	10.983 to 11.017	10.998	0.0013
-295.80	12	11.983 to 12.017	11.998	0.0015
-354.96	13	12.983 to 13.017	12.998	0.0017
-414.12	14	13.983 to 14.017	13.997	0.0019

Reference Temperature : 25° C

Metrohm
Siam Ltd.

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NSC-TISI-TIS17025
CALIBRATION 0376

Calibration Report

Certificate No: 231872/ME

3. Temperature

PT-1000 (385)

[1]STD Setting (Ω)	Nominal Value (°C)	[2]Tolerance (°C)	[3]UUC Reading (°C)	Uncertainty (± °C)
1000.0	0	-0.5 to 0.5	0.0	0.18
1077.9	20	19.5 to 20.5	20.0	0.18
1097.3	25	24.5 to 25.5	24.9	0.18
1116.7	30	29.5 to 30.5	30.0	0.18
1194.0	50	49.5 to 50.5	50.0	0.22
1385.1	100	99.5 to 100.5	99.9	0.22

Remark:

1. [1]STD = Standard Equipment.
2. [2]Tolerance according to manufacturer specification and service manual.
3. [3]UUC = Unit Under Calibration.
4. The result as per (*) marked are not TISI Accreditation Scope.

End of data

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ใบรับรองการสอบเทียบ “เครื่องวัดอุณหภูมิ-ความชื้นสัมพัทธ์”

(Calibration Certificate of Thermo - Hygrometer)

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23H2216

Equipment :	Dial Thermo-Hygrometer
Manufacturer:	Barigo
Model :	-
Serial No.:	-
ID No.:	EQL-064
Condition As-Received:	Used Item
Received Date:	12 October 2023
Calibration Date:	17 October 2023 to 20 October 2023
Reference:	2310-0447DN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

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.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1523	3240076	23I305	15 Mar 2024
2) Dew Point Hygrometer	Optidew 401	164756	TH-0158-22	13 Dec 2023

2.The 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 maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Surasit Phansudnoi
Issue Date : 26 October 2023

Approved Signatory : Viporn

[ ] Chakrit Waewwanjua
[ ] Pornthippa Tameyakul
[✓] Viporn Tantiyawutti

B 0327545

Result of Calibration:- Without Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	30.1	30.0	-0.1	1.5
25.0	40.1	39.0	-1.1	1.5
25.0	50.1	49.0	-1.1	1.7
25.0	60.0	59.0	-1.0	1.7
25.0	75.2	75.5	0.3	1.8

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.046	15.0	-0.046	0.72
19.975	20.0	0.025	0.72
25.022	25.0	-0.022	0.72
30.000	30.0	0.000	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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ใบรับรองการสอบเทียบ "ตู้อบ"

(Calibration Certificate of Oven)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T8798
REFERENCE No : 70515-6

Certificate of Calibration

EQUIPMENT	:	HOT AIR OVEN
MANUFACTURER	:	MEMMERT
MODEL	:	UFE 500
SERIAL No	:	G508.0791
ID No	:	EQL-128
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	11-Sep-23

APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Sep-23
RECEIVED DATE	:	11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T8798

Calibration Report

EQUIPMENT	:	HOT AIR OVEN			
MANUFACTURER	:	MEMMERT			
MODEL	:	UFE 500			
ID No	:	EQL-128	S/N	:	G508.0791
RECEIVED DATE	:	11-Sep-23	CALIBRATION DATE	:	11-Sep-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	RELATIVE HUMIDITY	:	51 %RH ± 10 %RH

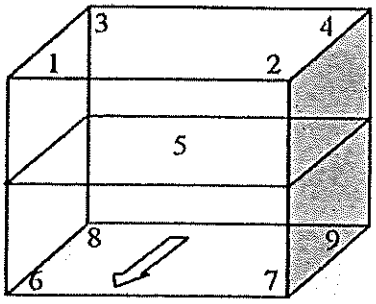
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 10
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm

CHAMBER PERFORMANCE

Calibrate Piont (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.49	0.28	0.66	0.93
180.0	180.25	0.32	0.62	1.11

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.46	104.13	104.45	104.28	104.57	104.67	104.60	104.58	104.67	0.38
180.0	180.0	180.27	179.85	180.41	179.93	180.19	180.54	180.41	180.51	180.13	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T8799
REFERENCE No : 70515-7

Certificate of Calibration

EQUIPMENT	:	HOT AIR OVEN
MANUFACTURER	:	MEMMERT
MODEL	:	UFE 500
SERIAL No	:	G512.2005
ID No	:	EQL-161
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	11-Sep-23

APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Sep-23
RECEIVED DATE	:	11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T8799

Calibration Report

EQUIPMENT	:	HOT AIR OVEN			
MANUFACTURER	:	MEMMERT			
MODEL	:	UFE 500			
ID No	:	EQL-161	**S/N**	:	G512.2005
RECEIVED DATE	:	11-Sep-23	**CALIBRATION DATE**	:	11-Sep-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	**RELATIVE HUMIDITY**	:	51 %RH ± 10 %RH

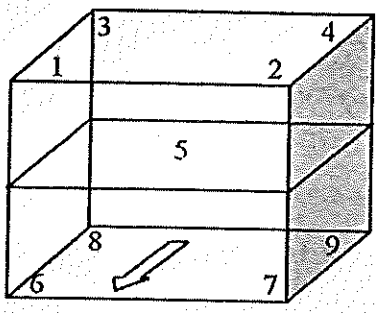
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 10
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm

CHAMBER PERFORMANCE

Calibrate Piont (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	103.96	0.14	0.58	0.73
180.0	179.55	0.22	0.93	1.47

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.16	104.13	104.20	103.98	103.76	103.76	104.06	103.71	103.93	0.38
180.0	180.0	179.73	179.89	180.04	179.54	179.30	178.98	179.75	178.97	179.77	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
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www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T8797
REFERENCE No : 70515-5

Certificate of Calibration

EQUIPMENT	:	HOT AIR OVEN
MANUFACTURER	:	MEMMERT
MODEL	:	UF 110
SERIAL No	:	B414.0764
ID No	:	EQL-169
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	11-Sep-23

APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Sep-23
RECEIVED DATE	:	11-Sep-23

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QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T8797

Calibration Report

EQUIPMENT	:	HOT AIR OVEN			
MANUFACTURER	:	MEMMERT			
MODEL	:	UF 110			
ID No	:	EQL-169	**S/N**	:	B414.0764
RECEIVED DATE	:	11-Sep-23	**CALIBRATION DATE**	:	11-Sep-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	**RELATIVE HUMIDITY**	:	51 %RH ± 10 %RH

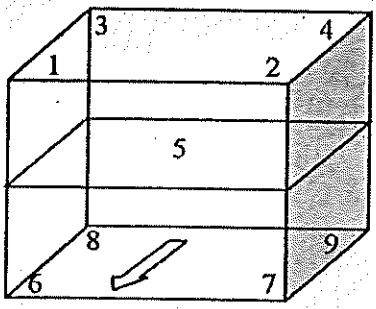
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm

CHAMBER PERFORMANCE

Calibrate Piont (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.04	0.10	0.55	1.06
120.0	120.10	0.11	0.65	1.20
140.0	140.03	0.14	0.77	1.33
150.0	150.05	0.14	0.79	1.48

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.34	104.25	104.10	104.00	104.05	103.61	103.93	103.57	104.54	0.38
120.0	120.0	120.39	120.38	120.27	120.06	120.13	119.57	119.98	119.52	120.56	0.46
140.0	140.0	140.47	140.39	140.24	139.99	140.01	139.39	139.94	139.30	140.54	0.46
150.0	150.0	150.55	150.49	150.32	150.00	149.98	149.35	149.97	149.25	150.57	0.46

