

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง
ของเครื่องมือเก็บตัวอย่าง

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha
Zip / Postal: 20230
State / Province: Chonburi
Order Number: 40332192694

Contact: Sasirom Nakin

Weighing Device

Manufacturer: Mettler Toledo
Model: XS205DU
Serial No.: 1126323724
Building: Laboratory
Floor: 1
Room: Laboratory
Instrument Type: Weighing Instrument
Asset Number: LABC 05/1
Terminal Model: SAT
Terminal Serial No.: 1126323724
Terminal Asset No.: N/A

Range	Max. Capacity	Readability (d)
1	81 g	0.0001 g
2	220 g	0.0001 g

Procedure

Calibration Guidelines:

METTLER TOLEDO Work Instruction:

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight. In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
	As Found	Start: 26.9 °C End: 26.8 °C	Start: 73.8 % End: 71.9 %	

As Found Calibration Date: 22-Jul-2021

As Left Calibration Date: N/A

Issue Date: 23-Jul-2021

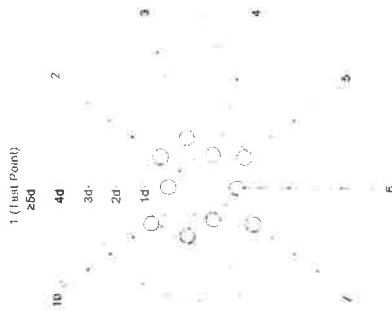
Approved Signatory:

☒ Kassakorn Tassanachaisakul
☒ Santi Jitriyom
☐ Surachet Sukkate

Measurement Results

Repeatability

Test Load: 70 g		
	As Found	As Left
1	69.99998 g	N/A
2	69.99997 g	N/A
3	69.99997 g	N/A
4	69.99998 g	N/A
5	69.99997 g	N/A
6	69.99998 g	N/A
7	69.99999 g	N/A
8	69.99998 g	N/A
9	69.99997 g	N/A
10	69.99999 g	N/A
Standard Deviation		N/A

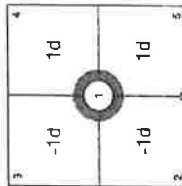


The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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



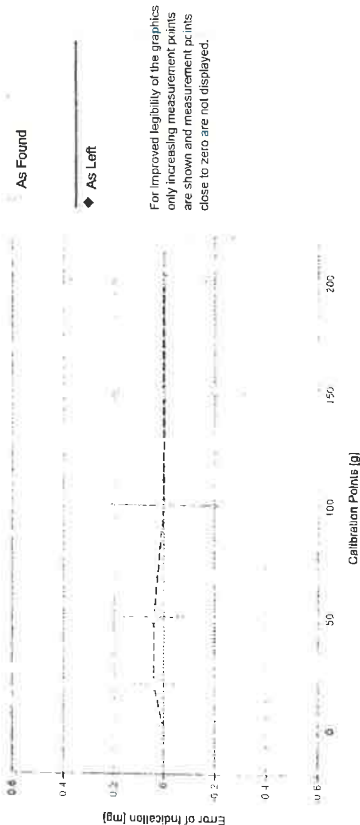
As Found

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

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.019 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99999 g	5.00000 g	0.00002 g	0.044 mg	2
6	9.99999 g	10.00001 g	0.00002 g	0.067 mg	2
7	20.00001 g	20.00005 g	0.00004 g	0.082 mg	2
8*	49.99999 g	49.99997 g	-0.00002 g	0.12 mg	2
9	99.99999 g	99.99999 g	0.00000 g	0.21 mg	2
10	149.99998 g	149.99998 g	0.00000 g	0.32 mg	2
11	199.99998 g	199.99998 g	0.00000 g	0.37 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

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

Test Equipment

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

Weight Set 1: OIML E2			
Weight Set No.:	WS29	Date of Issue:	17-Nov-2020
Certificate Number:	170241	Calibration Due Date:	15-May-2022
Thermo Hygrometer			
Equipment No.:	IN51	Date of Issue:	02-Mar-2021
Certificate Number:	21H403	Calibration Due Date:	23-Feb-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: 5 K

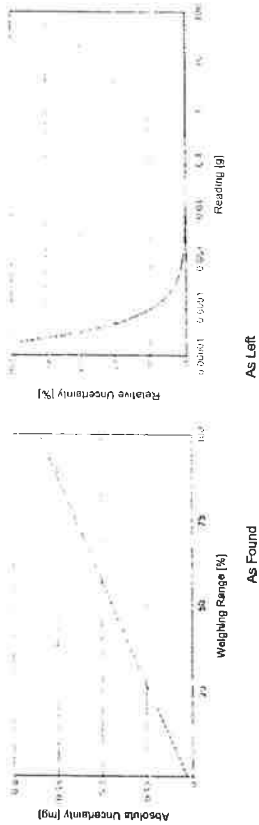
Linearization of Uncertainty Equation

Range	As Found		As Left
	d	Max	
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00608 \text{ mg/g} \cdot R$
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00603 \text{ mg/g} \cdot R$

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

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

Net Indication	As Found		As Left
	As Found	As Left	
0.00220 g	0.018 mg	0.82%	N/A
0.02200 g	0.018 mg	0.082%	N/A
0.22000 g	0.019 mg	0.0088%	N/A
2.20000 g	0.031 mg	0.0014%	N/A
220.0000 g	1.4 mg	0.00063%	N/A



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

GWP®
Certificate



As Found

As Left

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

As Found

As Left

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

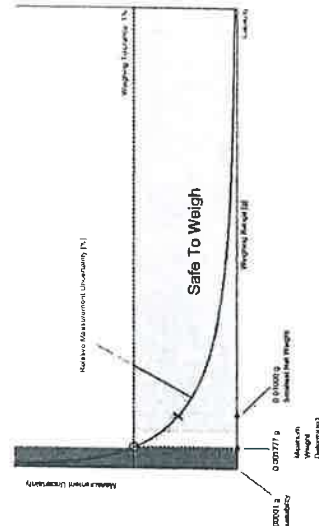
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045955 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

The minimum weight table applies to the fine range of the weighing device.

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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045955 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

The minimum weight table applies to the fine range of the weighing device.

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 70 g

Tolerance			As Found			As Left		
	Control Limit		Std. Deviation	Result		Std. Deviation	Result	
0.1%	0.000005 g			✗			✗	
0.2%	0.000010 g			✓			✓	
0.5%	0.000025 g			✓			✓	
1%	0.000050 g		0.000009 g	✓		0.000008 g	✓	
2%	0.000100 g			✓			✓	
5%	0.000250 g			✓			✓	

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

Eccentricity

Test Load: 100 g

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

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

Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99999 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99998 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99998 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99998 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99998 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99999 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99998 g	0.00000 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99998 g	0.00000 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

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

Service Date:
Document Number:
EASTERN THAI CONSULTING 1992 CO., LTD.
803 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha, Chonburi 20230
Sasiporn Nakin

2021-07-22
TH2046-542-072221-LABBalanceHR

METTLER TOLEDO

Balance Health Report

Device Details	
Manufacturer:	Mettler Toledo
Model:	XS205DU
Serial number:	1125323724
Firmware:	4.00 / 5.61
System Balpas:	Accessory 1: Accessory 2: Weight test for routine testing: Yes /

History	
Device History	
Instrument in use:	Yes
Instrument age:	> 10 years
Spare parts available:	Yes
Regulations:	ISO
Process tolerance in %:	1%
Smallest sample net weight:	0.01000 g
Service History	
Last preventive maintenance:	< 1 year
Last instrument calibration:	< 1 year
Last minimum weight determination:	Never
Routine testing performed:	Yes

Check List	
Environmental Conditions	
Room temperature fluctuation	✓
Exposure to direct sun	✓
Vibrations	✓
Draft	✓
Dirt or dust	✓
Static	✓
Mechanical Component Checks	
Draft shield	✓
Weighing pan position	✓
Housing	✓
Other - objections noted as additional remarks	Other - objections noted as additional remarks
General & Functional Checks	
Leveling	✓
Cleanliness	✓
Completeness - missing parts see additional remarks	✓
Settings optimized for operating environment	✓
Other - objections noted as additional remarks	✓
Electrical Component Checks	
Power supply	✓
Sliding door drive	✓
Internal weight drive	✓
Display	✓
Other - objections noted as additional remarks	Other - objections noted as additional remarks

Recommendations	
Maintenance / Result Quality	
Instrument calibration	Uninstall instrument
Identify safe weighing range	Replace instrument
GWP verification / risk assessment	Yes
Preventive maintenance	Replace / add parts (see additional remarks)
Perform routine testing with test weights	Onsite repair
User training	Depot repair
Use of accessories (see additional remarks)	Use of accessories (see additional remarks)
Contact	Name: Sasiporn Nakin
Position:	Phone: 090513343
Email: 06.10.2021.1992.com	Engineer Details
Date:	22-Jul-2021
Name:	Palpat Sweaparnunat
Signature:	

This is not a certificate.

It should not be used to interpret final results for the testing of these devices.

Legend: ✓ Good/Pass ▲ Needs Attention ✗ Bad/Fail — Not Applicable

8464 - 8465 Lachan Rd., Bangpa Ti, Sub-District, Bangpa District, Bangkok 10260, +66 2723 0382
MTH-ServiceSupport@m.com
www.m.com

METTLER TOLEDO Service
Report Version: 1.13, Software Version: 2.0.3, Page: 11, 6 METTLER TOLEDO

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030



Airgas Specialty Gases
Airgas USA, LLC
6140 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E15AC004 Reference Number: 160-40224242-1
Cylinder Number: EB0145030 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12021 Valve Outlet: 350
Gas Code: CH4,PPN,BALN Certification Date: Oct 15, 2021
Expiration Date: Oct 15, 2029

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 800E-12/01, using the assay procedures listed. The assay methodology does not require correction for analytical interference. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.5%	May 15, 2025
CO NTRM	200602-06	6162860Y	243.3 PPM PROPANE/AIR	+/- 0.5%	Mar 17, 2027
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration		
Nicolet IS50 FTIR AUP2110295 CH4	FTIR		Oct 13, 2021		
Nicolet IS50 FTIR AUP2110295 C3H8	FTIR		Oct 14, 2021		

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 5221004861



CERT 3082.05

DRY GAS METER MC-572-V

Serial No. : 1007055

5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	MC-572-V
Console Serial Number	1007055
DGM Model Number	SK25EX
DGM Serial Number	0005459

