

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

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

Calibration Data									
Metering Console				Calibration Meter					
Run Time	DGM Orifice ΔH	Volume Initial (V _m) m ³	Volume Final (V _{mf}) m ³	Outlet Temp Initial (t _m) °C	Outlet Temp Final (t _{mf}) °C	Volume Initial (V _m) m ³	Volume Final (V _{mf}) m ³	Outlet Temp Initial (t _m) °C	Outlet Temp Final (t _{mf}) °C
Elapsed (t) min									
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) m ³	(Q _m) m ³ /min	(V _m) m ³	(Q _m) m ³ /min	Value (Y)	Variation (ΔY)	Std & Corr (Q _m) m ³ /min	(ΔH) mm H ₂ O	Variation (ΔH)	(ΔH)
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	ΔH @ 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 ΔH , orifice pressure differential that equates to 0.75scfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

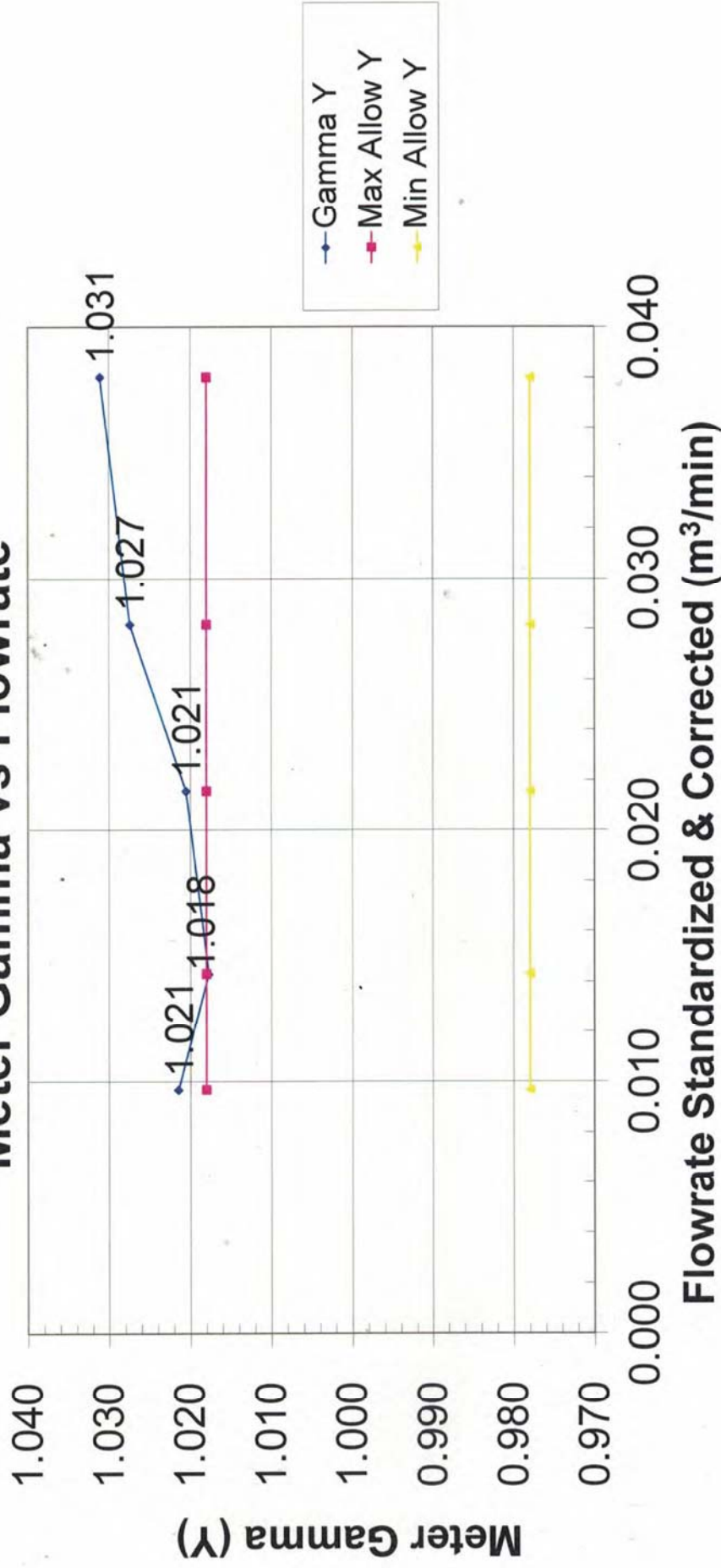
Signature Surachai Chaisana
(Surachai Chaisana)
Service Engineer