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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ใบรับรองการสอบเทียบ “เครื่องชั่ง”

(Calibration Certificate of Electronic Balance)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23M6754
REFERENCE No : 69854-1

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BP210S
SERIAL No	:	S0736477
ID No	:	EQL-008
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	PRASERT D.
CALIBRATION DATE	:	13-Jul-23

APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	17-Jul-23
RECEIVED DATE	:	13-Jul-23

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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BP210S
MANUFACTURER	:	SARTORIUS	**S/N**	:	S0736477
ID No	:	EQL-008	**RECEIVED DATE**	:	13-Jul-23
AIR PRESSURE	:	1011mbar ± 1mbar	**CALIBRATION DATE**	:	13-Jul-23
AMBIENT TEMPERATURE	:	23° C ± 1° C	**RELATIVE HUMIDITY**	:	50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

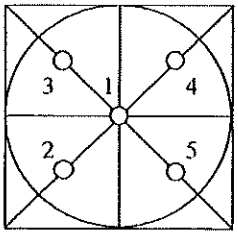
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	49.9999	0.0001	0.00012
100.0	99.9999	0.0001	0.00019
200.0	199.9997	0.0003	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9998
2	99.9997
3	99.9998
4	99.9998
5	99.9998
OFF-CENTER LOADING	0.0001

6. INTERNAL WEIGHT ERROR :0.000499999999988177 g

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23M8800
REFERENCE No : 70515-8

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	AND
MODEL	:	GR-200
SERIAL No	:	14243876
ID No	:	EQL-130
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	PRASERT P.
CALIBRATION DATE	:	11-Sep-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	15-Sep-23
RECEIVED DATE	:	11-Sep-23

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CERTIFICATE No : 23M8800

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	GR-200
MANUFACTURER	:	AND	**S/N**	:	14243876
ID No	:	EQL-130	**RECEIVED DATE**	:	11-Sep-23
AIR PRESSURE	:	1011mbar ± 1mbar	**CALIBRATION DATE**	:	11-Sep-23
AMBIENT TEMPERATURE	:	24° C ± 1° C	**RELATIVE HUMIDITY**	:	50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

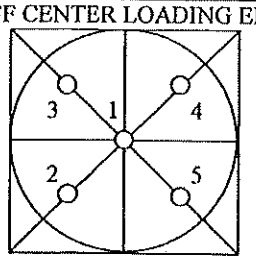
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0000	0.0000	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0000	0.0000	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0001
3	100.0001
4	99.9999
5	100.0001
OFF-CENTER LOADING	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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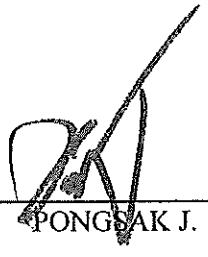
NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23M11118
REFERENCE No : 71188-2

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BCA3202I-1S
SERIAL No	:	0039407364
ID No	:	EQL-257
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	PRASERT D.
CALIBRATION DATE	:	09-Nov-23



APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	13-Nov-23
RECEIVED DATE	:	09-Nov-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	BCA3202I-1S
MANUFACTURER	:	SARTORIUS	S/N	:	0039407364
ID No	:	EQL-257	RECEIVED DATE	:	09-Nov-23
AIR PRESSURE	:	1010mbar ± 1mbar	CALIBRATION DATE	:	09-Nov-23
AMBIENT TEMPERATURE	:	23° C ± 1° C	RELATIVE HUMIDITY	:	49 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	---	0094-51	23M1296	07-Feb-24
2) STANDARD WEIGHT	---	QK-I-009	23M1297	07-Feb-24
3) STANDARD WEIGHT	---	QK-I-010	M2302003S	01-Feb-25

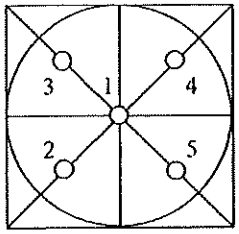
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 2500 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.0	0.00	0.00	0.012
10.0	10.00	0.00	0.012
20.0	20.00	0.00	0.012
50.0	50.00	0.00	0.012
100.0	100.00	0.00	0.012
200.0	200.00	0.00	0.012
500.0	500.00	0.00	0.012
700.0	700.00	0.00	0.012
1000.0	1000.00	0.00	0.012
2000.0	2000.00	0.00	0.012
3000.0	3000.00	0.00	0.012

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	1000.00
2	1000.00
3	1000.00
4	1000.00
5	1000.00
OFF-CENTER LOADING	0.00

NOTE : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

DKSH

ilac-MRA

ISO/IEC 17025
ISC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01232449
Model:	BCA224I-1S	Issued Date:	08 July 2023
Serial No. (or ID.):	0043402017 (EQL - 268)	Job No.:	KSPR2310693
Manufacturer:	Sartorius	Page:	1 of 2
Condition:	New		

Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand.

Environment Condition:

Temperature	23 °C	±	0.4 °C
Humidity	59 %RH	±	4.2 %RH

Calibration Place: TEST TECH CO., LTD. (302 Room)
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand.

Calibration By: Mr. Hattapong Pumnil

Calibration Date: 07 July 2023

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02220533

(Mr. Hattapong Pumnil)
Person in charge

(Mr. Rungrod Jenkittrakulchai)
Authorized signatory

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

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

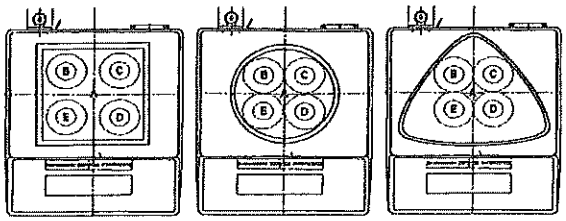
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without Adjustment

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



Nominal Test Value 100 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0000	0.0000	-0.0001	-0.0001

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00005

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

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.001	0.00100	0.0010	0.0000	0.00010	2.03
0.01	0.01000	0.0100	0.0000	0.00010	2.03
0.1	0.10001	0.1000	0.0000	0.00010	2.03
0.5	0.50000	0.5000	0.0000	0.00010	2.03
1	1.00001	1.0000	0.0000	0.00010	2.03
2	2.00002	2.0000	0.0000	0.00010	2.03
5	5.00002	5.0000	0.0000	0.00011	2.03
10	10.00002	10.0000	0.0000	0.00011	2.03
20	20.00000	20.0000	0.0000	0.00011	2.02
25	25.00003	25.0000	0.0000	0.00012	2.02
50	49.99996	50.0000	0.0000	0.00013	2.01
100	100.00002	100.0000	0.0000	0.00017	2.00
120	120.00002	120.0000	0.0000	0.00021	2.00
150	149.99998	150.0000	0.0000	0.00023	2.00
200	200.00004	200.0000	0.0000	0.00029	2.00

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

ฆ9

ใบรับรองการสอบเทียบ "ห้องเย็น"

(Calibration Certificate of Cool Room)

SCG

Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com

NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T240070

Certificate of Calibration

Equipment	:	**Chamber (Cooling Room)**
Manufacturer	:	-
Model	:	-
Serial No.	:	-
Customer Code	:	**EQL-167**
ID No.	:	**T1447A1**
Customer	:	**Test Tech Co.,Ltd** **30, 32 Rama II Soi 63, Rama II Rd., Samaedam,** **Bangkhunthian Bangkok 10150**
Customer Location	:	**LABORATORY FLOOR 3**
Date of Receipt	:	**12 January 2024**
Calibrated By	:	**Sujjar Naknakred (Site Calibration Manager)**
Approved By	:	_____ / **Boonchai Suriyawong (Site Calibration Manager)**
Date of Issue	:	24 JAN 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrolo

