

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING REFERENCE METER # WET TEST METER W-NK5A No. 540961
5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.	HC65APE0023		
Barometric Pressure	758	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(t_{wi})	(t_{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	3826.4749	3826.6201	26	26	268.44500	268.59380	26	26
10.00	25.0	3826.6500	3826.7934	26	26	268.61426	268.76088	26	26
8.00	50.0	3826.8148	3826.9870	26	26	268.77850	268.95544	26	26
7.00	80.0	3827.0198	3827.2147	26	26	268.98871	269.19091	26	26
5.00	120.0	3827.5000	3827.6865	26	26	269.19122	269.38615	26	26

Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	ΔH @	
($V_{m(Std)}$)	($Q_{m(Std)}$)	($V_{w(Std)}$)	($Q_{w(Std)}$)	Value	Variation	Std & Corr	.0212 m ³ _{std} /min	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	($Q_{m(Std)(Corr)}$)	($\Delta H_{@}$)	($\Delta \Delta H_{@}$)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.142	0.009	0.145	0.010	1.021	-0.002	0.010	61.378	12.190
0.140	0.014	0.143	0.014	1.018	-0.006	0.014	54.157	4.969
0.169	0.021	0.173	0.022	1.021	-0.003	0.022	47.830	-1.358
0.192	0.027	0.197	0.028	1.027	0.004	0.028	45.127	-4.061
0.184	0.037	0.190	0.038	1.031	0.007	0.038	37.447	-11.741
				1.024	Y Average		49.188	$\Delta H_{@}$ Average

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

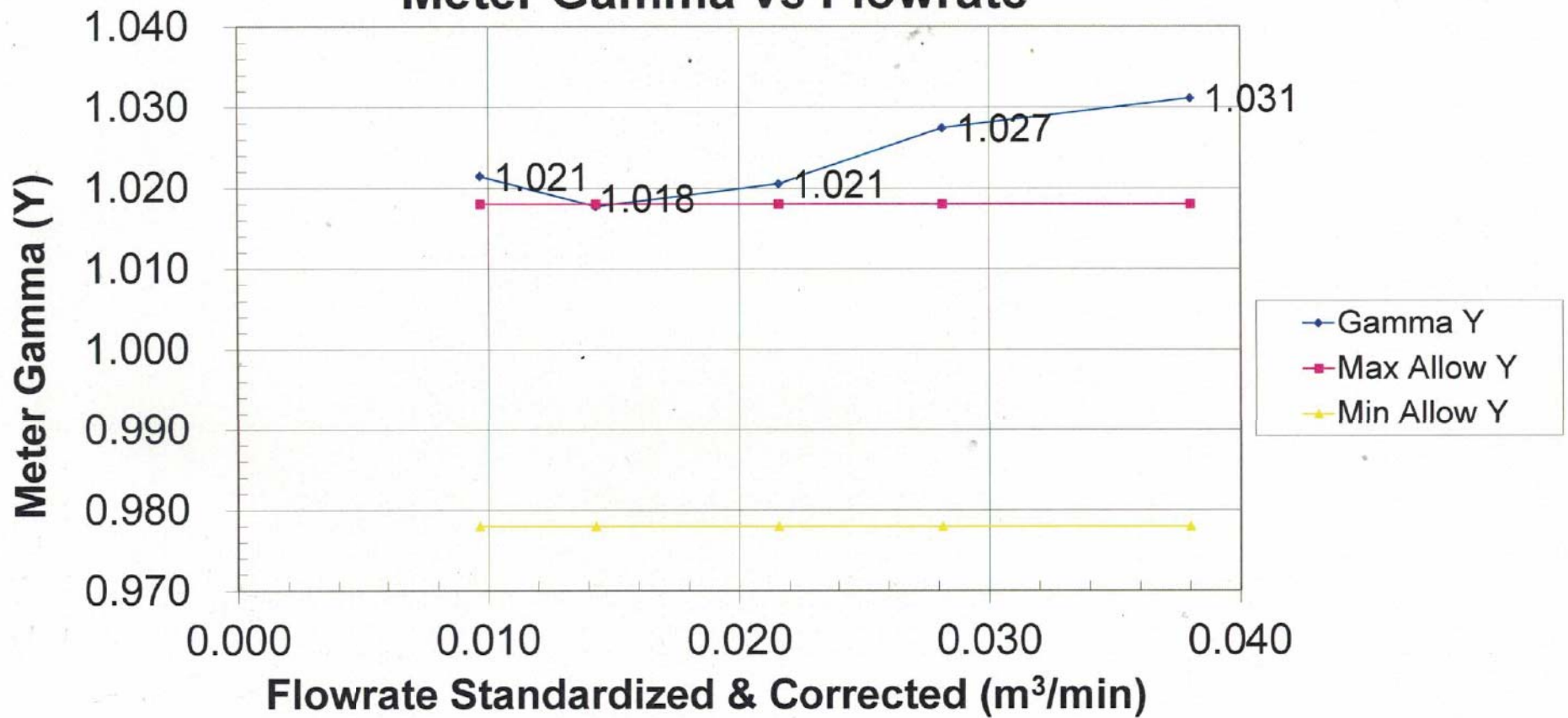
Note: For $\Delta H_{@}$, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Signature _____ **SITHIPORN ASSOCIATES COMPANY LIMITED** Date 24/02/2022

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023

Meter Gamma vs Flowrate



Console Serial: 0509047

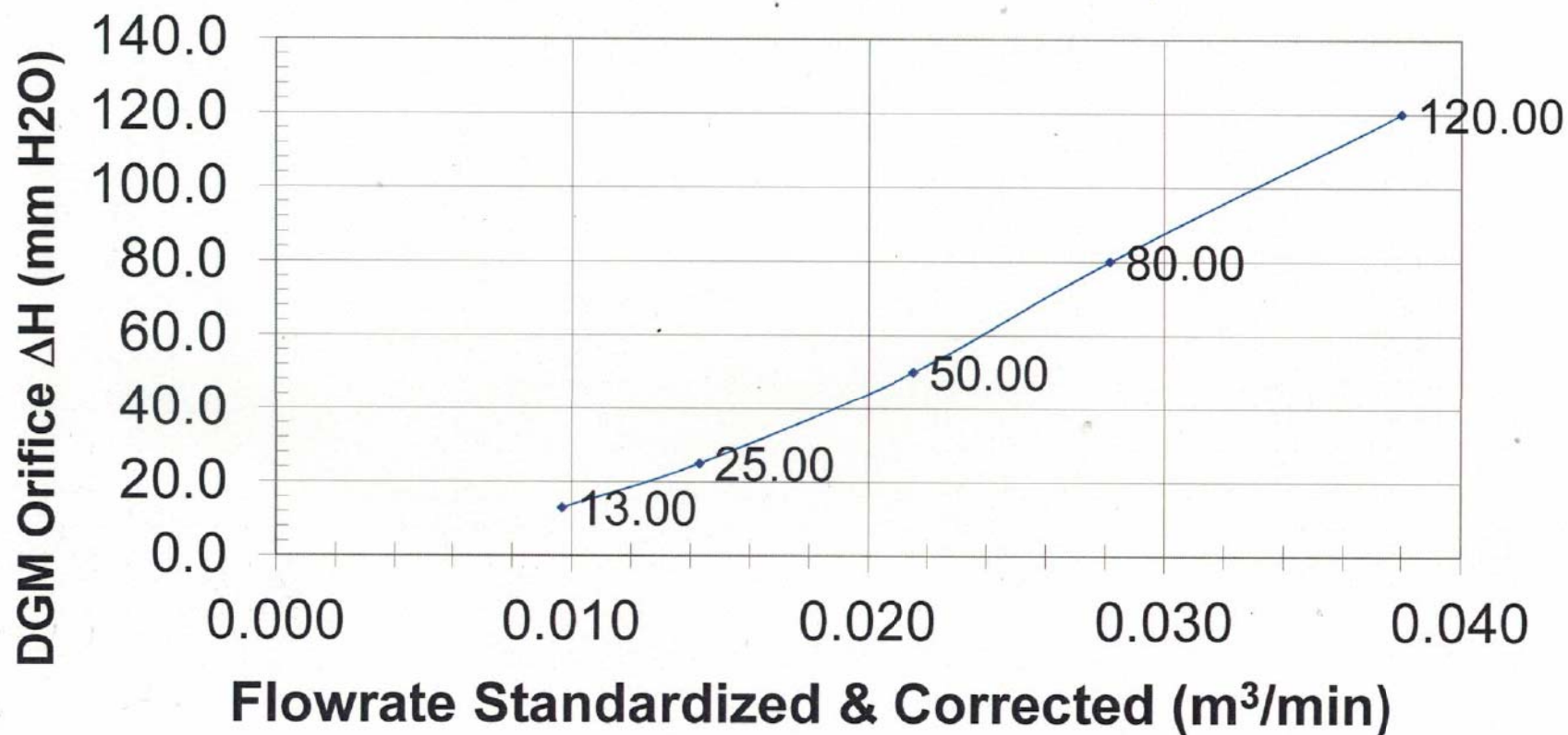
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SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model: XC572V

