

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง
ของเครื่องมือเก็บตัวอย่าง

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

Mettler-Toledo (Thailand) Ltd.
046/4 - 846/5 Lasilai Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServicesSupport@mt.com



Accuracy Calibration Certificate

Customer

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

Contact: Sasiporn Nadin

Weighing Device

Manufacturer: Mettler Toledo
Model: XS20SDU
Serial No.: 1126323724
Building: Laboratory
Floor: 1
Room: Laboratory
Instrument Type: Weighing Instrument
Asset Number: SAT
Terminal Model: 1126323724
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

Calibration Guidelines:
EURAMET cp-18 v. 4.0 (11/2015)
CPM002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
This sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cp-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Start: 24.9 °C	End: 25.7 °C	Start: 54.0 %	End: 51.3 %
Temperature				
Humidity				

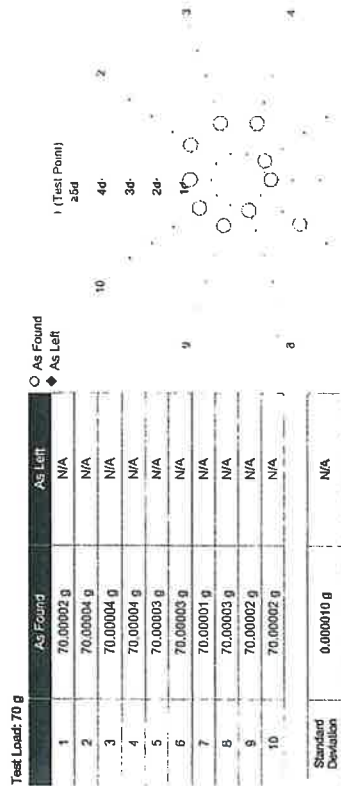
As Found Calibration Date: 01-Feb-2022
As Left Calibration Date: N/A
Issue Date: 05-Feb-2022
Calibrator: Sathaporn Tabson
Approved Signatory: 

☒ Kassakorn Tassanachaisakul
☐ Sanit Jitinyom
☐ Surachai Sukkate



Measurement Results

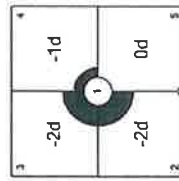
Repeatability



Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	99.9998 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0002 g	N/A



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



Remarks

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

End of Accredited Section

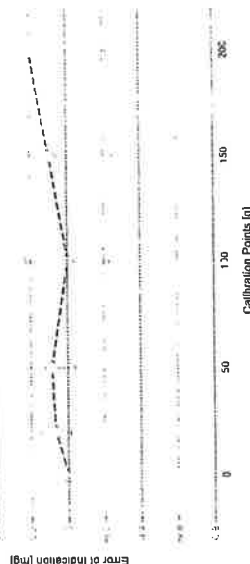
The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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	0.01000 g	0.01002 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	0.065 mg	2
8	49.99997 g	50.00005 g	0.00009 g	0.13 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.22 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 are shown and measurement points close to zero are not displayed.



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

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

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.:	189521	Calibration Due Date:	13-Mar-2022
Certificate Number:			
Thermo Baro Hygrometer	INT4	Date of Issue:	09-Jul-2021
Equipment No.:	21H1470	Calibration Due Date:	28-Jun-2022
Certificate Number:			

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

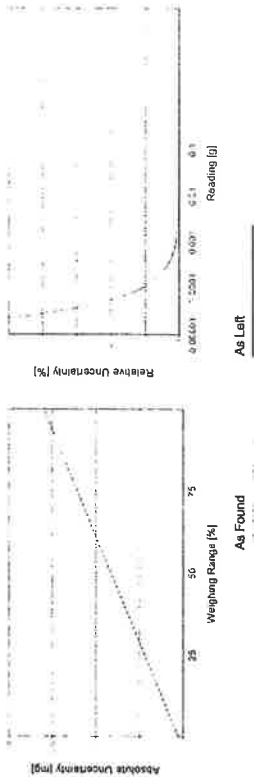
Linearization of Uncertainty Equation

	Range				
	g	Max			
1	0.00001 g	81 g	$U_1 = 0.022 \text{ mg} + 0.00763 \text{ mg/g} \cdot R$	As Found	As Left
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00762 \text{ mg/g} \cdot R$	N/A	N/A