Certificate No. T240070

Calibration Report

Equipment : **Chamber (Cooling Room)**
Date of Calibration : **16 January 2024**
Environment : **Temperature : 19.4-24.1 °C**
Line Voltage : 221.3-226.1 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

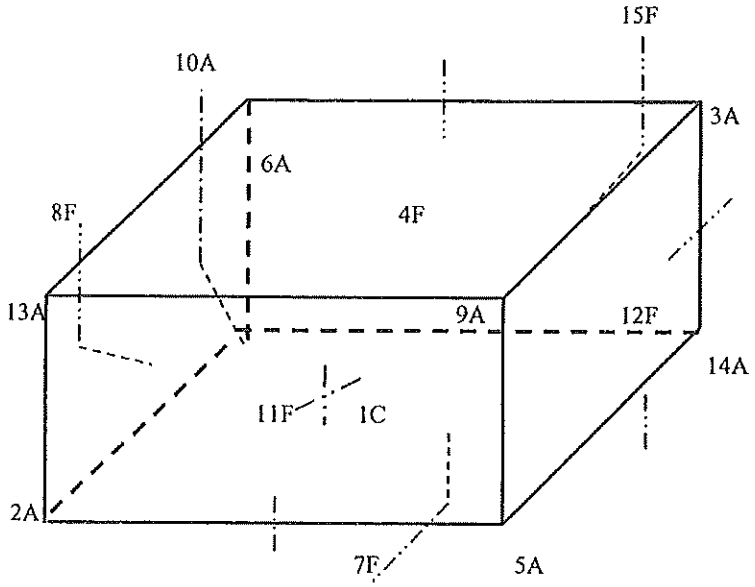
Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN161-TN170	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant - Hour 37 Minute At 3 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☐ Close
   ☒ Not Available
5. Adjustment :
   ( ) without adjustment (X) after adjustment

Approved By

Certificate No. T240070

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170

11F	=	TN161
12F	=	TN162
13A	=	TN163
14A	=	TN164
15F	=	TN165

Approved By._____

Certificate No. T240070

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	3.17	3.11	3.11	3.33	2.94	3.06	2.95	3.17	2.86	2.59
	TN161	TN162	TN163	TN164	TN165					
	2.74	2.95	2.75	2.95	2.85					

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor *k*
	Min , Max	Average					
3.0	2.9 , 3.1	3.0	2.97	0.29	0.64	0.80	2.00

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____

SCG

Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com

NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T240161

Certificate of Calibration

Equipment	:	Chamber (Cooling Room)
Manufacturer	:	-
Model	:	-
Serial No.	:	-
Customer Code	:	EQL-181
ID No.	:	T0399A5
Customer	:	Test Tech Co.,Ltd 30, 32 Rama II Soi 63, Rama II Rd., Samaedam, Bangkhunthian Bangkok 10150
Customer Location	:	LABORATORY FLOOR 4
Date of Receipt	:	24 January 2024
Calibrated By	:	Preecha Phisassutthikul (Temperature Calibration Manager)
Approved By	:	_____/ Boonchai Suriyawong (Site Calibration Manager)
Date of Issue	:	31 JAN 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Calibration Report

Equipment : **Chamber (Cooling Room)**
Date of Calibration : **29 January 2024**
Environment : **Temperature : 25.4-27.9 °C**
Line Voltage : 223.4-227.1 V
Relative Humidity : 45 - 49 %RH

Condition of this results of calibration :

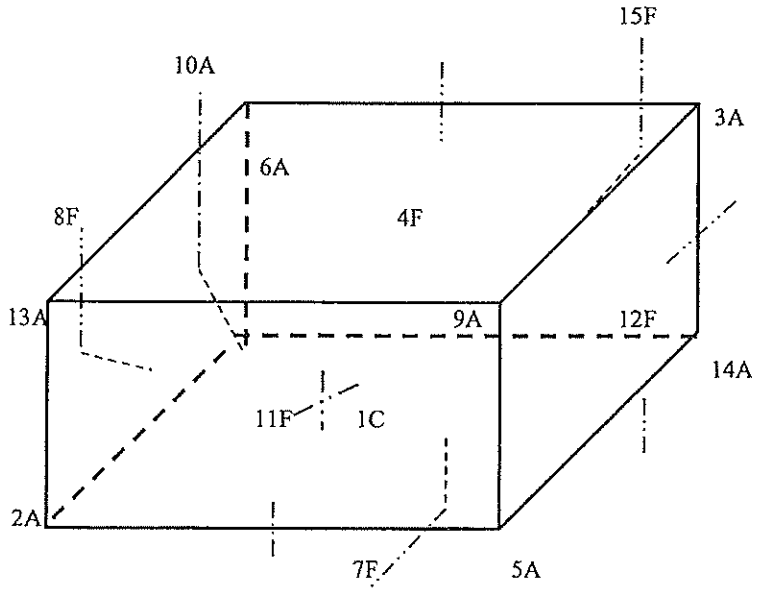
1. Thisequipment was calibrated by insert 15 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
   All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 1 Hour 30 Minute At 3 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☐ Close
   ☒ Not Available
5. Adjustment :
   (X) without adjustment ( ) after adjustment

Approved By

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170
11F	=	TN171

12F	=	TN172
13A	=	TN173
14A	=	TN174
15F	=	TN175

Approved By._____

Certificate No. T240161

Calibration Report

Measurement Results

	Average Standard Reading at each position (°C)									
Calibration Point	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3.0	2.81	3.01	2.99	2.87	2.92	3.08	3.04	2.93	3.31	3.10
	TN171	TN172	TN173	TN174	TN175					
	3.08	3.10	3.40	3.00	3.24					

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor *k*
	Min , Max	Average					
3.0	2.8 , 3.1	3.0	3.06	0.40	0.92	1.07	2.00

* The Acuoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

ช10

ใบรับรองการสอบเทียบ "ตู้บ่มเชื้อ"

(Calibration Certificate of Incubator)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T6749
REFERENCE No : 69853-3

Certificate of Calibration

EQUIPMENT	:	INCUBATOR
MANUFACTURER	:	MEMMERT
MODEL	:	INB 400
SERIAL No	:	E405.0946
ID No	:	EQL-087
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	10-Jul-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	17-Jul-23
RECEIVED DATE	:	10-Jul-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T6749

Calibration Report

EQUIPMENT	:	INCUBATOR			
MANUFACTURER	:	MEMMERT			
MODEL	:	INB 400			
ID No	:	EQL-087	S/N	:	E405.0946
RECEIVED DATE	:	10-Jul-23	CALIBRATION DATE	:	10-Jul-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	RELATIVE HUMIDITY	:	51 %RH ± 10 %RH

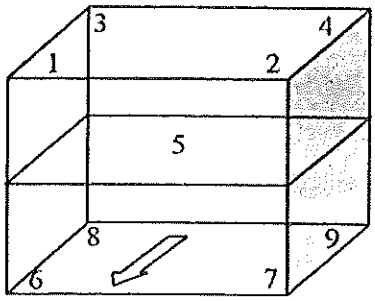
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	22T7508	10-Aug-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 40*33*40 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Location (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.0	43.96	0.06	0.54	0.71
55.0	55.00	0.05	0.58	0.79
58.0	57.96	0.06	0.69	0.81