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023

Meter Pressure vs Flowrate



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SITIPORN ASSOCIATES COMPANY

Console Serial: 0509047

Console Model: XC572V

HEATER SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Probe Heater	Standard Method 5 Assemblies
Heated Filter Box	SB-2-V

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.	HC65APE0023		
Barometric Pressure	758	mm Hg	

Results				
System Heat	Control Acceptance	Reference thermometer temperature	Thermocouple potentiometer temperature	Temperature difference
	°C	°C	°C	°C
Probe Heater System for 5ft. Probe	120 °C ± 14 °C	121	120.5	0.13
Heated Filter Box	120 °C ± 14 °C	121	120	0.25

Note: Check Acceptance Limits, capable of maintaining 120 °C ± 14 °C at 20-lpm flow rate

Signature _____

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SITHIPHORN ASSOCIATES COMPANY LTD.

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Sithiphorn Associates Co., Ltd.

451-451/1 ถนนสีรินธร แขวงบางบำหรุ เขตบางพลัด กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-1679, 0-2434-9510

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL: center@sithiphorn.com

www.sithiphorn.com

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Meter Box Model Number	JENCO 765
Meter Box Model Number	REX-C100

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.	HC65APE0023		
Barometric Pressure	758	mm Hg	
Reference Thermometer	FLUKE 714		
Serial Number	9038005		

Results												
Console Thermocouple Simulator												
Channel and test point	Meter Box Channel Temperature Reading (°C)											
	0.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0	
Stack	0	25	38	94	152	260	371	485	596	818	1041	
Probe	0	25	38	94	151							
Filter	0	25	38	94	151							
Aux	0	25	38	94	152							
Exit	0	25	38									
Meter	0	25	38									

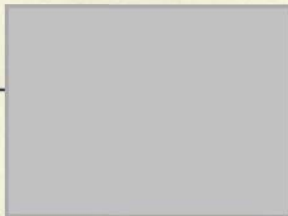
Tolerance Range

Stack $\pm 1.50\%$ Absolute
Probe $\pm 3.0\text{ }^{\circ}\text{C}$
Filter $\pm 3.0\text{ }^{\circ}\text{C}$

Aux $\pm 3.0\text{ }^{\circ}\text{C}$
Exit $\pm 2.0\text{ }^{\circ}\text{C}$
Meter $\pm 2.0\text{ }^{\circ}\text{C}$

Note. Cabel socket temp probe wrong + -

Signature _____



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NOZZLE CALIBRATION

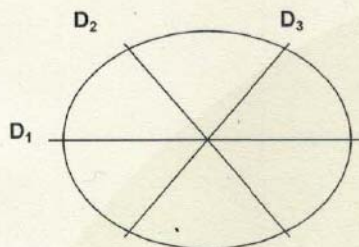
Samplig System Equipment Information		Inspection Conditions			
Console Model Number	XC572V	Date	Time	24-Feb-22	8:30 AM
Console Serial Number	0509047	Calibration Reference No.	HC65APE0023		
DGM Model Number	SK25	Barometric Pressure	758	mm Hg	
DGM Serial Number	8001032	Calibration	Vernier ,0-150mm	0.01 mm increments	
		Method Reference	US.EPA Method		

Inspection Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
4	3.2	3.04	3.04	3.03	0.006	3.037
5	4.0	4.01	4.01	4.00	0.006	4.007
8	6.4	5.99	5.89	6.04	0.076	5.973
10	8.0	7.58	7.53	7.50	0.040	7.537
12	9.5	9.38	9.37	9.46	0.049	9.403
14	11.1	11.01	11.02	11.12	0.061	11.050
16	12.7	12.43	12.49	12.52	0.046	12.480

D1, D2, D3 = There difference nozzle diameters at 60 degrees to each other, each measured to the nearest 0.025 mm

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

Davg = $(D_1 + D_2 + D_3) / 3$



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SITHIPORN ASSOCIATES COMPANY

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Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-01550998	Planned Maintenance	Contract	19/12/2564 20:50 น.	ICPN0780011	078S1407053C
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanan	SC-0035483289	31/07/2022	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท เอ็มอีที จำกัด(สำนักงานใหญ่) อำเภอบางบัวทอง จังหวัดนนทบุรี 36 11110 TH			บริษัท เอ็มอีที จำกัด(สำนักงานใหญ่) อำเภอบางบัวทอง จังหวัดนนทบุรี 36 11110 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
K. ศศิธร สุวรรณวิทย์/087-799-1303	(02) 920-1458-9 #102	02-920-1460	met_jj@yahoo.com	PO62-093	

Work Description		
- PM 2 of 2 , สำรองเปลี่ยนอะไหล่ Torch Pneumatic Board ระหว่างรอการสั่งซื้อ. - Cleaning Torch, Injector, Chamber - Detector calibration. - Torch view alignment. - Wavelength Calibration. ; Pass		
Start Date	End Date	Work Description
23/06/2022	23/06/2022	
23/06/2022	23/06/2022	
29/06/2022	29/06/2022	
29/06/2022	29/06/2022	

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details			
Part Number	Part Description	Start Date	Quantity
SV000013	Preventative maintenance	23/06/2022	6
SV000002	Service Travel	23/06/2022	1
SV000013	Preventative maintenance	29/06/2022	4
SV000002	Service Travel	29/06/2022	2

Work Complete	Customer Signature	Technician Signature
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> PM/OQ/IPV Left with Customer Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		

	Please Date and Sign	29/6/2565 Kanan, Chayanan
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Terms & Conditions
<p>Customer Acknowledgment of receipt of the above repair / replacement.</p> <p>Special Terms and Conditions: This is not an invoice.</p> <p>Taxes will be applied to your invoice if applicable.</p>

ใบรับรองการสอบเทียบ “เครื่องวัดก๊าซคาร์บอนมอนนอกไซด์”
(Calibration Certificate of CO Analyzer)



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : EMEX ASSOCIATION COMPANY LIMITED

วันที่ : 26 กันยายน 2565

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 92

TEST VALUES			
API MODEL T300		BEFORE	AFTER
1	RANGE 1 - 1000 PPM	50.0	50.0
2	STABILITY ≤ 1 PPM	0.1	0.0
3	CO MEASURE 2500 - 4800 mV	3444.4	3485.2
4	CO REFERENCE 2000 - 4800 mV	2850.4	2875.6
5	MR RATION 1.1 ± 1.3	1.218	1.222
6	PRESEEURE 25 - 35 in - Hg-A	30.0	29.7
7	SAMPLE FLOW $800 \pm 10\%$ cc/min	874	824
8	SAMPLE TEMP 48 ± 4 °C	47.2	46.5
9	BENCH TEMP 48 ± 2 °C	48.0	48.0
10	WHEEL TEMP 68 ± 2 °C	68.1	68.0
11	BOX TEMP AMBIENT ± 5 °C	31.2	31.0
12	PHT DRIVE 250-4750 Mv	2916.8	2914.7
13	CO SLOPE 1.0 ± 0.3	0.923	0.943
14	CO OFFSET 0.0 ± 0.3	0.012	0.012
15	CO READING (AMBIENT) PPM	2.2	0.6
16	ELECTRICAL TEST 40 ± 2 PPM	40.3	40.3
17	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.18 / 12.13 / 16.53 / -15.10	5.18 / 12.13 / 16.53 / -15.10
18	ZERO GAS 0.00 PPM	0.8	0.0
19	SPAN GAS 40.0 PPM	42.0	39.9