SITHIPHORN ASSOCIATES COMPANY LIMITED

Date

24 / 02 / 2022

Meter Gamma vs Flowrate



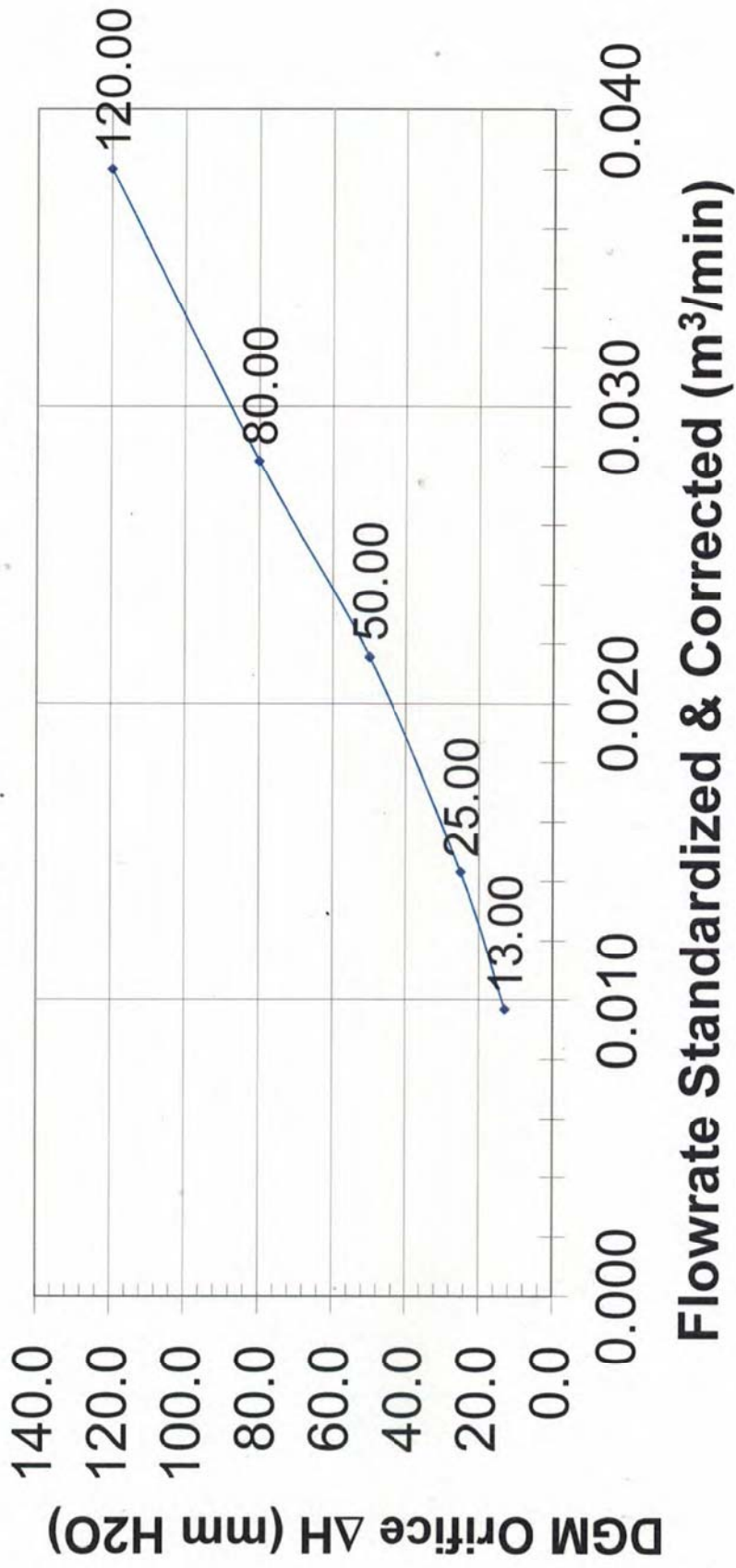
Calibration Date:

24-2-2022

Calibration Reference No:

HC65APE0023

Meter Pressure vs Flowrate



บริษัท สหภาพอุตสาหกรรม
SIPORN 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 \pm 14 °C	121	120.5	0.13
Heated Filter Box	120 °C \pm 14 °C	121	120	0.25

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

Signature

(Surachai Chaisana)
Service Engineer

บริษัท สกทิพรแอสโซซิเอต จำกัด
SITHIPHORN ASSOCIATES COMPANY LTD.

บริษัท สกทิพร แอสโซซิเอต จำกัด

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 + 1.50% Absolute
Probe + 3.0 °C
Filter + 3.0 °C

Aux + 3.0 °C
Exit + 2.0 °C
Meter + 2.0 °C

Note. Cabel socket temp probe wrong + -

Signature _____

(Surachai Chaisana)
Service Engineer

บริษัท สกทิพแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

บริษัท สกทิพแอสโซซิเอต จำกัด

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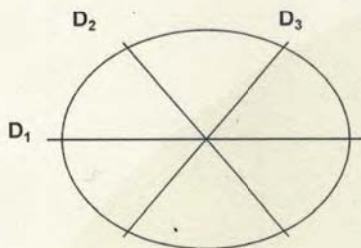
EMAIL: center@sithiphorn.com www.sithiphorn.com

NOZZLE CALIBRATION

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



Signature

Surachai
(Surachai Chaisana)
Service Engineer

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 8000

Customer : <u>M E T CO.,LTD.</u>	Date Tested: <u>October 6, 2021</u>
Address : <u>BANGBUATHONG,</u> <u>NONTHABURI,11110</u> <u>BANGKOK 10160</u>	Recommendation Recertification Period <u>6</u> Months Recertification Due: <u>April 6, 2022</u> Date Last Certified: <u>March 4, 2021</u>
User Name: <u>KHUN SUPAPORN.</u>	Visit Number: <u>2 of 2</u>
Phone: <u>087-799-1303</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
E-mail : <u>laboratorymet@gmail.com</u>	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		
MODEL <u>OPTIMA 8000</u>	SERIAL NUMBER <u>078S1407053C</u>	SOFTWARE <u>ICP Syngistix Version 1.0</u>
TESTED EQUIPMENT <u>IPV Method</u>	CALIBRATION NUMBER <u> </u>	EXPIRATION <u> </u>
TEST STANDARD USED <u>Multielement Standard</u> <u>Instrument Cal. STD4</u>	PART NUMBER <u>N069-1579</u> <u>N930-0221</u>	EXPIRATION DATE <u>October 30,2022</u> <u>October 30,2021</u>
CUSTOMER SUPPLIED <u>2 % HNO3</u> <u>10 % HNO3</u>	COMMENTS <u> </u> <u> </u>	CUSTOMER INITIALS <u> </u> <u> </u>

MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1407053C**DATE TESTED:** October 6, 2021**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgebfilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 8000

SERIAL NUMBER: 078S1407053C		DATE TESTED: October 6, 2021	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV			
As	193.696 nm	≤ 0.009 nm	0.00697 nm
Ni	231.604 nm	≤ 0.011 nm	0.00855 nm
Ni	341.476 nm	≤ 0.015 nm	0.01287 nm
Spectral Resolution : VIS			
Ba	455.403 nm	≤ 0.020 nm	0.01541 nm
Precision			
Zn	206.200 nm	% RSD ≤ 1.0 %	0.12 %
Mg	280.271 nm	% RSD ≤ 1.0 %	0.61 %
Mg	285.213 nm	% RSD ≤ 1.0 %	0.22 %
Ba	455.403 nm	% RSD ≤ 1.0 %	0.08 %
Detection Limits : Axial			
Tl	190.801 nm	3(sd)	6.31 ppb
As	193.696 nm	3(sd)	6.72 ppb
Se	196.026 nm	3(sd)	2.13 ppb
Pb	220.353 nm	3(sd)	5.21 ppb
Detection Limits : Radial			
As	193.696 nm	3(sd)	2.74 ppb
Zn	213.857 nm	3(sd)	0.54 ppb
Mn	257.610 nm	3(sd)	0.21 ppb
La	379.478 nm	3(sd)	0.13 ppb
Ba	455.403 nm	3(sd)	0.05 ppb
Ba	493.408 nm	3(sd)	0.04 ppb
BEC : Axial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	10.46 ppb
BEC : Radial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	10.44 ppb



MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1407053CDATE TESTED: October 6, 2021**Remarks :**Test all pass

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.**Service Department PerkinElmer Ltd.**

Customer Service Engineer:

(Weerayoot Keadpon)

Service Engineer

ใบรับรองการสอบเทียบ “เครื่องวัดก๊าซคาร์บอนมอนนอกไซด์”

(Calibration Certificate of CO Analyzer)



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : เอ็มเม็กซ์ แอสโซซิเอชั่น จำกัด

วันที่ : 20 กันยายน 2564

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 92

TEST VALUES			
API MODEL T300		BEFORE	AFTER
1	RANGE PPM	50	50
2	STABILITY < 1 PPM	0.0	0.0
3	CO MEAS (Zero Air) 3600 - 4800 Mv	3276.0	3656.8
4	CO REF (Zero Air) 3000 - 4000 mV	2706.0	3036.8
5	MR RATION (Zero Air) 1.2 ± 0.05	1.221	1.220
6	PRES IN-HG-A	30.6	29.9
7	SAMP FL 800 ± 10% cc/min	740	819
8	SAMPLE TEMP 48 ± 4 °C	46.6	46.8
9	BENCH TEMP 48 ± 1 °C	48.0	48.0
10	WHEEL TEMP 68 ± 2 °C	68.0	68.0
11	BOX TEMP AMBIENT ± 10 °C	33.8	33.5
12	PHT DRIVE 250 - 4750 Mv	2922.6	2928.8
13	SLOPE 1.0 ± 0.2	0.947	0.915
14	OFFSET 0.05 ± 0.2	0.011	0.012
15	SLOPE H 1.0 ± 0.2	2.765	0.904
16	OFFSET H 0.05 ± 0.2	0.0012	0.011
17	CO READING (Ambient) PPM	-0.5	0.3
18	ELECTRICAL TEST 40.0 ± 2 PPM	36.9	39.8
19	VOLTAGE TEST +5V +12V +15V -15V	5.23 / 12.12 / 16.67 / -15.09	5.24 / 12.10 / 15.67 / -15.01
20	Zero GAS 0.00 PPM	0	0.0
21	Span GAS 0.00 PPM	40	39.8

หมายเหตุ

- ทำการ Calibrate Sample Flow	รายการอะไหล่ที่เปลี่ยน
- ทำการ Calibrate Sample Pressure	- เปลี่ยน Sintered Filter 1 ชิ้น
- ทำการ Calibrate ค่า Co MEAS และ Co REF ใหม่เนื่องจากค่าเดิมมีค่าต่ำ	- เปลี่ยน Sample Filter 47 mm 1 ชิ้น
	- เปลี่ยน O-Ring 2 ชิ้น
	- เปลี่ยน Spring Flow 1 ชิ้น

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

ห้องปฏิบัติการวิเคราะห์เอกชน

เลขที่ใบรับแจ้ง : 23 ก.ค. 64
KINETICS
บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

(นายสันหรีฐา พัฒนภิรมย์กุล)
ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณสันหรีฐา พัฒนภิรมย์กุล

โทรศัพท์ : 0-2515-8987

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

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : เอ็มเม็กซ์ แอสโซซิเอชัน จำกัด

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API

MODEL : T300

SERIAL NO : 92

STANDARD GAS CONCENTRATION (PPM) : 4448

CYLINDER NO : CC715528

CYLINDER PRESSURE (psig) : 1000

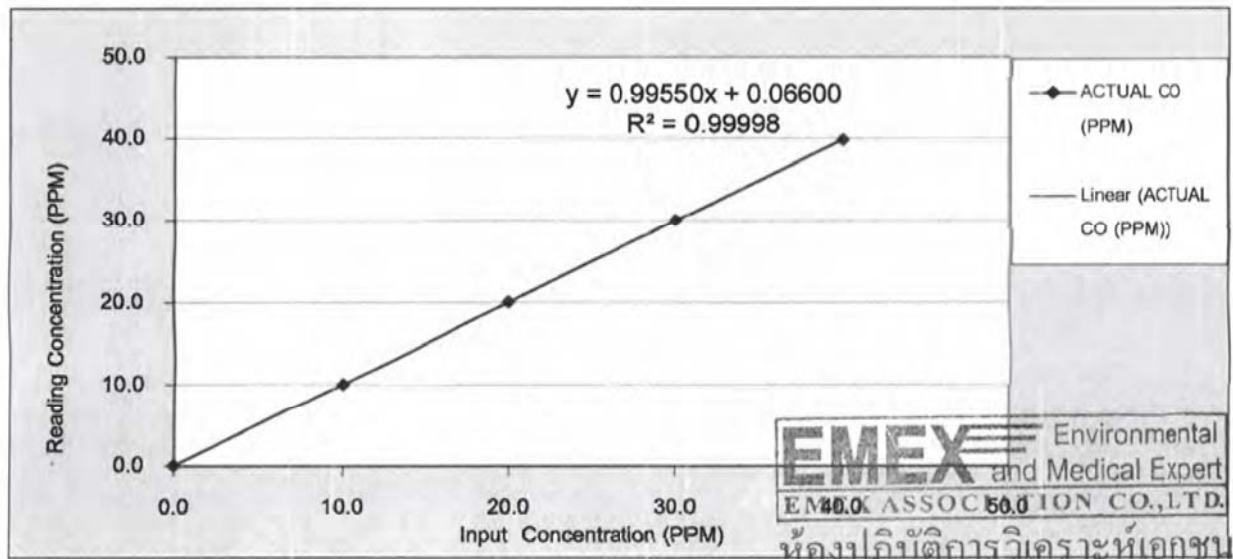
CERTIFIED DATE : Feb 13, 2019

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Feb 13, 2022

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.00	0.00	0.00	-
1	10.00	10.05	0.05	0.50
2	20.00	20.03	0.03	0.15
3	30.00	30.00	0.00	0.00
4	40.00	39.80	-0.20	-0.50
AVERAGE (%)				0.29



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

KINETICS

CALIBRATED BY : คุณสัณห์จุฑา พัฒนภิรมย์กุล

DATE : 20 กันยายน 2564
 บริษัท เอ็มเม็กซ์ แอสโซซิเอชัน จำกัด

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณสัณห์จุฑา พัฒนภิรมย์กุล โทรศัพท์ : 02-515-8987



DECLARATION OF CONFORMITY to manufacturing specifications

Product Number: 7890B

Serial Number: CN13143040

With the following options:

G3430-63192

EPC CAP IP 0-100 PSIG

G3430-63192

EPC CAP IP 0-100 PSIG

G3430-63211

FID-FLOW CONTROL

G3440-60508

Generic Mainframe

successfully passed all our production quality tests.