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
43.5	43.5	43.72	43.78	43.73	43.75	44.22	43.86	44.17	44.06	44.34	0.36
54.5	54.5	54.75	54.78	54.76	54.75	55.30	54.83	55.27	55.07	55.47	0.36
57.5	57.5	57.67	57.74	57.62	57.67	58.28	57.86	58.28	58.11	58.38	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

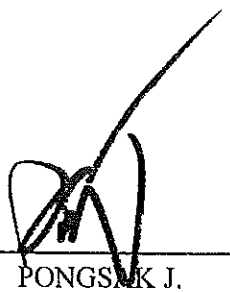
NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1186
REFERENCE No : 72116-4

Certificate of Calibration

EQUIPMENT	:	INCUBATOR
MANUFACTURER	:	MEMMERT
MODEL	:	IF 110
SERIAL No	:	D415.0802
ID No	:	EQL-190
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24



APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1186

Calibration Report

EQUIPMENT	:	INCUBATOR			
MANUFACTURER	:	MEMMERT			
MODEL	:	IF 110			
ID No	:	EQL-190	S/N	:	D415.0802
RECEIVED DATE	:	09-Feb-24	CALIBRATION DATE	:	09-Feb-24
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	RELATIVE HUMIDITY	:	53 %RH ± 10 %RH

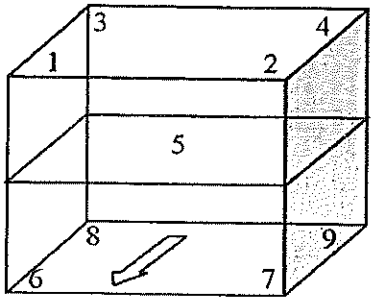
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7408027	23T6638	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
37.0	36.99	0.09	0.20	0.24
44.0	44.11	0.08	0.26	0.31

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
37.0	37.0	36.99	36.97	36.98	36.95	37.05	37.03	37.03	36.98	36.96	0.25
44.0	44.0	44.09	44.12	44.02	44.08	44.20	44.11	44.20	44.12	44.08	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1185
REFERENCE No : 72116-3

Certificate of Calibration

EQUIPMENT	:	INCUBATOR
MANUFACTURER	:	MEMMERT
MODEL	:	IF 160
SERIAL No	:	D518.0082
ID No	:	EQL-205
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24



APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1185

Calibration Report

EQUIPMENT	:	INCUBATOR			
MANUFACTURER	:	MEMMERT			
MODEL	:	IF 160			
ID No	:	EQL-205	**S/N**	:	D518.0082
RECEIVED DATE	:	09-Feb-24	**CALIBRATION DATE**	:	09-Feb-24
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 %RH

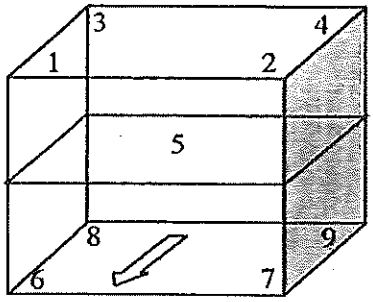
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.03	0.05	0.09	0.16
36.0	36.05	0.07	0.08	0.19
41.5	41.45	0.08	0.13	0.20

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	34.98	35.01	35.00	35.00	35.02	35.08	35.07	35.04	35.10	0.25
36.0	36.0	36.00	36.03	36.03	36.02	36.04	36.09	36.10	36.04	36.12	0.25
41.5	41.5	41.45	41.45	41.39	41.46	41.46	41.47	41.43	41.44	41.49	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
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END OF CALIBRATION REPORT

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www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1184
REFERENCE No : 72116-2

Certificate of Calibration

EQUIPMENT	:	INCUBATOR
MANUFACTURER	:	MEMMERT
MODEL	:	IF 160
SERIAL No	:	D518.0240
ID No	:	EQL-218
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24

APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

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QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1184

Calibration Report

EQUIPMENT	:	INCUBATOR			
MANUFACTURER	:	MEMMERT			
MODEL	:	IF 160			
ID No	:	EQL-218	**S/N**	:	D518.0240
RECEIVED DATE	:	09-Feb-24	**CALIBRATION DATE**	:	09-Feb-24
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 %RH

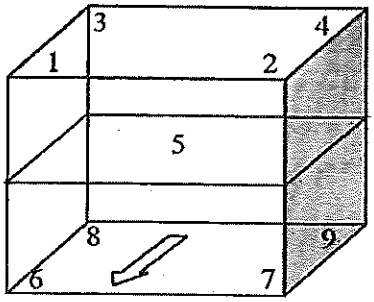
CONDITION OF THIS RESULTS OF CALIBRATION

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2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7408027	23T6638	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
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   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.01	0.06	0.14	0.20
36.0	36.01	0.07	0.16	0.23

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	34.97	34.97	34.99	34.99	35.06	35.05	34.95	35.02	35.05	0.25
36.0	36.0	35.97	35.96	35.98	35.99	36.06	36.07	35.96	36.02	36.05	0.25

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
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END OF CALIBRATION REPORT

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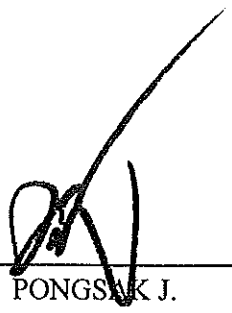
NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1187
REFERENCE No : 72116-5

Certificate of Calibration

EQUIPMENT	:	INCUBATOR
MANUFACTURER	:	MEMMERT
MODEL	:	IF 160
SERIAL No	:	D519.0140
ID No	:	EQL-231
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24



APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1187

Calibration Report

EQUIPMENT	:	INCUBATOR			
MANUFACTURER	:	MEMMERT			
MODEL	:	IF 160			
ID No	:	EQL-231	S/N	:	D519.0140
RECEIVED DATE	:	09-Feb-24	CALIBRATION DATE	:	09-Feb-24
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	RELATIVE HUMIDITY	:	53 %RH ± 10 %RH

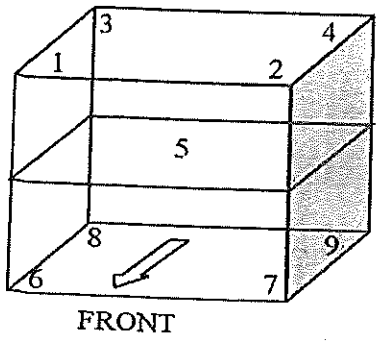
CONDITION OF THIS RESULTS OF CALIBRATION

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2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	6635300	23T6637	19-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
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RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): ** cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.06	0.07	0.17	0.27
37.0	37.05	0.07	0.14	0.22
41.5	41.59	0.07	0.17	0.24

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	35.00	35.06	35.03	35.05	35.07	35.05	35.05	35.13	35.11	0.25
37.0	37.0	37.06	37.03	37.02	37.00	37.04	37.06	37.07	37.07	37.10	0.25
41.5	41.5	41.57	41.57	41.54	41.53	41.56	41.63	41.69	41.63	41.63	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
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END OF CALIBRATION REPORT

ช11

ใบรับรองการทวนสอบ "เครื่อง Atomic Absorption Spectrophotometer"

(Calibration Certificate of Atomic Absorption Spectrophotometer)

PerkinElmer®
For the Better

PinAAcle 900F
Preventive Maintenance Report

Company Name: TEST TECH CO., LTD

Instrument Location: 30,32 Rama II Soi 63 Rama II Road.

