

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

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.

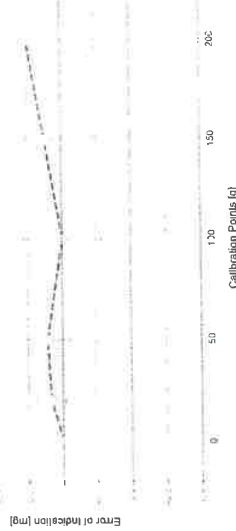
Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.021 mg	2
2	0.10000 g	0.10002 g	0.00002 g	0.023 mg	2
3	0.10000 g	0.10002 g	0.00002 g	0.026 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.035 mg	2
5	4.99999 g	4.99999 g	0.00000 g	0.050 mg	2
6	10.00002 g	10.00005 g	0.00003 g	0.063 mg	2
7	19.99954 g	20.00001 g	0.00007 g	0.085 mg	2
8	49.99997 g	50.00008 g	0.00009 g	0.13 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.23 mg	2
10	149.99999 g	150.00000 g	0.00001 g	0.35 mg	2
11	200.00000 g	200.00002 g	0.00002 g	0.42 mg	2

As Found

As Left

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



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor $k = 2$ - 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	WS32	Date of Issue:	15-Sep-2020
Weight Set No.:	169521	Calibration Due Date:	13-Mar-2022
Certificate Number:			
Thermo Buro Hygrometer	IN74	Date of Issue:	09-Jul-2021
Equipment No.:	21H1470	Calibration Due Date:	28-Jun-2022
Certificate Number:			

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	$U_1 = 0.022 \text{ mg} + 0.00763 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.05 \text{ mg} + 0.00752 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of this 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	0.022 mg	N/A
0.02200 g	0.022 mg	0.10%
0.22000 g	0.024 mg	0.011%
2.20000 g	0.039 mg	0.0018%
220.0000 g	1.7 mg	0.00079%



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.

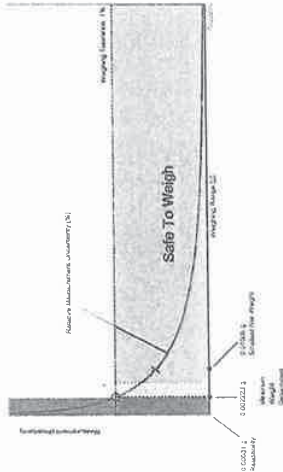
The weighing device meets the given process requirements.

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

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.022382 g	0.045110 g	0.068193 g	0.115457 g	0.240445 g
0.2%	0.011148 g	0.022382 g	0.033702 g	0.056607 g	0.115157 g
0.5%	0.004449 g	0.008912 g	0.013368 g	0.022382 g	0.045110 g
1%	0.002223 g	0.004449 g	0.006679 g	0.011148 g	0.022382 g
2%	0.001111 g	0.002223 g	0.003335 g	0.005563 g	0.011148 g
5%	0.000444 g	0.000889 g	0.001333 g	0.002223 g	0.004449 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

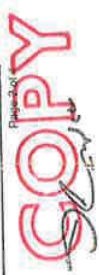
Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.022382 g	0.045110 g	0.068193 g	0.115457 g	0.240445 g
0.2%	0.011148 g	0.022382 g	0.033702 g	0.056607 g	0.115157 g
0.5%	0.004449 g	0.008912 g	0.013368 g	0.022382 g	0.045110 g
1%	0.002223 g	0.004449 g	0.006679 g	0.011148 g	0.022382 g
2%	0.001111 g	0.002223 g	0.003335 g	0.005563 g	0.011148 g
5%	0.000444 g	0.000889 g	0.001333 g	0.002223 g	0.004449 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 protective 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
✓	✓	✓	✓
Error of Indication			
✓	✓	✓	✓

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

Repeatability

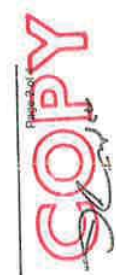
Tolerance			
Control Limit	Std. Deviation	Result	As Left
0.000005 g		✗	✗
0.000010 g		✓	✓
0.000025 g		✓	✓
0.000050 g	0.000010 g	✓	0.000010 g
0.000100 g		✓	✓
0.000250 g		✓	✓

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

Eccentricity

Tolerance			
Control Limit	Std. Deviation	Result	As Left
0.00005 g		✓	✓
0.00010 g		✓	✓
0.00025 g	0.00002 g	✓	0.00002 g
0.00050 g		✓	✓
0.00100 g		✓	✓
0.00250 g		✓	✓

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



METTLER TOLEDO Service

Attachment to Calibration Certificate:

T14004-018-020722-ACC-TH

GWP® Certificate

Error of Indication

As Found

Control limits for various weighing tolerances									
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%		
0.00000 g	0.00000 g	N/A	N/A	0.05000 g	0.10000 g	0.20000 g	0.50000 g	N/A	
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g		
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g		
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g		
149.99989 g	0.00001 g	0.07500 g	0.15000 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g		
200.00000 g	0.00002 g	0.10000 g	0.20000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g		
Result		✓	✓	✓	✓	✓	✓	✓	✓

As Left

Control limits for various weighing tolerances									
Reference Value	Error	0.1%	0.2%	0.4%	1%	2%	5%		
0.00000 g	0.00000 g	N/A	N/A	0.05000 g	0.10000 g	0.20000 g	0.50000 g	N/A	
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g		
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.2500 g	0.5000 g	1.25000 g		
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.2500 g	0.3750 g	0.7500 g	1.5000 g		
149.99989 g	0.00001 g	0.07500 g	0.15000 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g		
200.00000 g	0.00002 g	0.10000 g	0.20000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g		
Result		✓	✓	✓	✓	✓	✓	✓	✓

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

METTLER TOLEDO

Service Date: 2022-02-07
Document Number: T14004-029-020722-LABBalanceHR
EASTERN THAI CONSULTING 1992 CO., LTD.
883 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha, Chonburi 20230
Krua Sasiporn Nakin

Balance Health Report

Device Details			
Manufacturer:	Mettler Toledo		
Model:	XS205DU		
Serial number:	1128323724		
Primary:	4.0		
System Details			
Accessory 1:	Other		
Accessory 2:			
Weight set for routine testing:	No		
History			
Instrument in use:	Yes		
Last preventive maintenance:	< 1 year		
Instrument age:	3-10 years		
Spare parts available:	Yes		
Regulations:	ISO		
Process tolerance in %:	1 %		
Smallest sample net weight:	0.0100 g		
Service History			
Last preventive maintenance:	< 1 year		
Last instrument calibration:	< 1 year		
Last minimum weight determination:	Never		
Routine testing performed:	Don't know		
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	✓		
Heating	✓		
Electrical Component Checks			
Power supply	✓		
Starting door drive	✓		
Internal weight drive	✓		
Display	✓		
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	✓		
Recommendations			
Uninstall instrument			
Replace instrument			
Replace / add parts (see additional remarks)			
Onsite repair			
Depot repair			
Use of accessories (see additional remarks)			
Additional Remarks & Recommendations			
Contact Name:	Krua Sasiporn Nakin	Position:	Document Control
Phone:	086-051-3303	Email:	dc.la@mett.com
Engineer Details			
Date:	07-Feb-2022	Name:	Sasiporn Tabson
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



ANALYTICAL BALANCE

Model : SECURA224-1S

Serial No. : 0036707137



Certificate No. : 22-011768
Sample Code : 22-04498-005

Page 1 of 4

CERTIFICATE OF CALIBRATION

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

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 03 February 2022

Date of Calibration : 03 February 2022

Calibrated by : Mr. Thanadol Pholthep
Scientist

Issue date : 07 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).

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Phialapha, Wang Thonglang, Bangkok 10310
FM-CL-007

TEL 02-516-2422
FAX 02-516-6949
Rev.05

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-011768
Sample Code : 22-04498-005

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE
Manufacturer : SARTORIUS
Model : SECURA224-1S
Capacity : Max 220 g
Resolution : 0.0001 g
Serial No. : 0036707137
ID No. : LABE 05/2

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 220	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000022	200.000141
	Average reading of indicator	99.9998	199.9998
	Standard deviation	0.00009	0.00005
Unit : -	Range : -	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	-	-
<input type="checkbox"/> Adjustment	Standard weight	-	-
	Average reading of indicator	-	-
	Standard deviation	-	-

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FAX 02-516-6949
Rev.03

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WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-011768
Sample Code : 22-04498-005

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REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range :	Test Point	Sensitivity, S	Test Point	Sensitivity, S
220	0	0.7981	-	-
	100	0.9976	-	-
	200	0.9976	-	-

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100045	0.0100	0.0000	0.000094	2.01
0.1	0.1000102	0.1000	0.0000	0.000094	2.01
1	1.0000055	1.0000	0.0000	0.000095	2.01
2	2.0000144	1.9999	0.0001	0.000095	2.01
5	5.0000060	5.0000	0.0000	0.000096	2.01
10	10.000007	9.9999	0.0001	0.000097	2.01
20	20.000022	20.0000	0.0000	0.00010	2.01
50	50.000038	50.0000	0.0000	0.00012	2.01
100	100.000022	99.9999	0.0001	0.00016	2.00
200	200.000141	200.0000	0.0001	0.00027	2.00

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.



Certificate No. : 22-011768
Sample Code : 22-04498-005

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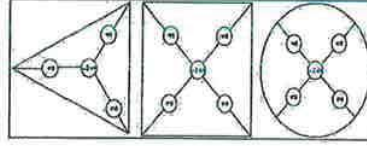
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

④ Circle	Test weight : 100
<input type="radio"/> Triangular	Unit : g
<input type="radio"/> Rectangular	
Range	220
Position	Reading of indicator
1	99.9999
2	100.0000
3	99.9999
4	99.9997
5	100.0000
6	99.9999
Max num difference	0.0002



Condition of Calibration

- Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- This certification is traceable to the International System of Unit maintained at :
- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).
- Reference standard instrument :

Ambient conditions	Min	Max
Temperature (°C)	24.9	26.7
Relative Humidity (%)	40.3	55.6
Air pressure (hPa)	1009.3	1010.7

Instrument

Class ID No.

Certificate No.

Due Date

1) STANDARD WEIGHT 1 mg to 1 kg

E2 LB-WF-57

21-055461

29 June 2022

- End of Report -

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



CALIBRATION CERTIFICATE

Certificate No. : AD2205-163-0001
 Date Issued : 20-May-22

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

Equipment : Analog Barometer

Manufacturer : Barigo
Model : -
Serial No. : -
ID No./Tag No. : BN001/41
Date Received : 12-May-22
Date Calibrated : 20-May-22

Calibrated by : Mr. Saruth Sritchutikul

Calibration Method or Calibration Procedure Used

In-house method : CP-2) 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 Miracle International Technology Company Limited.

Approved by: K. Nathong
 (Mr. Nathapong Krudaum)



Page 1 of 2

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Certificate No : AD2205-163-0001

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	990.0	0.00	0.59
1000.00	1000.0	1000.0	0.00	0.59
1010.00	1010.0	1010.0	0.00	0.59
1020.00	1020.0	1020.0	0.00	0.59
1030.00	1030.0	1030.0	0.00	0.59

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium Air : Density = 1.19 kg/m³ @ 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

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P210086 for Reference Pressure Monitor Serial No. 1598, Due 08-Nov-22

End of Certificate

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BOD INCUBATOR

ID No. : LABE 19/1



CERTIFICATE OF CALIBRATION

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

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

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : N/A Model : N/A

Serial No. : S540040277 ID No. : LABE 19/2

Date of Receipt : 24 January 2022 Date of Calibration : 24 January 2022

Condition of Calibration

1. Environment
 - 1.1 Ambient temperature : Maximum 30.4 °C : Minimum 30.0 °C
 - 1.2 Relative humidity : Maximum 51.2 % : Minimum 46.2 %
 - 1.3 Line voltage supplied : Maximum 225.3 VAC : Minimum 224.1 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-P100)	LB-DA-12 (RTD-158 to RTD-166)	21-038920	10 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 : Mr. Pattarakorn Panklong
Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 28 January 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).