Calibration Conditions			
Date	Time	15-Jun-21	8:30 AM
Calibration Reference No.	GC64APE0037		
Barometric Pressure	751	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	298	K
Std Press	760	mm Hg
K ₁	0.392	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed (t)	DGM Orifice (P _o)	Volume Initial (V _{in})	Volume Final (V _{fin})	Outlet Temp Initial (t _o)	Outlet Temp Final (t _f)	Volume Initial (V _{in})	Volume Final (V _{fin})	Outlet Temp Initial (t _o)	Outlet Temp Final (t _f)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	342.0737	342.2483	25	26	204.97437	205.17455	27	26
10.00	25.0	342.2809	342.4453	26	26	205.21227	205.39526	26	26
8.00	50.0	342.4747	342.6575	26	26	205.42816	205.62204	26	26
7.00	80.0	342.6743	342.8792	26	26	205.63987	205.85738	26	26
5.00	120.0	342.8033	343.0823	26	26	205.88286	206.07264	26	26

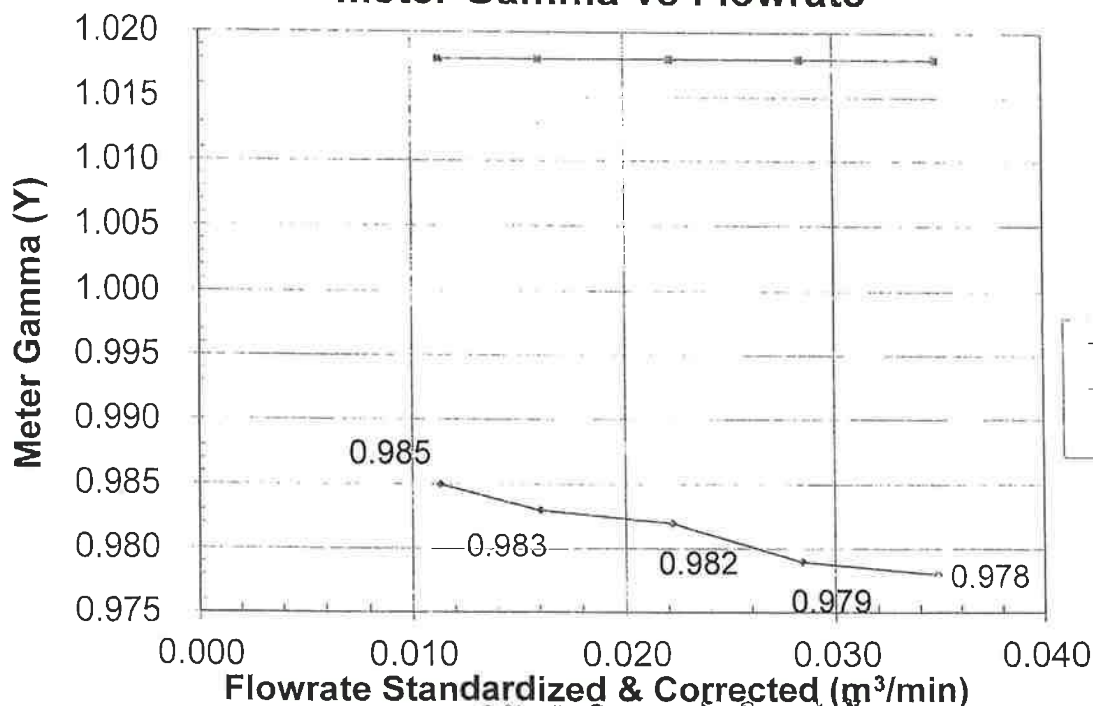
Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{Wet})	(Q _{Wet})	(V _{Wet})	(Q _{Wet})	Value	Variation	Flowrate	ΔH @	
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr	.0212 m ³ /min	Variation
						(Q _{Wet})	(ΔH @)	(ΔΔH @)
						m ³ /min	mm H ₂ O	
0.172	0.011	0.196	0.013	0.985	0.004	0.011	45.997	0.533
0.163	0.016	0.180	0.018	0.983	0.002	0.016	44.060	-1.403
0.181	0.023	0.192	0.024	0.982	0.001	0.022	46.266	0.803
0.203	0.029	0.214	0.031	0.979	-0.002	0.028	45.386	-0.077
0.178	0.036	0.186	0.037	0.978	-0.003	0.035	45.606	0.143
				0.981	Y Average		45.463	ΔH @ Average

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

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

Signature: [Redacted] Date: 15/06/2021 [Redacted]

Meter Gamma vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	MC-572-V
Console Serial Number	1007055
DGM Model Number	SK25EX
DGM Serial Number	0005459
Meter Box Model Number	JENCO 765
Meter Box Serial Number	JC02484

Calibration Conditions	
Date	15-Jun-21
Time	8:30 AM
Calibration Reference No.	GC64APE0037
Barometric Pressure	756
Reference Thermometer	FLUKE 714
Serial Number	9038005

Results									
Console Thermocouple Simulator									
Channel and test point		Meter Box Channel Temperature Reading (°C)							
Stack	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0
	-17	25	38	94	150	262	372	485	596
Probe	-17	25	38	94	150				
	-17	25	38	94	150				
Filter	-17	25	38	94	150				
	-17	25	38	94	150				
Aux	-17	25	38	94	150				
	-17	25	38	94	150				
Exit	-17	25	38						
	-17	25	38						

Stack
Probe
Filter

Tolerance Range

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

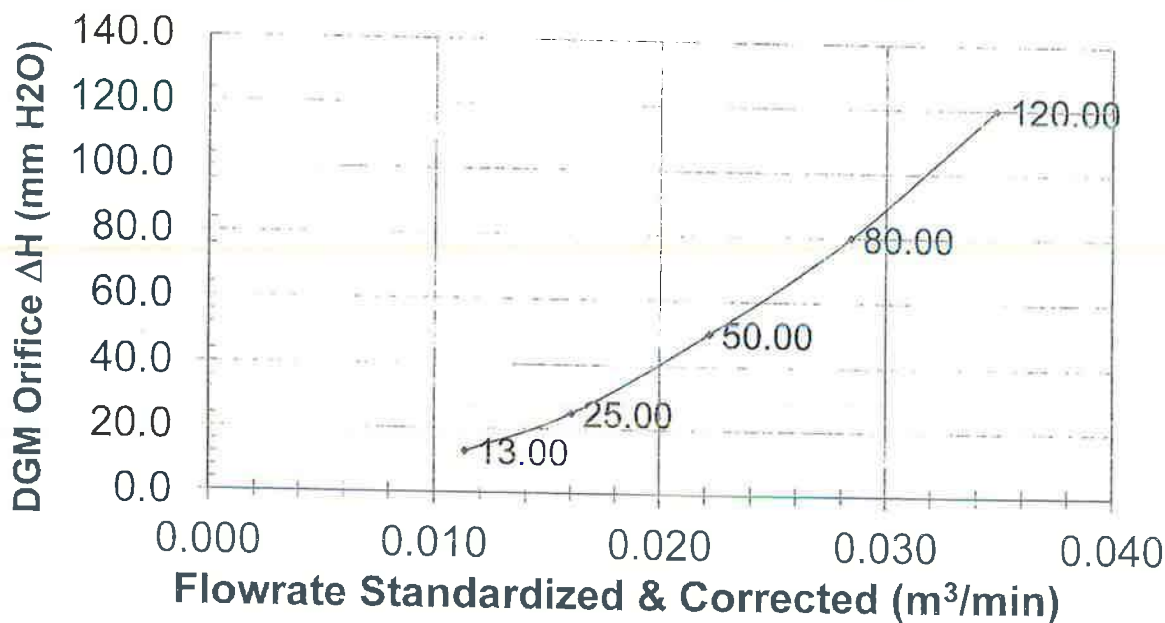
Meter
Exit

± 3.0 °C
± 2.0 °C

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Signature

Meter Pressure vs Flowrate



บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Serial:

1007055

Console Model:

MC-572-V

บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

DRY GAS METER XC-572-V

Serial No. : A2007510

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	XC-572-V
Console Serial Number	A2007510
DGM Model Number	SK25EX
DGM Serial Number	00005115

Calibration Conditions			
Date	Time	11-Aug-21	1:00 PM
Calibration Reference No.	GC64APE00040		
Barometric Pressure	761	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed (t)	DGM Orifice ΔH (P _o)	Volume Initial (V _i)	Volume Final (V _f)	Outlet Temp Initial (T _i)	Outlet Temp Final (T _f)	Volume Initial (V _w)	Volume Final (V _w)	Outlet Temp Initial (T _i)	Outlet Temp Final (T _f)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	192.9377	193.1065	25	25	217.64994	217.82028	25	25
10.00	25.0	193.1438	193.3008	25	25	217.85800	218.01650	25	25
8.00	50.0	193.3330	193.5109	25	25	218.04911	218.22929	25	25
7.00	80.0	193.5431	193.7402	25	25	218.26189	218.46254	25	25
5.00	120.0	193.7826	193.9548	25	25	218.50573	218.68184	25	25

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{actual})	(Q _{actual})	(V _w)	(Q _w)	Value (Y)	Variation (ΔY)	Flowrate Std & Corr (Q _{std & corr})	ΔH @ (ΔH@)	Variation (ΔΔH@)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.166	0.011	0.167	0.011	1.006	-0.001	0.011	46.495	0.632
0.155	0.015	0.156	0.016	1.005	-0.002	0.016	46.005	0.141
0.176	0.022	0.177	0.022	1.006	-0.001	0.022	45.788	-0.076
0.195	0.028	0.197	0.028	1.008	0.001	0.028	45.491	-0.373
0.171	0.034	0.173	0.035	1.009	0.002	0.035	45.540	-0.324
				1.007	Y Average		45.864	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_o, 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