During various stages of manufacturing process the following functional characteristics were individually tested for conformance with our internal specifications:

Electrical Safety Check

Passed

AC Line Configuration

Passed

Instrument Configuration vs. Order

Passed

Instrument Power Consumption

Passed

Oven Heater Configuration

Passed

Oven Fan Motor Vibration Level

Passed

Oven Thermal Control/Flaps Operation

Passed

Inlet/Detector Thermal Control

Passed

Pneumatics Leak Test

Passed

Manufacturing Site:

Agilent Technologies (Shanghai) Co., Ltd.
412 Ying Lun Road,
Waigaoqiao Free Trade Zone
Shanghai 200131 P.R. China

Test System:

PCOHANAASA04

Customer Contact:

M E T Company Limited
Head Office
36/659 Moo 6 Tambol Bangrakpattana
Amphor Bang Bua Thong
NONTABURI 11110
TAX ID : 0125546002271
laboratorymet@gmail.com
29201458

Invoice To:

M E T Company Limited
Head Office
36/659 Moo 6 Tambol Bangrakpattana
Amphor Bang Bua Thong NONTABURI
11110

Delivery Site:

M E T Company Limited
Head Office
36/659 Moo 6 Tambol Bangrakpattana
Amphor Bang Bua Thong
NONTABURI 11110

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70423064
Service Request:	Service Request Date:
Service Order: 6004657810	Service Confirmation: 6903693638

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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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

ORIGINAL

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-GC-7890	GC 7890 System		J8-MET-GC01	
G4513A	7693A Autoinjector	CN13120012	J8-MET-GC01	SYS-GC-7890
G3440B	Agilent 7890B Series GC Custom	CN13143040	J8-MET-GC01	SYS-GC-7890

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	PM	Preventive Maintenance	1.00	Agreement Entitlement - 100 % covered	29.07.2021	29.07.2021
1050	5200-0176	FID Jet, universal fit, 0.011 inch ID	1.00	Agreement Entitlement - 100 % covered		
1040	19231-60680	Ignitor Glow Plug Assembly	1.00	Agreement Entitlement - 100 % covered		
1030	5188-6498	QuickPick Purged Packed Inlet PM Kit	1.00	Agreement Entitlement - 100 % covered		
1020	5188-6497	QuickPick Splitless Inlet/Vent PM Kit	1.00	Agreement Entitlement - 100 % covered		
1010	5188-6496	QuickPick Split Vent + Inlet PM Kit	1.00	Agreement Entitlement - 100 % covered		

Additional Information:

Service Information:**Problem Description:**

T-WM-S-PM-GC-5000856928

Service Provided:

Discuss with customer about the Preventative maintenance and replacement part PM kits and restore instrument and method verify by customer >>normal operation

Service Overview Code:

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

Reported Hours:

2.0

Travel Hours:

1.0

Customer Field Service**Representative Name:**

Saenguthai Tarak

Customer Field Service**Representative Signature:**

Date:

29 Jul 2021

Customer Name:

PIYANUCH PHUDPHONG

Customer Signature:

Date:

29 Jul 2021

Additional Comments:

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 31, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.21	Transfer Standard Type	Orifice	Stop Time	9:35 AM
Motor Serial Number	BL-21	Calibrator Model	TE-5025A	Person Mr.Preecha Srisuk	
Recorder Serial Number	-	Calibrator Serial Number	1		

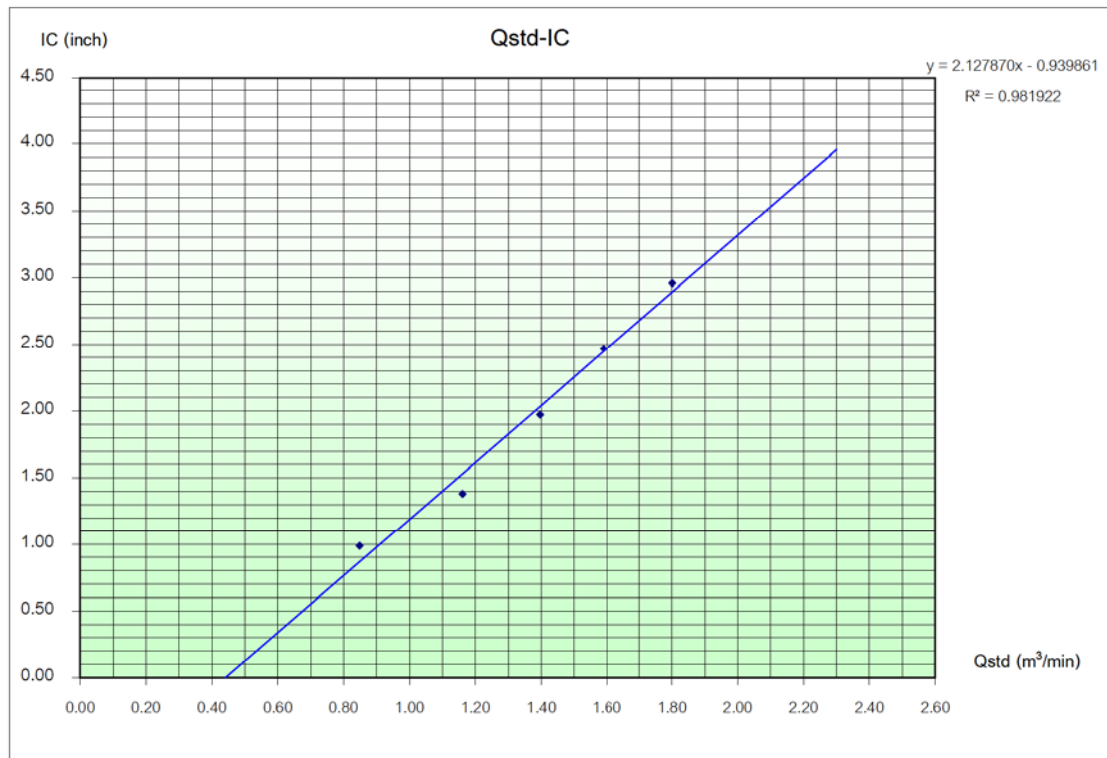
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	Qstd = (1/m)[(A-b)] (m ³ /min)	Sample Flow Rate Indicator (inch)	IC = I[(Pa/P _{std})(T _{std} /T _a)] ^{1/2}	("K = °C+273)	Pressure (mmHg)	Meter	Meter
	Positive	Negative	ΔH ₂ O								
5	1.4	1.4	2.8	1.65074	0.84821	1.0	0.99	305.0	757.0		
7	2.6	2.6	5.2	2.24958	1.16117	1.4	1.38	305.0	757.0		
10	3.7	3.8	7.5	2.70166	1.39744	2.0	1.97	305.0	757.0		
13	4.8	4.9	9.7	3.07087	1.59039	2.5	2.47	305.0	757.0		
18	6.2	6.2	12.4	3.47384	1.80099	3.0	2.96	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	1.91345	Linear Equation		Average	305.0	757.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r ²	0.999283	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	r	0.9946271	T _{NTP}	298.0	
Result							C=(Pa/Pstd)*(Tstd/Ta)*0.5		0.986505148