หมายเหตุ

- เปลี่ยน O-ring 2 ชิ้น , Spring 1 ชิ้น , Sintered Filter 1 ชิ้น



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



ปฏิบัติการวิเคราะห์เอกชน
เลขที่

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : EMEX ASSOCIATION COMPANY LIMITED

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API

MODEL : T300

SERIAL NO : 92

STANDARD GAS CONCENTRATION (PPM) : 4512

CYLINDER NO : CC745169

CYLINDER PRESSURE (psig) : 1700

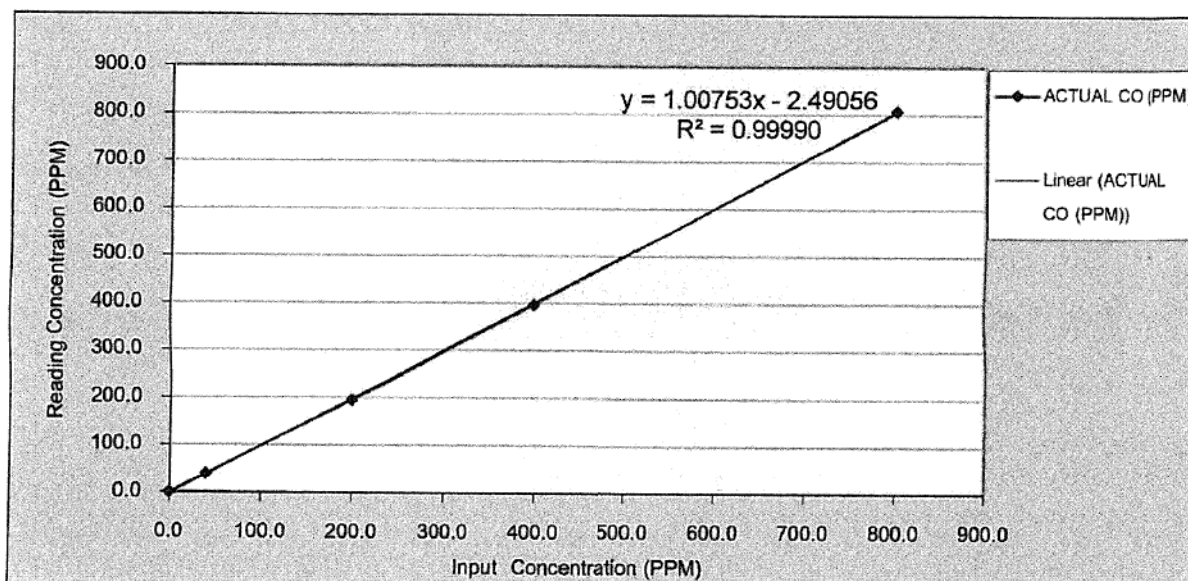
CERTIFIED DATE : Mar 10, 2021

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Mar 10, 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.00	0.00	0.00	-
1	40.00	39.90	-0.10	-0.25
2	199.20	195.00	-4.20	-2.11
3	400.30	396.70	-3.60	-0.90
4	800.90	807.20	6.30	0.79
AVERAGE (%)				1.01



EMEX Environmental and Medical Expert
EME ASSOCIATION CO., LTD.

KINETICS

CALIBRATED BY : คุณพรชัย ผาติวนารักษ์

DATE

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณพรชัย ผาติวนารักษ์ โทรศัพท์ : 02-515-8987

เลขทะเบียน ว-244

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



Customer Contact:
Tax ID: 0125546002271

laboratorymet@gmail.com
292014589

Invoice To:

INSTALLATION REPORT

Sales Order Number: 0310740420	Customer Number:
Service Order: 6005072113	Service Confirmation: 6904154189
Software license #:	

Direct Inquiries to:

Contact Name:	Customer Contact Center
Contact E-mail:	ccc-smt@agilent.com
Contact Telephone:	+662 637 6363
Contact Fax:	+662 632 4334

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Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007 ,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330 Thailand
Acc. No: 052-132-125-5

ORIGINAL

Order Confirmation Number: 6904154189

Service Instrument:

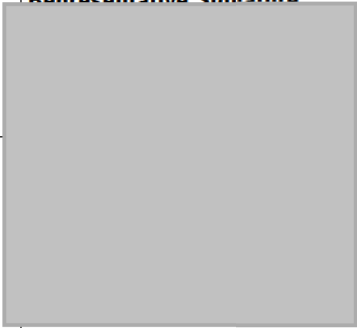
Model Number	Model Description	Serial Number	System Handle	System	Warranty Start	Warranty End
G3540A		CN2138A118	GC8890	SYS-GC-8890	09.03.2022	09.03.2023
G4514A		CN22047055	GC8890	SYS-GC-8890	09.03.2022	09.03.2023
M8301AA		DCA6FA0B4F		M E T COMPANY LIMITED	09.03.2022	09.03.2023
G4513A		CN22035277	GC8890	SYS-GC-8890	09.03.2022	09.03.2023
M8400AA		DF08D0F56E		M E T COMPANY LIMITED	09.03.2022	09.03.2023
G4600AA		DEW0822456		M E T COMPANY LIMITED	09.03.2022	09.03.2023
G4600AA		DEW0822464		M E T COMPANY LIMITED	09.03.2022	09.03.2023
G4600AA		DEW0831956		M E T COMPANY LIMITED	09.03.2022	09.03.2023
G4600AA		DEW0821978		M E T COMPANY LIMITED	09.03.2022	09.03.2023

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Installation Service Start	Installation Service End
3000	EIQ	Enterprise Installation Qualification	1.00	Site Services	05.04.2022	05.04.2022

Additional Information:

Service Information:

Service Provided: Perform EIQ follow by EQP GC2.53 and run ACE version 3.x.		
Reported Hours: 4.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Phuwanai Yoktragul	Customer Field Service Representative Signature: 	Date: 5 Apr 2022
Customer Name: Piyanut Phutphong		Date: 5 Apr 2022
Additional Comments:		



Customer Contact:
Tax ID: 0125546002271

laboratorymet@gmail.com
292014589

Invoice To:

INSTALLATION REPORT

Sales Order Number: 0310740420	Customer Number:
Service Order: 6005072113	Service Confirmation: 6904154252
Software license #:	

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

Delivery Site:

Location:

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THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330 Thailand
Acc. No: 052-132-125-5

ORIGINAL

Order Confirmation Number: 6904154252

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	System	Warranty Start	Warranty End
G3540A		CN2138A118	GC8890	SYS-GC-8890	09.03.2022	09.03.2023
G4514A		CN22047055	GC8890	SYS-GC-8890	09.03.2022	09.03.2023
G4513A		CN22035277	GC8890	SYS-GC-8890	09.03.2022	09.03.2023

Service Items:



Item	Service/Part #	Description	Qty	Entitlement	Installation Service Start	Installation Service End
1000	INSTALLATION	Installation	1.00	Site Services	04.04.2022	04.04.2022

Additional Information:

Service Information:

Service Provided:

Perform Installation GC8890 with G4514A,G4513A,FID detector , SW openLab Chemstation C.01.10 update 03.