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

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

Net Indication	As Found		As Left	
	Absolute Uncertainty [mg]	Relative Uncertainty [%]	Absolute Uncertainty [mg]	Relative Uncertainty [%]
0.00220 g	0.022 mg	1.0%	N/A	N/A
0.02200 g	0.022 mg	0.10%	N/A	N/A
0.22000 g	0.024 mg	0.011%	N/A	N/A
2.20000 g	0.038 mg	0.0018%	N/A	N/A
22.0000 g	1.7 mg	0.0079%	N/A	N/A



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

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

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

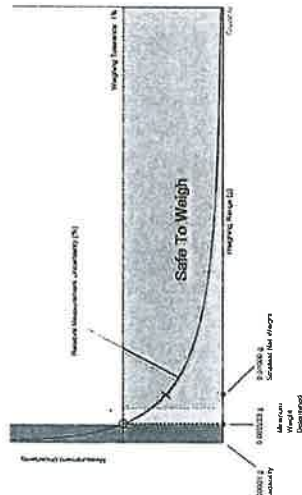
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



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

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	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	0.055607 g	0.115457 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

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	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	0.055607 g	0.115457 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 proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 70 g

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

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

Eccentricity

Test Load: 100 g

As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result
0.1%	0.0500 g		✓
0.2%	0.1000 g		✓
0.5%	0.2500 g		✓
1%	0.5000 g	0.0002 g	✓
2%	1.0000 g		✓
5%	2.5000 g		✓

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

As Found

METTLER TOLEDO Service

Reference Value		Control limits for various weighing tolerances							
		Error	0.1%	0.2%	0.5%	1%	2%	5%	
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A	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	0.50000 g	
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.00000 g	1.25000 g	
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.00000 g	2.50000 g	
149.99989 g	0.00011 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.00000 g	3.75000 g	
200.00000 g	0.00012 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g	5.00000 g	
Result		✓	✓	✓	✓	✓	✓	✓	✓

As Left

Reference Value		Control limits for various weighing tolerances							
		Error	0.1%	0.2%	0.5%	1%	2%	5%	
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A	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	0.50000 g	
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.00000 g	1.25000 g	
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.00000 g	2.50000 g	
149.99989 g	0.00011 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.00000 g	3.75000 g	
200.00000 g	0.00012 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g	5.00000 g	
Result		✓	✓	✓	✓	✓	✓	✓	✓

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

METTLER TOLEDO

Service Date: 2022-02-07
Document Number: TH4004-018-020722-LABBalanceHR
EASTERN THAI CONSULTING 1992 CO., LTD.
883 Moo 11, Sukthaphiban 8 Rd., Nong Kham, Sriracha, Chonburi 20230
Khun Sasiporn Nakin

Balance Health Report

Device Details	
Manufacturer:	Mettler Toledo
Model:	X5205DU
Serial number:	1126323724
Firmware:	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
Spares parts available:	Yes
Regulations:	ISO
Process tolerance in %:	1 %
Smallest sample net weight:	0.0100 g
Check List	
Room temperature fluctuation	✓
Exposure to direct sun	✓
Vibrations	✓
Draft or dust	✓
Static	✓
Draft shield	✓
Weighing pan position	✓
Housing	✓
Other - objections noted as additional remarks	Other - objections noted as additional remarks
Recommendations	
Instrument calibration	Uninstall instrument
Identify safe weighing range	Replace instrument
GWP verification / risk assessment	Yes
Preventive maintenance	Replace / add parts (see additional remarks)
Perform routine testing with test weights	Orbital repair
User training	Depot repair
Use of accessories (see additional remarks)	Use of accessories (see additional remarks)
Contact	Name: Khun Sasiporn Nakin Position: Document Control Phone: 096-461-3903 Email: de.ja@mettler.com
Additional Remarks & Recommendations	
Engineer Details	
Date:	07-Feb-2022
Name:	Sathaporn Taisen
Signature:	

This is not a certificate.

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

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

METTLER TOLEDO

Report Version: 1.13, Software Version: 1.27.0.0, Page: 1/1, © METTLER TOLEDO

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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: 160-402242242-1
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 100/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. 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 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	KC02584	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	
Nicolet iS50 FTIR AUP2110295 CH4			FTIR	
Nicolet iS50 FTIR AUP2110295 C3H8			FTIR	
Last Multipoint Calibration			Expiration Date	
Oct 13, 2021			May 15, 2025	
Oct 14, 2021			Mar 17, 2027	