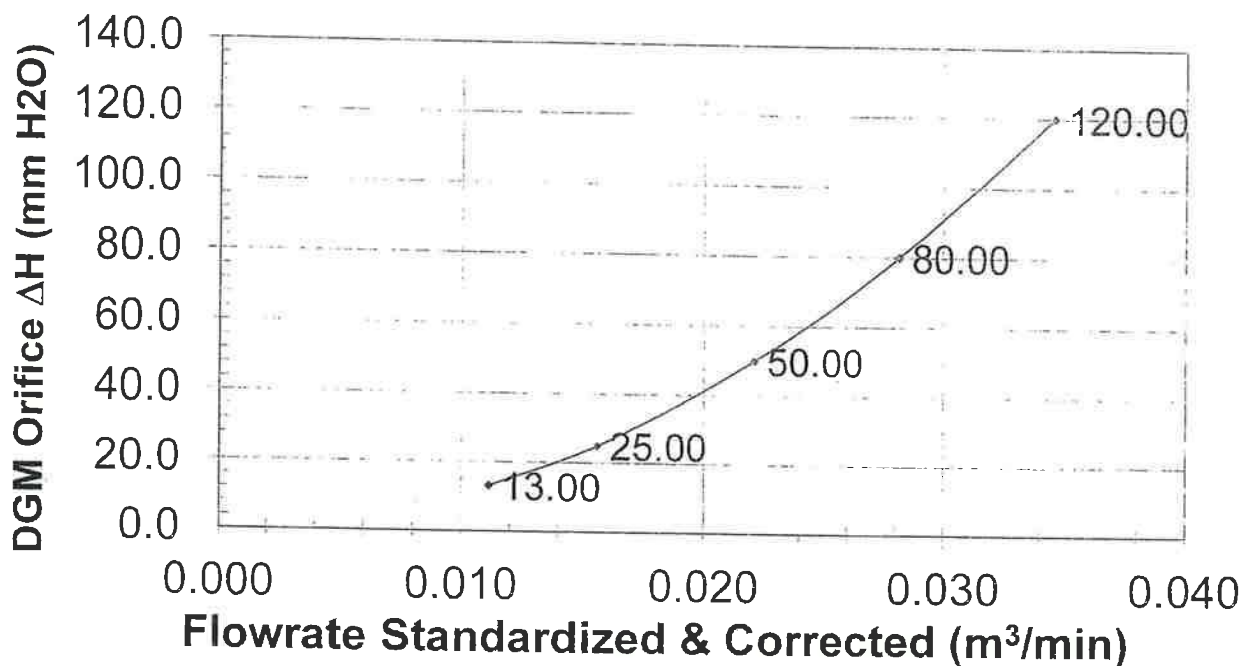
Date

11/8/2021

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

Meter Pressure vs Flowrate



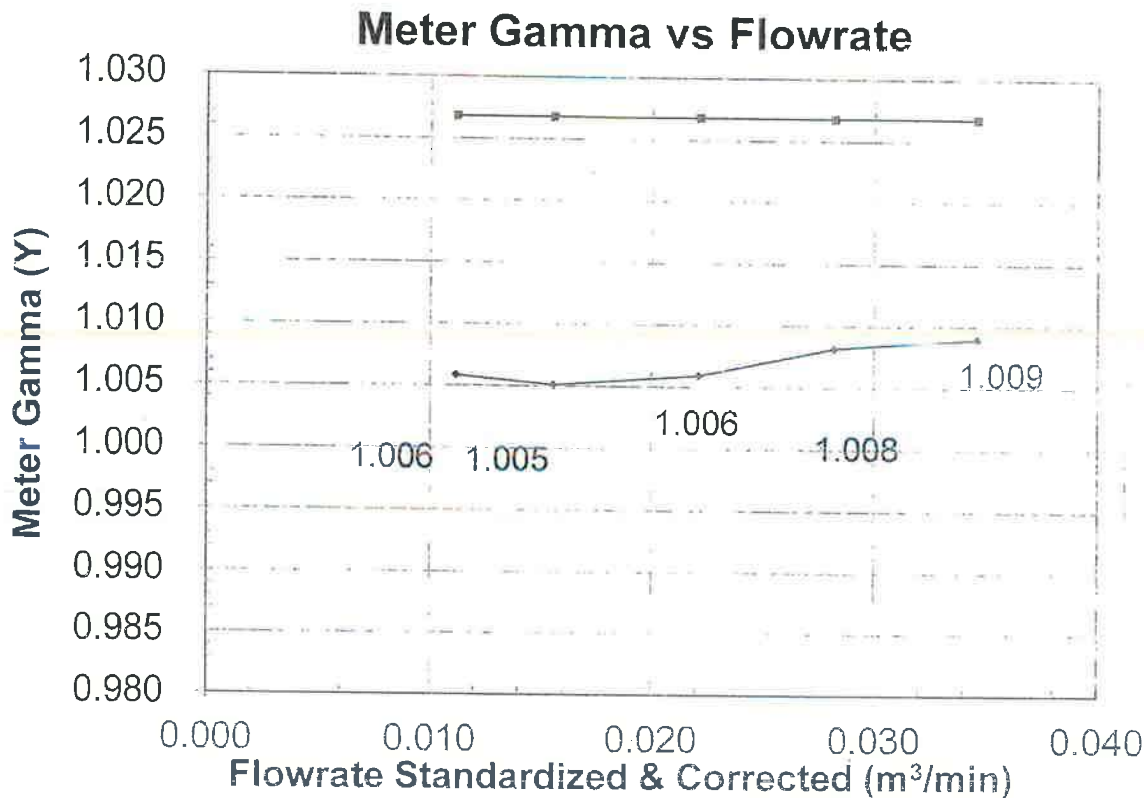
Console Serial:

A2007510

บริษัท สิทธีพรแอสซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

XC-572-V



Console Serial: A2007510

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

XC-S72-V

THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN
SA Environmental / Hygiene Products Division (EPD)
Web site: www.sithiporn.com E-mail: sithiporn@epd.sithiporn.com

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-S72-V	Date	11-Aug-21 1:00 PM
Console Serial Number	A2007510	Calibration Reference No.	GC64APE0040
DGM Model Number	SK25EX	Barometric Pressure	761 mm Hg
DGM Serial Number	00005115	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005

Meter Box Serial Number	JC02982
-------------------------	---------

Results									
Console Thermocouple Simulator									
Channel and test point		Meter Box Channel Temperature Reading (°C)							
		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0
Stack									
Probe									
Filter									
Aux									
Exit									

Stack
Probe
Filter

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Exit

± 3.0 °C
± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates

451-451/1 ถนนศรีนครินทร์ แขวงบางนา เขตคลองเตย กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-8191 แฟกซ์ : 0-2433-1673, 0-2434-9510
451-451/1 Sirinthon Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-951

DRY GAS METER MC-572

Serial No. : 0011024

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	MC-572
Console Serial Number	0011024
DGM Model Number	SK25EX
DGM Serial Number	00005437

Calibration Conditions			
Date	Time	07-Jan-22	1:00 PM
Calibration Reference No.	HC65APE0005		
Barometric Pressure	759	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	

Calibration Data									
Run Time	Metering Console				Calibration Meter				
Elapsed (θ)	DGM Orifice ΔH (P _o)	Volume Initial (V _i)	Volume Final (V _f)	Outlet Temp Initial (T _i)	Outlet Temp Final (T _f)	Volume Initial (V _i)	Volume Final (V _f)	Outlet Temp Initial (T _i)	Outlet Temp Final (T _f)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	519.3522	519.5372	25	25	248.31965	248.50831	25	25
10.00	25.0	519.5505	519.7196	25	25	248.52318	248.69613	25	25
8.00	50.0	519.7505	519.9399	25	25	248.72918	248.92339	25	25
7.00	80.0	519.9562	520.1641	25	25	248.94255	249.15608	25	25
5.00	120.0	520.1817	520.3645	25	25	249.17802	249.36602	25	25

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{std})	(Q _{std})	(V _{ref})	(Q _{ref})	Value	Variation	Flowrate	ΔH @	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr (Q _{std} corrected)	.0212 m ³ /min (ΔH@)	(ΔΔH@)
						m ³ /min	mm H ₂ O	
0.182	0.012	0.185	0.012	1.016	-0.001	0.012	38.004	-1.317
0.186	0.017	0.169	0.017	1.018	0.001	0.017	38.741	-0.580
0.187	0.023	0.190	0.024	1.018	0.001	0.024	39.516	0.195
0.206	0.029	0.209	0.030	1.017	0.000	0.030	40.276	0.955
0.181	0.036	0.184	0.037	1.015	-0.002	0.037	40.070	0.748
				1.017	Y Average		39.321	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_o, 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

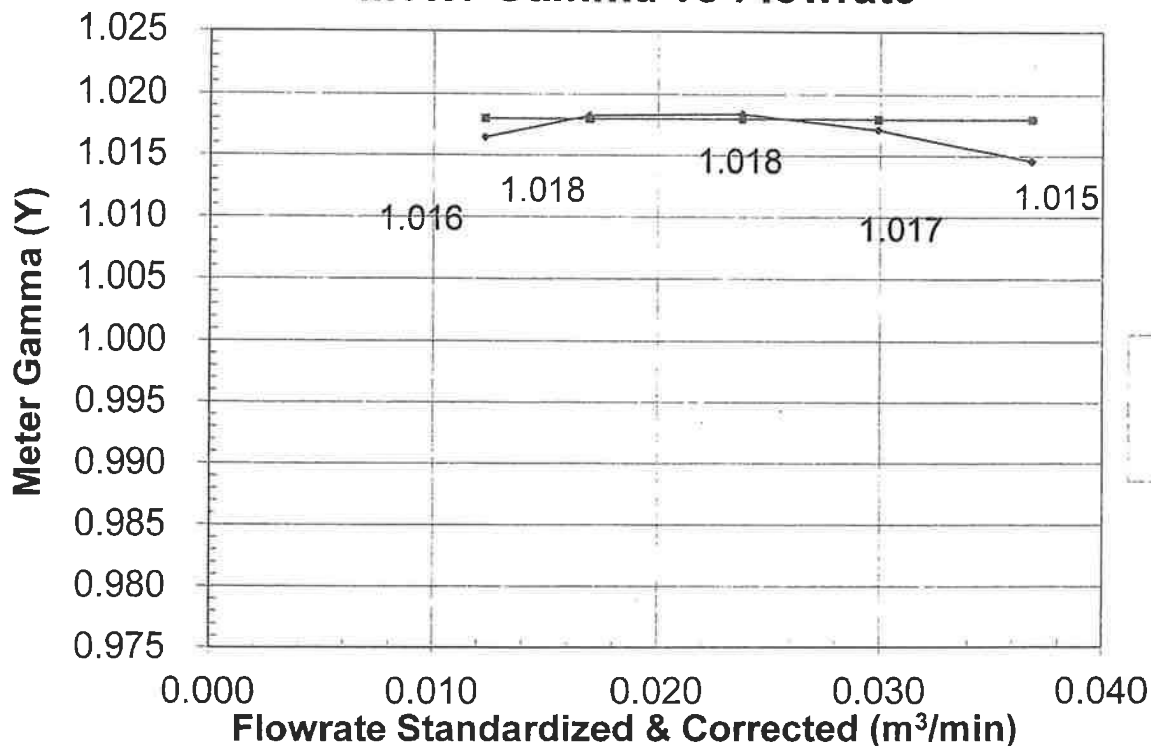
Signature: [Redacted] ชื่อ: สิทธิพร แอ๊ดไช้จิเรอ จำกัด