Reported Hours: 6.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Phuwanai Yoktragul	Customer Field Service Representative Signature: 	Date: 5 Apr 2022
Customer Name: Piyanut Phutphong	Customer Signature: 	Date: 5 Apr 2022
Additional Comments:		

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	September 30, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.9	Transfer Standard Type	Orifice	Stop Time	9:35 AM
Motor Serial Number	BL-09	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

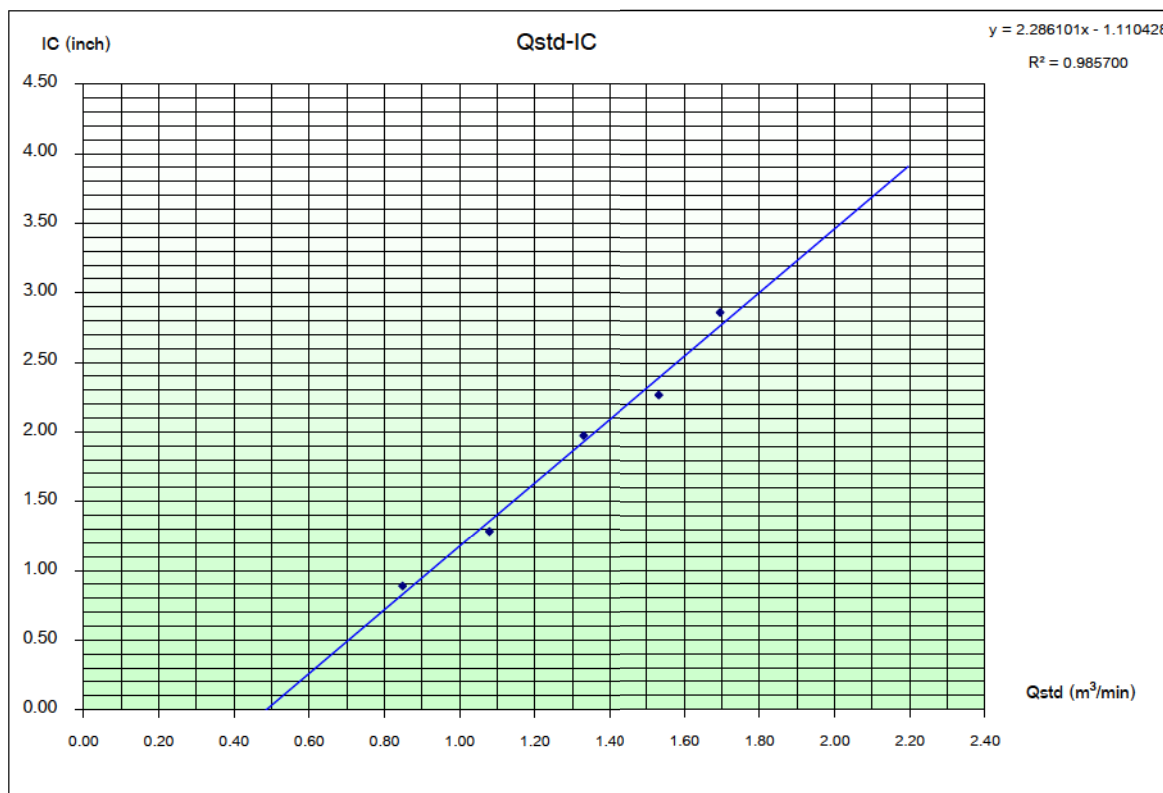
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_{H_2O}	$[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	sample Flow Rate Indication (inch)	$IC = [[(Pa/P_{std})(T_{std}/Ta)]^{1/2}]$	(°K = °C+273)	(mmHg)		
5	1.4	1.4	2.8	1.65074	0.84821	0.9	0.89	305.0	757.0		
7	2.2	2.3	4.5	2.09269	1.07918	1.3	1.28	305.0	757.0		
10	3.4	3.4	6.8	2.57249	1.32993	2.0	1.97	305.0	757.0		
13	4.5	4.5	9.0	2.95952	1.53220	2.3	2.27	305.0	757.0		
18	5.5	5.5	11.0	3.27187	1.69544	2.9	2.86	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

Linear Regression - Pstd*(Tstd/Ta)^0.5					Average		305.0		757.0	
1	Slope (m)	1.91345	Linear Equation			r^2	0.9857	Pstd(mmHg)	760.0	
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9928243	T _{NTP}	298.0		
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	(Pa/Pstd)*(Tstd/Ta)	0.973192407				
Result						C=(Pa/Pstd)*(Tstd/Ta)^0.5	0.986505148			

COMMENT

Andersen Instruments, Inc.



Calibrated By

Approved By

(M

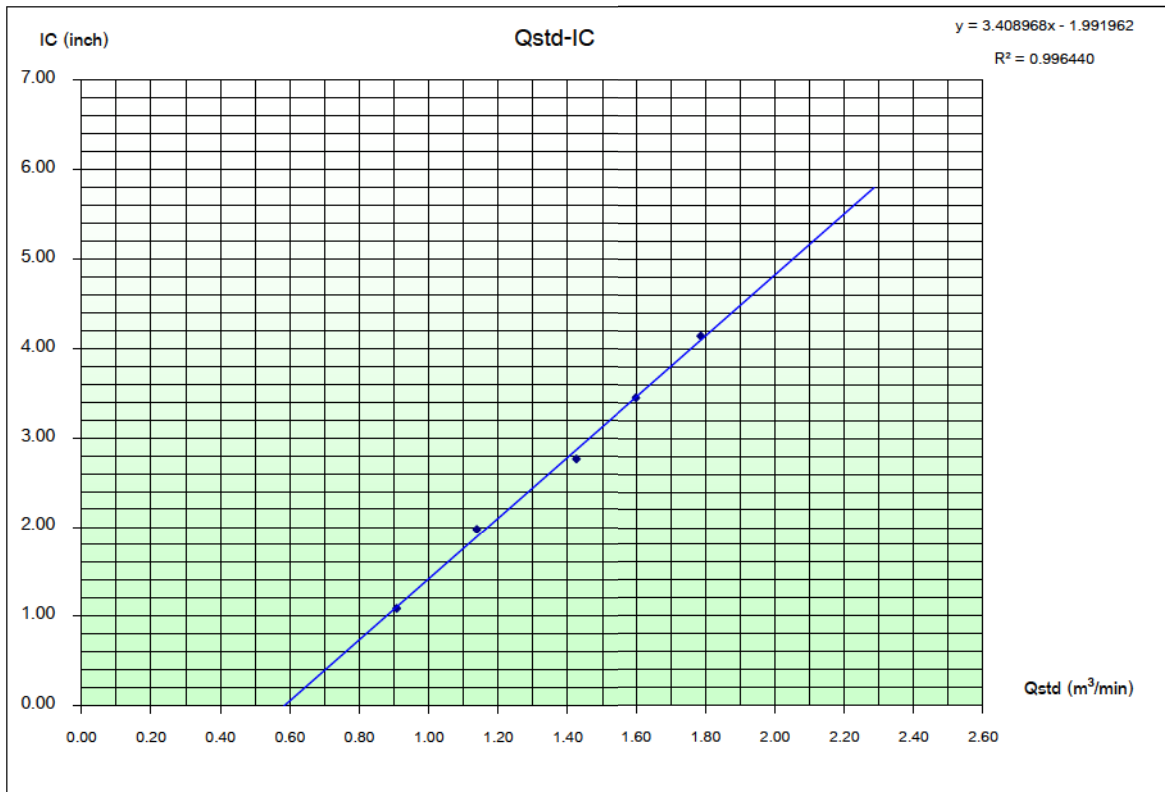
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	September 30, 2022
Project Site				Start Time	9:30 PM
Sampler Number	PM-10 No.6	Transfer Standard Type	Orifice	Stop Time	9:35 PM
Motor Serial Number	HVL-06	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	sample Flow Rate Indication	$IC = [(Pa/P_{std})(T_{std}/Ta)]^{1/2}$					
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)		(°K = °C+273)	(mmHg)			
5	1.6	1.6	3.2	1.76471	0.90778	1.1	1.09	305.0	757.0			
7	2.5	2.5	5.0	2.20589	1.13834	2.0	1.97	305.0	757.0			
10	3.9	3.9	7.8	2.75516	1.42540	2.8	2.76	305.0	757.0			
13	4.9	4.9	9.8	3.08825	1.59948	3.5	3.45	305.0	757.0			
18	6.1	6.1	12.2	3.44571	1.78629	4.2	4.14	305.0	757.0			
Linear Regression Y ON X : Y= mX + b							Average	305.0	757.0			
1	Slope (m)			1.91345	Linear Equation			r ²	0.997347	Pstd(mmHg)	760.0	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9986726	T _{NTP}	298.0	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.973192407		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By