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.

(Mr.Preecha Srisuk)
Field Environmental

Approved By A. Srisuk

(Mr.Jarung Jamnongbut)
Division Manager

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 31, 2022
Project Site				Start Time	9:30 PM
Sampler Number	PM-10 No.5	Transfer Standard Type		Stop Time	9:35 PM
Motor Serial Number	HVL-05	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

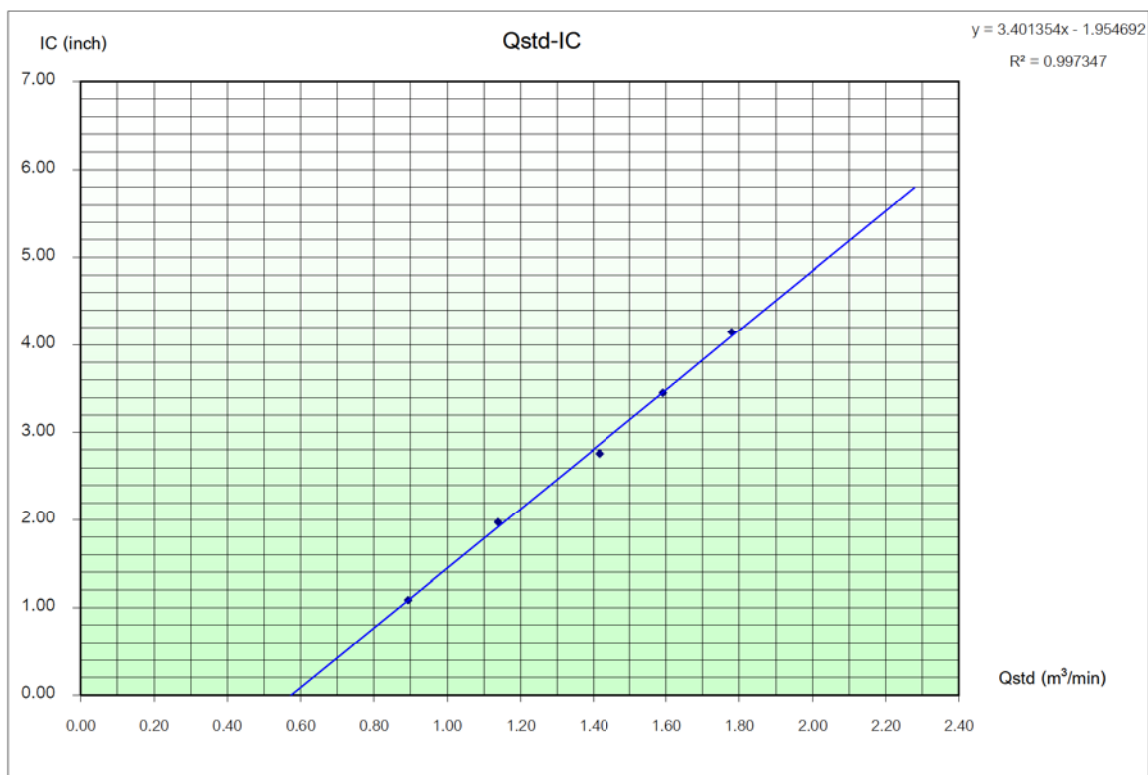
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O								
5	1.5	1.6	3.1	1.73692	0.89325	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	3.8	3.0	7.7	2.73744	1.41614	2.8	2.76	305.0	757.0		
13	4.8	4.9	9.7	3.07245	1.59122	3.5	3.45	305.0	757.0		
18	6.0	6.1	12.1	3.43156	1.77890	4.2	4.14	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	1.91345	Linear Equation			r^2		Pstd(mmHg)	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.99867262	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

(Mr.Preecha Srisuk)
Field Environmental

Approved By

(Mr.Jarung Jamnongbut)
Division Manager

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 31, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.7	Transfer Standard Type		Stop Time	9:35 AM
Motor Serial Number	BL-07	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