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 5221004651



Approved for Release

CERT 3082.05

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DRY GAS METER MC-572-V

Serial No. : 0504003

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

Calibration Conditions			
Date	Time	05-Apr-22	8:30 AM
Calibration Reference No.	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									
Metering Console					Calibration Meter				
Run Time	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (t) min	(P _h) mm H ₂ O	(V _h) m ³	(V _h) m ³	(t _h) °C	(t _h) °C	(V _h) m ³	(V _h) m ³	(t _h) °C	(t _h) °C
15.00	13.0	234.9529	235.0859	27	27	276.54575	276.67750	27	27
10.00	25.0	235.1718	235.3277	27	27	276.76357	276.91678	27	27
8.00	50.0	235.3676	235.5510	27	27	276.95578	277.13668	27	27
7.00	80.0	235.5744	235.7803	27	27	277.15828	277.36140	27	27
5.00	120.0	235.8320	236.0138	27	27	277.41235	277.59265	27	27

Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	ΔH @	Variation
(V _{std}) m ³	(Q _{std}) m ³ /min	(V _{cal}) m ³	(Q _{cal}) m ³ /min	Value (Y)	Variation (ΔY)	Std & Corr (Q _{std}) m ³ /min	.0212 m ³ /min (ΔH@) mm H ₂ O	(ΔΔH@)
0.130	0.009	0.129	0.009	0.987	0.007	0.009	78.243	25.850
0.153	0.015	0.149	0.015	0.978	-0.002	0.015	49.567	-2.826
0.180	0.023	0.176	0.022	0.980	-0.001	0.022	45.729	-6.665
0.203	0.029	0.198	0.028	0.977	-0.003	0.028	44.689	-7.705
0.180	0.036	0.176	0.035	0.979	-0.001	0.035	43.739	-8.654
				0.980	Y Average			ΔH@ Average
								52.393

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

Signature

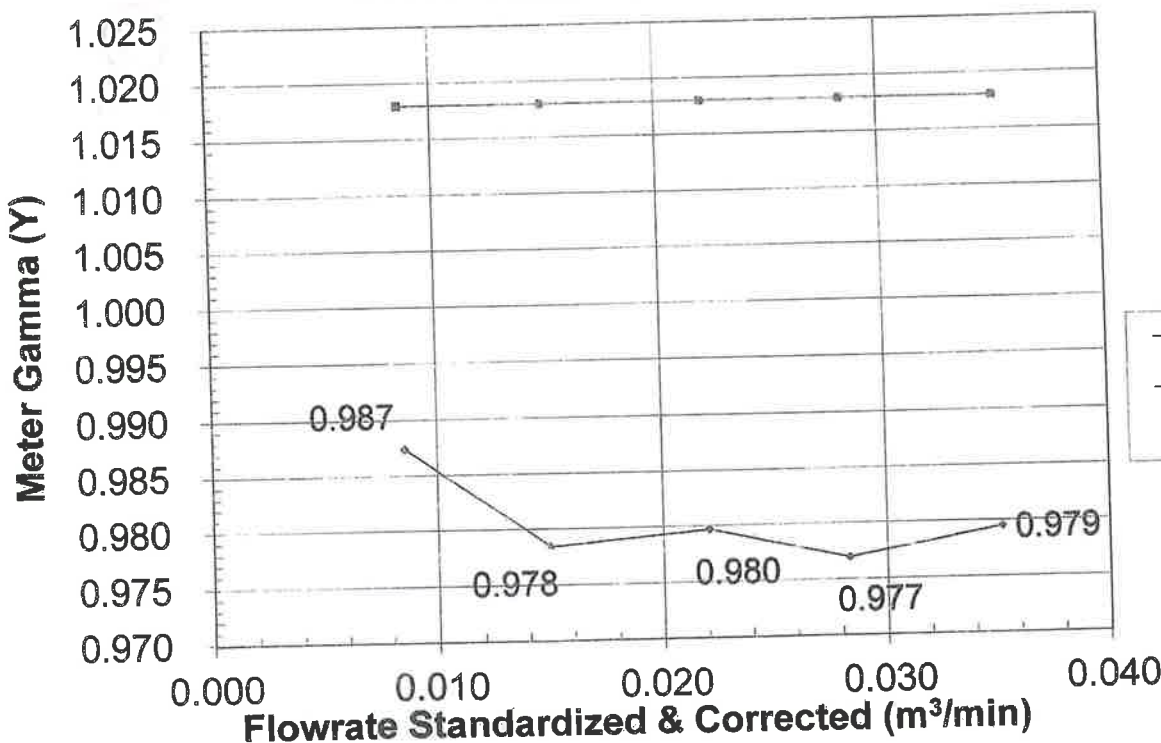
Surachai Chaisana
(Surachai Chaisana)
Service Engineer