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Rev. 01



REPORT OF CALIBRATION

Certificate No. : 22-007487
Sample Code : 22-02978-006

Results of Calibration

Resolution : 0.1 °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}
20	20.0	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	0.30	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.94	1.22

Notes

UUC* = Unit Under Calibration





REPORT OF CALIBRATION

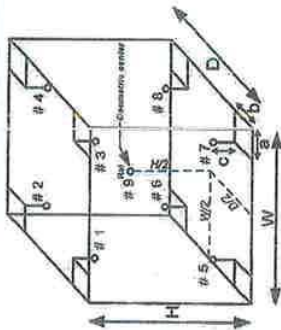
Certificate No. : 22-007487

Sample Code : 22-02978-006

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 = 60 cm ; D = 70 cm ; H = 124 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.

Figure: Example of sensor
Installation Positions

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 -

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BOD INCUBATOR

ID No. : LABE 19/2



CERTIFICATE OF CALIBRATION

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

Certificate No. : 22-007487
Sample Code : 22-02978-006

Page 1 of 3

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

Equipment : Temperature controlled enclosures (Incubator)
Manufacturer : N/A Model : N/A
Serial No. : S540040277 ID No. : LABE 19/2
Date of Receipt : 24 January 2022 Date of Calibration : 24 January 2022

Condition of Calibration

1. Environment
1.1 Ambient temperature : Maximum 30.4 °C ; Minimum 30.0 °C
1.2 Relative humidity : Maximum 51.2 % ; Minimum 46.2 %
1.3 Line voltage supplied : Maximum 225.3 VAC ; Minimum 224.1 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-P100)	LB-DA-12 (RTD-158 to RTD-166)	21-038920	10 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. Petrarakorn Penklong
Issue date : 28 January 2022
Scientist :
Approved by : (Mr. Somchai Neampunt)
Signed for Director

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



REPORT OF CALIBRATION

Certificate No. : 22-007487
Sample Code : 22-02978-006

Results of Calibration

Resolution : 0.1 °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}		
20	20.0	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	0.30	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.94	1.22

Notes

- UUC* = Unit Under Calibration

COPY



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 = 60 cm; D = 70 cm; H = 124 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 temperatures 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.

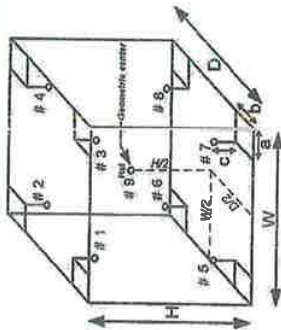


Figure: Example of sensor

Installation Positions

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 MD003.

- End of Report -

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030



Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-40224242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
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 8200R-12/201, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder is a total 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/mole 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
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002584	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162860Y	243.3 PPM PROPANE/AIR	+/- 0.5%
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



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Madison A. Stokes

Approved for Release

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

Part Number:	E04N09E15A5XC9C	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-12/331, 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 this 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.
volumes/volumes basis unless otherwise noted.

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
NTRM	16060907	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN
PRM	12367	APEX1089237	9.82 PPM NITROGEN DIOXIDE/AIR
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN
NTRM	12060735	CC356192	2486 PPM CARBON MONOXIDE/NITROGEN

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
Nicolet 6700 APWV100391 CO	FTIR
Nicolet 6700 APWV100391 NO	FTIR
Nicolet 6700 APWV100391 SO2	FTIR
Nicolet 6700 APWV100391 SO2	FTIR

Last Multipoint Calibration	
Feb 08, 2018	
Feb 15, 2018	
Feb 16, 2018	
Mar 01, 2018	

NOTES: NET WEIGHT: 10.43lbs
GROSS WEIGHT: 60.93lbs

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 EPA Method 8270-G and EPA Method 8210-G. The results are reported as follows:
ISO/IEC 17025 and to Alugas ISO 9001:2000 and relate only to items identified on this certificate.
The results are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty.
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TESTING CERT No. 3082.05

Approved for Release

Page 1 of 82-401135335-1

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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 (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 _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	249.36802	25	25

Standardized Data				Results			
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter	
(V _{avg})	(Q _{avg})	(V _{std})	(Q _{std})	Value	Variation	Flowrate	ΔH @
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr (Q _{avg})	(ΔH@)
						m ³ /min	mm H ₂ O
0.182	0.012	0.185	0.012	1.016	-0.001	0.012	38.004
0.166	0.017	0.169	0.017	1.018	0.001	0.017	38.741
0.187	0.023	0.190	0.024	1.018	0.001	0.024	39.516
0.206	0.029	0.209	0.030	1.017	0.000	0.030	40.276
0.181	0.036	0.184	0.037	1.015	-0.002	0.037	40.070
				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_{avg}, 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.

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Signature: *Sirichok Sansomsup*
(Sirichok Sansomsup)
Service Engineer

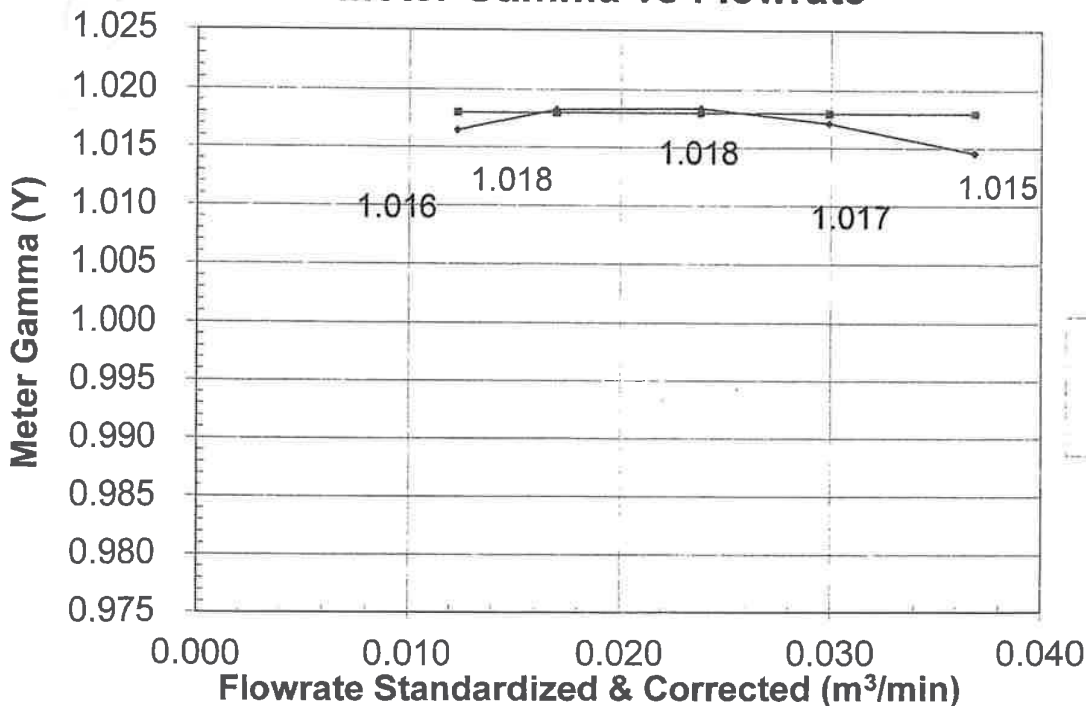
บริษัท สิกฟรอนไฮจีเอจ จำกัด

Date: 07/01/2022

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

Meter Gamma vs Flowrate



→ Gamma Y
■ Max Allow Y
■ Min Allow Y

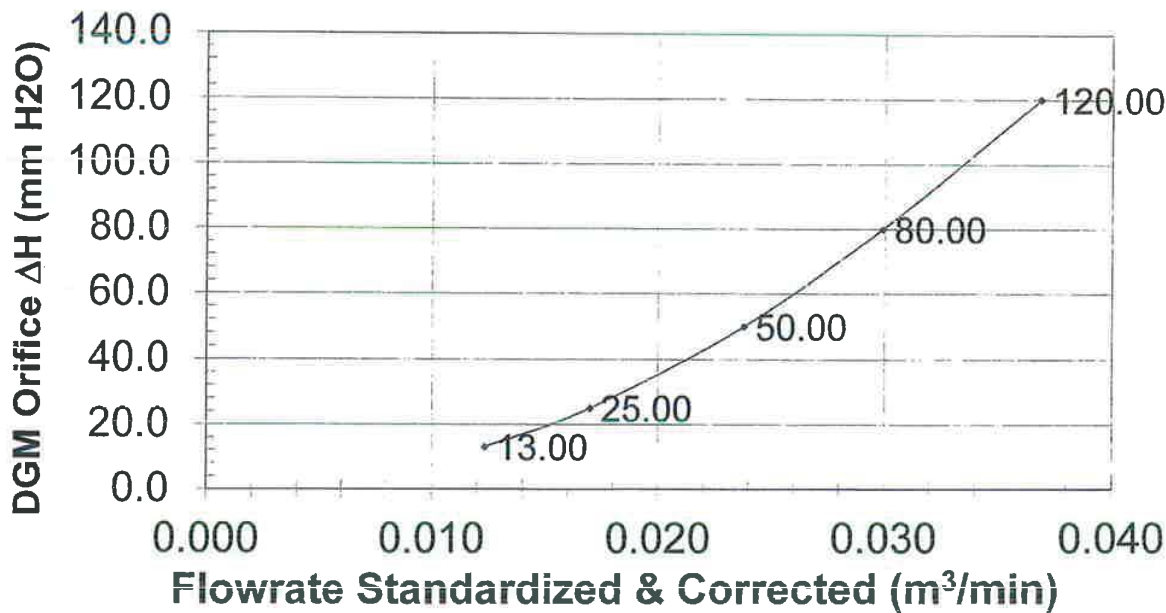
Console Serial: 0011024

บริษัท สิกฟรอนไฮจีเอจ จำกัด
Sikphon Associates Company Limited

Console Model: MC-572

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Meter Pressure vs Flowrate



Console Serial: 0011024

Console Model: MC572

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN
ASSOCIATES

SA Environmental / Hygiene Products Division (EPD)
Web site : www.sithiporn.com & Email: service-epd@sithiporn.com

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-572	Date	07-Jan-22
Console Serial Number	0011024	Calibration Reference No.	HC65APE0005
DGM Model Number	SK25EX	Barometric Pressure	759 mm Hg
DGM Serial Number	00005437	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)
Stack	-18.0 25.0 38.0 94 150 261 372 483 595 817 1040
Probe	-18 25 38 94 150
Filter	-18 25 38 94 150
Aux	-18 25 38 94 150
Exit	-18 25 38

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

Note: Temperature difference $\leq 1.5\%$

Signature _____
 (Sirichok Sansomsup)
 Service Engineer

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

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Sithiporn Associates Co., Ltd.
451-451/1 ถนนศรีนครินทร์ แขวงบางนาพรุ เขตบางนา กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510
451-451/1 Sirinthorn Road, Bangburu, 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

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

☒ Preventive Maintenance & Check

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.	HC65APE0026		
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	DGM Orifice	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Outlet Temp	Outlet Temp
(G)	ΔH	Initial	Final	Initial	Final	Initial	Final	Initial	Final
(min)	(mm H ₂ O)	(V _{in})	(V _{out})	(T _{in})	(T _{out})	(V _{in})	(V _{out})	(T _{in})	(T _{out})
		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	276.78357	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	236.0138	27	27	277.41235	277.59265	27	27