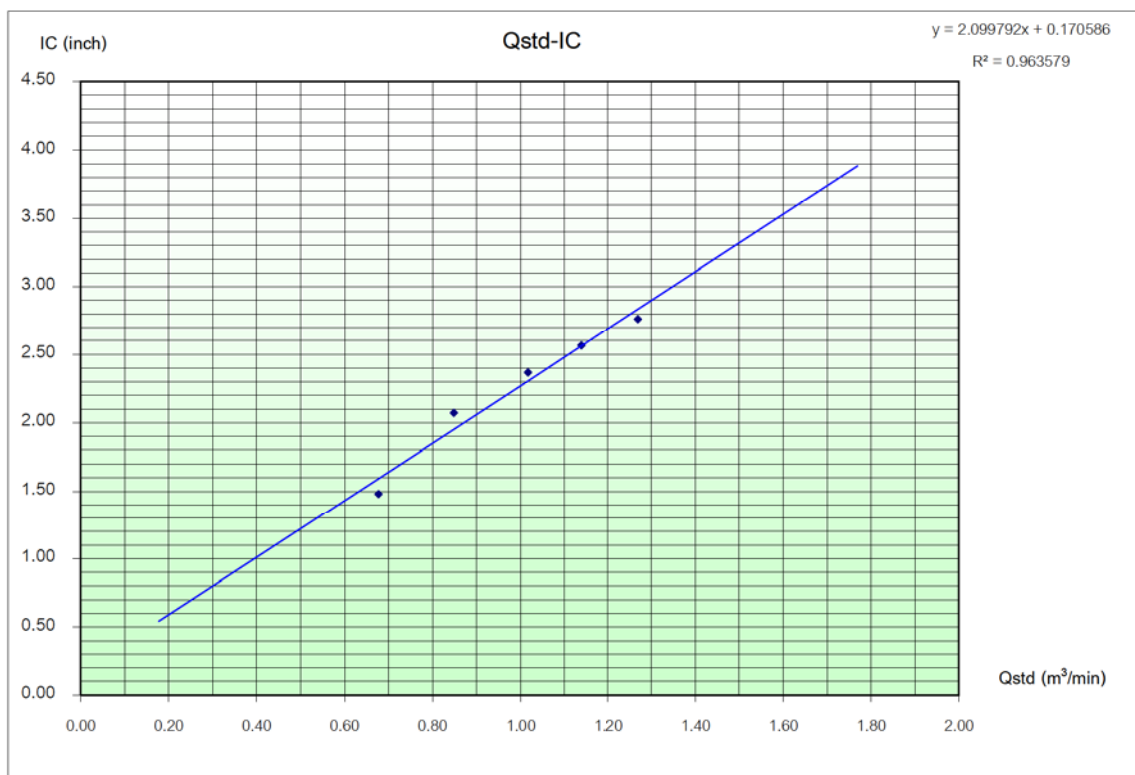
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mmH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (inch)	$IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O								
5	0.9	0.9	1.8	1.32354	0.67721	1.5	1.48	305.0	757.0		
7	1.4	1.4	2.8	1.65074	0.84821	2.1	2.07	305.0	757.0		
10	2.0	2.0	4.0	1.97301	1.01664	2.4	2.37	305.0	757.0		
13	2.5	2.5	5.0	2.20589	1.13834	2.6	2.56	305.0	757.0		
18	3.1	3.1	6.2	2.45638	1.26925	2.8	2.76	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

Linear Regression Y ON X : Y= mX + b					Average	305.0	757.0		
1	Slope (m)	1.91345	Linear Equation		r^2	0.963579	Pstd(mmHg)	760.0	
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9816206	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

(Mr.Preecha Srisuk)
Field Environmental

Approved By

(Mr.Jarung Jamnongbut)
Division Manager

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 31, 2022
Project Site				Start Time	13:10:00 AM
Sampler Number	PM-10 No.12	Transfer Standard Type		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		

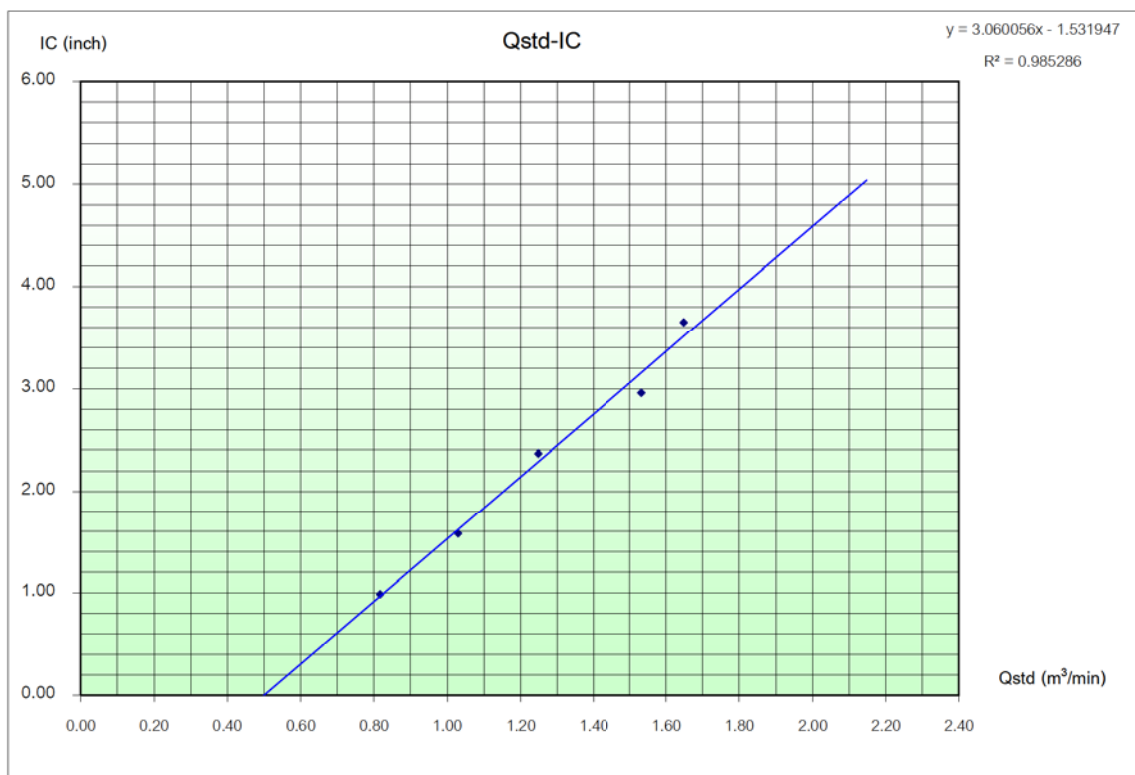
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mmH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O								
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	305.0	757.0		
1	Slope (m)	1.91345	Linear Equation		r^2	0.985286	Pstd(mmHg) 760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.99261574	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

Preecha Sr.

(Mr.Preecha Srisuk)
Field Environmental

Approved By

A. Jarung

(Mr.Jarung Jamnongbut)
Division Manager



National Institute of Metrology (Thailand)

Certificate of Calibration



Certificate No. : AA-2013-21
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,
Bangbuathong, Nonthaburi 11110
MEASUREMENT DATE : 6 September 2021

*The calibration results only marked with an asterisk * in this certificate are not included in Appendix C of the MRA drawn up by the CIPM.*

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
AUV084-01/21

Date
6 September 2021

Authorized Signatory

(Pairoj Rattanangul)

Person in charge

(Yada Juntarapaso)

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	0.2	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 Con : The average values during measurement are
(100.965 ± 0.013) kPa, (22.3 ± 0.3) °C and (62.2 ± 2.6) %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

B&K Type 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 microphone volume corrections and the calibrator pressure corrections are excluded in the calibration results.