Approved By

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	September 30, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.12	Transfer Standard Type	Orifice	Stop Time	9:35 AM
Motor Serial Number	BL-12	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

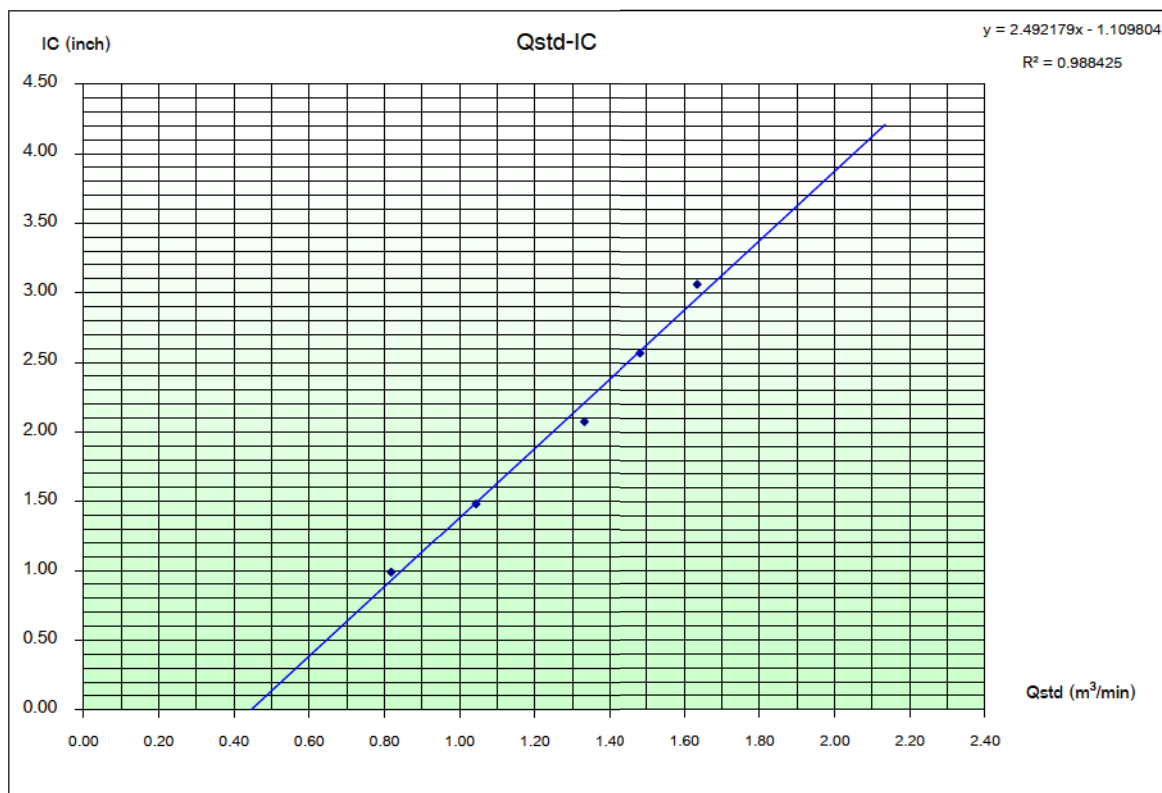
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_{H_2O}	$[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	sample Flow Rate Indication (inch)	$IC = [[(Pa/P_{std})(T_{std}/Ta)]^{1/2}]$	(°K = °C+273)	(mmHg)		
5	1.3	1.3	2.6	1.59279	0.81793	1.0	0.99	305.0	757.0		
7	2.1	2.1	4.2	2.02440	1.04349	1.5	1.48	305.0	758.0		
10	3.4	3.4	6.8	2.57589	1.33171	2.1	2.07	305.0	759.0		
13	4.2	4.2	8.4	2.86294	1.48173	2.6	2.57	305.0	760.0		
18	5.1	5.1	10.2	3.15480	1.63426	3.1	3.06	305.0	761.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	1.91345	Linear Equation		Average	305.0	759.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r ²	0.988425	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	r	0.9941957	T _{NTP}	298.0	
Result							(Pa/Pstd)*(Tstd/Ta)	0.975763589	
							C=(Pa/Pstd)*(Tstd/Ta)^0.5	0.987807466	

COMMENT

Andersen Instruments, Inc.



Calibrated By ...

Approved By ...

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	September 30, 2022
Project Site				Start Time	13:10:00 AM
Sampler Number	PM-10 No.12	Transfer Standard Type	Orifice	Stop Time	13:15:00 AM
Motor Serial Number	HVL-12	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

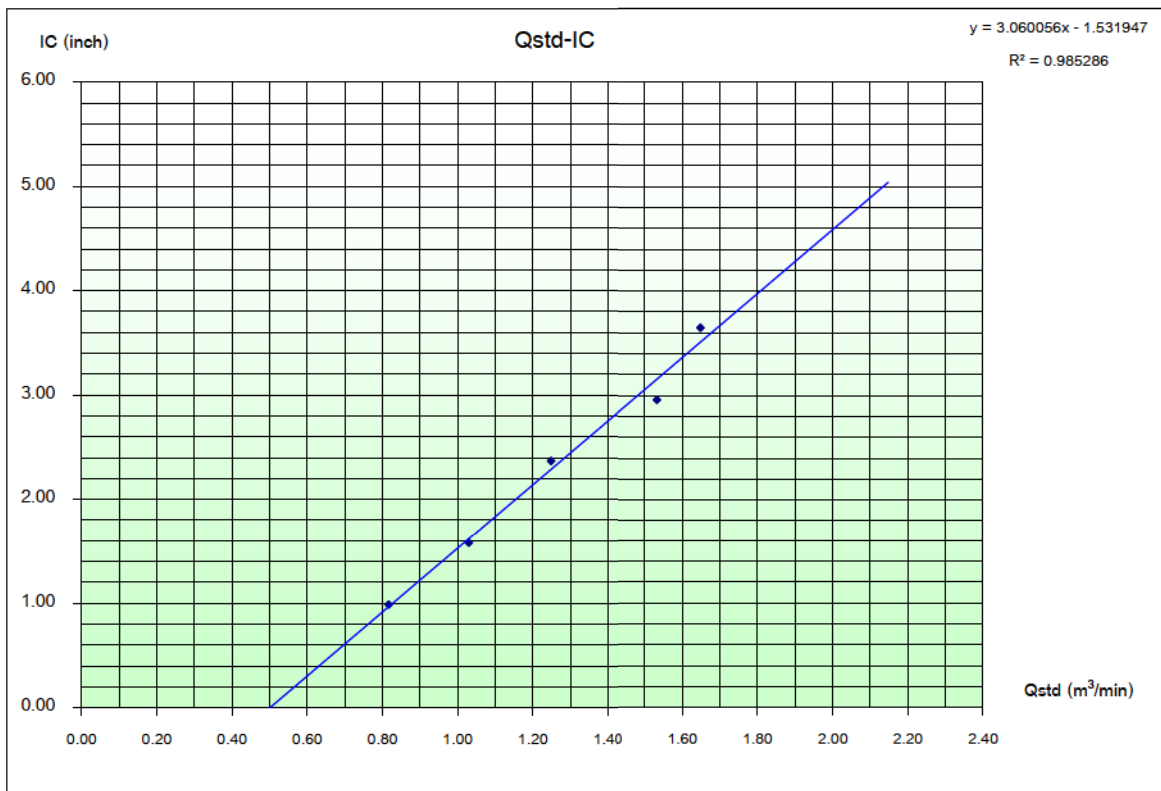
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	sample Flow Rate Indication	$IC = [[(Pa/P_{std})(T_{std}/Ta)]^{1/2}]$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_{H_2O}		(m ³ /min)	(inch)					
5	1.3	1.3	2.6	1.59069	0.81683	1.0	0.99	305.0	757.0		
7	2.0	2.1	4.1	1.99752	1.02944	1.6	1.58	305.0	757.0		
10	3.0	3.0	6.0	2.41643	1.24838	2.4	2.37	305.0	757.0		
13	4.5	4.5	9.0	2.95952	1.53220	3.0	2.96	305.0	757.0		
18	5.2	5.2	10.4	3.18138	1.64815	3.7	3.65	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