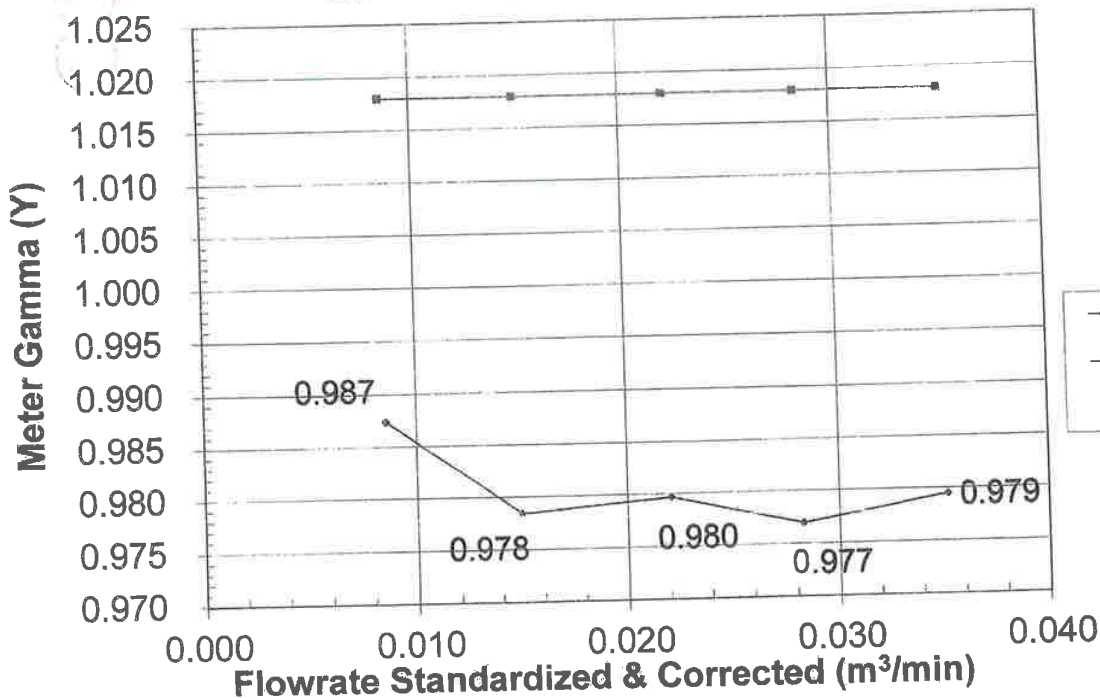
Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		ΔH @
(V _{actual})	(Q _{actual})	(V _{wet})	(Q _{wet})	Value	Variation	Std & Corr	.0212 m ³ /min	Variation
(m ³)	(m ³ /min)	(m ³)	(m ³ /min)	(Y)	(ΔY)	(Q _{corrected})	(ΔH@)	(ΔΔH@)
						m ³ /min	mm H ₂ O	
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_{avg}, orifice pressure differential that equates to 0.75scfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Signature _____
(Surachai Chaisana)
Service Engineer

Date 5/4/2022

Meter Gamma vs Flowrate



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

THERMOCOUPLES SYSTEM CALIBRATION

Sample System Equipment Information		Calibration Conditions	
Console Model Number	MC-572-V	Date	05-Apr-22
Console Serial Number	0504003	Calibration Reference No.	HC55APE0026
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	
Channel and test point	Meter Box Channel Temperature Reading (°C)
-18.0	38.0
-18.0	25.0
-18.0	93.0
-18.0	149.0
-18.0	260.0
-18.0	371.0
-18.0	482.0
-18.0	593.0
-18.0	816.0
-18.0	1038.0
Stack	38.0
Probe	25.0
Filter	93.0
Aux	149.0
Exit	260.0

Stack
Probe
Filter

Tolerance Range
± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Exit

+ 3.0 °C
± 2.0 °C

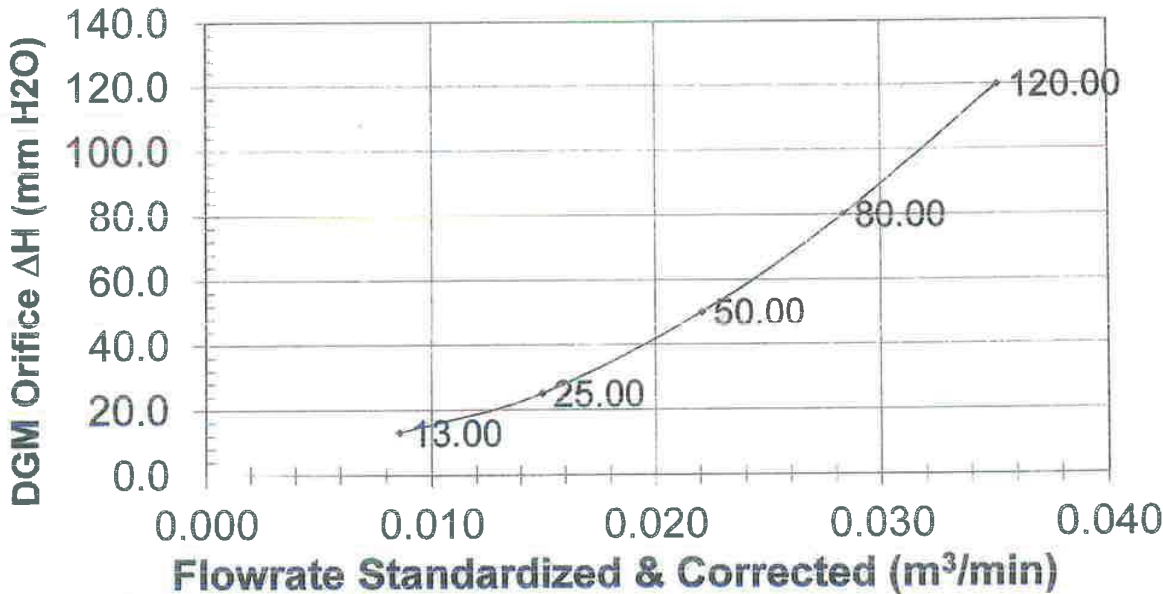
Signature
(Surachai Chaisana)
Service Engineer

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SITHIPORN ASSOCIATES COMPANY LIMITED

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Sithiporn Associates Co., Ltd.
451-451/1 ถนนสุขุมวิท แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2433-1679, 0-2434-9510
451-451/1 Srinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

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Meter Pressure vs Flowrate



Console Serial:

0504003

บริษัท สกิปอร์นแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

MC-572-V

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DRY GAS METER XC-572V

Serial No. : 1110070

Meter Console Information

Console Model #: XC-572V
 Console Serial #: 1110070
 DGM Model #: SK25EX
 DGM Serial #: 0005413

Calibration Conditions

Calibration Reference No.: WDS-SV850004
 Ambient Temp (°C): 26.4
 Barometric Pressure (mm Hg): 766
 Relative Humidity (%): 66

Factors/Conversions

Std Temp (°K): 298
 Std Press. (mm Hg): 760
 K₁: 0.392

Reference Equipment

WTM Model: W-NKDa-5B
 WTM Serial: S46321
 WTM Cal. Due: Mar-23
 Gamma: 1.0000
 WTM Thermometer: Internal

Run Time (minutes)	Orifice, ΔH (mm H ₂ O)	Volume (m³)		Outlet Temperature (°C)		Volume (m³)		Outlet Temp Initial (°C)	Outlet Temp Final (°C)
		Initial (V _{in})	Final (V _{out})	Initial (T _{in})	Final (T _{out})	Initial (V _{in})	Final (V _{out})		
15.00	13.0	397.7244	397.9056	25	25	289.58787	289.78942	25	25
10.00	25.0	397.9285	398.0884	25	26	289.79207	289.95964	25	25
8.00	50.0	398.1162	398.3058	26	26	289.97735	290.16549	25	25
7.00	80.0	398.3366	398.5469	26	26	290.19612	290.40517	25	25
5.00	120.0	398.6993	398.7513	26	27	290.42752	290.60906	25	25

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Calibration Factor		Flowrate	
(V _{test})	(Q _{test})	(V _{ref})	(Q _{ref})	Value (Y)	Variation (ΔY)	Std & Corr (Q _{corrected})	ΔH @ (mm H ₂ O)
m³	m³/min	m³	m³/min			m³/min	(ΔH ₉₀)
0.180	0.012	0.181	0.012	1.001	0.009	0.012	41.038
0.189	0.017	0.187	0.017	0.986	-0.006	0.017	41.198
0.189	0.024	0.187	0.023	0.991	-0.001	0.023	41.856
0.210	0.030	0.208	0.030	0.990	-0.002	0.030	41.881
0.182	0.036	0.180	0.036	0.991	-0.001	0.036	42.759
				0.992			41.768
							= 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 ±0.005.
 Note: For ΔH₉₀, 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 ±0.2inches (5.1mm) H₂O

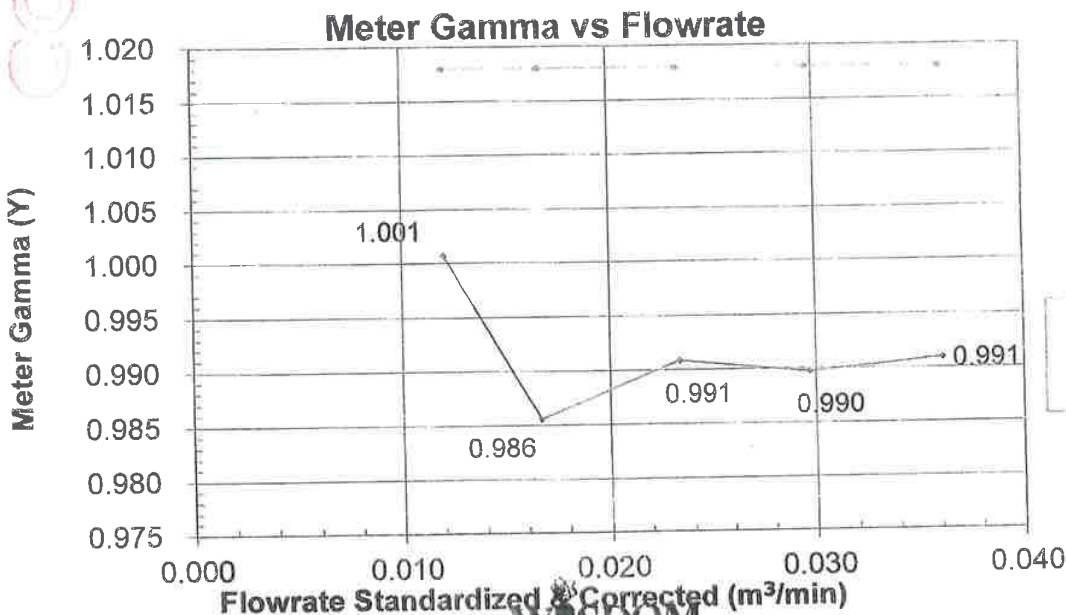
Pass/Fail Result: ☐ Pass

Signature: _____

(Palpasu Chaisana)
 Service Engineer

บริษัท วิสโดม ไนน์เทคโนโลยี จำกัด
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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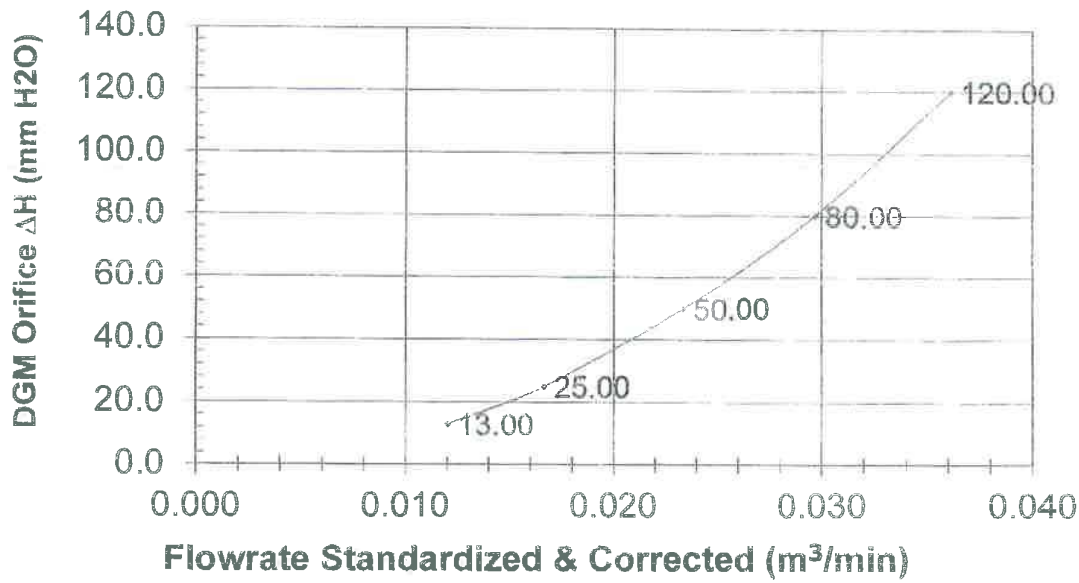
Console Serial: 1110070