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	94.12	0.12	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	
1.5	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



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. : 6504003

Calibrated Date : 31 March 2022

Acoustic Calibrator Data

Brand	: RION	Serial No.	: 34480442
Model	: NC-75	Last Calibration	: 6 September 2021
Range of Calibration	: 94 dB, 1000 Hz	Due Date	: 6 September 2022

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
ACO 6226	170023	94.2	94.0
ACO 6226	140035	94.1	94.0
ACO 6226	100100	94.3	94.0
ACO 6226	170075	94.1	94.0

Calibrated by

Preecha Sr.

(Mr. Preecha Srisuk)

Approved by

Preecha Sr.

(Mr. Preecha Srisuk)



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. : 6504004

Calibrated Date : 1 April 2022

Acoustic Calibrator Data

Brand	: RION	Serial No.	: 34480442
Model	: NC-75	Last Calibration	: 6 September 2021
Range of Calibration	: 94 dB, 1000 Hz	Due Date	: 6 September 2022

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 :

(Mr. Santipap Khaonual)

Approved by :

(Mr. Chitsanuphon Toothong)



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. : 6501001

Calibrated Date : 21 January 2022

Acoustic Calibrator Data

Brand	: RION	Serial No.	: 34480442
Model	: NC-75	Last Calibration	: 6 September 2021
Range of Calibration	: 94 dB, 1000 Hz	Due Date	: 6 September 2022

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
ACO 6226	150084	94.1	94.0
ACO 6226	140034	94.3	94.0
ACO 6226	080084	94.2	94.0
ACO 6226	110112	94.1	94.0
ACO 6226	180007	94.1	94.0
ACO 6226	150067	94.4	94.0
ACO 6226	150066	94.1	94.0
ACO 6226	140035	94.1	94.0
ACO 6226	170103	94.2	94.0
ACO 6226	080086	94.1	94.0
ACO 6226	080087	94.3	94.0
ACO 6226	170025	94.1	94.0
ACO 6226	080188	94.2	94.0
ACO 6226	150085	94.2	94.0
ACO 6226	150084	94.1	94.0
ACO 6226	180010	94.2	94.0

Calibrated by :

(Mr. Santipap Khaonual)

Approved by :

(Mr. Chitsanuphon Toothong)



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

Received Date : 04 Jan 2022

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

Calibration Date : 04 Jan 2022

Location of Calibration : In-Lab

Recommend Due Date : 04 Jan 2023

Calibration Procedure : SP-CPE-04-01

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

(Mr. Worapong Sinthusopa)

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 Bangkoe Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2111-091-0001

Date Issued : 11-Nov-21

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

Equipment : Heat Stress Meter

Manufacturer : QUEST TECHNOLOGY

Model : QUESTemp 34

Serial No. : TFB060016

ID No./Tag No. : HT-11

Date Received : 09-Nov-21

Date Calibrated : 10-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 :

K. Nathong

(Mr. Nathapong Krudaum)



Page 1 of 2

Certificate No. : AD2111-091-0001

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	24.1	-	0.11	0.40
27.99	DRY	28.1	-	0.11	0.35
30.01	GLOBE	30.1	-	0.09	0.35
26.99	WET	26.9	-	-0.09	0.40
32.00	DRY	32.1	-	0.10	0.35
35.01	GLOBE	35.1	-	0.09	0.35
30.01	WET	30.0	-	-0.01	0.40
36.00	DRY	36.0	-	0.00	0.35
40.03	GLOBE	40.0	-	-0.03	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. AD2011-059-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 13-Nov-21

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.

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 ± (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 :
(Bunjerd Masri)
Supervisor

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 -

B



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 : PHWPTEM01W

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

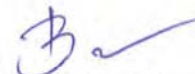
1. Platinum Resistance Thermometer (PRT)

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 :



(Bunjerd Masri)

Supervisor

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 -

B



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 : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

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	64-400106-1	30 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-5

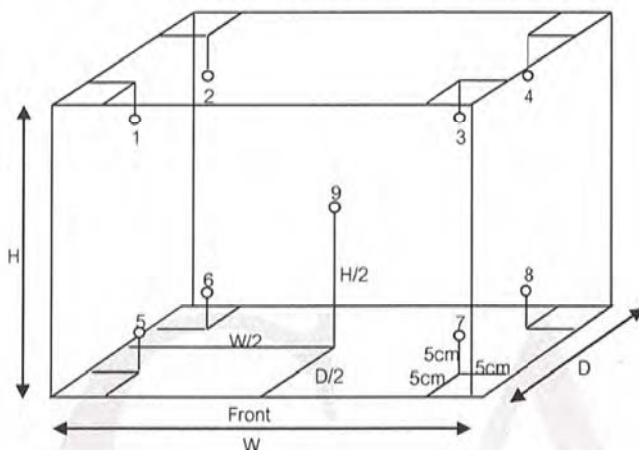
Page : 2 of 2

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	19.9	19.8	19.7	19.5	20.4	20.4	20.3	20.1	20.4	0.57

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

B



Certificate of Calibration

Certificate No. : 64-400425-7

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 : SRR3-0687 AR

Range : N/A °C

Resolution : 1 °C

Serial No. : SRR3675A-210400065 R

ID No. : MET-RE04/64

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

Ambient Temperature : (28.6 to 30.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.0 to 220.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

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

400022 & 400028

64-400103-1

02 Sep 2021

National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-7

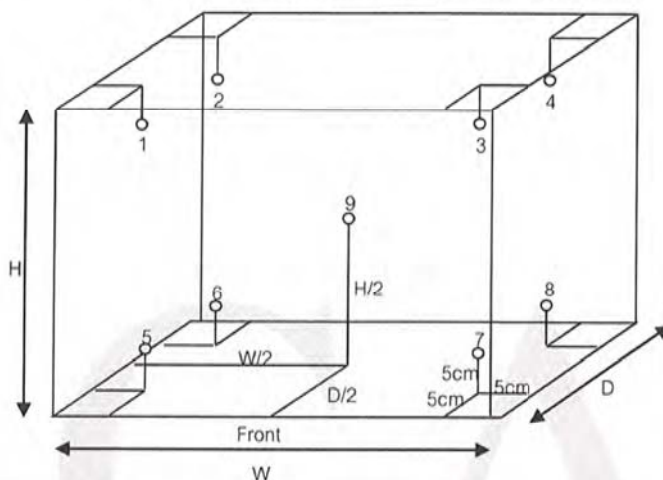
Page : 2 of 2

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	3	3	3.5	3.6	3.4	3.2	3.1	2.7	3.1	3.0	3.1	0.83