			Average				
1	Slope (m)	1.91345	Linear Equation		r^2	0.985286	Pstd(mmHg)
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9926157	T _{NTP}
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	(Pa/Pstd)*(Tstd/Ta)	0.973192407	
Result					C=(Pa/Pstd)*(Tstd/Ta)^0.5	0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By

(Mr.Preecha Srisuk)
Field Environmental

Approved By

(Mr.Jarung Jamnongbut)
Division Manager



National Institute of Metrology (Thailand)

Certificate of Calibration



Certificate No. : AA-2018-22
Issued by : Acoustics Laboratory
Acoustics and Vibration Group

Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator
MANUFACTURER : RION
MODEL/TYPE : NC-75
SERIAL NUMBER : 34480442
CUSTOMER : MET Co., Ltd.
36/659 Moo 6, T. Bangrakphatthana,
A. Bangbuathong, Nonthaburi 11110
MEASUREMENT DATE : 28 September 2022

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

*The calibration results only marked with an asterisk * in this certificate are not included in the scope of accreditation.*

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. This calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference	Date	Authorized Signatory	Person in charge
AUVC844-01/22	29 September 2022		

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation

3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659

75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



UNCERTAINTY OF MEASUREMENT

The stated uncertainty is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$. It has been determined in accordance with EA publication EA-4/02 M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of measurement data --Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measured lies within the assigned range of value with a probability of 95 %.

Parameter	Uncertainty at SPL94 dB	Maximum-permitted uncertainty of measurement for a coverage probability of 95%
1.Sound Pressure level	0.08	0.15
2. Frequency	0.1	0.2
3. THD+N	0.1	0.5

TRACEABILITY

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



ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature : (23.0 ± 1.0) °C
Pressure : (101.325 ± 1.500) kPa
Relative Humidity : (50.0 ± 15.0) %

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

Calibration Condition

Preconditionings : 16 hours at ambient conditions.
Measurement Conditions : The average values during measurement are
 (100.313 ± 0.014) kPa, (22.0 ± 0.3) °C and (57.0 ± 2.1) %RH

MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

Reference Microphone

4180 serial no.1395446

TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 µPa are corrected to the values under the reference environmental conditions.

The calibration results exclude the calibrator pressure correction but include the microphone volume correction, which was obtained from the manufacturer instruction manual of the sound calibrator, at the level of 94 dB.



MEASUREMENT RESULTS

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)*	Deviated value ^[1] (dB)	Acceptance Limit (dB)
Microphone 4180 Serial No.1395446			
94	94.15	0.15	0.25

Note ^[1] : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

2. Frequency*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance Limit (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	0.7

Note ^[2] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.



3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

Measured value ^[3] (%)	Maximum total distortion + Noise (%)
At the sound pressure level of 94 dB	
0.2	2.5

Note ^[3]: The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz. The measured value must not exceed the maximum total distortion + noise appeared in the table.

End of Certificate of Calibration

NIMT



บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6510001

Calibrated Date : 30 September 2022

Acoustic Calibrator Data

Brand	: RION	Serial No.	: 34480442
Model	: NC-75	Last Calibration	: 28 September 2022
Range of Calibration	: 94 dB, 1000 Hz	Due Date	: 28 September 2023

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
RION/NL-21	00722042	94.2	94.0
RION/NL-21	00722043	94.1	94.0
ACO 6236	79210	94.3	94.0
ACO 6236	76238	94.1	94.0

Calibrated by



Approved by





บริษัท เอ็ม อี ที จำกัด MET CO.,LTD.

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110

36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6507001

Calibrated Date : 18 July 2022

Acoustic Calibrator Data

Brand	: RION	Serial No.	: 34480442
Model	: NC-75	Last Calibration	: 28 September 2022
Range of Calibration	: 94 dB, 1000 Hz	Due Date	: 28 September 2023

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
RION/NL-21	00722042	94.1	94.0
RION/NL-21	00722043	94.3	94.0
ACO 6236	79210	94.2	94.0
ACO 6236	76238	94.1	94.0

Calibrated by :



Approved by :





บริษัท เอ็ม อี ที จำกัด MET CO.,LTD.

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110

36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6510002

Calibrated Date : 3 October 2022

Acoustic Calibrator Data

Brand : RION	Serial No. : 34480442
Model : NC-75	Last Calibration : 28 September 2022
Range of Calibration : 94 dB, 1000 Hz	Due Date : 28 September 2023

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
RION/NL-21	00722042	94.1	94.0
RION/NL-21	00722043	94.3	94.0
ACO 6236	79210	94.2	94.0
ACO 6236	76238	94.1	94.0
ACO 6236	76239	94.1	94.0
ACO 6236	222064	94.4	94.0
ACO 6236	222065	94.1	94.0
ACO 6236	222066	94.1	94.0
ACO 6236	222067	94.2	94.0
ACO 6236	222068	94.1	94.0
ACO 6236	222069	94.3	94.0
ACO 6236	222070	94.1	94.0
ACO 6236	222071	94.2	94.0
ACO 6236	222072	94.2	94.0
ACO 6236	222073	94.1	94.0
ACO 6236	222101	94.2	94.0

Calibrated by : _____

Approved by : _____



Certificate of Calibration

Certificate Number : SPR22010006-2

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Noise Dosimeter

Manufacturer : TENMARS

Model : ST-130

Serial Number : 200300156

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 04 Jan 2022

Calibration Date : 04 Jan 2022

Recommend Due Date : 04 Jan 2023

Date of Issue : 05 Jan 2022

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Surasak Vakjan

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR22010006-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR22010006-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2111-099-0002

Date Issued : 15-Nov-21

Customer : MET CO.,LTD.
36/659 Moo 6 T. Bangrakpattana A.Bangbuatong Nonthaburi 11110

Equipment : Heat Stress Meter

Manufacturer : METROSONIC

Model : hs-32

Serial No. : MCE010018

ID No./Tag No. : HT-02

Date Received : 09-Nov-21

Date Calibrated : 12-Nov-21

Calibrated by : Ms. Yaowanuch Jirakiattikul

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :



Page 1 of 2

Certificate No. : AD2111-099-0002

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\% \text{RH}$

STD Reading ($^\circ\text{C}$)	UUC Reading ($^\circ\text{C}$)			UUC Error ($^\circ\text{C}$)	Measurement Uncertainty ($\pm^\circ\text{C}$)
		Before Adjusted	After Adjusted		
23.99	WET	24.0	-	0.01	0.35
27.99	DRY	27.9	-	-0.09	0.35
30.01	GLOBE	29.7	-	-0.31	0.35
26.99	WET	27.0	-	0.01	0.35
32.00	DRY	31.9	-	-0.10	0.35
35.01	GLOBE	34.8	-	-0.21	0.35
30.01	WET	29.8	-	-0.21	0.35
36.01	DRY	35.7	-	-0.31	0.35
39.99	GLOBE	39.7	-	-0.29	0.35

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 100 $^\circ\text{C}$
Resolution 0.1 $^\circ\text{C}$

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate



GIIC Calibration Laboratory

700/20-21 Phaholyothin Rd., Samsennai, Phayathai,
Bangkok 10400 Thailand

Tel : +66 (02) 615 4999

Fax : +66 (02) 615 4644

E-mail : cal@giic.co.th



NSC-TISI-TIS 17025
CALIBRATION 0256

CERTIFICATE No.CAL01652-21..... PAGE1..... OF3.....

Certificate of Calibration

Equipment : DIGITAL LIGHT METER

Manufacturer : DIGICON

Model / Type : LX-73

Serial No. : T.017761

ID No. : -

Customer : M E T CO., LTD.
36/659 Moo 6 T.Bangrakpattana A.Bangbuathong Nonthaburi
11110.