Console Model: XC-572V

บริษัท วิสโดม ไนน์เทคโนโลยี จำกัด
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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Meter Pressure vs Flowrate



Console Serial: 1110070

**WISDOM
SCIENCE**

Console Model: XC-572V

บริษัท วิสโดม ซายน์แอนด์เซอร์วิส แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

COPY

WISDOM THERMOCOUPLES SYSTEM CALIBRATION

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572V	Calibration Reference No.	WDS-SV150004
Console Serial Number	1110070	Ambient Temp	25.4 °C
Meter Box Model Number	JENCO 765	Barometric Pressure	756 mm Hg
Meter Box Serial Number	JC02484	Relative Humidity	55 %
		Reference Thermometer	FLUKE 714
		Serial Number	9038005

Results	
Console Thermocouple Simulator	
Channel and test point	Temperature Reading (°C)
Stack	-18.0 25.0 38.0 93.0 149.0 280.0 371.0 482.0 593.0 816.0 1038.0
Probe	-18 24 37 92 150 261 373 485 596 821 1045
Filter	-18 24 37 92 150
Aux	-18 24 37 92 150
Exit	-18 24 37

Tolerance Range

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

Meter ± 3.0 °C
Exit ± 2.0 °C

Signature

(Patpasu Chaisana)
Service Engineer

**WISDOM
SCIENCE**

บริษัท วิสโดม ซายน์แอนด์เซอร์วิส แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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DRY GAS METER MC-572V

Serial No. : 1007055

W SDOM

บริษัท วิสโดม ไซนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m³)

Meter Console Information

Model #: MC-572V
Serial #: 1007055
DGM Model #: SK26EX
DGM Serial #: 00008432

Calibration Condition

Calibration Date: 27/07/2022
Calibration Ref.: WDS-SV850005
Ambient Temp (°C): 23.5
Pressure (mm Hg): 756
Relative Humidity (%): 60

Factors/Conversion

Std. Temp. (°K): 298
Std. Pressure (mm Hg): 760
K₁ (K/mm Hg): 0.3857

Reference Equipment


WTM Model: W-NKoDa-5B
WTM Serial: 548258
TM Cal. Due Date: Feb. 2022
Gamma: 0.9980

UUT Meter (DGM)						Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O) P _{avg}	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial V _{ini}	Final V _{fin}	Initial T _{ini}	Final T _{fin}	Initial V _{ref}	Final V _{ref}	Initial T _{ref}	Final T _{ref}
15.00	13.0	0.0025	0.1685	25	25	307.83244	307.99616	25	25
10.00	25.0	0.1910	0.3469	25	25	308.00127	308.15867	25	25
8.00	50.0	0.3711	0.5509	25	25	308.16244	308.34119	25	25
7.00	80.0	0.5844	0.7861	25	25	308.34877	308.55037	25	25
5.00	120.0	0.8310	1.0074	25	25	308.59261	308.77072	25	25

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H ₂ O)	
Std. Volume V _{std} (m ³)	Std. Flow Rate Q _{std} m ³ /min	Std. Volume V _{ref} (m ³)	Std. Flow Rate Q _{ref} m ³ /min	"Gamma" (Y)	Variation (ΔY)	Std & Corr Q _{std} m ³ /min	ΔH ₀	Variation ΔΔH ₀
0.163	0.011	0.160	0.011	0.983	-0.005	0.011	50.685	3.735
0.158	0.016	0.154	0.015	0.986	-0.002	0.015	46.980	0.030
0.177	0.022	0.174	0.022	0.987	-0.001	0.022	46.834	-0.098
0.199	0.028	0.197	0.028	0.990	0.001	0.028	45.366	-1.564
0.175	0.035	0.174	0.035	0.986	0.008	0.035	44.824	-2.108
				0.988	= Y Avg.		46.930	= ΔH@ Avg

Pass/Fail Result: **Pass**

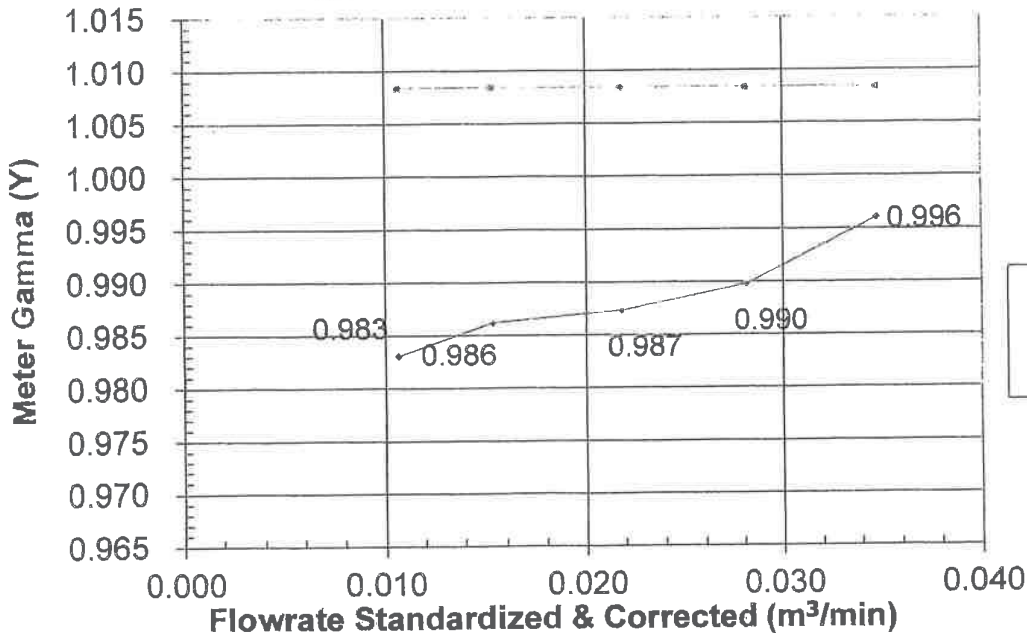
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02
Note: For ΔH₀, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O

Signature: 
(Patpasu Chalsana)
Service Engineer

บริษัท วิสโดม ไซนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 27/07/2022

Meter Gamma vs Flowrate



Console Serial: 1007055

Console Model: MC-572V

COPY

While these technical and legal hurdles are not for

Sampling System Equipment Information	
Console Model Number	MC-572V
Console Serial Number	1007055
Meter Box Model Number	DIGICON
Meter Box Serial Number	N/A

THERMOCOUPLES SYSTEM CALIBRATION

Calibration Conditions		
Date	Time	9:30 AM
Calibration Reference No.	WDS-SV650005	
Barometric Pressure	756	mm Hg
Reference Thermometer	FLUKE 714	
Serial Number	9038005	

Results

		Console Thermocouple Simulator										Results	
		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	1038.0	
	Stack	-18	25	38	93	150	261	373	486	596	821	1045	
	Probe	-18	25	38	92	150							
	Filter	-18	25	38	92	150							
	Aux	-18	25	38	92	150							
	Exit	-18	25	38									

ance Range

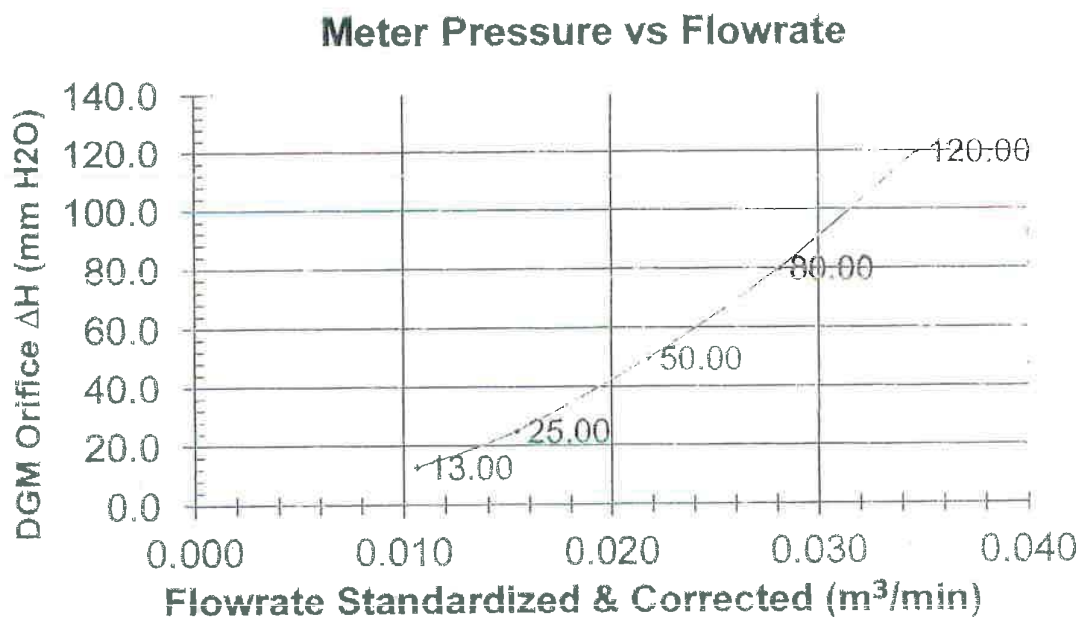
+ 1.50% °K
+ 3.0 °C
+ 3.0 °C

Meter
Exit

3.0 °C
±1

Signature _____

(Patpasu Chaisana)
Service Engineer



Console Serial:

1007055

Console Model:

MC-572

COPY
Shane

COPY

Flue gas Analyzer

Testo 350XL

Serial No. 01807527



ENTECH

Calibration Certificate

Where
Baan

REC-1218-115-002
CALIBRATION UNIT

Certificate No: G 650383
Date of issue : 15-Jun-22

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350XL
Instrument serial no. : 01807527
ID no. or control no. :
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapham 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 3 Pages
Receiving no. : L-222062
Receiving date : 09-Jun-22

Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.00, 21.00 %Vol, Carbon Monoxide 80.97, 309.9, 1003 ppm, Nitrogen Dioxide 10.19, 80.62, 202.2 ppm, Nitric Oxide 10.08, 150.9, 320.6 ppm, Sulphur Dioxide 50.04, 100.9, 601.1 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 Ngamwongwan 47 Yaek 48, Toongsonghong, Lakso, Bangkok 10210

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

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement 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 : 15-Jun-22

FM-CL-09-C Rev.8

Page 1 of 3

Issued Date 26/02/16

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Mrs. Nongluck Wongsettee

Technical Manager

Calibration Technician

Mr. Sediawut Nueathong

Entech Industrial Solution Co., Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48 Toongsonghong Lakso Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co



ENTECH

Calibration Certificate

Where
Baan

REC-1218-115-002
CALIBRATION UNIT

Certificate No: G 650383
Date of issue : 15-Jun-22

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
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) 10.19 ppm	3372/21	Linde	02-Aug-23
Nitrogen Dioxide (NO ₂) 80.62 ppm	3240/21	Linde	25-Jul-23
Nitrogen Dioxide (NO ₂) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide (NO) 10.08 ppm	3241/21	Linde	25-Jul-23
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 25.1 °C Humidity : 51.8 %RH Pressure : 1011.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,000 ml/min Gas pressure : 1021.9 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.498	2.53	0.032	0.20
O ₂ (%Vol)	10.00	10.01	0.01	0.40
O ₂ (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	83	2.03	2.8
CO (ppm)	309.9	323	13.1	11
CO (ppm)	1003	1050	47	34
NO ₂ (ppm)	10.19	9.2	-0.99	1.5
NO ₂ (ppm)	80.62	77.5	-3.12	5.0
NO ₂ (ppm)	202.2	194.6	-7.6	5.0
NO (ppm)	10.08	8	-2.08	6.0
NO (ppm)	150.9	148	-2.9	5.0
NO (ppm)	320.6	312	-8.6	10
SO ₂ (ppm)	50.04	46	-4.04	5.0
SO ₂ (ppm)	100.9	98	-2.9	5.0
SO ₂ (ppm)	601.1	598	-3.1	14