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	3	3	0.6	0.2	1.4

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 -

Signature



CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 **Serial No. :** 1021810
Manufacturer : Hanna Instruments
Made in : Romania
Condition As-Received : Used Product
Reference : RE211263
Customer name : MET Co., Ltd.
36/659 Moo. 6, Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110
Received date : 1 September 2021
Calibrate date : 1 September 2021
Issue date : 6 September 2021
Ambient Temperature : (25 ± 2) °C
Relative Humidity : (50 ± 15) % RH
Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by :

Mr. Athakom Sumphan
Calibration Engineer

Approved by :



Mr. Anan Suwanchaisakul

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand)

Condition of this result of calibration**Reference Standard Instruments :**

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935005	03250060101	21T167	Technology Promotion Association (Thailand-Japan)

Reference / Procedure :

This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90

All data shown below were as-received values without adjustment.

SITE CALIBRATION

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Result of Calibration :

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	150.2 (°C)	150.5 (°C)	1.3 (°C)	±0.40 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	149.9	150.7	150.9	151.1	150.2
	6	7	8	9	10
	150.0	149.9	150.4	150.9	150.6
	11	12	13	14	15
	150.3	150.8	151.1	150.9	150.5
	16	17	18	19	20
	149.9	149.9	150.5	151.0	150.5
	21	22	23	24	25
	150.5	150.7	150.6	150.4	149.8

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%

**** End of certificate ****

Certificate of Calibration

Certificate No. : 64-400425-2

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 : (31.0 to 33.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

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	64-400104-1	29 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-2

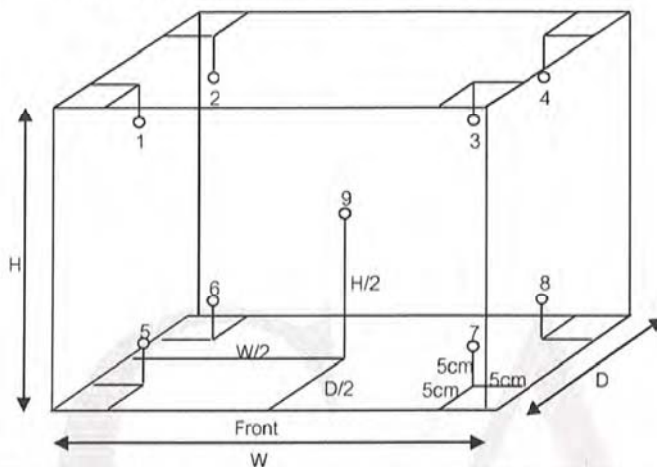
Page : 2 of 2

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	109	109	104.8	105.0	104.4	104.6	103.4	103.5	103.6	103.7	103.7	0.96
180	184	184	180.8	181.8	179.9	180.6	180.6	180.8	180.6	180.9	180.5	1.1

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	109	109	1.5	0.2	1.8
180	184	184	1.6	0.2	2.3

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 -

B



Certificate of Calibration

Certificate No. : 64-400425-1

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 : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400032	64-400106-1	30 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-1

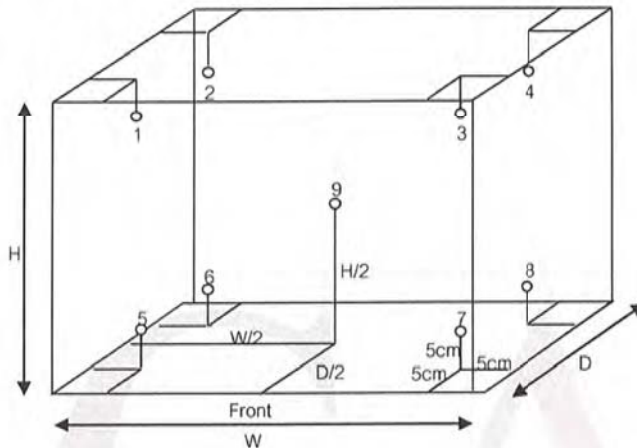
Page : 2 of 2

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	180.9	181.2	180.7	181.0	181.1	181.3	180.6	180.7	179.6	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	1.9	0.2	2.0

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%

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Bo



Certificate of Calibration

Certificate No. : 65-200064-1

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 : METTLER TOLEDO Model : AG285

Serial No. : 1122140126 ID No. : MET-EB01/46

Capacity : 210 g Resolution : 0.00001g/81g, 0.0001g/210g

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

Ambient Temperature : (26.2 to 26.8) °C

Relative Humidity : (55.3 to 64.1) %

Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 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 :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-200064-1

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)
0.01	0.00000	0.000016
0.1	0.00001	0.000021
1	-0.00001	0.000029
5	-0.00002	0.000043
10	-0.00006	0.000053
20	-0.00015	0.000071
50	-0.00035	0.00011
100	-0.0006	0.00021
150	-0.0009	0.00038
200	-0.0012	0.00038

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

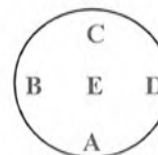
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.23$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.00044 0.00006 -0.00052 -0.00019 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.000052 g

- o0o -

Handwritten signature



Certificate of Calibration

Certificate No. : 65-200064-2

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 : AND Model : FX-2000i
Serial No. : 15639789 ID No. : MET-EB03/61
Capacity : 2200 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.1 to 26.2) °C
Relative Humidity : (55.5 to 61.9) %
Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 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
F181-F1821	65-210044-1	31 Jul 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 65-200064-2

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Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)	Error before Adjustment (g)
200	0.00	0.0083	-0.08
500	0.00	0.0085	-0.20
600	0.00	0.0086	-0.24
700	0.00	0.0087	-0.28
800	0.00	0.0089	-0.34
1000	0.01	0.0093	-0.41
1200	0.01	0.011	-0.50
1500	0.01	0.011	-0.61
2000	0.00	0.012	-0.79
2200	0.00	0.023	-0.87

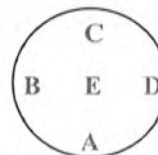
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 500 g

A	B	C	D	E	
0.00	0.01	0.00	0.00	0.00	g



Repeatability

Load test : 2000 g

Stdev. : 0.000 g

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