C.S.R. No. : L0001697-21

Received Date : 15 December 2021

Calibration Date : 17 December 2021

Calibrated By : TONTRAKARN SRIKACHA

Approved By : NATTAPOL KINGKAEW

Issue Date : 18 December 2021

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

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

CERTIFICATE No.: CAL01652-21

PAGE: 2

OF: 3

CALIBRATION REPORT

Condition of this calibration result:

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

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

2. Reference / Procedure Used :

- This Instrument was calibrated by substitution with reference illuminance meter, the Instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement. Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GLIC Calibration Laboratory calibration procedure No.GLICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	25531 / 025000	TP-1010-21	27 May 22

4. This Certification is traceable to the SI unit through :

- The National Institute of Metrology (Thailand) .

5. Uncertainty :

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



CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement

U.U.C. Range (lux)	Standard Setting (lux)	U.U.C. Reading (lux)	Error (lux)	Uncertainty of measurement \pm (lux)
400	0	0.0	0.0	0.60
	50	49.4	-0.6	1.6
	250	242.1	-7.9	6.5
4000	500	504	4	13
	1000	1012	12	26
	1500	1515	15	36
	2000	2017	17	48
	3000	3007	7	72
40000	4000	4000	0	96
	5000	5010	10	0.12 klux

- U.U.C. = Unit Under Calibration

This result of calibration was found accurate as show on data and place of calibration only.

- END -

Certificate of Calibration

Certificate No. : 65-420003-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode
pH meter
Manufacturer : Thermo Scientific Model : pH 150
Range : N/A pH Resolution : 0.01 pH
Serial No. : 2913288 ID No. : MET-PH05/63
Electrode
Model : N/A Serial No. : 48393

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$
Relative Humidity : $(50 \pm 15) \%$

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Bunjerd Masri

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

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	21E997	17 Mar 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.004	61218215	769926	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.963	61208865	769928	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420003-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.060
	0.0000	7	7.00	0.2	-0.2	0.058
	-177.4800	10	10.00	-177.2	-0.3	0.060

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.004	4.01	0.00	0.011
	6.985	7.00	-0.01	0.011
	9.963	10.01	-0.04	0.016

Remark

UUC : Unit Under Calibration

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

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

- o()o -



Certificate of Calibration

Certificate No. : 65-400021-2

Page : 1 of 2

Submitted by : M E T Company Limited
6/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Digital Thermometer with Thermistor Probe

Temperature Indicator

Manufacturer : Thermo Scientific

Model : pH 150

Range : N/A

Resolution : 0.1 °C

Serial No. : 2913288

ID No. : MET-PH05/63

Thermistor Probe

Model : PHWPTM01W

Sheath Material : Stainless

Diameter : 3 mm.

Length : 85 mm.

Serial No. : 459

ID No. : MET-PH05/63

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by



The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400021-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
85	10.0024	10.1	-0.1	0.11
85	50.0038	50.4	-0.4	0.11

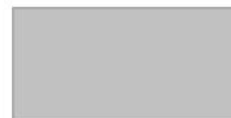
Remark

UUC : Unit Under Calibration

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

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

- o()o -



Certificate of Calibration

Certificate No. : 64-400425-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400032

65-400274-1

25 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. :64-400425-5

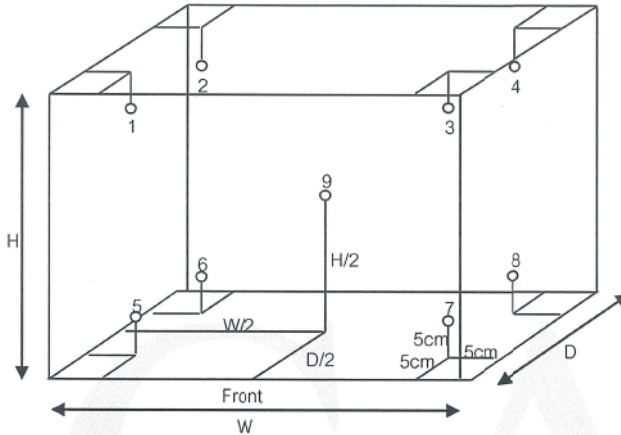
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.8	19.7	19.6	19.6	20.4	20.2	20.3	19.8	19.9	0.54

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.6	0.1	1.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 65-400424-3

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : YPR-068S

Range : N/A °C

Resolution : 1 °C

Serial No. : YPR0659S-141200060R

ID No. : MET-RE03/59

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (29.8 to 31.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.8 to 222.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400023

65-400157-1

02 Oct 2022

National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400424-3

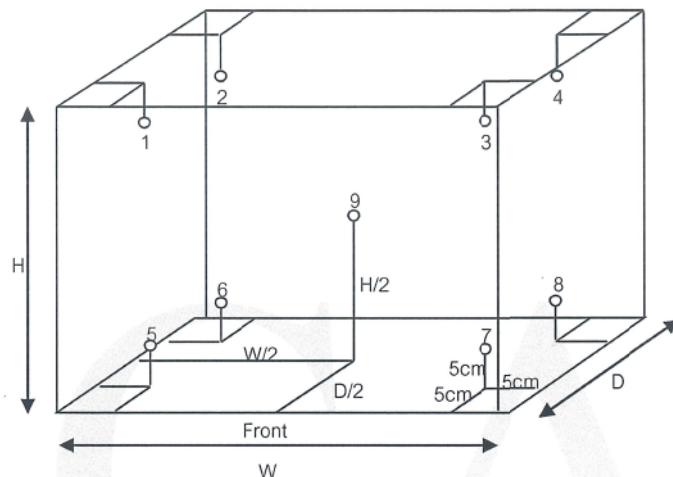
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	2	2	3.7	3.7	4.0	3.7	3.0	3.5	2.8	3.4	2.9	0.84

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.2	0.2	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Calibration Certificate

Cert. No. : CT-22-04-22785

Page : 1 of 4

Issued date : 01 April 2022

Equipment : COD Reactor , Manufacturer : MLAB , Model : DB1602
S/N = 0169 , Customer ID = -

Client : M E T COMPANY LIMITED.

36/659 M.6 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 30 March 2022

Ref. Job No. : SO6503-00042

Calibrate by : Mr.Pramot Srisukum

Cert. prepare by : Ms.Pimlada Ittiprawet

Calibrated Date : 30 March 2022

Approved by : Mr.Montree Ruschasetkul

Calibration Place : Laboratory of Metrology Technical Co.,Ltd.

Environment Condition : Temperature $27.1 \pm 0.1 (^{\circ}\text{C})$, Humidity $35.5 \pm 4.5 (\% \text{RH})$

Calibration Method : Measure temperature distribution by 9 channel in flat level. , (MTEC WI No. # WICAL-02-005-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Thermo Hygrometer	MTEC-CE-0181	TH-03A	06-2022
2	Temperature Datalogger	MTEC-CE-0180	MLAB	10-2022

Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k =$ (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

Certificate No. : CT-22-04-22785

Calibration Result :

Page : 2 of 4

Condition of UUC :

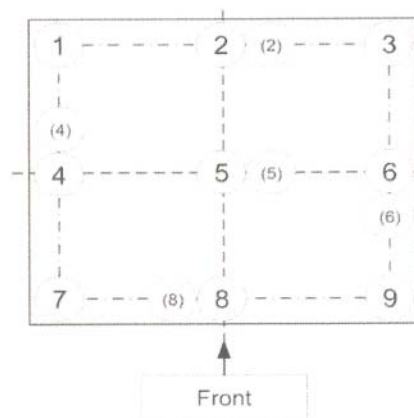
- 1) Without Adjustment
- 2) Immersion : 1/2 of the depth of the hole

(1) The quoted uncertainty include with " Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.

(3) Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughtout observation time.



Pic 1 : Position of each sensor No.