FM-CL-09-C Rev.8

Page 2 of 3

Issued Date 26/02/16

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Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48 Toongsonghong Lakso Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (\pm)
O ₂ (%Vol)	2.498	2.53	0.032	0.20
O ₂ (%Vol)	10.00	10.01	0.01	0.40
O ₂ (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	81	0.03	2.8
CO (ppm)	309.9	310	0.1	11
CO (ppm)	1003	1005	2	34
NO ₂ (ppm)	10.19	9.2	-0.99	1.5
NO ₂ (ppm)	80.62	77.5	-3.12	5.0
NO ₂ (ppm)	202.2	194.6	-7.6	5.0
NO (ppm)	10.08	8	-2.08	6.0
NO (ppm)	150.9	148	-2.9	5.0
NO (ppm)	320.6	312	-8.6	10
SO ₂ (ppm)	50.04	46	-4.04	5.0
SO ₂ (ppm)	100.9	98	-2.9	5.0
SO ₂ (ppm)	601.1	598	-3.1	14

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

End of Report

GAS CHROMATOGRAPH
MODEL : GC-2010 Plus AF
S/N : C12095200986

Operational Qualification Record

Operational Qualification

Operational Qualification

Operational Qualification

Operational Qualification

Operational Qualification Record

Operational Qualification Record

Operational Qualification		Operational Qualification Record	
No.	Item	Criteria	Results
6	Pressure program test	Verify that the pressure program operates normally	2. A 7.2 kPa
7	Flowrate test	Verify accuracy of the full-flow and septum purging.	2. A 7.2 kPa
8	Column oven test	Verify accuracy of the column oven temperature.	Septum purge 9.1 mL/min
9	Temperature program test	Verify that the column temperature program operates normally.	Split vent 7.4 mL/min
10	Sensitivity test	Verify the detector sensitivity.	Total 10.6 mL/min

Date: 25 / 08 / 2021

Date: 7/1/

Date: 25 / 08 / 2021

Date: 7/1/

Rev. 3.31

Rev. 3.31

Rev. 3.31

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Applicable
 ☐ Not Applicable

☒ Single
 ☐ Dual system, main injector

Component ID		Model Name		AOC-20i	
Serial No. (SN)		C 1 2 1 2 5 4 1 0 3 0 9			
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display: 000	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.			Pass
3	Firmware version check	Verify the program version		Version No. 3.4	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.			Pass

☒ Not Applicable
 ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (SN)					
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display: 000	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.			Pass
3	Firmware version check	Verify the program version		Version No. 3.4	Pass
4	Basic operation test	Verify that the auto injector basic operation is correct.			Pass

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable
 ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (SN)		C 1 2 1 3 5 4 0 5 4 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red	Pass
2	Firmware version check	Verify the program version		Version No. 3.5	Pass
3	Basic operation test	Verify that the auto injector basic operation is correct.			Pass

Performer (signature):

Date: 25 / 03 / 2021

Reviewer (signature):

Date: / /

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Performer (signature):

Date: 25 / 03 / 2021

Reviewer (signature):

Date: / /

GAS CHROMATOGRAPH

MODEL : GC-2010 Plus AF

S/N : C12095200986

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Applicable ☐ Not Applicable☒ Single ☐ Dual system, main injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 9 5 4 1 0 8 0 9			
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display: 000	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.	The version number matches the controlled version number.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		<input type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display: 000	<input type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	<input type="checkbox"/>	<input type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.	The version number matches the controlled version number.	<input type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 25 / 03 / 2022

Reviewer (signature):

Date: 25 / 03 / 2022

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria	Results	Pass	Fail
1	Initial operator test	Verify that the auto sampler basic operation is correct.	LED lights green, not red.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 25 / 03 / 2022

Reviewer (signature):

Date: 25 / 03 / 2022

Hot Air Oven

Model : UM 400

Serial No. : 900982



CERTIFICATE OF CALIBRATION

Page 1 of 3
Certificate No. : 22-025399
Sample Code : 22-09604-002

Customer

EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siracha, Chonburi 20230

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

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert Model : UM 400

Serial No. : 900982 ID No. : LABE 17/1

Date of Receipt : 11 March 2022 Date of Calibration : 11 March 2022

Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum	28.7 °C	: Minimum	27.4 °C
	1.2 Relative humidity	: Maximum	61.5 %	: Minimum	55.8 %
	1.3 Line voltage supplied	: Maximum	226.5 VAC	: Minimum	224.7 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-138 to RTD-146)	21-035792	18 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. Nathanan Phosri Approved by

(Mr. Somchai Neampunt)

Scientist

14 March 2022

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 recognised 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,
Phlabphla, Wang Thonglang, Bangkok 10310

TEL 02-516-2422
FAX 02-516-6949

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date, 15/07/21



REPORT OF CALIBRATION

Page 2 of 3
Certificate No. : 22-025399
Sample Code : 22-09604-002

Results of Calibration

Resolution : 0.1 °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 ^{Rev}
85	85.0	85.0	85.05	84.99	84.66	84.71	84.85	84.92	84.96	84.86	84.98	0.25	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.08	0.35	0.54

Notes

- UUC* = Unit Under Calibration

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NSC-TIS-11517025
CALIBRATION0352

Page 3 of 3

REPORT OF CALIBRATION

Certificate No. : 22-025399

Sample Code : 22-09604-002

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 = 40 cm ; D = 28 cm ; H = 39 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 K3003.

- End of Report -

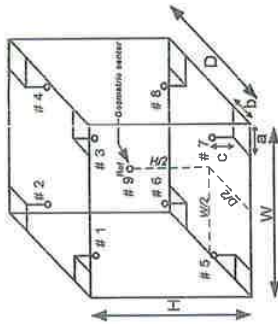


Figure: Example of sensor
Installation Positions

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CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date 15/10/21

TEL 02-516-2422
FAX 02-516-6948
Rev.09

361 Sai Ladprao 102, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-016

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



CERTIFICATE OF CALIBRATION

NSC-TIS1-TS1 7025
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, 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. : G511.0182
Date of Receipt : 03 February 2022
Model : UFE 500
ID No. : LABE 17/4
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-P1100)	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.

6. Condition of calibration item : Normal

Calibrated by : Mr. Pattarakorn Panklong
Approved by : (Mr. Somchai Neampunt)
Solentist : Signed for Director

Issue 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,
PhilaPhla, Wang Thonglang, Bangkok 10310
Rev.01
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date, 15/10/21



REPORT OF CALIBRATION

NSC-TIS1-TS1 7025
CALIBRATION 0152
Page 2 of 3

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

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NSC-TIS-71517025
CALIBRATION 0152

Page 3 of 3

Certificate No.: 22-011768

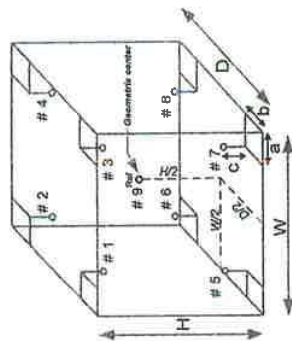
Sample Code : 22-04498-003

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.

Figure: Example of sensor
installation Positions

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 -

COPY

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LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



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



CERTIFICATE No : 21T10802
REFERENCE No : 62916-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : 0 °C TO 100 °C
SERIAL No : 43560
ID No : LABE 16/1
RESOLUTION : 0.1 °C
TYPE : TOTAL IMMERSION
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : EASTERN THAI CONSULTING 1992 COMPANY LIMITED
999 MOO.11 NONGKHAM, SRIRACHA, CHONBURI 20230

CALIBRATED BY : CHARUKIT L.
CALIBRATION DATE : 27-Oct-21
APPROVED BY :
ISSUED DATE : 27-Oct-21
RECEIVED DATE : 21-Oct-21

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

F-G010 REV 02

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

CERTIFICATE No : 21T10802

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : 0 °C TO 100 °C
ID No : LABE 16/1
RESOLUTION : 0.1 °C
RECEIVED DATE : 21-Oct-21
AMBIENT TEMPERATURE : 23 °C ± 3 °C
SERIAL NUMBER : 43560
TYPE : TOTAL IMMERSION
CALIBRATION DATE : 27-Oct-21
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	21T3033	08-Mar-22
2) SPRT PROBE	5614	63626	21T3033	08-Mar-22
3) PRECISION BATH	7320	A21105	20T12163	16-Dec-21
4) PRECISION BATH	CTR-40	A68155	20T12164	22-Dec-21
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
0.004	0.0	60	0.004	N/A	0.090
25.009	25.0	160	0.009	N/A	0.090
50.012	50.0	270	0.012	N/A	0.090

UUC* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

COPY

F-G010 REV 02

LIQUID IN GLASS THERMOMETER

Model : Total immersion

Serial No. : 43560

Calibration Certificate

Certificate No.: 2300368-001-01
Client name: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhapibam 8 Rd.,
Nongkham, Sriracha, Chonburi 20230

Equipment: Liquid-in-Glass Thermometer
Manufacturer: Precision
Model / Type: Total Immersion
Serial No.: 43560
ID No.: LABE 16/1
Order No.: 2300368
Operation No.: 2300368-001
Date of Receipt: 7 November 2022
Date of Calibration: 15 November 2022

Calibrated by Mr.Nuttapol Miyomchat
Specialist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 18 November 2022

The uncertainties are for a confidence probability of approximately 95 %.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

Calibration Report

Certificate No.: 2300368-001-01
Equipment: Liquid-in-Glass Thermometer
Range: -1.9 to 101.1 °C
ID No.: LABE 16/1
Type: Total Immersion
Resolution: 0.1 °C
Serial No.: 43560
Manufacturer: Precision
Date of Calibration: 15 November 2022

Location: Temperature Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 3 °C
Relative Humidity 55 % ± 15 %

Condition of this results of Calibration:

- Calibration Method : - In-house method : W-TE-015 based on ASTM E77-07
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature Scale in use at this laboratory is the International Temperature Scale of 1990 (ITS-90).
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
BLACK STACK THERMOMETER	1560/2560	A39258/A39719	PSL-T 0674/65	7-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5615	808926			

Support Equipment : - Ice point Unit, ID No.: ana. 614/21

- Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: B53496.
- Low Temperature Bath (Deep Well Compact Bath), Model: 7341, S/N: A5A084.
- High Temperature Bath (Deep Well Compact Bath), Model: 6331, S/N: A5A087.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated Item : ☒ Good ☐ After adjustment
- Result of Calibration : ☒ Without adjustment ☐

COPY

Calibration Report

Certificate No.:

2300368-001-01

Equipment:

Liquid-in-Glass Thermometer Type: Total Immersion

Range: -1.9 to 101.1 °C Resolution: 0.1 °C

ID No.: LABE 16/1 Serial No.: 43560

Manufacturer: Precision

Date of Calibration:

15 November 2022

Page 3 of 3

Calibration point:

3.0, 25.0 and 50.0 °C

Calibration result:

Reporting of ice-point or reference point

UUC* Reading (°C)	Standard Temperature/Ice Point (°C)	Correction Value (°C)	Uncertainty ± (°C)
0.0	0.0032	0.0	0.091

Reporting of temperature calibration point

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
25.0	24.9990	0.0	0.088
50.0	49.9943	0.0	0.088

Note

* UUC* : Unit Under Calibration

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

----- End -----



ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2016 Rootmeter 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	0.9311
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}

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pH Meter

Model : SevenCompactTM pH/Ion Meter S220

Serial No. : B448305208

Certificate Number CCP-1416-22

Calibration Certificate
SevenCompact™ pH/Ion Meter S220

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.
Address 663 Moo 11, Sukhaphan 8 Rd., Nong KhamSriacha
Chonburi 20230

Customer ID number 30160441

Customer representative Sasipon Nakh

Assignment ID

00000000000000000000

Instrument

Type SevenCompact™ S220 Instrument Serial Number B446302208
Internal Identification LABE 11/4 Firmware version 1.20.06

Technical specifications

Measuring Range -1999.9 ... 1999.9 mV
Resolution 0.1 mV
Limit of Error ± 0.02 pHTemperature range MTC -30.0 ... 130.0 °C
Temperature range ATC -5.0 ... 130.0 °C
Resolution 0.1 °C
Limit of Error ± 0.1 °C

Procedure Statement

METTLER TOLEDO Calibration SOP (Doc. No. ME-300275761H) will be used as extending documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" column. The measurement results of this certification were obtained at different conditions.