Date: 07/01/2022

Calibration Date: 25-2-2014

Calibration Reference No: V057AP0011

Meter Gamma vs Flowrate



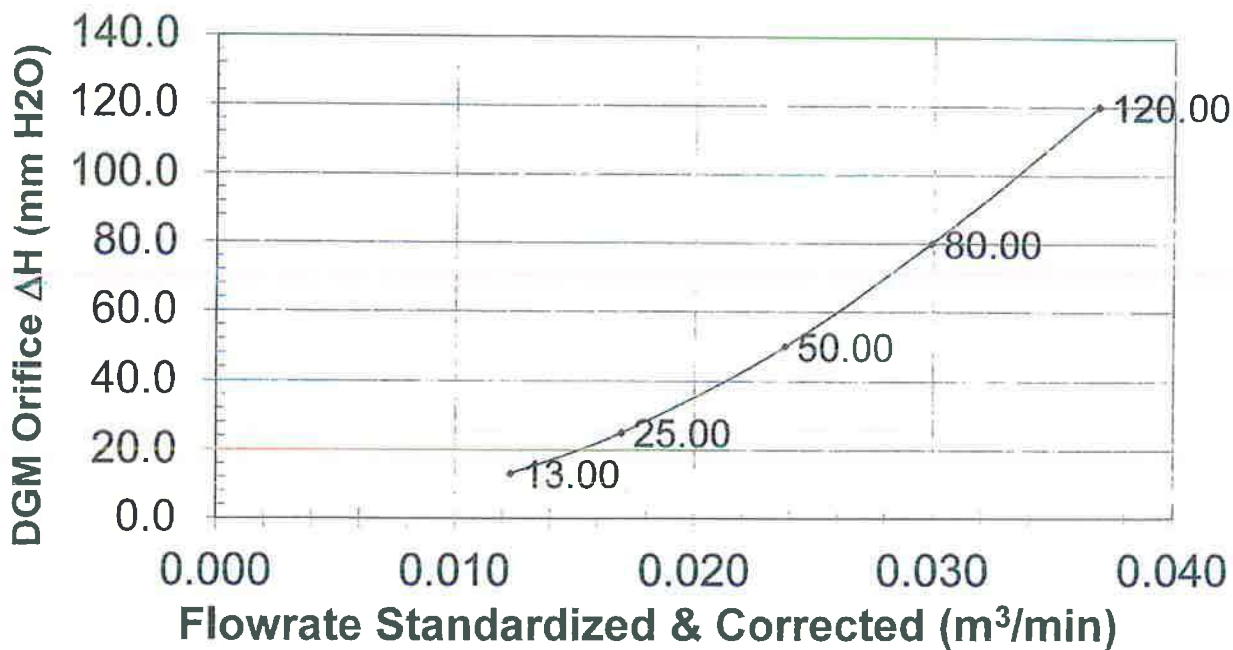
Console Serial: 0011024

Console Model: MC-572

บริษัท สิทธิพร แอ๊ดไช้จิเรอ จำกัด
SIRIPHORN ENVIRONMENTAL HYGIENE PRODUCTS DIVISION (EPD)

COPY

Meter Pressure vs Flowrate



Console Serial:

0011024

Console Model:

M

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN

SA S O C I A T E S
SA Environmental / Hygiene Products Division (EPD1)
Web site : www.sithiporn.com E-mail : service-epd1@sithiporn.com

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-572	Date	07-Jan-22
Console Serial Number	0011024	Calibration Reference No.	HC85APE0005
DGM Model Number	SK25EX	Barometric Pressure	759 mm Hg
DGM Serial Number	0005437	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005
Meter Box Serial Number	JC02982		

Results											
Console Thermocouple Simulator											
Channel and test point		Meter Box Channel Temperature Reading (°C)									
		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack		-18	25	38	94	150	261	372	483	595	817
Probe		-18	25	38	94	150					1040
Filter		-18	25	38	94	150					
Aux		-18	25	38	94	150					
Exit		-18	25	38	94	150					

Stack ± 1.50% Absolute
Probe ± 3.0 °C
Filter ± 3.0 °C

Meter
Exit

± 3.0 °C
± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสีลม แขวงบางนาพรุ เขตบางนา กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-1678, 0-2434-9510
451-451/1 Sirinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

DRY GAS METER MC-572-V

Serial No. : 0504003

Meter Console Information	
Console Model Number	MC-572-V
Console Serial Number	0504003
DGM Model Number	SK25EX
DGM Serial Number	0005303

Calibration Conditions			
Date	Time	05-Apr-22	8:30 AM
Calibration Reference No.	HC85APE0026		
Barometric Pressure	761	mm Hg	
Calibration Meter Gamma	0.9980	unless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K _s	0.386	

Calibration Data									
Run Time	Metering Console				Calibration Meter				
Elapsed	DGM Orifice	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Outlet Temp	Outlet Temp
(t)	ΔH	Initial	Final	Initial	Final	Initial	Final	Initial	Final
(s)	(Pa)	(V _{std})	(V _{ref})	(t _{std})	(t _{ref})	(V _{std})	(V _{ref})	(t _{std})	(t _{ref})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	234.9529	235.0859	27	27	276.54575	276.67750	27	27
10.00	25.0	235.1718	235.3277	27	27	276.76357	276.91678	27	27
8.00	50.0	235.3676	235.5510	27	27	276.95578	277.13668	27	27
7.00	80.0	235.5744	235.7803	27	27	277.15828	277.36140	27	27
5.00	120.0	235.8320	236.0136	27	27	277.41235	277.59265	27	27

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{ref})	(Q _{ref})	(V _{std})	(Q _{std})	Value	Variation	Flowrate	ΔH @	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr	.0212 m ³ /min	(ΔH@)
							(ΔH@)	(ΔΔH@)
0.130	0.009	0.129	0.009	0.987	0.007	0.009	78.243	25.850
0.153	0.015	0.149	0.015	0.978	-0.002	0.015	49.567	-2.826
0.180	0.023	0.176	0.022	0.980	-0.001	0.022	45.729	-6.665
0.203	0.029	0.198	0.028	0.977	-0.003	0.028	44.689	-7.705
0.180	0.036	0.176	0.035	0.979	-0.001	0.035	43.739	-8.654
				0.980	Y Average		52.393	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_{ref}, 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

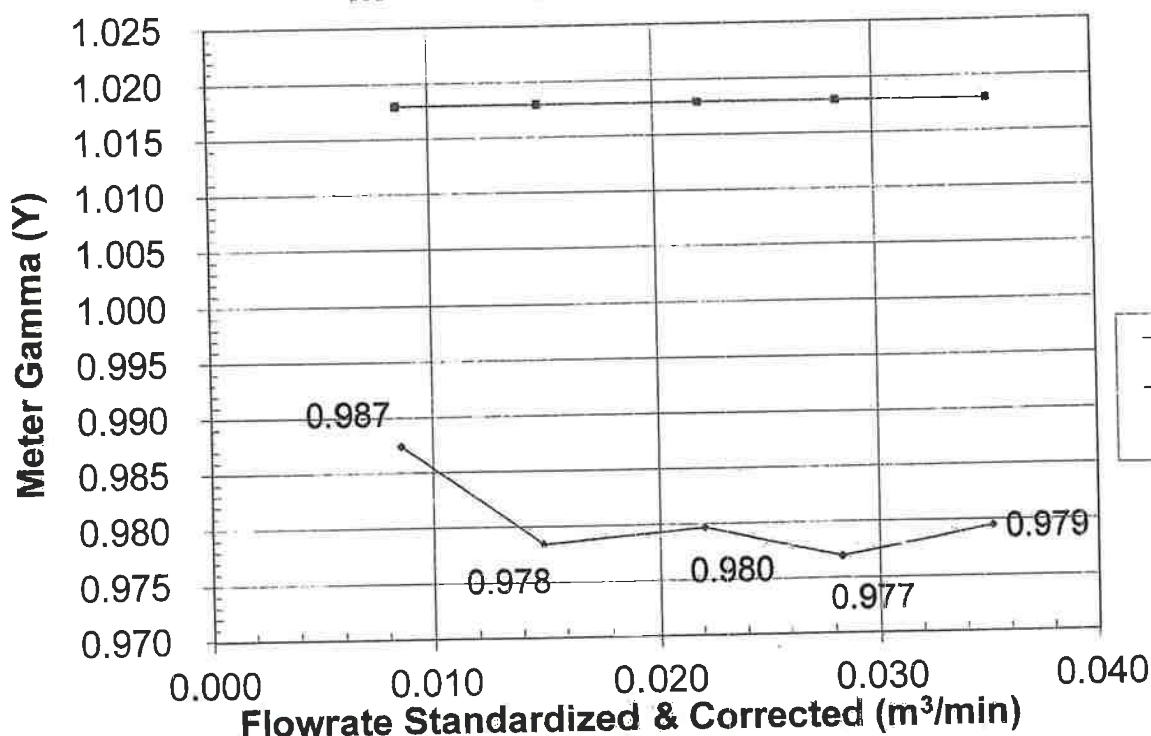
(Surachai Chaisana)
Service Engineer

บริษัท สกทิพอร์น จำกัด
SITHIPORN ASSOCIATES COMPANY

Date

5/4/2022

Meter Gamma vs Flowrate



SITHIPORN ASSOCIATES CO., LTD.
Environmental / Hygiene Products Division (EPD)
Web site : www.sithiporn.com E-mail: service-epd@sithiporn.com

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibrator Conditions	
Console Model Number	MC-572-V	Date	05-Apr-22
Console Serial Number	0504003	Calibration Reference No.	HC55AFPE0026
DGM Model Number	SK25EX	Barometric Pressure	761 mm Hg
DGM Serial Number	0005303	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005
Meter Box Serial Number	JC02484		

Results											
Console Thermocouple Simulator											
Meter Box Channel Temperature Reading (°C)											
Channel and test point		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack		-18	25	38	94	151	262	373	485	595	818
Probe		-18	25	38	94	151					1041
Filter		-18	25	38	94	151					
Aux		-18	25	38	94	151					
Exit		-18	25	38							