Section 1 : Report of Temperature distribution

Unit : (°c)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.									Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5	#6	#7	#8	#9		
150	150	150	150.55	149.75	150.33	149.86	150.75	150.83	150.00	150.33	150.03	0.424	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°c)

Calibration Point	UUC Setting	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °c)	Temperature Overall Variation
150	150	150	0.9	0.1	1.2

(*) = The average of 30 values in each point

Approved Signatory :

Certificate No. : CT-22-04-22785

Page : 3 of 4

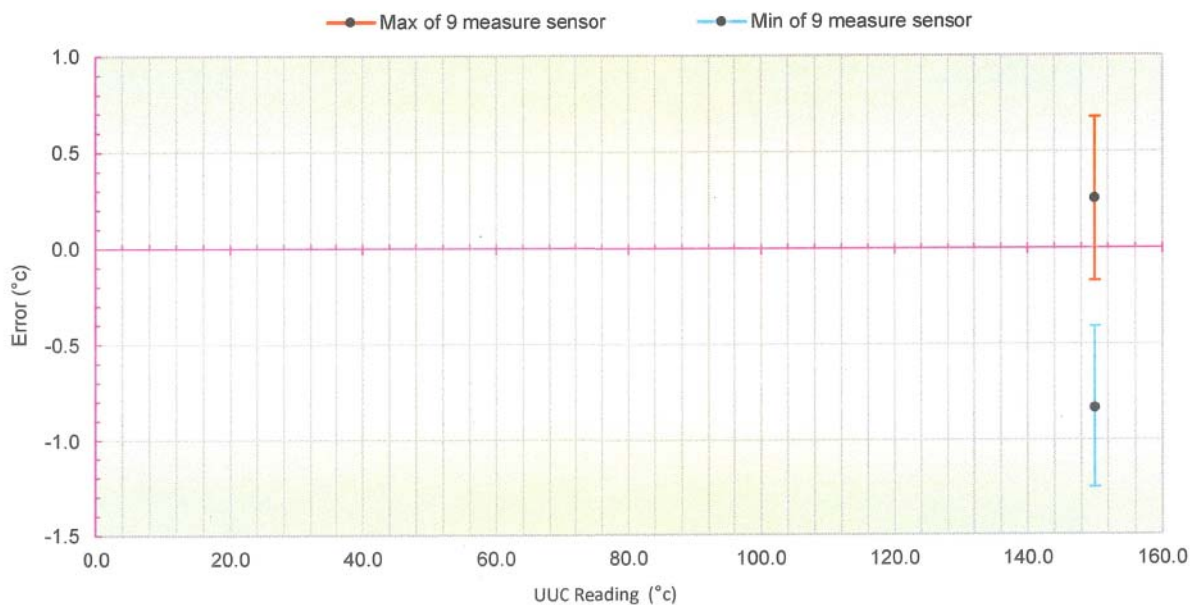
Section 3 : Possible of temperature. Show minimum and maximum of the average values and Include with uncertainty of measurement. The average values is average of each position standard sensor throughout observation time.

Unit : (°c)

Calibration Point	UUC Setting ^(*)	UUC Reading ^(*)	Possible of Minimum temperature	Possible of Maximum temperature
150	150	150	149.32	151.26

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy



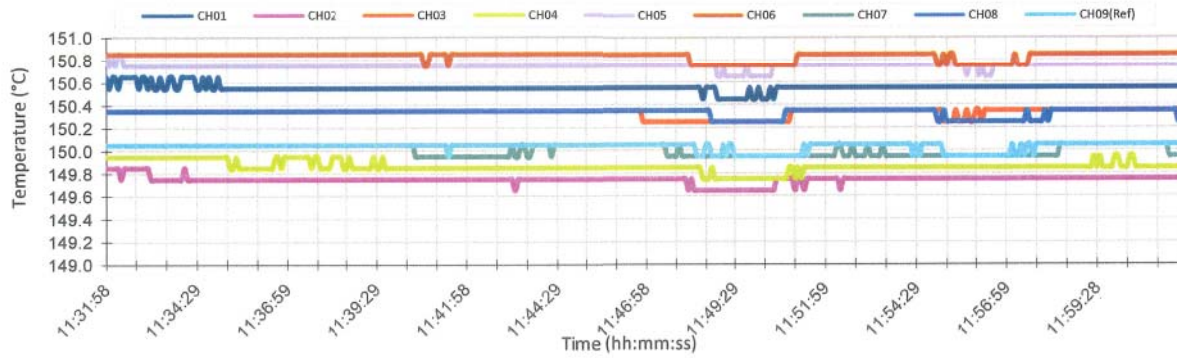
Approved Signatory :

Certificate No. : CT-22-04-22785

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

(5.1) Temperature Distribution at UUC Reading 150 °C



Approved Signatory :

Certificate of Calibration

Certificate No. : 65-400424-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-07419

ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400272-1	24 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400424-2

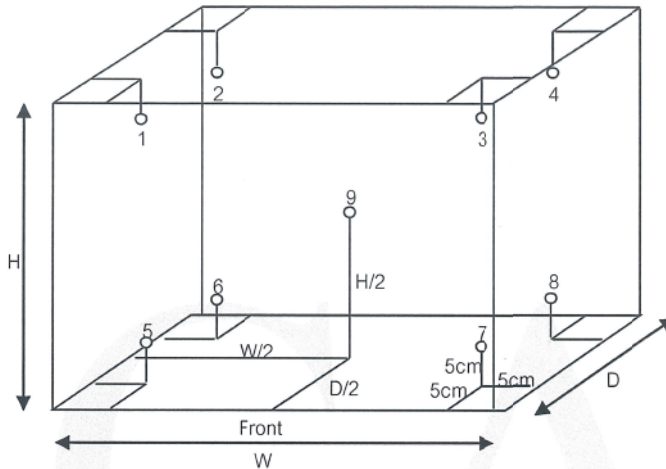
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	105.0	105.0	104.7	105.0	104.4	104.5	104.0	103.7	104.2	0.95
180	184	184	180.8	182.0	179.4	180.8	180.8	180.8	180.3	180.0	180.0	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.0	0.2	1.7
180	184	184	2.3	0.3	3.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 65-400424-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UM 100

Range : N/A °C

Resolution : 0.1 °C

Serial No. : b197.0985

ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400032

65-400274-1

25 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved by



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400424-1

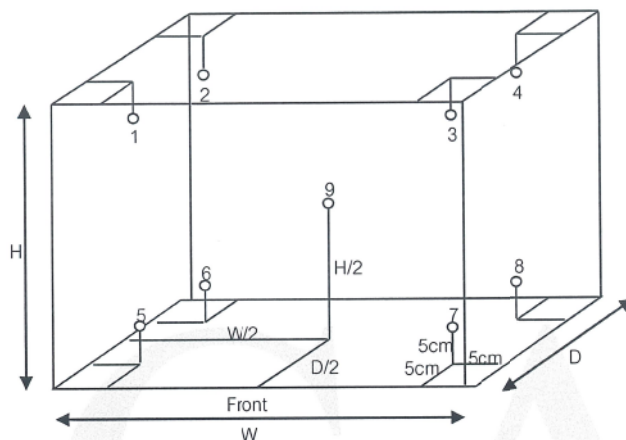
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.32 m

D = 0.18 m

H = 0.24 m

Capacity = 0.01 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	181.2	181.3	180.6	180.4	179.9	181.0	179.5	179.1	180.0	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.4	0.3	2.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 65-200253-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.6 to 25.8) °C
Relative Humidity : (57.3 to 57.8) %
Air Pressure : 1005.0 mbar

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 11 August 2022

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02213103	18 Nov 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-200253-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.05	0.0000	0.00011
0.1	0.0000	0.00013
0.5	0.0000	0.00013
1	0.0000	0.00011
5	0.0000	0.00011
10	0.0001	0.00011
50	0.0001	0.00013
100	0.0000	0.00020
150	0.0000	0.00038
200	0.0000	0.00038

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

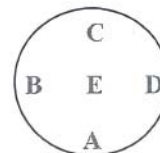
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.11$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.0001 0.0001 0.0001 0.0000 0.0000 g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

- o0o -