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Certificate Number CCP-1416-22

Certification Tools

Certified digital voltmeter

Manufacturer GOSSEN METRAWATT

Control No. ANA17

Serial number ZD1740

Certificate number ETU213186

Due date August 8, 2022

Certified Temperature Resistors

Manufacturer METTLER TOLEDO / ME-S132410

Control No. ANA137

Serial number A424

Certificate number 31344

Due date August 25, 2023

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94.950 kΩ	94.9558 kΩ
NTC 30 kΩ, 25 °C	30.000 kΩ	30.0137 kΩ
NTC 30 kΩ, 50 °C	10.869 kΩ	10.9649 kΩ
NTC 30 kΩ, 75 °C	4.528 kΩ	4.5257 kΩ
NTC 30 kΩ, 100 °C	2.070 kΩ	2.06849 kΩ
PT1000, 0 °C	1.000 kΩ	1.000155 kΩ
PT1000, 25 °C	1.0874 kΩ	1.087464 kΩ
PT1000, 50 °C	1.1940 kΩ	1.194202 kΩ
PT1000, 75 °C	1.2899 kΩ	1.290130 kΩ
PT1000, 100 °C	1.3851 kΩ	1.385061 kΩ

COPY

Certificate Number CCP-1416-22

Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passes / Failed
pH/mV Sensor Input				
-1500 mV	-1500.0 mV	-1500.0 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-1000.0 mV	0.2 mV	Passed
-500 mV	-500.0 mV	-500.0 mV	0.2 mV	Passed
0 mV	0.0 mV	0.0 mV	0.2 mV	Passed
500 mV	500.0 mV	500.0 mV	0.2 mV	Passed
1000 mV	1000.0 mV	1000.0 mV	0.2 mV	Passed
1500 mV	1500.0 mV	1500.0 mV	0.2 mV	Passed

Designation	Measured low Imp.	Measured high Imp.	Max. Tolerance	Passes / Failed
pH/mV Sensor Input at high Impedance				
1500 mV	1500.0 mV	1500.0 mV	0.6 mV	Passed

Designation	Nominal value	Measured value	Max. Tolerance	Passes / Failed
Temperature Sensor Input				
NTC 30 kΩ, 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
NTC 30 kΩ, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
NTC 30 kΩ, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
NTC 30 kΩ, 75 °C	75.0 °C	74.9 °C	0.1 °C	Passed
NTC 30 kΩ, 100 °C	100.0 °C	99.9 °C	0.1 °C	Passed
PT1000, 0 °C	0.0 °C	0.1 °C	0.1 °C	Passed
PT1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
PT1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
PT1000, 75 °C	75.0 °C	75.1 °C	0.1 °C	Passed
PT1000, 100 °C	100.0 °C	100.1 °C	0.1 °C	Passed

Digital sensor input with pH Sensor
The sensor was recognized correctly by the meter

Summary of Certification

Certification of instrument

Passed

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation **Passed** in the column above.

Remarks

Certification of the instrument was performed by

Name Palpat Sweetspanuwat
Function Service Engineer
Place Laboratory room

Calibration Date: February 7, 2022

Signature ELECTRONIC SIGNATURE

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Mettler-Toledo (Thailand) Limited

Performance Test

Control No. CCE-1416-22/1

Company: EASTERN THAI CONSULTING 1992 CO., LTD.

Address: 683 Moo 11, Sukhaphiban 9 Rd., Nong KhamSiha Zhu

Charubut 20230 /signature/ID "033242430"

pH Electrode

Type: Inlab Expert Pro-ISM

SA: 1976465

Certified standards used

Standard 1:	Type	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: Dec-22
		Nominal value: pH (25.00 °C):	4.01	Lot No.: 1F351C

Standard 2:	Type	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: Dec-22
		Nominal value: pH (25.00 °C):	7.00	Lot No.: 1F361M

Standard 3:	Type	pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: Jan-23
		Nominal value: pH (25.00 °C):	9.21	Lot No.: 1G072G

Test equipment: Type: pH Meter Manufacturer: METTLER TOLEDO Cal date: 7-Feb-22
S/N: B448305208 No. of certificate: CCP-1416-22 Model: S220

Adjustment

Set Calibration Buffer	B2: (25 °C) 7.00, 4.01, 9.21					
	Select Calibration Mode	3-Point calibration		2-Point calibration		2-Point calibration
		3-Point Calibration	Cal 1	Cal 2	Cal 3	Cal 4
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
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		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	Cal 5
		Cal 1	Cal 2	Cal 3	Cal 4	

Measurements

Before adjustment			After adjustment		
Buffer values	Measured	Difference	Buffer values	Measured	Difference
pH	°C	pH	pH	°C	pH
4.01	25.0	ATC	4.01	24.9	ATC
7.00	25.0	ATC	7.00	24.8	ATC
9.21	24.6	ATC	9.21	24.7	ATC

Remarks: The difference result of calibrated electrode should be within ± 0.05 pH

Place: Laboratory room Calibration Date: February 7, 2022

Service Specialist: Palpat Sweetspanuwat Signature: Electronic Signature

This is an original document, copies are not released by METTLER TOLEDO

COPY

Primary Flow Calibrator

Serial No. : 110619

Certificate of Calibration

Customer : Eastern Thai Consulting 1992 Co., Ltd.
Name : 683 Moo 11, Sukdapham 8 Rd., Nongkham, Sriracha, Chonburi 20230
Address : 683 Moo 11, Sukdapham 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
Model : Defender 510-L
Serial Number : 110619
ID : -

Sensor Model : -
Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 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. Noppadon Luangart
Service Calibration Engineer

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :

11 February 2022





The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.00 Issue date 01/07/19

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.00 Issue date 01/07/19

STANDARD WEIGHT 50 g



Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 1 of 3

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 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,

Phlabphla, Wang Thonglang, Bangkok 10310

FM-CL-07

TEL 02-516-2422

FAX 02-516-6949

Rev.05

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TSI-181-7035
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-052238

Sample Code : 22-19150-003

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Result of Calibration :

☒ Without adjustment☐ AdjustmentConventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_a) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
	(mg)	Mass	Uncertainty	Permissible Error	
			(mg)	± (mg)	
50 g	-0.324	49.999676 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.0$, 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

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FM-CL-064

TEL 02-516-2422

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Rev.03

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.20 kg/m³
2. Calibration Method : Direct comparison weighing according to OIML R111-1: 2004(E)
3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

COPY

STANDARD WEIGHT 100 g

NSC-TSI-TSI7025
CALIBRATION 0152

Page 1 of 3

Certificate No. : 22-052239
Sample Code : 22-19150-004

CERTIFICATE OF CALIBRATION

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

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 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).

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Rev.05

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21

NSC-TSI-TSI7025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-052239
Sample Code : 22-19150-004

REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Result of Calibration : ☒ Without adjustment ☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	\pm (mg)	
100 g	-0.171	99.999829 g	0.16	0.50	LABE 10/2

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, 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

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Phlabphla, Wang Thonglang, Bangkok 10310
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Rev.03

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-052239

Sample Code : 22-19150-004

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature $20 \pm 1.5^\circ\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.18 kg/m^3
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)
3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

STANDARD WEIGHT 50 g



Certificate No. : 22-052237
Sample Code : 22-19150-002

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Issue date : 31 May 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 recognised 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).



Certificate No. : 22-052237
Sample Code : 22-19150-002

Page 2 of 3

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
50 g	(mg)	Mass	Uncertainty	Permissible Error	
	-0.111	49.999889 g	(mg)	± (mg)	
			0.10	0.30	LABE 10/4

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, 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

[Signature]

COPY

Certificate No. : 22-052237

Sample Code : 22-19150-002

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³

2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

End of Report

COPY

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

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

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1

Serial No. : 45106737 ID No. : LABE 09/7

Date of Receipt : 22 June 2022 Date of Calibration : 24 June 2022

Condition of Calibration

1. Environment 1.1 Ambient temperature : 23.0 °C ± 3.0 °C
- 1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

- 2.1 In-house method: WI-Q-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 a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-01 & LB-DP-01 (DP)	TH-0014-22	16 February 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-01 & LB-DP-01 (Temp.)	22-029549	14 March 2023
3.3 Digital Thermometer	34572A	LB-DA-07 with RTD-89	21-072473	13 September 2022

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 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 : Miss Pornsuda Lohabai Scientist
Issue date : 27 June 2022

Approved by : (Mr. Somchai Neampunt)
Signed for Director

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 standard 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

Results of Calibration

Temperature measurement

Resolution : 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	20.00	20.2	- 0.20	± 0.39
25	50	25.00	24.9	+ 0.10	± 0.39
30	50	30.00	29.8	+ 0.20	± 0.39

Humidity measurement

Resolution : 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	51.4	- 6.27	± 1.3
60	25.00	60.03	66.5	- 6.47	± 1.5
75	25.00	75.20	81.5	- 6.30	± 1.7

Notes

- 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 M3000

- End of Report -

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UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



Bara Scientific
Source of Success

Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor7 Ramad Road
Siam 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-167/22
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
LABE 03/2
Date of receipt 18 May 2022
Date of calibration 18 May 2022
Date of issue 25 May 2022

Customer name Eastern Thai Consulting 1992 Co., Ltd.
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230.

Temperature (23.8-24.5) °C (On site)
Humidity (47.6-48.3) %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. 96367 and 96366
Photometric Accuracy is traceable to certificate No. 99925 and 100147
Stray Light is traceable to certificate No. 96346
The above certificate are traceable to SI unit through Siama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choothep

Approved by

Mr.Kanchit Choothep
Technical Manager

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

FM-UV-706-02 Rev.01 (2001/53)



Bara Scientific
Source of Success

Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor7 Ramad Road
Siam Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-167/22

Calibration Results:
1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.80	0.09	0.18
445.82	445.95	0.13	0.18
536.52	536.60	0.08	0.18
741.02	741.00	-0.02	0.18
879.41	879.40	-0.01	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
	0.7311	0.7321	0.0010	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
	0.6306	0.6314	0.0008	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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FM-UV-706-02 Rev.01 (2001/53)



Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor 7 Rama4 Road
Silom Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375495-7
www.barascientific.com



Certificate of Calibration

3 of 3

Number of Page(s)

Certificate No.

BSCC-UV-167/22

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
	1.0480	1.0487	0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
	0.7457	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6861	-0.0017	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
	0.9533	0.9519	-0.0014	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200 810.11nm	201.10	0.9543
		2.0204

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

*Stray Light not NSC-ONSC Accredited.