Samaedam, Bankhuntien, Bangkok, 10510

Instrument Serial No.: PFBS21091601

Date: 27-Feb-2023

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	TEST TECH CO., LTD		
Address (Instrument Location):	30,32Rama IISoi 63Rama II Road.Samaedam,Bangkhuntien,Bangkok,10510		
Serial Number:	PFBS21091601	**PM Number:**	2/2
Customer Name (If applicable):	K. AOYJAI	**Telephone Number:**	02-877-3271
Customer Support Engineer Name:	K. DUANG	**Service Order Number:**	-
Date PM Performed: (DD-MMM-YYYY)	27-Feb-2023	**Next PM Due Date:** (DD-MMM-YYYY)	27-Feb-2024
Standard Labor Hours to Complete PM :		**5 hours**	

Part Number	Release	Publication Date	
09370145 Rev.9	A	January 2018	PerkinElmer®

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F 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	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	**Description**	**Quality**	**Batch/Lot #**	**Expired Date (MM/YY)**
N9300183	1000 mg/L Copper Standard	AR		

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 #**
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG0-358
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

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 lines for leaks and/or wear. Replace if needed.
   - ☑ Clean exterior of the instrument.
   - ☑ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
   - ☑ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
   - ☑ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
   - ☑ Check the drain system for signs of wear. Replace worn or damaged parts.
   - ☑ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. **Electrical:**
   - ☑ Inspect PC boards. Clean if necessary.
   - ☑ Carefully check all internal and external cable connections.
   - ☑ 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 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 acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
C_2H_2 Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9796	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.2015	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0010	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D_2 Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0084	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (If applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (If applicable)	> 0.250 Abs.	0.3313	Passed

10. 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	
PERFORMANCE TEST FOR FIAS	
1. Characteristics mass for Mercury.	0.0693 Abs.
(500 ul of 10 ug/l for Hg And 5 replicates).	317.5 pg/0.0044 Abs.
Characteristic Mass	
%RSD.	2.02%
2. Characteristics mass for Arsenic.	0.1670 Abs.
(500 ul of 10 ug/l for As And 5 replicates).	131.7 pg/0.0044 Abs
Characteristic Mass	
%RSD.	2.42%
3. Characteristics mass for Serenium.	0.2597 Abs.
(500 ul of 10 ug/l for Se And 5 replicates).	84.7 pg/0.0044 Abs.
Characteristic Mass	
%RSD	2.95%
Wavelength Accuracy Check	
As 193.70 nm +/- 0.3 nm	193.70
Cu 324.75 nm +/- 0.3 nm	324.70
Ba 553.55 nm +/- 0.3 nm	553.60
K 766.49 nm +/- 0.3 nm	766.50

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☑ ***Fails*** ☐ ***the preventive maintenance.***

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 27-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 27-Feb-2023 (DD-MMM-YYYY)

ช12

ใบรับรองการทวนสอบ "เครื่องอังไอน้ำ"

(Calibration Certificate of Water bath)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T8796
REFERENCE No : 70515-4

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	MEMMERT
MODEL	:	WNE 45
SERIAL No	:	L720.0266
ID No	:	EQL-241
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	16-Aug-23
APPROVED BY	:	RONGSAK J.
ISSUED DATE	:	16-Aug-23
RECEIVED DATE	:	16-Aug-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 23T8796

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	MEMMERT	MODEL	:	WNE 45
ID NUMBER	:	EQL-241	SERIAL NUMBER	:	L720.0266
RECEIVED DATE	:	16-Aug-23	CALIBRATION DATE	:	16-Aug-23
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	RELATIVE HUMIDITY	:	50 %RH ± 10 % RH

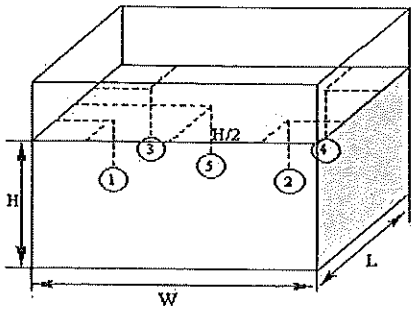
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	23T6642	19-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.6
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 59*35*20 cm

BATH PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (±°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
83.0	83.09	0.05	0.07	0.05	0.16
92.0	92.13	0.11	0.06	0.06	0.28

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
83.0	83.0	83.08	83.09	83.06	83.11	83.12	0.15
92.0	92.0	92.11	92.13	92.10	92.16	92.16	0.19

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

ilac-MRA

THAILAND
NSC-ISO/IEC 17025
CALIBRATION 0049

CERTIFICATE No : 23T6748
REFERENCE No : 69853-2

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	MEMMERT
MODEL	:	WPE 45
SERIAL No	:	L711.0024
ID No	:	EQL-147
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	10-Jul-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	17-Jul-23
RECEIVED DATE	:	10-Jul-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 23T6748

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	MEMMERT	**MODEL**	:	WPE 45
ID NUMBER	:	EQL-147	**SERIAL NUMBER**	:	L711.0024
RECEIVED DATE	:	10-Jul-23	**CALIBRATION DATE**	:	10-Jul-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 % RH

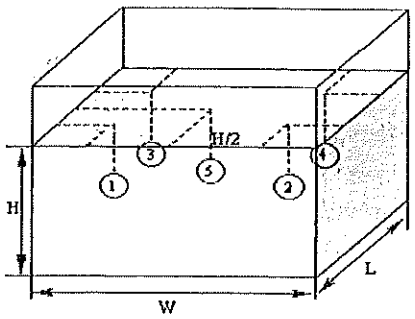
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Aug-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 1.4
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 59*35*22 cm

BATH PERFORMANCE

Calibrate Point (°C)	Temperature Stability (±°C)	Average All Location (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
41.5	0.03	41.49	0.03	0.02	0.07
44.5	0.04	44.50	0.02	0.01	0.11

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
41.5	41.5	41.48	41.50	41.49	41.51	41.48	0.14
44.5	44.5	44.50	44.51	44.50	44.49	44.51	0.14

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 23T6747
REFERENCE No : 69853-1

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	N/A
MODEL	:	N/A
SERIAL No	:	N/A
ID No	:	EQL-046
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	10-Jul-23
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	17-Jul-23
RECEIVED DATE	:	10-Jul-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	N/A	**MODEL**	:	N/A
ID NUMBER	:	EQL-046	**SERIAL NUMBER**	:	N/A
RECEIVED DATE	:	10-Jul-23	**CALIBRATION DATE**	:	10-Jul-23
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 % RH

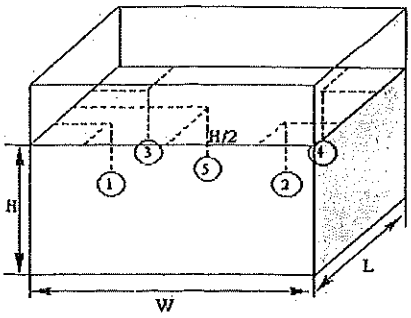
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
') DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Aug-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 2.3
Overall Variation of Line Voltage (V) : 10
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 45*33*13 cm

BATH PERFORMANCE

Calibrate Point (°C)	Temperature Stability (±°C)	Average All Location (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
44.5	0.04	44.52	0.01	0.02	0.08
45.0	0.01	45.04	0.01	0.02	0.03
50.0	0.06	49.99	0.01	0.02	0.14

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
44.5	44.5	44.52	44.52	44.52	44.52	44.52	0.14
45.0	45.0	45.04	45.04	45.04	45.04	45.04	0.14
50.0	50.0	49.99	49.99	49.98	49.98	49.99	0.15