Stack
Probe
Filter

Tolerance Range

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

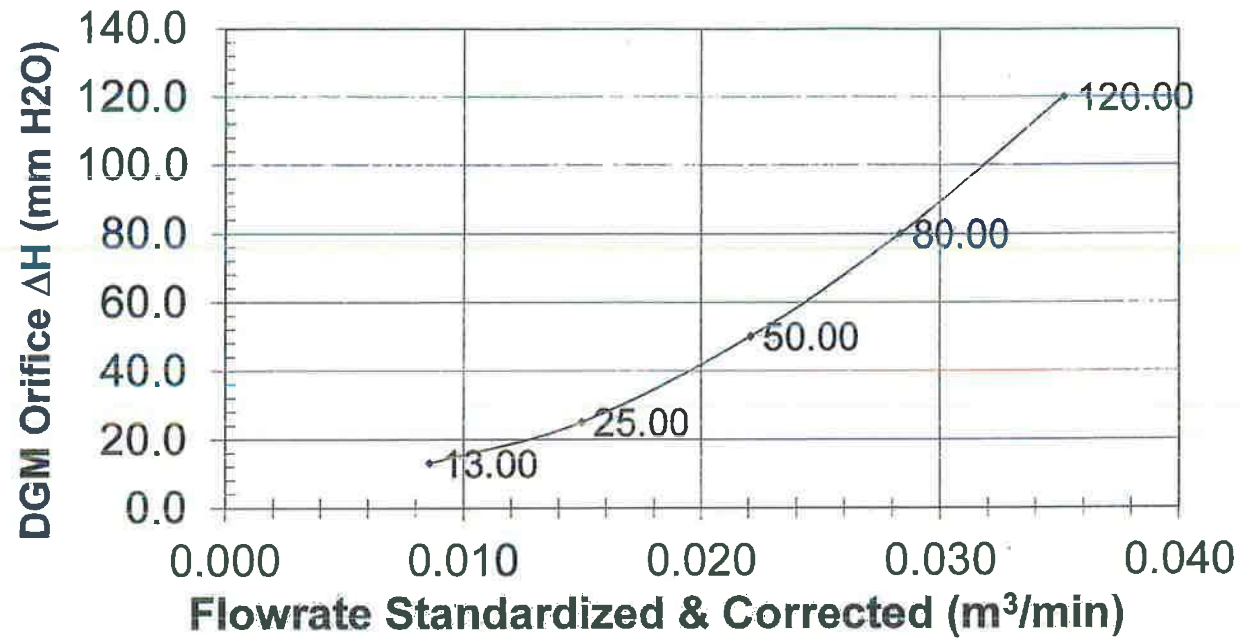
Meter
Exit

± 3.0 °C
± 2.0 °C

Signature

บริษัท สหชีพพรแอสซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Meter Pressure vs Flowrate



Console Serial: 0504003

บริษัท สหชีพพรแอสซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model: MC-572-V

Flue gas Analyzer
Testo 350XL
Serial No. 01859560



Calibration Certificate

ENTECH
Difference For Greater Value

Certificate No: G 640712
Date of issue : 29-Oct-21

Instrument description : Flue gas Analyzer
Instrument model : Testo 350XL
Instrument serial no. : 01859560
ID no. or control no. :
Manufacturer : testo SE
Probe description :
Probe model :
Probe serial :
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages
Receiving no. : L-213012
Receiving date. : 28-Oct-21
Parameter of calibration : Gas Calibration (Oxygen 2.501, 10.00, 21.00 %vol, Carbon Monoxide 80.97, 309.9, 1003 ppm, Nitrogen Dioxide 80.62 ppm, Sulphur Dioxide 100.9 ppm, Nitric Oxide 150.9 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongvan 47 Yaek 48, Toongsonghong, Laksoi, Bangkok 10210

Calibration procedure no. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measured multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal not valid.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 25-Oct-21



ENTECH
Difference For Greater Value

Calibration Certificate

Certificate No.: G 640712

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen (O ₂) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O ₂) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide (CO) 80.97 ppm	2842/21	Linde	24-Jun-23
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2829/21	Linde	23-Apr-23
Nitrogen Dioxide (NO ₂) 80.62 ppm	3240/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.9 ppm	4942/20	Linde	20-Nov-22
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23

Measured room conditions

Temperature : 23.6 °C Humidity : 57.8 %RH Pressure : 1014.1 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1023.6 mbar

Calibration Results (without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501	2.45	-0.051	0.20
O ₂ (%Vol)	10.00	9.86	-0.14	0.40
O ₂ (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	82	1.03	2.8
CO (ppm)	309.9	314	4.1	11
CO (ppm)	1003	1017	14	34
*NO ₂ (ppm)	80.62	80.2	-0.42	5.0
*SO ₂ (ppm)	100.9	102	1.1	5.0
*NO (ppm)	150.9	149	-1.9	5.0

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm.

* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report



Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC** setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# g ^{Ref}
104	103.5	103.5	104.46	104.45	####	104.07	104.46	104.42	104.34	104.07	104.30	0.53	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.12	0.80	1.13

Notes

UUC* = Unit Under Calibration

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhaphan 8 Rd., Nongkham,
Sriacha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Serial No. : GS11.0182

Date of Receipt : 03 February 2022

Model : UFE 500

ID No. : LABE T7/4

Date of Calibration : 03 February 2022

Condition of Calibration

1.1 Ambient temperature	± Maximum	27.5 °C	± Minimum	26.4 °C
1.2 Relative humidity	± Maximum	59.5 %	± Minimum	50.8 %
1.3 Line voltage supplied	± Maximum	225.1 VAC	± Minimum	223.2 VAC

Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P1100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	21-041213	08 May 2022

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by : Mr. Pattarakorn Panklong

Approved by : Scientist

Issue date : 11 February 2022

The uncertainties are for a confidence probability of approximately 65%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

REPORT OF CALIBRATION

Certificate No. : 22-011756

Sample Code : 22-04498-003

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
 $W = 56 \text{ cm}$; $D = 40 \text{ cm}$; $H = 48 \text{ cm}$
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes " Stability of chamber and loading effect in chamber at 20% of uniformity ".
6. 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.

7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of this enclosure.
10. Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

- End of Report -

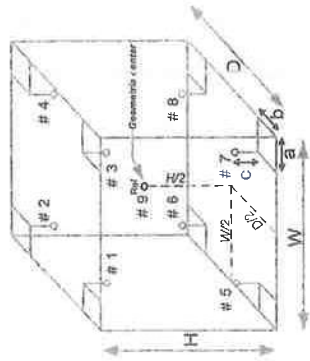


Figure: Example of sensor installation Positions

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-152/21
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643CD
ID No. LABE 03/2
Date of receipt 24 May 2021
Date of calibration 24 May 2021
Date of issue 1 June 2021
Customer name Eastern Thai Consulting 1992 Co., Ltd.
Address 683 Moo 11, Sukkaphibam 8 Rd., Nongkham, Sitracha, Chonburi 20230

Temperature (20.1-22.2) °C (On site)
Humidity (43.9-49.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department.

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 87839 and 87844
Photometric Accuracy is traceable to certificate No. 87846 and 87877
Stray Light is traceable to certificate No. 87825
The above certificate are traceable to SI unit through Stama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choothep

Approved by



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



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor 7 Rama4 Road
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Tel : 02-6324300 Fax : 02-6375496-7
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Certificate of Calibration

Certificate No. BSCC-UV-152/21 **Number of Page(s)** 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.70	-0.01	0.18
445.82	445.85	0.03	0.18
536.52	536.45	-0.07	0.18
741.02	741.05	0.03	0.18
879.41	879.35	-0.06	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7174	0.7178	0.0004	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6202	0.6214	0.0012	0.0075

*CNR = Customer not request

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



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Bara Scientific
(INCORPORATED)

Certificate of Calibration

Certificate No. BSCE-UW-152/21 Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000 0.5631 0.7390 1.0863	0.0000 0.5615 0.7376 1.0846	0.0000 -0.0016 -0.0014 -0.0017	0.0042 0.0042 0.0042 0.0042
440.0	0.0000 0.5524 0.7217 1.0506	0.0000 0.5501 0.7199 1.0587	0.0000 -0.0023 -0.0018 -0.0019	0.0042 0.0042 0.0042 0.0042
465.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
546.1	0.0000 0.5147 0.6743 0.9909	0.0000 0.5124 0.6720 0.9882	0.0000 -0.0023 -0.0023 -0.0027	0.0042 0.0042 0.0042 0.0042
590.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
635.0	0.0000 0.5268 0.6720 0.9854	0.0000 0.5271 0.6708 0.9854	0.0000 0.0003 -0.0012 -0.0010	0.0042 0.0042 0.0042 0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.86±0.1nm	201.05	2.0123

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

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

End of Certificate

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

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Laksale Rd., Bangna Tai Sub-District
Bangna District, Bangkok - 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 663 Moo 11, Sukhaphiban 8 Rd., Mong Kham
City: Sriracha
Zip / Postal: 20230
State / Province: Chonburi
Contact: Sasiporn Nakin
Order Number: 40332194644

Weighing Device

Manufacturer: Mettler Toledo
Model: XS205DU
Serial No.: 1126323724
Building: Laboratory
Floor: 1
Room: Laboratory
Instrument Type: Weighing Instrument
Asset Number: LABE 05/1
Terminal Model: SAT
Terminal Serial No.: 1126323724
Terminal Asset No.: N/A

Range	Max. Capacity	Readability (g)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (1/2015)
CPIW03220

METTLER TOLEDO Work Instruction:

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (1/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 26.9 °C	End: 26.8 °C	Start: 73.8 %	End: 71.9 %

As Found Calibration Date: 22-Jul-2021
As Left Calibration Date: N/A
Issue Date: 23-Jul-2021

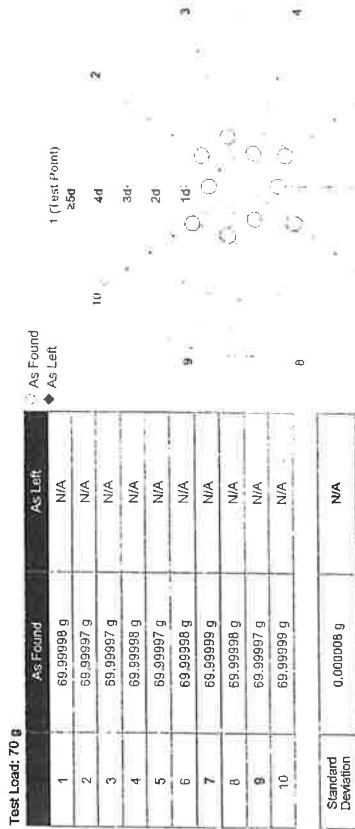
Calibrator: N/A

Approved Signatory:

☒ Kassakorn Tassanachaisakul
☐ Santi Jinnyorn
☐ Surachet Sukkale

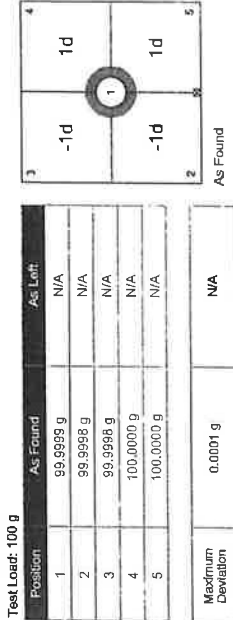
Measurement Results

Repeatability



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

Eccentricity

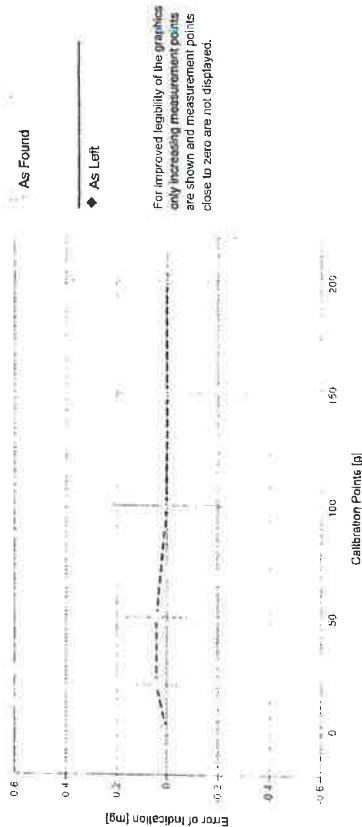


The "d" in the graph represents the readability of the range interval in which the test was performed.