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

End of Certificate

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

FM-UV-708-02 Rev.01 (2301/63)

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34302326



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0470 MTC No. EEL. BP. 21/0565

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Sfracha, Chonburi 20230.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Rion
Model : NC-75
Serial No. : 34302326
Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 6 May 2022

Date of Calibration : 10 May 2022

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FMBL/MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0470 MTC No. EEL. BP. 21/0565

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

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.04	0.04	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.57	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

(Mr. Nuttapong Nijrusvanit)



(Mr. Tawikiat Iamsamran)

Electrical and Electronic Standards Laboratory

Date of Calibration : 10 May 2022 Industrial Metrology and Testing Service Centre

Date of Issue : 10 May 2022 Ref : 2011265050601965005 2 / 2

End of Certificate

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FMBL/MTC-002 Re

SOUND LEVEL METER

MODEL : NL-42

SERIAL No. : 01147300



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0470

MTC No. EEL. BP. 20/0565

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi 20230
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Ambient Environment	Temperature	: (23 ± 3) °C
Manufacturer	: Rion	Relative Humidity		: (50 ± 15) %
Model	: NL-42	Ambient Pressure		: (101.325±1.5) kPa

Serial No. : 01147300 (No.27)
Microphone : Type UC-52 No.191027
Preamplifier : Type NH-24 No.47529

Standards used :

1. Band Pass Filter Stamford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 6 May 2022

Date of Calibration : 2 Jun. 2022

COPY
1/8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0470

MTC No. EEL. BP. 20/0565

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 2 Jun. 2022

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2/

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
	113.91	114.0			

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 112.4 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.0	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency	Measured Value (dB)	Uncertainty (±dB)
Weighting	12.7	0.10
A-Weighting	16.8	0.10
C-Weighting	22.5	0.10

Date of Calibration : 2 Jun. 2022

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W/L

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	-0.1	0.0	0.0	0.40	2.0
1 000	0.0	0.0	0.0	0.40	1.4
4 000	-0.5	-0.4	-0.5	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.0	0.0	0.1	0.20	2.5
125	-0.1	0.1	0.1	0.20	2.0
250	0.0	0.0	0.1	0.20	1.9
500	-0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.0	0.20	2.6
4 000	0.3	0.3	0.3	0.20	3.6
8 000	2.1	2.2	2.1	0.20	5.6

Date of Calibration : 2 Jun. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
137	137.0	0.0	0.30	1.4
136	136.1	0.1	0.30	1.4
135	135.0	0.0	0.30	1.4
134	134.1	0.1	0.30	1.4
133	133.0	0.0	0.30	1.4
132	132.0	0.0	0.30	1.4
131	131.0	0.0	0.30	1.4

Date of Calibration : 2 Jun. 2022

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6. Level linearity on the reference level range (con.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
130	130.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.0	0.0	0.30	1.4
28	28.0	0.0	0.30	1.4

Date of Calibration : 2 Jun. 2022

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6. Level linearity on the reference level range (con.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
27	27.1	0.1	0.30	1.4
26	26.1	0.1	0.30	1.4
25	25.1	0.1	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
30-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	126.1	0.1	0.20	±1.3
	2	109.0	0.0	0.20	+1.3; -2.8
	0.25	99.9	-0.1	0.20	+1.8; -5.3
Slow	200	119.6	0.0	0.20	±1.3
	2	100.0	0.0	0.20	+1.3; -5.3
	200	120.0	0.0	0.20	±1.3
SEL	2	100.0	0.0	0.20	+1.3; -2.8
	0.25	90.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 2 Jun. 2022

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.0	-0.4	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
135.9	135.9	0.0	0.30	1.8

Calibrated by :

Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by :

Pannasit Phasingstri

(Mr. Pannasit Phasingstri)



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265050601965004

Date of Calibration : 2 Jun. 2022

Date of Issue : 2 Jun. 2022

End of Certificate

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SOUND LEVEL METER

MODEL : NL-42

SERIAL No. : 01147298



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0292

MTC No. EEL. BP. 26/0265

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphibai 8 Rd., Nongkham, Sriracha, Chonburi 20230.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description	: Sound Level Meter	Ambient Environment	Temperature	: $(23 \pm 3) ^\circ\text{C}$
Manufacturer	: Rion	Relative Humidity	: $(50 \pm 15) \%$	
Model	: NL-42	Ambient Pressure	: $(101.325 \pm 1.5) \text{ kPa}$	
Serial No.	: 01147298			
Microphone	: Type UC-52 No.191028			
Preamplifier	: Type NH-24 No.47531			

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 2 Feb. 2022

Date of Calibration : 3 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0292

MTC No. EEL. BP. 26/0265

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor

$k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 3 Mar. 2022

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FMBLMTC.002 Rev.4

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
113.97	Before adjust 114.2	After adjust 114.0	0.0	0.30
				1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 123.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.8	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	11.9	0.10
C-Weighting	17.3	0.10
Flat	22.5	0.10

Date of Calibration : 3 Mar. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	-0.3	-0.2	-0.2	0.40	2.0
1 000	0.4	0.4	0.4	0.40	1.4
4 000	-1.1	-1.0	-1.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.0	-0.1	-0.1	0.20	2.5
125	-0.1	0.0	-0.1	0.20	2.0
250	0.0	0.0	0.0	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.1	0.0	-0.1	0.20	2.6
4 000	0.0	0.0	-0.1	0.20	3.6
8 000	0.1	0.0	-0.1	0.20	5.6

Date of Calibration : 3 Mar. 2022

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FM.BLMTC.002 Rev.4

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
137	137.1	0.1	0.30	1.4
136	136.1	0.1	0.30	1.4
135	135.1	0.1	0.30	1.4
134	134.1	0.1	0.30	1.4
133	133.1	0.1	0.30	1.4
132	132.1	0.1	0.30	1.4
131	131.1	0.1	0.30	1.4

Date of Calibration : 3 Mar. 2022

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6. Level linearity on the reference level range (con.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
130	130.1	0.1	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.1	0.1	0.30	1.4
114	114.1	0.1	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.1	0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.0	0.0	0.30	1.4
28	28.0	0.0	0.30	1.4

Date of Calibration : 3 Mar. 2022

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6. Level linearity on the reference level range (con.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
27	27.0	0.0	0.30	1.4
26	26.0	0.0	0.30	1.4
25	25.0	0.0	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
30-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	126.1	0.1	0.20	±1.3
	2	109.0	0.0	0.20	+1.3; -2.8
	0.25	99.9	-0.1	0.20	+1.8; -5.3
Slow	200	119.5	-0.1	0.20	±1.3
	2	100.0	0.0	0.20	+1.3; -5.3
	200	120.0	0.0	0.20	±1.3
SEL	2	100.0	0.0	0.20	+1.3; -2.8
	0.25	90.8	-0.2	0.20	+1.8; -5.3

Date of Calibration : 3 Mar. 2022

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FM.BL.MTC.002 Rev.4

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E-mail : mtc@tistr.or.th

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.2	-0.2	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	131.9	0.0	0.30
Negative one-half cycle	131.9	0.0	0.30

Calibrated by : *Witthol Sengul*

(Mr. Witawat Supanich)

Approved by :

Pannasit Phasingsri

(Mr. Pannasit Phasingsri)

Date of Calibration : 3 Mar. 2022

Date of Issue : 4 Mar. 2022

End of Certificate

COPY

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SOUND LEVEL METER

MODEL : 6236

SERIAL No. : 162032



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0468

MTC No. EEL BP 6/0565

CALIBRATION CERTIFICATE

Submitted by : Blue Consultant Limited Partnership.
Address : 32/751 Pracha-Ubhi Rd., Thungkhru, Thungkhru, Bangkok 10140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sot IC, Bangpoo Industrial Estate, Sukhumvit Rd., A Muang, Samuiprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : ACO
Model : 6236
Serial No. : 162032(No.21)
Microphone : Type 7052NR No.68385
Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 123037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 May 2022

Date of Calibration : 25-26 May 2022

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The results refer only to the items tested and are not valid for other items. The results are not valid for other items unless otherwise stated. The results are not valid for other items unless otherwise stated.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0468

MTC No. EEL BP 6/0565

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 25-26 May 2022

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The results refer only to the items tested and are not valid for other items. The results are not valid for other items unless otherwise stated. The results are not valid for other items unless otherwise stated.

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FM.BL.MTC.002 Rev.4



1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.95	114.8	114.0	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 111.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
20.3	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	11.6	0.10
C-Weighting	17.7	0.10
Flat	22.4	0.10

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Uncertainty (±dB)	
125	1.2	1.3	0.40	Class 2 (±dB) 2.0
1000	-0.9	-0.9	0.40	1.4
4000	1.0	0.9	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Uncertainty (±dB)	
63	0.1	0.1	0.20	2.5
125	0.0	0.1	0.20	2.0
250	0.0	0.0	0.20	1.9
500	0.0	0.0	0.20	1.9
1000	0.0	0.0	0.20	1.4
2000	-0.1	-0.1	0.20	2.6
4000	-0.4	-0.4	0.20	3.6
8000	-0.7	-0.7	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Weighting	94.0	0.0	0.20	0.4
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Weighting	94.0	0.0	0.20	0.3
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Lsq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	118.9	-0.1	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.8	-0.2	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.1	0.1	0.30	1.4
30	30.2	0.2	0.30	1.4

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	118.9	-0.1	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.8	-0.2	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.1	0.1	0.30	1.4
30	30.2	0.2	0.30	1.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0468

MTC No. EEL BP 6/0565

MTC No. EEL BP 6/0565

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	116.1	0.1	0.20	±1.3
	2	98.7	-0.3	0.20	+1.3; -2.8
	0.25	89.3	-0.7	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	±1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
	200	110.0	0.0	0.20	±1.3
SEL	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 25-26 May 2022

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Request No. 21-65/0468

MTC No. EEL BP 6/0565

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.3	-0.1	0.20	1.4
Negative half cycle	124.4	124.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	133.0	0.0	1.8
Negative one-half cycle	133.0	0.0	1.8

Calibrated by :

Approved by :

(Mr. Parnasit Phasitgarn)
(Mr. Tawakiat Jamsanvan)



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 25-26 May 2022

Date of Issue : 30 May 2022

Ref : 2011265C503019_2002

End of Certificate

8/8

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Page 1 of 1

NOISE DOSI METER

MODEL : NP-DLX

SERIAL No. : NXL060044

Certificate of Calibration

Customer
Name : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11, Sukhapham 8 Rd., Nongkham, Srachha, Chonburi 20230

Certificate No : 22-ACT-304
Request No : Req-2022-0691

Unit Under Calibration Details


Measurement item : Noise Dosimeter
Manufacturer : 3M
Model : NP-DLX
Serial Number : NXL060044
ID : -
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 28 March 2022
Calibrated Date : 6 May 2022
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Microphone Class : 2
Microphone Model : -
Microphone S/N : -
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Sine Generator	Svante	Svnt401	131	18 October 2022	WK Electric
Timer	EXTECH	-	05-ACT	24 March 2023	TPA

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 6 May 2022

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)		
FAST / A / 70-140						
Calibrator Setting						
1000 Hz 114 dB	120.00	120	3.63	3.65	+0.55	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 70-140				
STD Setting				
*63 Hz	-0.1	-0.1	0.40	2.0
125 Hz	0.2	0.3	0.40	1.5
250 Hz	0.2	0.3	0.40	1.5
500 Hz	0.2	0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.6	-0.6	0.40	2.0
4000 Hz	-1.0	-1.0	0.40	3.0
8000 Hz	-1.9	-2.0	0.40	5.0

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Certificate No : 22-ACT-304
Request No : Req-2022-0691

Certificate No : 22-ACT-304
Request No : Req-2022-0691

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High												
1000 Hz	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0			
	Level A	(dB)	70.1	80.0	90.0	100.0	110.0	114.0	120.0	130.1	140.2			
	Error	(dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2			
	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9			
8000 Hz	Level A	(dB)			89.0	99.0	108.9	112.9	118.8	128.8	138.9			
	Error	(dB)			0.1	0.1	0.0	0.0	-0.1	-0.1	0.0			
	Ref	(dB)							87.8	93.8	103.8	113.8		
	Level A	(dB)							87.8	93.7	103.7	113.7		
63 Hz	Error	(dB)							0.0	-0.1	-0.1	-0.1		
	Tolerances Limit		(±dB)	1.0										
UNCERTAINTY		(±dB)	0.27											

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement				UNCERTAINTY	Tolerances
		Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		Limit (%)	
b. Sound exposure meter linearity of error	FAST / A / 70-140								
	Calibrator Setting								
	1000 Hz 110 dB	27	27	0.30	0.30	0.00	4.3	-21, +26	
	1000 Hz 110 dB	45	45	0.50	0.50	0.00			
	1000 Hz 110 dB	90	90	1.00	1.00	0.00			
	1000 Hz 110 dB	180	180	2.00	1.99	-0.50			
	1000 Hz 120 dB	36	36	4.00	3.99	-0.25	3.8		
	1000 Hz 120 dB	72	72	8.00	7.98	-0.25			
	1000 Hz 120 dB	90	90	10.00	9.98	-0.20			
	1000 Hz 120 dB	180	180	20.00	19.96	-0.20			
1000 Hz 120 dB	360	360	40.00	39.92	-0.20				
1000 Hz 120 dB	720	720	80.00	79.83	-0.21				

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4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
		Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		
FAST / A / 70-140								
Calibrator Setting								
4000 Hz 95 dB		2846	2846	1.00	0.99	-1.00	0.01	0.71 - 1.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit (%)
		Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		
FAST / A / 70-140 Calibrator Setting	Burst 1 ms, 95 dB	2846	2846	1.00	0.99	-1.00	3.0	-21 - +26
	Burst 1 ms, 100 dB	900	900	1.00	0.99	-1.00		-21 - +41
	Burst 1 ms, 108 dB	143	143	1.00	1.00	0.00		-21 - +41