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
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www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1183
REFERENCE No : 72116-1

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	MEMMERT
MODEL	:	WNE 22
SERIAL No	:	L516.1016
ID No	:	EQL-198
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	MEMMERT	**MODEL**	:	WNE 22
ID NUMBER	:	EQL-198	**SERIAL NUMBER**	:	L516.1016
RECEIVED DATE	:	09-Feb-24	**CALIBRATION DATE**	:	09-Feb-24
AMBIENT TEMPERATURE	:	25 °C ± 1 °C	**RELATIVE HUMIDITY**	:	50 %RH ± 10 % RH

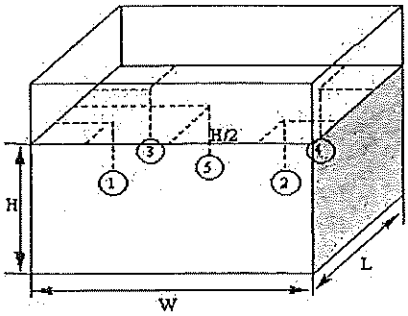
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	23T6641	14-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.6
Overall Variation of Line Voltage (V) : 5
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 35*29*22 cm

BATH PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (±°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
41.5	41.69	0.01	0.01	0.02	0.02
45.0	45.10	0.02	0.06	0.05	0.12
50.0	50.11	0.02	0.05	0.05	0.07

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
41.5	41.5	41.69	41.69	41.70	41.70	41.69	0.14
45.0	45.0	45.06	45.12	45.08	45.13	45.12	0.15
50.0	50.0	50.09	50.13	50.08	50.13	50.12	0.15

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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ใบรับรองการทวนสอบ "เครื่องนึ่งฆ่าเชื้อ"

(Calibration Certificate of Autoclave)

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T1189
REFERENCE No : 72116-7

Certificate of Calibration

EQUIPMENT	:	AUTOCLAVE
MANUFACTURER	:	HIRAYAMA
MODEL	:	HVE-50
SERIAL No	:	30612085166
ID No	:	EQL-155
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	TEST TECH CO., LTD. 30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM, BANGKHUNTHIAN, BANGKOK 10150
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	09-Feb-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	12-Feb-24
RECEIVED DATE	:	09-Feb-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

QUALITY CALIBRATION CO.,LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	AUTOCLAVE			
MANUFACTURER	:	HIRAYAMA	MODEL	:	HVE-50
ID NUMBER	:	EQL-155	SERIAL NUMBER	:	30612085166
RECEIVED DATE	:	09-Feb-24	CALIBRATION DATE	:	09-Feb-24
AMBIENT TEMPERATURE	:	30° C ± 1° C	RELATIVE HUMIDITY	:	53 %RH ± 10 % RH

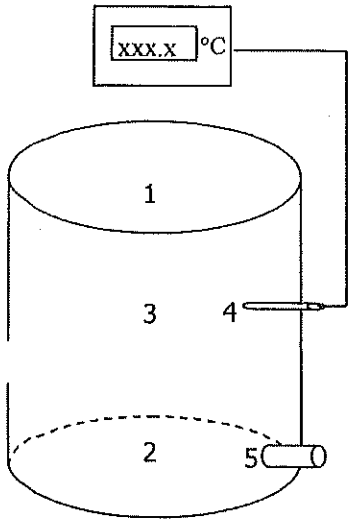
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. THE THIRD SENSOR WAS PLACED WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT CHAMBER. SENSOR NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 15 mm OF ITS TIP. SENSOR NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER	VALPROBE	S350,S367,DV35,DN94	24T0890	26-Jan-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber variation : 0.5 °C
Autoclave Condition : Normal
Chamber Size (Diameter*H): 30 * 71 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average all Position (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
115	115.74	0.09	0.11	0.25	0.090	20	60
121	121.59	0.06	0.21	0.28	0.125	20	60

TEMPERATURE MEASUREMENT ACCURACY TEST(° C)

Cont Temp	Ind Temp	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
115	115	115.72	115.74	115.79	115.71	115.71	0.59
121	121	121.59	121.62	121.56	121.58	121.59	0.59

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT OF TEMPERATURE MEASUREMENT ACCURACY TEST EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : THE STABILITY TERM IN THE UNCERTAINTY BUDGET WAS REPLACED BY THE STANDARD REPEATABILITY.
NOTE 3: LOCATION 3 WAS REFERENCE LOCATION.
NOTE 4 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

ช14

ใบรับรองการทวนสอบ "เครื่อง Spectrophotometer"

(Calibration Certificate of Spectrophotometer)

Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com

Bara Scientific
Solution of Success

NSC-TISI-TIS 17025
CALIBRATION 0209

Certificate of Calibration

Certificate No.	BSCC-UV-163/23
Equipment	UV/Vis Spectrophotometer
Model	UV-1900i
Manufacturer	Shimadzu
Serial No.	A12535780311ML
ID No.	EQL-233
Date of receipt	27 April 2023
Date of calibration	27 April 2023
Date of issue	8 May 2023
Customer name	Test Tech Co., Ltd.
Address	30, 32 Rama II Soi 63, Rama II RD., Samaedam, Bangkhunthian, Bangkok 10150
Temperature	(23.5-24.4) °C (On site)
Humidity	(50.8-48.2) %RH (On site)
Equipment condition	Good Operation
Calibration Location	Clean Room Circubond
Calibration Procedure	In-house method WI-UV-702-01 based on ASTM E275-01
Traceability	Wavelength Accuracy is traceable to certificate No. 96367 and 96366 Photometric Accuracy is traceable to certificate No. 99925 and 96363 Stray Light is traceable to certificate No. 96346 The above certificate are traceble to SI unit through Starna Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)
Calibrated by	Mr.Poomjai Korsawatvorakul

Approved by

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the resuits are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0209

Certificate of Calibration

Certificate No. BSCC-UV-163/23 Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
279.44	279.17	-0.27	0.18
418.53	418.45	-0.08	0.18
536.52	536.58	0.06	0.18
684.50	684.62	0.12	0.18
879.41	879.43	0.02	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
257	0.0000	0.0000	0.0000	0.0075
	0.8552	0.8532	-0.0020	0.0075
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0001	0.0001	0.0075
	0.6349	0.6336	-0.0013	0.0075

*CNR = Customer not request

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Solution of Success

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0299

Certificate of Calibration

Certificate No. BSCC-UV-163/23 Number of Page(s) 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5485	0.0013	0.0042
	0.7637	0.7637	0.0000	0.0042
	1.0480	1.0494	0.0014	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5384	0.0013	0.0042
	0.7457	0.7457	0.0000	0.0042
	1.0233	1.0247	0.0014	0.0042
465.0	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5017	0.0011	0.0042
	0.6961	0.6954	-0.0007	0.0042
	0.9563	0.9565	0.0002	0.0042
590.0	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5147	0.0010	0.0042
	0.6907	0.6900	-0.0007	0.0042
	0.9533	0.9536	0.0003	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelenght (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91±0.11nm	200.55	0.9670	2.0147

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
***Stray Light not NSC-ONSC Accredited.**

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

*****End of Certificate*****

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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DKSH

HSC-TISI-TIS 17025
Calibration 0037

Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06230165
Model:	DR6000	Issued Date:	24 April 2023
Serial No. (or ID.):	1693421 (EQL-197)	Job No.:	KSPR2306121
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand

Environment Condition:

Temperature	25.3	°C	±	0.2	°C
Humidity	48.9	%RH	±	1.7	%RH

Calibration Place: TEST TECH CO., LTD. (แผนกน้ำดี)
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand

Calibration By: Mr. Atachai Ngamchanat

Calibration Date: 21 April 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 93907 and 93914
The standard for Photometric Certificate No. 94010 and 93900
The standard for Stray light Certificate No. 93903 and 93902
The standard for Spectral resolution Certificate No. 103140

(Mr. Atachai Ngamchanat)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

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

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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	637.9	0.08	0.13
748.48	748.7	-0.22	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5816	0.580	0.0016	0.0045
	0.7130	0.712	0.0010	0.0045
	1.0151	1.013	0.0021	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5649	0.563	0.0019	0.0045
	0.7012	0.699	0.0022	0.0045
	0.9982	0.996	0.0022	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5249	0.524	0.0009	0.0045
	0.6621	0.661	0.0011	0.0045
	0.9420	0.939	0.0030	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.520	0.0014	0.0045
	0.6982	0.697	0.0012	0.0045
	0.9947	0.992	0.0027	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5549	0.553	0.0019	0.0045
	0.7736	0.771	0.0026	0.0045
	1.1041	1.101	0.0031	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.561	0.0011	0.0045
	0.7630	0.761	0.0020	0.0045
	1.0890	1.086	0.0030	0.0045

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7440	0.737	0.0070	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8635	0.855	0.0085	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2902	0.288	0.0022	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6409	0.634	0.0069	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.51 +/- 0.11 nm	260.5	0.7	2.155
391.84 +/- 0.11 nm	391.8	1.2	1.921

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.73	266.77	1.35	2.00
UUC: Wavelength (nm)	268.6	266.6		
Std Absorbance (A)	0.4237	0.2591		
Absorbance (A)	0.385	0.285		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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ช15

ใบรับรองการทวนสอบ "เครื่องกลั่นไนโตรเจน"

(Calibration Certificate of Distillation Unit VAPODEST VAP20, VAP30s)

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance

Gerhardt

Analytical Systems

DKSH

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

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

เงื่อนไขการให้บริการ Preventive Maintenance

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

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

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

ช่องทางการติดต่อ

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

LINE: @dkshscientific

Call center 0 2 639 7000

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Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ....1.... ครั้ง ต่อ ปี
ครั้งที่1/1วันที่ ....28 Mar 2023.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท เทสท์ เทค จำกัด		
ที่อยู่	30,32 ซอยพระรามที่ 2 ซอย 63 ถนนพระรามที่ 2 แขวงแสมดำ เขตบางขุนเทียน กรุงเทพมหานคร 10150		
โทรศัพท์	0-2893-4211-7	แฟกซ์	0-2893-4218

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณมาริสา วิเศษสังข์				
ตำแหน่ง	หัวหน้าส่วน				
โทรศัพท์	0-2893-4211-7	เบอร์ต่อ		แฟกซ์	0-2893-4218
E-mail	Lab_center@testtech.co.th				

รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: siriporn.sy@dksh.com Line ID : siripon3007 เจ้าหน้าที่ประสานงาน : คุณศิริพร อยู่ทองจุ้ย โทรศัพท์ 090 678 6924 ,02 301 7467			
เจ้าหน้าที่ผู้ให้บริการ	นายจิรายุษ สเลอาด		
ตำแหน่ง	Specialist,TechnicalService.		
โทรศัพท์	0938138736	แฟกซ์	-
E-mail	Jirayut.js@dksh.com		

ลงนามผู้รับบริการ	
ตัวบรรจง	(.....)
ตำแหน่ง	
วันที่ / ประทับตราบริษัท	

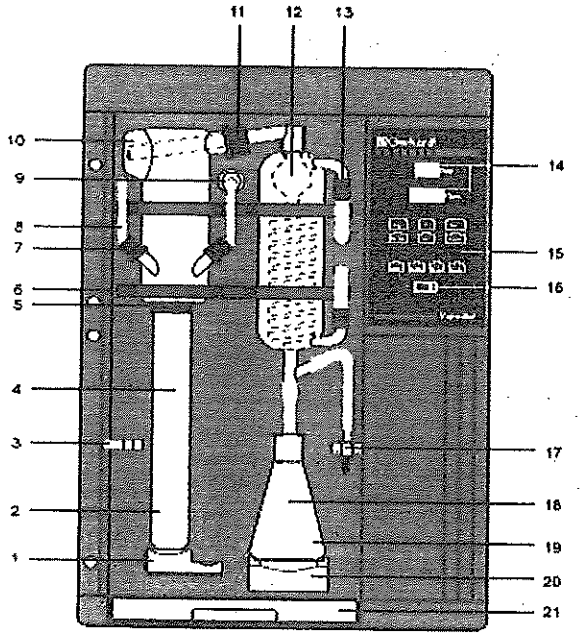
ลงนามผู้ให้บริการ	
ตัวบรรจง	(...นายจิรายุษ สเลอาด...)
ตำแหน่ง	Specialist,TechnicalService
วันที่ / ประทับตราบริษัท	28/3/2023

JOB No: Lspr2302591 **MODEL:** Vap30 **S/N:** 003718

Part : Operational Qualification (OQ)

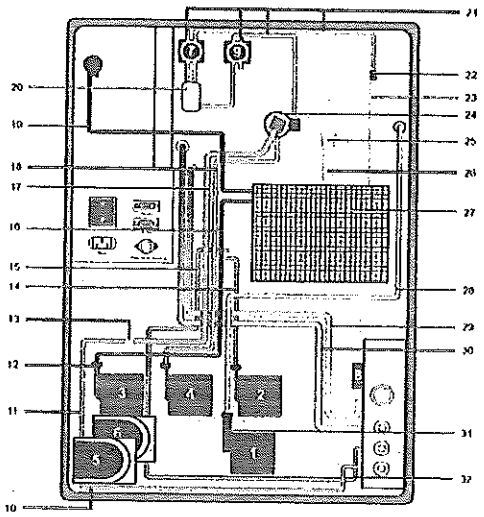
ตรวจสอบสภาพเครื่อง

FRONT



	Pass	Fail	N/A	Remark
1.Quick clamping device with wedge	☑	☐	☐	.....
2. Kjeldatherm digestion tube	☑	☐	☐	.....
3. Holder for steam inlet tubing	☑	☐	☐	.....
4. PTFP-Inlet tubing, steam	☑	☐	☐	.....
5. Viton-cone	☑	☐	☐	.....
6. Clamping for glassware	☑	☐	☐	.....
7. Screw cap GL18 with silicone seal	☑	☐	☐	.....
8. PTFP-Inlet tubing, NaOH	☑	☐	☐	.....
9. PP-Distributor with PP-threaded joint	☑	☐	☐	.....
10. Distribution head, glass	☑	☐	☐	.....
11. Screw cap GL32 with silicone seal	☑	☐	☐	.....
12. Distillation condenser	☑	☐	☐	.....
13. Screw cap GL14 with plastic screw connection	☑	☐	☐	.....
14. Display	☑	☐	☐	.....
15. Keyboard, chemical-resistant	☑	☐	☐	.....
16. Main switch, green	☑	☐	☐	.....
17. Ventilation valve	☑	☐	☐	.....
18. Distillate outlet tubing	☑	☐	☐	.....
19. Erlenmeyer flask	☑	☐	☐	.....
20. Platfrom	☑	☐	☐	.....
21. Drip tray	☑	☐	☐	.....