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.019 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.046 mg	2
6	9.99999 g	10.00001 g	0.00002 g	0.061 mg	2
7	20.00001 g	20.00005 g	0.00004 g	0.082 mg	2
8 *	49.99993 g	49.99997 g	0.00004 g	0.12 mg	2
9	99.9999 g	99.9999 g	0.0000 g	0.21 mg	2
10	149.9998 g	149.9998 g	0.0000 g	0.32 mg	2
11	199.9998 g	199.9998 g	0.0000 g	0.37 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

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

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: WS28

Date of Issue: 17-Nov-2020

Certificate Number: 170241

Calibration Due Date: 15-May-2022

Thermo Hygrometer

Equipment No.: IN51

Date of Issue: 02-Mar-2021

Certificate Number: 21H403

Calibration Due Date: 23-Feb-2022

Software Version: 1.23.0.128

Report Version: 2.16.2
Form Number: F103C

METTLER TOLEDO

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Calibration Certificate ID

TH2046-059-072221-ACC-TH

METTLER TOLEDO Service

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

End of Accredited Section

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

Software Version: 1.23.0.128

Report Version: 2.16.2
Form Number: F103C

METTLER TOLEDO

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Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-4} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: $5 K$

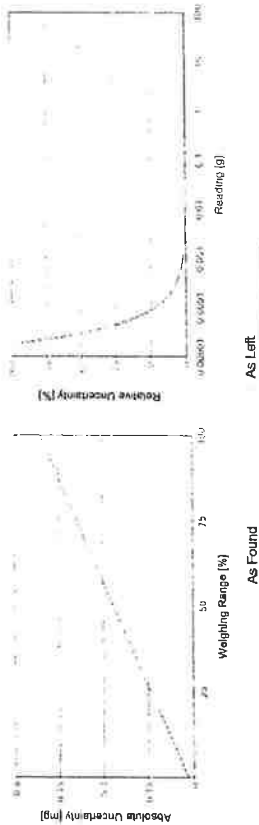
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00608 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00603 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found	As Left
0.00220 g	0.018 mg	N/A
0.02200 g	0.018 mg	N/A
0.22000 g	0.019 mg	N/A
2.20000 g	0.031 mg	N/A
220.0000 g	1.4 mg	N/A



The weighing range shown in the absolute uncertainty graph refers to the first interval range of the device.

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left



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

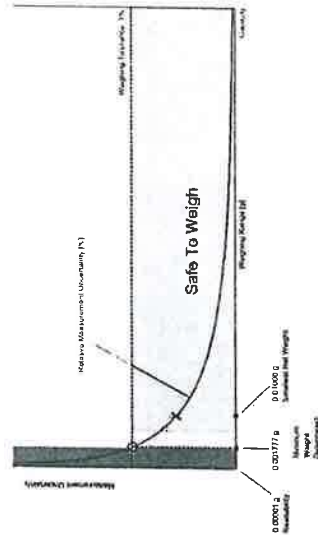
Process Requirements

Weighting Tolerance: 1 %

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



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

Minimum Weight

As Found Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.183140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045095 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

✓ The minimum weight table applies to the fine range of the weighing device.

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

As Left Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.183140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045095 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002667 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

✓ The minimum weight table applies to the fine range of the weighing device.

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

Repeatability			
As Found	As Left	As Found	As Left
✓	✓	✓	✓

✓ = Passed
✗ = Failed
A_s = Safety Factor not met.

Repeatability

Test Load: 70 g

Control Limit			
Tolerance	Control Limit	As Found	As Left
0.1%	0.000005 g	✗	✗
0.2%	0.000010 g	✓	✓
0.5%	0.000025 g	✓	✓
1%	0.000050 g	✓	✓
2%	0.000100 g	✓	✓
5%	0.000250 g	✓	✓

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

Eccentricity

Test Load: 100 g

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

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

As Found

METTLER TOLEDO Service

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.9999 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
149.9998 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
199.9998 g	0.0000 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.9999 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	2.5000 g
149.9998 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	3.7500 g
199.9998 g	0.0000 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓

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

Service Date:

2021-07-22

Document Number:

TH2046-542-072221-LABBalanceHR

EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha, Chonburi 20230

Sasiporn Nakin

METTLER TOLEDO

Balance Health Report

Device Details		System Details	
Manufacturer:	Mettler Toledo	Accessory 1:	
Model:	XS205DU	Accessory 2:	
Serial number:	1126323724	Weight set for routine testing:	Yes /
Firmware:	4.00 / 5.61		
History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	< 1 year
Instrument age:	> 10 years	Last instrument calibration:	< 1 year
Spare parts available:	Yes	Last minimum weight determination:	Never
Regulations:	ISO	Routine testing performed:	Yes
Process tolerance in %:	1%		
Smallest sample net weight:	0.01000 g		
Check List			
Environmental Conditions		General & Functional Checks	
Room temperature fluctuation	✓	Leveling	✓
Exposure to direct sun	✓	Cleanliness	✓
Vibrations	✓	Completeness - missing parts see additional remarks	✓
Draft	✓	Settings optimized for operating environment	✓
Dirt or dust	✓	Other - objections noted as additional remarks	✓
Static	✓	Electrical Component Checks	
Mechanical Component Checks		Power supply	✓
Draft shield	✓	Sliding door drive	✓
Weighting pan position	✓	Internal weight drive	✓
Housing	✓	Display	✓
Other - objections noted as additional remarks	✓	Other - objections noted as additional remarks	✓
Recommendations			
Measurements Result Quality		Process Efficiency	
Instrument calibration	Uninstall instrument		
Identify safe weighing range	Replace instrument		
GWP verification / risk assessment	Yes	Replace / add parts (see additional remarks)	
Preventive maintenance	Onsite repair		
Perform routine testing with test weights	Depot repair		
User training	Use of accessories (see additional remarks)		
Contact	Name: Sasiporn Nakin	Position:	Phone: 0860513303
			Email: de.ta@eur.mt.com
Additional Remarks & Recommendations			
Engineer Details			
Date:	22-Jul-2021		
Name:	Palpat Sweatpanuwat		
Signature:			

This is not a certificate.

It should not be used to interpret final results for the testing of these devices.

Legend: ✓ Good/Pass ⚠ Needs Attention ✗ Bad/Fail — Not Applicable

METTLER TOLEDO Service

846/4 - 56/65 Ladae Rd., Bangna 1st Sub-District, Bangna District, Bangkok 10260, +66 2723 0362

MT-TH.ServiceSupport@mt.com

www.mt.com

Report Version: 1.12, Software Version: 2.0.0, 1992 TH-TOLEDO

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD
214 Bangwack Rd. Bangpai Bangkok 10160
Tel: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2106-032-0001

Date Issued : 04-Jun-21

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhapharm 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 02-Jun-21

Date Calibrated : 04-Jun-21

Calibrated by : Mr. Somjet Onbua

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

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 Technical Manager, Miracle International Technology Company Limited.

Approved by :



Page 1 of 2

Certificate No : AD2106-032-0001

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty ± hPa
990.00	990.0	-	0.00	0.91
1000.00	1000.0	-	0.00	0.91
1010.00	1010.0	-	0.00	0.91
1020.00	1020.0	-	0.00	0.91
1030.00	1030.0	-	0.00	0.91

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium

Mounting Position

Reference Level

Air : Density = 1.19 kg/m³ @ 20°C, 1 bar

Vertical

at center of its dial

Description of UUC :

Range

955 - 1075 hPa Absolute

Calibration Range

990 - 1030 hPa Absolute

Scale Interval

1 hPa

Resolution

0.5 hPa Absolute

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P210029 for Digital Barometer Serial No. 290185, Due 19-Oct-21

End of Certificate

Page 2 of 2

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)Equipment : Temperature controlled enclosures (Hot air oven)
Manufacturer : Memmert
Serial No. : G511.0182
Date of Receipt : 03 February 2022
Condition of Calibration : 03 February 20221. Environment
1.1 Ambient temperature : Maximum 27.5 °C ; Minimum 26.4 °C
1.2 Relative humidity : Maximum 59.5 % ; Minimum 50.8 %
1.3 Line voltage supplied : Maximum 225.1 VAC ; Minimum 223.2 VAC2. Calibration method
2.1 Calibration method : UUCAS G-20: Guidelines for calibration and checks of temperature controlled enclosures.
3. Reference standard instrument : UUCAS G-20: Guidelines for calibration and checks of temperature controlled enclosures.Instrument : ID No. : Certificate No. : Due Date :
Data Acquisition With Sensor : LB-DA-11 (RTD-148 to RTD-227) : 21-041213 : 09 May 2022
(RTD-Pr100)4. This certificate is traceable to the international system of unit (SI Unit).
The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of calibration item : NormalCalibrated by : Mr. Pattarakorn Panklong : Approved by :
ScientistIssue date : 11 February 2022
The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,
Phialapha, Wang Thonglang, Bangkok 10310
TEL 02-516-2422
FAX 02-516-6949
Rev.01
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21

REPORT OF CALIBRATION

Certificate No. : 22-011766
Sample Code : 22-04498-003

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# 9 ^{ref}
104	103.5	103.5	104.46	104.45	####	104.07	104.46	104.42	104.34	104.07	104.30	0.53	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.12	0.80	1.13

Notes

- UUC* = Unit Under Calibration

361 Soi Ladprao 122, Ladprao Road,
Phialapha, Wang Thonglang, Bangkok 10310
TEL 02-516-2422
FAX 02-516-6949
Rev.09
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21

REPORT OF CALIBRATION

Results of Calibration

Notes

- Sensor installation locations
 - All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - The reference sensor is preferably located of the geometric center of the chamber.
- Interior dimensions approx of chamber :
 $W = 56 \text{ cm}$; $D = 40 \text{ cm}$; $H = 48 \text{ cm}$
- Air valve or fresh air level : Off
- Fan level : Open

5. The quoted uncertainty includes 'Stability of chamber and loading effect

in chamber at 20% of uniformity ".