5. Response to unipolar pulse

5. response to unipolar pulse					UNCERTAINTY (%)	Tolerances Limit (%)	
UUC Setting		Time		Exposure Measurement			
FAST / A / 70-140		UUC	(s)	UUC (Pa h)			Different (%)
Calibrator Setting							
Continuous Rectangle +		6		13.15	+0.03	2.4	
Continuous Rectangle -				13.18			

* Indicates non accredited

End of Certificate

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NOISE DOSI METER

MODEL : NP-DLX

SERIAL No. : NXQ070008

Certificate of Calibration

Customer
 Name : Eastern Thai Consulting 1992 Co., Ltd.
 Address : 683 Moo 11, Sukhapharn 8 Rd., Nongkharm, Sriracha, Chonburi 20230

Certificate No : 21-ACT-360
 Request No : Req-2021-1238

Unit Under Calibration Details

Measurement Item : Noise dosimeter
 Manufacturer : 3M
 Model : NP-DLX
 Serial Number : NXQ070008
 ID : -
 Resolution : 0.1 dB
 Microphone Class : 2
 Microphone Model : -
 Microphone SN : -
 Preamplifier Model : -
 Preamplifier SN : -
 Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
 Humidity : 50 %RH ± 20 %RH
 Barometric Pressure : 1013 hPa ± 10 hPa
 Received Date : 14 September 2021
 Calibrated Date : 14 September 2021
 Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
 Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-eal	188272	14 June 2022	TSL
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svanek	Svan401	131	30 September 2021	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TVA

Note

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

Calibrated By : *MC*

Mr. Nopadon Luangart
 Calibration Officer

Approved By : *MC*

Mr. Pacht Malhavorn
 Calibration Engineer Supervisor
 Issue Date : 14 September 2021

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (%)	
FAST / A / 70-140						
Calibrator Setting						
1000 Hz 114 dB	120.00	120	3.63	3.65	+0.55	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 70-140				
STD Setting				
*63 Hz	-0.3	-0.1	0.40	2.0
125 Hz	0.0	0.1	0.40	1.5
250 Hz	+0.1	0.0	0.40	1.5
500 Hz	0.0	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.2	0.2	0.40	2.0
4000 Hz	-0.4	-0.4	0.40	3.0
8000 Hz	-2.2	-2.4	0.40	5.0

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Certificate No : 21-ACT-360
Request No : Req-2021-1238

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	Ref	FAST / A / High									
		(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	70.1	80.0	90.0	100.0	110.0	114.0	120.1	130.2	140.5
	Error	(dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5
	Ref	(dB)	88.9	96.9	108.9	112.9	118.9	128.9	138.9		
8000 Hz	Level A	(dB)	89.0	99.0	108.9	112.9	118.8	128.9	139.1		
	Error	(dB)	0.1	0.1	0.0	0.0	-0.1	0.0	0.0	0.2	
	Ref	(dB)	87.8	95.8	105.8	113.8					
63 Hz	Level A	(dB)	87.8	95.8	103.8	113.8					
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tolerances Limit	(±dB)	1.0								
UNCERTAINTY		(±dB)	0.27								

b. Sound exposure meter linearity of error

UUC Setting	Ref	Time		Exposure Measurement			Tolerances Limit (%)
		(s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (%)	
FAST / A / 70-140 Calibrator Setting	1000 Hz 110 dB	27	27	0.30	0.30	0.00	-21, +26
	1000 Hz 110 dB	45	45	0.50	0.50	0.00	
	1000 Hz 110 dB	90	90	1.00	0.99	-1.00	
	1000 Hz 110 dB	180	180	2.00	1.99	-0.50	
	1000 Hz 120 dB	36	36	4.00	4.00	0.00	
	1000 Hz 120 dB	72	72	8.00	8.00	0.00	
	1000 Hz 120 dB	90	90	10.00	10.01	+0.10	
	1000 Hz 120 dB	180	180	20.00	20.02	+0.10	
	1000 Hz 120 dB	360	360	40.00	40.04	+0.10	
	1000 Hz 120 dB	720	720	80.00	80.09	+0.11	

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (Pa h)	
FAST / A / 70-140 Calibrator Setting	2846	2846	1.00	0.99	-0.01	-0.29 - 0.41
	4000 Hz 95 dB					

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Error (%)	
FAST / A / 70-140 Calibrator Setting	2846	2846	1.00	0.95	-1.00	-21 - +26
	Burst 1 ms, 95 dB					
	Burst 1 ms, 100 dB	900	1.00	0.95	-1.00	
	Burst 1 ms, 108 dB	143	1.00	1.00	0.00	

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)	Different (%)	
FAST / A / 70-140 Calibrator Setting	6	6	10.25	10.30	+0.49	-21 - +26
	Continuous Rectangle +					
	Continuous Rectangle -					

End of Certificate

NOISE DOSI METER

MODEL : NP-DLX

SERIAL No. : NXQ070008

Certificate No : 22-ACT-579 Rev.1
 Request No : Req-2022-1651

Certificate No : 22-ACT-579 Rev.1
 Request No : Req-2022-1651

Certificate of Calibration

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.
 Address : 683 Moo 11, Sukhapham 8 Rd., Nongkham, Sriracha, Chonburi 20230


Unit Under Calibration Details


Measurement item : Noise Dosimeter
 Manufacturer : 3M
 Model : NP-DLX
 Serial Number : NXQ070008
 ID :
 Resolution : 0.1 dB
 Calibration Environment and Details
 Temperature : 23 °C ± 2 °C
 Humidity : 50 %RH ± 20 %RH
 Barometric Pressure : 1013 hPa ± 10 hPa
 Received Date : 1 September 2022
 Calibrated Date : 6 September 2022
 Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
 Location of Calibration : Lab Acoustic
 Instrument Status : Used

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	29 June 2023	TSI
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Sine Generator	Svantek	Svan401	131	18 October 2022	WK Electric
Timer	EXTECH		05-ACT	24 March 2023	TPA

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-ACT-579

Calibrated By : 
 Mr. Noppadon Luangart
 Calibration Officer

Approved By : 
 Mr. Patti Mathavorn
 Calibration Engineer Supervis
 Issue Date : 13 September 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
 FM-708-NDM-01 Rev0 Issue date 01/07

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1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)		
FAST / A / 70-140						
Calibrator Setting						
1000 Hz 114 dB	120.00	120	3.73	3.72	-0.27	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 70-140				
STD Setting				
*63 Hz	0.3	0.5	0.40	2.0
125 Hz	-0.1	0.2	0.40	1.5
250 Hz	0.0	0.3	0.40	1.5
500 Hz	0.0	0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.4	-0.3	0.40	2.0
4000 Hz	-0.5	-0.4	0.40	3.0
8000 Hz	-1.3	-1.2	0.40	5.0

Certificate No : 22-ACT-579 Rev.1
 Request No : Req-2022-1651

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High											
	Ref	(dB)	70.1	79.9	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	70.1	79.9	90.0	100.0	110.0	114.0	120.1	130.2	140.5	
	Error	(dB)	0.1	-0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.5	
	Ref	(dB)	88.9	98.9	108.9	112.9	118.9	128.9	138.9			
8000 Hz	Level A	(dB)	89.0	99.0	108.9	112.9	118.9	128.9	139.2			
	Error	(dB)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	
	Ref	(dB)	87.8	93.8	103.8	113.8						
63 Hz	Level A	(dB)	87.8	93.8	103.8	113.8						
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Tolerances Limit	(±dB)	1.0									
UNCERTAINTY		(±dB)	0.27									

b. Sound exposure meter linearity of error

UUC Setting	Time				Exposure Measurement				UNCERTAINTY	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)					
FAST / A / 70-140	27	27	0.30	0.30	0.00					
	45	45	0.50	0.50	0.00					
	90	90	1.00	0.99	-1.00					
1000 Hz 110 dB	180	180	2.00	1.99	-0.50					
	36	36	4.00	3.99	-0.25					
	72	72	8.00	7.98	-0.25					
1000 Hz 120 dB	90	90	10.00	9.98	-0.20					
	180	180	20.00	19.95	-0.25					
	360	360	40.00	39.91	-0.23					
1000 Hz 120 dB	720	720	80.00	79.82	-0.23					

= Indicates non accredited

End of Certificate

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time				Exposure Measurement				UNCERTAINTY	Tolerances Limit
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)					
FAST / A / 70-140	2846	2846	1.00	0.99	-0.01					
	4000 Hz 95 dB									

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time				Exposure Measurement				UNCERTAINTY	Tolerances Limit
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)					
FAST / A / 70-140	2846	2846	1.00	0.99	-1.00					
	Burst 1 ms, 95 dB									
	Burst 1 ms, 100 dB									
Burst 1 ms, 108 dB	143	143	1.00	1.00	0.00					

5. Response to unipolar pulse

UUC Setting	Time				Exposure Measurement				UNCERTAINTY	Tolerances Limit
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Different (%)					
FAST / A / 70-140										
	Continuous Rectangle +									
	Continuous Rectangle -									

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0957

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168442



Cirrus Research plc
Acoustic House
Bridlington Road
Hummanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory
N. Smith
Electronically signed:

Dosimeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR-110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CB0957 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	Tri	TGA1241	419342
Multimeter	Fluke	8845A	2490007
Multimeter	Fluke	8845A	9440020

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0644

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168440



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1

Approved signatory
N.Smith
Electronically signed:

Dosimeter

Instrument Information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co.,Ltd. 683 Moo 11
Model: CR-110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CB0644 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TGA1241	419342
Multimeter	Fluke	8845A	9440020
Multimeter	Fluke	8845A	2490007

Notes

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NOISE DOSI METER

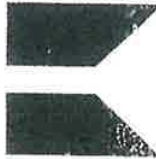
MODEL : CR:110A

SERIAL No. : CB0954

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168445



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory N. Smith
Electronically signed:

Dosimeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR-110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CB0954 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9440020
Multimeter	Fluke	8845A	2490007
Signal Generator	TTI	TGA1241	419342

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8889

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168429



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory N. Smith
Electronically signed:

Dosemeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR:110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CA8889 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9440020
Signal Generator	TTi	TGA1241	419342
Multimeter	Fluke	8845A	2490007

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0643

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 12/11/21
CERTIFICATE NUMBER 165840



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory
N. Smith
Electronically signed:

Dosimeter

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB0643
Firmware version: 504
Notes: Eastern Thai Consulting 1992 Co., Ltd.
683 Moo11 Sukaphibal 8 Rd., Nongkham, Sriracha,
Chonburi, 20230

Test summary

Date of calibration: 12/11/21
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TGA1241	257310
Multimeter	Fluke	8845A	1520023
Multimeter	Fluke	8845A	2490007

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0640

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168431



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory
N.Smith
Electronically signed:

Dosemeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co.Ltd. 683 Moo 11
Model: CR-110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi 2
Serial number: CB0640
Firmware version: 504

Test summary

Date of calibration: 14/01/22
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9440020
Signal Generator	TTi	TGA1241	419342
Multimeter	Fluke	8845A	2490007

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8879

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168428



Cirrus Research plc
Acoustic House
Bridlington Road
Hummerby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory N. Smith
Electronically signed:

Dosemeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR:110A Sukaphibal 8 Rd., Nongkham, Shiracla, Chonburi
Serial number: CA8879 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	2490007
Signal Generator	TTi	TGA1241	419342
Multimeter	Fluke	8845A	9440020

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0956

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 12/11/21 CERTIFICATE NUMBER 165841



Cirrus Research plc
Acoustic House
Bridlington Road
Hummanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Approved signatory N. Smith
Electronically signed:

Dosimeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd.
Model: CR:110A 683 Moo11 Sukaphibal 8 Rd., Nongkham, Sriracha,
Serial number: CB0956 Chonburi, 20230
Firmware version: 504

Test summary

Date of calibration: 12/11/21

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TGA1241	257310
Multimeter	Fluke	8845A	1520023
Multimeter	Fluke	8845A	2490007

Notes

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