REAR



		Pass	Fail	N/A	Remark
1.	Diaphragm pump NaOH	☑	☐	☐	.....
2.	Diaphragm pump H_3BO_3	☐	☐	☑	vap 40 only
3.	Diaphragm pump H_2O for steam generator	☑	☐	☐	.....
4.	Diaphragm pump H_2O for sample	☑	☐	☐	vap 30,40 only
5.	Peristaltic pump for suction sample	☑	☐	☐	vap 30,40 only
6.	Peristaltic pump for suction receiver	☐	☐	☑	option
7.	Pinch-solenoid valve, steam	☑	☐	☐	.....
8.	Magnetic valve with pressure control	☑	☐	☐	.....
9.	Pinch-solenoid valve, shut-off	☑	☐	☐	.....
10.	Verprene-tubing 4x8 mm.	☑	☐	☐	.....
11.	Verprene-tubing 4x8 mm.	☑	☐	☐	vap 30,40 only
12.	Non-return valve for diaphragm pumps	☑	☐	☐	.....
13.	Tubing reduction PP 51x10x5 mm.	☑	☐	☐	vap 30,40 only
14.	Silicone tubing 4x7 mm.	☐	☐	☑	vap 40 only
15.	Silicone tubing 4x7 mm.	☐	☐	☑	option
16.	Silicone -tubing 4x7 mm.	☑	☐	☐	.....
17.	Verprene-tubing 8x12 mm.	☑	☐	☐	vap 30,40 only
18.	Verprene tubing 4x7 mm.	☑	☐	☐	vap 30,40 only
19.	Silicone tubing 4x7 mm.	☑	☐	☐	.....
20.	Ventilation glass	☑	☐	☐	.....
21.	Novoprene-tubing 4.8x8 mm.	☑	☐	☐	.....
22.	Tubing reduction	☑	☐	☐	.....
23.	Silicone tubing 6x10 mm.	☑	☐	☐	.....
24.	PP-distributor with PP-thread	☑	☐	☐	.....
25.	SKT-valve (built in with brass fitting)	☑	☐	☐	.....
26.	Silicone tubing 8x16x80 mm.	☑	☐	☐	.....
27.	Steam generator	☑	☐	☐	.....
28.	PTFE-inlet tubing NaOH	☑	☐	☐	.....
29.	Silicone tubing 8x16 for cooling water inlet	☑	☐	☐	.....
30.	Silicone tubing 8x16 for cooling water outlet	☑	☐	☐	.....
31.	Viton-tubing 6x12*50 mm.	☑	☐	☐	.....
32.	Silicone tubing 4x7 mm.	☐	☐	☑	option

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

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

ตรวจสอบ Function การทำงาน (The FunctionTest)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการ Suction ตั้ง Sample Tube และ Receiver

รายงานผลการให้บริการ

1. TECHNICAL DATA	Pass	Fail	N/A	Remark
Main Supply 220 volt + 10% 50 Hz with ground	☑	☐	☐	.....
Norminal current	☑	☐	☐	....6 a.....

1.1 COOLING WATER BATH	Pass	Fail	N/A	Remark
Temperature 15-20 °C	☑	☐	☐	.....
Cooling Water Outlet	☑	☐	☐	.....
Control Temperature	☑	☐	☐	.....

1.2 OPTICAL TEST VAP..30..	Pass	Fail	N/A	Remark
Screw cap GL14	☑	☐	☐	.....
Screw cap GL18	☑	☐	☐	.....
Screw cap GL32	☑	☐	☐	.....
Distillation Head	☑	☐	☐	.....
Condensor	☑	☐	☐	.....
Viton Cone	☑	☐	☐	.....
Ventilation Valve	☑	☐	☐	.....
Micro Switch Sample	☑	☐	☐	.....

2. SYSTEM COOLING WATER INLET	Pass	Fail	N/A	Remark
Cooling Water Inlet	☑	☐	☐	.....
Cooling Water Outlet	☑	☐	☐	.....
Magnetic valve	☑	☐	☐	.....

3.SYSTEM CONTROL	Pass	Fail	N/A	Remark
Key Board	☑	☐	☐	.....
Display	☑	☐	☐	.....
Program	☑	☐	☐	.....
Adding H_2O	☑	☐	☐	vap 30,40 only
Adding NaOH	☑	☐	☐	.....
Adding H_3BO_3	☐	☐	☑	vap 40 only
Suction Sample	☑	☐	☐	vap 30,40 only

4.SYSTEM DISTILLATION	Pass	Fail	N/A	Remark
Boiler	☑	☐	☐	.....
Level Sensor	☑	☐	☐	.....
Novoprene-Tubing	☑	☐	☐	.....
Solenoid Valve Shut-Off	☑	☐	☐	.....
Solenoid Valve Steam	☑	☐	☐	.....
Excess Pressure Detector	☑	☐	☐	.....
Ventilation Valve	☑	☐	☐	.....
Heater	☑	☐	☐	.....

5. PUMP	Pass	Fail	N/A	Remark
Pump H_2O Steam	☑	☐	☐	.....
- Non-Return Valve	☑	☐	☐	.....
Pump H_2O Sample	☑	☐	☐	.....
- Non-Return Valve	☑	☐	☐	.....
Pump NaOH	☑	☐	☐	.....
- Non-Ruturn Valve	☑	☐	☐	.....
Pump H3BO3	☐	☐	☑	.....
- Non-Ruturn Valve	☐	☐	☑	.....
Pump Suction	☑	☐	☐	.....

6. The Following Program Run :		Pass	Fail	N/A	Remark
Addition H_2O	0-99 sec.	☑	☐	☐	.....
Addition NaOH	0-99 sec.	☑	☐	☐	.....
Addition H_3BO_3	0-99 sec.	☐	☐	☑	.....
Reaction Time	0-99 min.	☑	☐	☐	.....
Distillation Time	0-99 min	☑	☐	☐	.....
Steam Capacity	30%-100%	☑	☐	☐	.....
Suction Time	0-99 sec.	☑	☐	☐	.....
The Instrument is in perfect technical shape		☑	☐	☐	.....

Remark :

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Part : ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning

Glass parts and suction pump should be cleaned before long periods of non-usage (i.e. holidays). This way blockages caused by crystalline deposits are avoided.

The following program should be run:

Addition H_3BO_3	0	s
Addition H_2O:	13	s
Addition NaOH:	0	s
Reaction time:	0	s
Distillation time:	7	min.
Steam capacity:	100	%
Suction time:	20	s

Place an empty digestion tube and an Erlenmeyer flask into position, and start the program.
In case of extreme deposits in the glassware you can clean the system by putting about 10 ml of sulphuric acid into the digestion tube.

Error Code

The micro-processor continually surveys all the functions of the distillation system. As soon as an error arises it is shown on the display and accompanied by an acoustic signal.

Error message	Measures
No tap water	Check cooling water inlet for blockages. Ensure the tap is turned on
No sample tube	Insert tube
Check chemicals	Check set of tanks
Low water Press Enter ↓ Filling Steam generator	Check the water inlet distilled H_2O This message disappears as soon as steam generator is filled

After the above mentioned errors are corrected, the following message is displayed.

Error message	Measures
Stop Prog.No. x continue=Enter	Enter = continue of interrupted program Reset = Standby-mode

Other error messages

Error message	Measures
Wait for steam	Message disappears as soon as stand-by is reached
Add sol. > 1min Continue=Enter	Check programming Enter=continue of interrupted program Reset=Standby-mode
Program undefined	Check programming
Excess steam pressure	Switch the system off and call service
Sensor error	Switch the system off and call service