6. 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.

7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.

9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.

10. Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

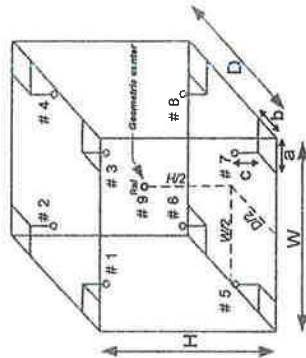


Figure: Example of sensor
installation Positions

COPY

Primary Flow Calibrator

Serial No. : 110619

Certificate of Calibration

Customer

Name Eastern Thai Consulting 1992 Co., Ltd

Address
= 683 Moo 11, Sukchapibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

Certificate No : 22-AFM-016 Rev.1

Request No : Req-2022-0122

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : BIOS
Sensor Serial Number : -

Model: Defender 510-L

Serial Number : 110619

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Humidity : 55 %RH \pm 20 %RHBarometric Pressure : 1013 hPa \pm 10 hPa

Received Date : 21 January 2022

Calibration Date : 27 January 2022

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	21 May 2022
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	20 May 2022

Traceability:

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of

Units (SI)

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

This Certificate was issued to replace to Calibration Certificate No. 22-AFM-016

Calibration By:

Approved By:

Mr. Pacit Mathavom

Calibration Engineer Supervisor

Issue Date : 11 February 2022

Result of Calibration :				
Flow Setting (cc/min)	STD Flow Reading (cc/min)	UUC Flow Reading (cc/min)	Correction Flow (cc/min)	Uncertainty (cc/min)
20	20.73	20.697	0.03	0.69
50	49.66	49.541	0.12	0.99
100	102.7	102.93	-0.2	1.9
250	249.0	248.45	0.5	4.8
500	502.0	500.51	1.4	7.9

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

Calibration Certificate ID
TH2046-059-072221-ACC-TH

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServicesSupport@mtl.com

METTLER TOLEDO



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 883 Moo 11, Subhaphibun 8 Rd., Nong Kham
City: Sriracha Contact: Sasiporn Nakin
Zip / Postal: 20230
State / Province: Chonburi
Order Number: 4033219464

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XS205DU Asset Number: LABE 05/1
Serial No.: 1126323724 Terminal Model: SAT
Building: Laboratory Terminal Serial No.: 1126323724
Floor: 1 Terminal Asset No.: N/A
Room: Laboratory

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guidelines:

METTLER TOLEDO Work Instruction:
EURAMET cg-18 v. 4.0 (11/2015)
CFI/W002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 26.9 °C	End: 26.9 °C	Start: 73.8 %	End: 71.9 %

As Found Calibration Date: 22-Jul-2021
As Left Calibration Date: N/A
Issue Date: 23-Jul-2021

Approved Signatory:

☒ Kssakorn Tassanachaisakul
☐ Santi Jitnyom
☐ Surachet Sukkate

Software Version: 1.23.0.129
Report Version: 2.16.2
Form Number: F100C

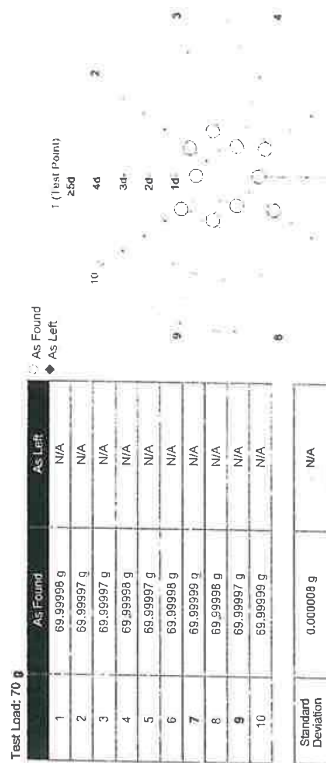
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This is an original document and may not be partially reproduced without the written permission of the issuing calibration laboratory.

Calibration Certificate ID
TH2046-459-072221-ACC-TH

METTLER TOLEDO Service

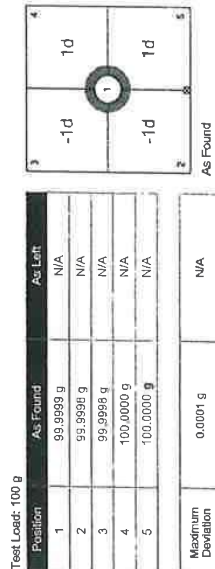
Measurement Results

Repeatability



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

Eccentricity



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

Software Version: 1.23.0.129
Report Version: 2.16.2
Form Number: F100C

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Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

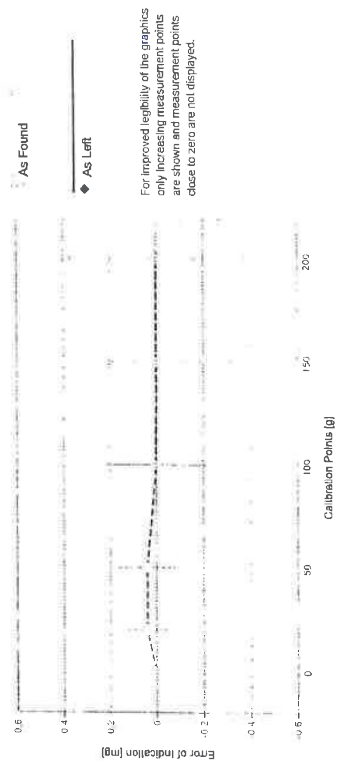
End of Accredited Section

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

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.019 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg	2
6	9.99998 g	10.00001 g	0.00002 g	0.061 mg	2
7	20.00001 g	20.00005 g	0.00004 g	0.082 mg	2
8*	49.99993 g	49.99997 g	0.00004 g	0.12 mg	2
9	99.9999 g	99.9999 g	0.0000 g	0.21 mg	2
10	149.9998 g	149.9998 g	0.0000 g	0.32 mg	2
11	199.9998 g	199.9998 g	0.0000 g	0.37 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET CG-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

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

Test Equipment

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

Weight Set 1: OIML E2			
Weight Set No.:	WS28	Date of Issue:	17-Nov-2020
Certificate Number:	170241	Calibration Due Date:	15-May-2022
Thermo Hygrometer			
Equipment No.:	IN51	Date of Issue:	02-Mar-2021
Certificate Number:	211403	Calibration Due Date:	23-Feb-2022

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / ^\circ\text{C}$
Temperature range on site for the evaluation of the measurement uncertainty in use: 5 K

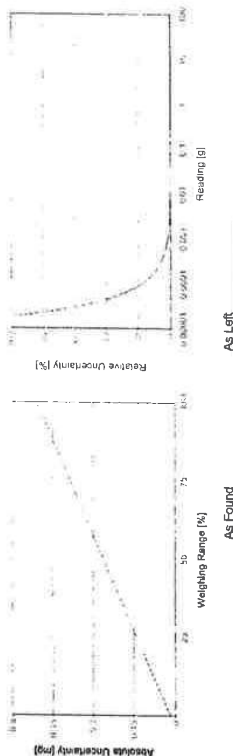
Linearization of Uncertainty Equation

d	Range		As Found	As Left
	Min	Max		
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00603 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.05 \text{ mg} + 0.00603 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found	As Left
0.00220 g	0.018 mg	0.82%
0.02200 g	0.018 mg	0.082%
0.22000 g	0.019 mg	0.0088%
2.20000 g	0.031 mg	0.0014%
220.0000 g	1.4 mg	0.0063%



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

As Found

As Left

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

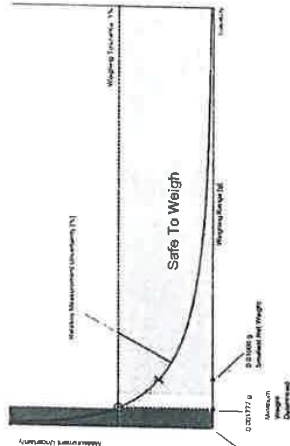
Process Requirements

Weighing Tolerance: 1 %

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



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

Minimum Weight As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors						
Tolerance	Safety Factor					
	1	2	3	5	10	
0.1%	0.017873 g	0.035955 g	0.054282 g	0.091605 g	0.189140 g	
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045805 g	0.091605 g	
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035955 g	
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g	
2%	0.000888 g	0.001777 g	0.002687 g	0.004448 g	0.008909 g	
5%	0.000355 g	0.000711 g	0.001069 g	0.001777 g	0.003557 g	

The minimum weight table applies to the fine range of the weighing device.

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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors						
Tolerance	Safety Factor					
	1	2	3	5	10	
0.1%	0.017873 g	0.035955 g	0.054282 g	0.091605 g	0.189140 g	
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045805 g	0.091605 g	
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035955 g	
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g	
2%	0.000889 g	0.001777 g	0.002687 g	0.004448 g	0.008909 g	
5%	0.000355 g	0.000711 g	0.001069 g	0.001777 g	0.003557 g	

The minimum weight table applies to the fine range of the weighing device.

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results Results Summary

		Repeatability	Eccentricity	Error of indication
✓ = Passed ✗ = Failed A = Safety Factor not met	As Found	✓	✓	✓
	As Left	✓	✓	✓

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found	Std. Deviation	Result	As Left	Std. Deviation	Result
0.1%	0.000005 g			✗			✗
0.2%	0.000010 g			✓			✓
0.5%	0.000025 g			✓			✓
1%	0.000050 g	0.000009 g		✓		0.000008 g	✓
2%	0.000100 g			✓			✓
5%	0.000250 g			✓			✓

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

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found	Deviation	Result	As Left	Deviation	Result
0.1%	0.0000 g			✓			✓
0.2%	0.0000 g			✓			✓
0.5%	0.0000 g			✓			✓
1%	0.0000 g	0.0001 g		✓		0.0001 g	✓
2%	0.0000 g			✓			✓
5%	0.0000 g			✓			✓

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

METTLER TOLEDO Service

Error of Indication

As Found

Control limits for various weighing tolerances						
Reference Value	Error	0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99989 g	0.00009 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99986 g	0.00009 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99986 g	0.00009 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

As Left

Control limits for various weighing tolerances						
Reference Value	Error	0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00004 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99993 g	0.00004 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
99.99989 g	0.00009 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99986 g	0.00009 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
199.99986 g	0.00009 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

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

Service Date: 2021-07-22
Document Number: TH2046-542-072221-LABBalanceHR
EASTERN THAI CONSULTING 1992 CO., LTD.
883 Moo 11, Sukhaphiban 6 Rd., Nong Kham, Sriracha, Chonburi 20230
Suepporn Nakin

METTLER TOLEDO

Balance Health Report

System Details	
Manufacturer:	Mettler Toledo
Model:	XS205DU
Serial number:	1126323724
Firmware:	4.00.15.61
Weight set for routine testing: Yes /	
History	
Device History	
Instrument in use:	Yes
Instrument age:	> 10 years
Spare parts available:	Yes
Regulations:	ISO
Process tolerance in %:	1%
Smallest sample net weight:	0.01000 g
Service History	
Last preventive maintenance:	< 1 year
Last instrument calibration:	< 1 year
Last minimum weight determination:	Never
Routine testing performed:	Yes
Check List	
Environmental Conditions	
Room temperature fluctuation	✓
Exposure to direct sun	✓
Vibrations	✓
Draft	✓
Static	✓
Mechanical Component Checks	
Draft shield	✓
Weighing pan position	✓
Housing	✓
Other - objections noted as additional remarks	—
General & Functional Checks	
Leveling	✓
Cleanliness	✓
Compliance - missing parts see additional remarks	✓
Settings optimized for operating environment	✓
Other - objections noted as additional remarks	—
Electrical Component Checks	
Power supply	✓
Sliding door drive	✓
Internal weight drive	✓
Display	✓
Other - objections noted as additional remarks	—
Recommendations	
Maintenance / Repair Quality	
Instrument calibration	Uninstall instrument
Identify safe weighing range	Replace instrument
GMP verification / risk assessment	Yes
Preventive maintenance	Replace / add parts (see additional remarks)
Perform routine testing with test weights	Onsite repair
User training	Depot repair
Use of accessories (see additional remarks)	
Contact	Name: Suepporn Nakin Position: Phone: 0924513303 Email: de.ue@eur.1992.com
Additional Remarks & Recommendations	
Engineer Details	
Date:	22-Jul-2021
Name:	Palipat Suanpanuwat
Signature:	

This is not a certificate.

It should not be used to interpret final results for the testing of these devices.

Legend: ✓ Good/Pass ▲ Needs Attention ✗ Bad/Fail — Not Applicable

848/1, 446/1 Lashin Rd., Bangkok 10160, +66 2721 0882
MT-TH-Service@acc-th.com
www.mt.com

METTLER TOLEDO Service
Report Version: 1.13, Service Version: 1.13, Page 4 of 4

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD
214 Bangwaek Rd. Bangpai Bangkok 10160
Tel: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2106-032-0001

Date Issued : 04-Jun-21

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhaphibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 02-Jun-21

Date Calibrated : 04-Jun-21

Calibrated by : Mr. Somjet Onbua

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1; Edition 3 2014.

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 Technical Manager, Miracle International Technology Company Limited.

Approved by :



Page of 2

Certificate No. : AD2106-032-0001

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

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty \pm hPa
990.00	990.0	-	0.00	0.91
1000.00	1000.0	-	0.00	0.91
1010.00	1010.0	-	0.00	0.91
1020.00	1020.0	-	0.00	0.91
1030.00	1030.0	-	0.00	0.91

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium : Air : Density = 1.19 kg/m^3 @ 20°C , 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial

Description of UUC :

Range : 955 - 1075 hPa Absolute
Calibration Range : 990 - 1030 hPa Absolute
Scale Interval : 1 hPa
Resolution : 0.5 hPa Absolute

Measurement Standards Used & Traceability :

The International System of Units (SI) through
IRPC Certificate No. CL1-P210029 for Digital Barometer Serial No. 290185, Due 19-Oct-21

End of Certificate

Page 2 of 2

COPY

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



CERTIFICATE OF CALIBRATION

NSC-TSI-TIS17025
CALIBRATION 0152

Page 1 of 3

Certificate No. : 22-011766

Sample Code : 22-04498-003

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhaphiban 8 Rd., Nongkham,
Sriacha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)
Manufacturer : Memmert
Serial No. : G511.0182
Date of Receipt : 03 February 2022
Model : UFE 500
ID No. : LABE T7/4
Date of Calibration : 03 February 2022

Condition of Calibration

1. Environment
 - 1.1 Ambient temperature : Maximum 27.5 °C ; Minimum 26.4 °C
 - 1.2 Relative humidity : Maximum 59.5 % ; Minimum 50.8 %
 - 1.3 Line voltage supplied : Maximum 225.1 VAC ; Minimum 223.2 VAC

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-PT100)	LB-DA-11 (RTD-148 to RTD-155; RTD-227)	21-041213	09 May 2022

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

Condition of calibration item : Normal

Calibrated by

M

Approved by

Issue date

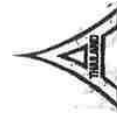
The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,
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PM-CL-114
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CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21

361 Soi Ladprao 122, Ladprao Road,
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FAX 02-516-5949
Rev.09
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21

NSC-TSI-TIS17025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-011766

Sample Code : 22-04498-003

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor <i>k</i>
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8		
104	103.5	103.5	104.46	104.45	#####	104.07	104.46	104.34	104.07	104.30	0.53	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.12	0.80	1.13

Notes

- UUC* = Unit Under Calibration

REPORT OF CALIBRATION

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. 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.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

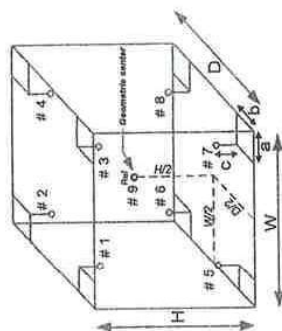


Figure: Example of sensor
installation positions

ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320



Tisch Environmental, Inc.
145 South Miami Ave
Village of Cleves, OH
45002
513.467.9000
877.263.7510 Toll Free
513.467.9009 Fax

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2016 Rootsmeter S/N 0438320 Ta (K) - 295
Operator Tisch Orifice I.D. - 0136 Pa (mm) - 742.95

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORIFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3400	3.2	2.00
2	NA	NA	1.00	0.9510	6.3	4.00
3	NA	NA	1.00	0.8510	7.8	5.00
4	NA	NA	1.00	0.8130	8.6	5.50
5	NA	NA	1.00	0.6690	12.6	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
Qstd slope (m) =	1.96262		Qa slope (m) =	1.22896	
intercept (b) =	-0.03249		intercept (b) =	-0.02060	
coefficient (r) =	0.99993		coefficient (r) =	0.99993	
y axis = SQRT[H2O(Pa/760) (298/Ta)]					
y axis = SQRT[H2O(Ta/Pa)]					

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760) (298/Ta))] - b}
Qa = 1/m{[SQRT H2O(Ta/Pa)] - b}

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



ASIA MEDICAL AND AGRICULTURAL LABORATORY
AND RESEARCH CENTER CO., LTD.

361/36171-4 Soi Ladprao 122, (Mahachulalongkornrajavidyalaya)
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http://www.amarc.co.th Email: cl@amarc.co.th



NSC-TISI-TIS 17025
CALIBRATION 0152

Certificate No. : 21-062722
Sample code : 21-24788-002

Page 1 of 2

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD
683 Moo 11, Sukhaphiban 8 Rd. Nongkham,
Sriracha, Chonburi 20230
Location of calibration : Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.
(Calibration laboratory)

Equipment : Digital thermo-hygrometer
Manufacturer : Testo
Serial No. : 45106737
Date of receipt : 23 July 2021
Model : 608-H1
ID No. : LABE 09/7
Date of calibration : 29 July 2021

Condition of calibration

1 Environment Ambient temperature : 23.0 °C ± 3.0 °C
Relative humidity : 55.0 % ± 15.0 %

2 Calibration method

2.1 In-house method : WI-CL-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.
2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in controlled chamber in a chamber at the controlled temperature / relative humidity.

3 Reference standard instrument

Instrument	Model	Code No.	Certificate No.	Due date
3.1 Chilled Mirror	Optidew Vision	LB-DP-02 & LB-DP-02 (DP)	TH-0016-21	10 March 2022
3.2 Digital Thermometer	Optidew Vision	LB-DP-02 & LB-DP-02 (Temp.)	21-032217	05 April 2022
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	20-085967	17 September 2021

4 This certificate is traceable to the international system of unit (SI Unit)

4.1 Instrument No.3.1 through : National Institute of Metrology (Thailand)

4.2 Instrument No.3.2 and 3.3 through : Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.

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

6 Condition of calibration item : Normal

Calibrated by

Approved by (Mr)

Date of issue

The uncertainties are for a confidence probability of approximately 95%
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Co., Ltd. (AMARC)

FM-CL-314

Rev.00

Effective Date: 04/05/21



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NSC-TISI-TIS 17025
CALIBRATION 0152

Certificate No. : 21-062722
Sample code : 21-24788-002

Page 2 of 2

REPORT OF CALIBRATION

Results of calibration

Temperature measurement

Resolution of unit under calibration : 0.1 °C
Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.02	20.1	- 0.08	± 0.40
25	50	25.02	25.0	+ 0.02	± 0.40
30	50	30.00	29.7	+ 0.30	± 0.40

Humidity measurement

Resolution of unit under calibration : 0.1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	52.4	- 7.27	± 1.3
60	25.00	60.03	67.5	- 7.47	± 1.5
75	25.00	75.20	82.5	- 7.30	± 1.7

Note

- Calibration results without adjustment

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2.00, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

End of report

COPY

Effective Date: 04/05/21

Rev.08

FM-CL-018

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15ACX9C Reference Number: 82-401135335-1
Cylinder Number: EB0062815 Cylinder Volume: 144.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52018 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of the calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable 03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable 03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable 03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable 03/06/2018
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty Expiration Date
NTRM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8% Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0% Jun 02, 2017
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.5% Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8% Jun 07, 2022
NTRM	12060735	CC356192	2488 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6% Dec 14, 2026
The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration		
Nicolet 6700 APW1100391 CO	FTIR	Feb 08, 2018		
Nicolet 6700 APW1100391 NO	FTIR	Feb 15, 2018		
Nicolet 6700 APW1100391 NO2	FTIR	Feb 16, 2018		
Nicolet 6700 APW1100391 SO2	FTIR	Mar 01, 2018		

Triad Data Available Upon Request

NOTES-NET WEIGHT: 10.43lbs

GROSS WEIGHT: 60.93lbs

PC# 5218000763

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All calibration standards are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05