SITHIPORN ASSOCIATES COMPANY

Date

5/4/2022

Meter Gamma vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

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

Sampling System Equipment Information	
Console Model Number	MC-572-V
Console Serial Number	0504003
DGM Model Number	SK25EX
DGM Serial Number	0005303
Meter Box Model Number	JENCO 765
Meter Box Serial Number	JC02484

Calibration Conditions	
Date	05-Apr-22
Calibration Reference No.	HC65APE0026
Barometric Pressure	761
Reference Thermometer	FLUKE 714
Serial Number	9038005

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
-18.0	25.0
-18	38.0
25	93.0
38	149.0
94	280.0
151	371.0
262	482.0
485	593.0
595	816.0
818	1038.0
1041	
Stack	
Probe	
Filter	
Aux	
Exit	

Stack
Probe
Filter
Aux
Exit

Tolerance Range

+ 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Exit

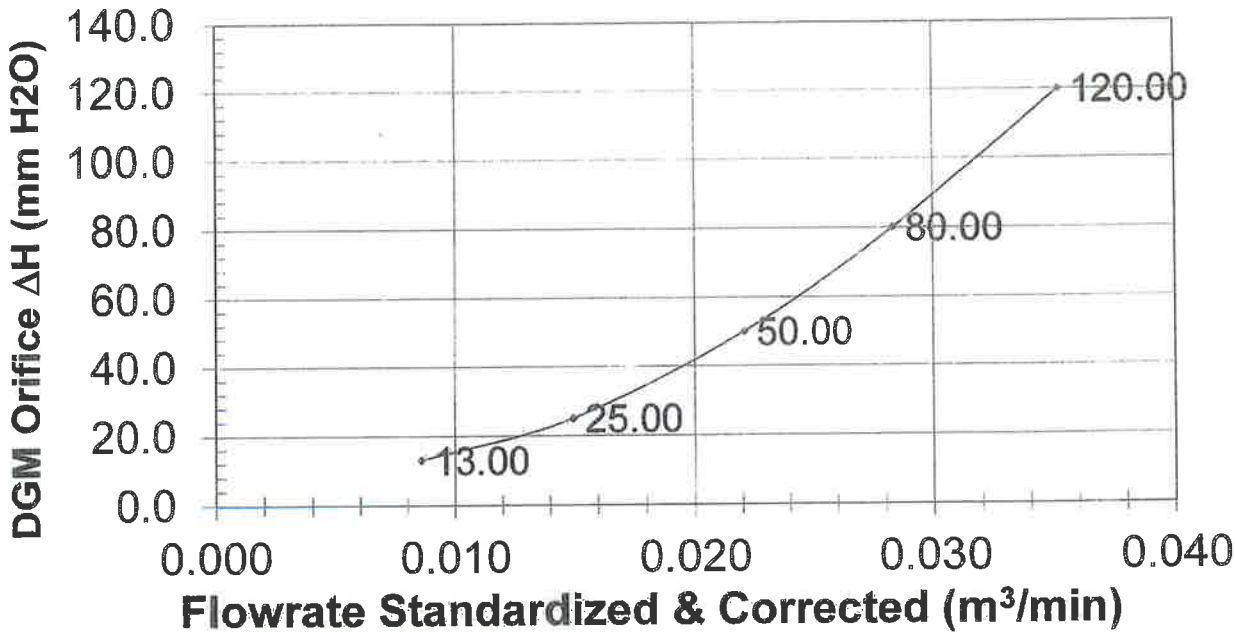
+ 3.0 °C
± 2.0 °C

Signature

(Surachai Chaisana)
Service Engineer

บริษัท สิทิพอร์นแอสซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Meter Pressure vs Flowrate



Console Serial:

0504003

บริษัท สิทิพอร์นแอสซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

MC-572-V

COPY

COPY

บริษัท สิทิพอร์นแอสซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700 โทร. 0-2433-8831, 0-2435-8800, 0-2494-9191 แฟกซ์ : 0-2433-1679, 0-2434-9510
451-451/1 Srinthorn Road, Bangumru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

DRY GAS METER XC-572V

Serial No. : 1110070

Meter Console Information

Console Model #: XC-572V
Console Serial #: 1110070
DGM Model #: SK25EX
DGM Serial #: 0006413

Calibration Conditions

Calibration Reference No.: WDS-SV080004
Ambient Temp (°C): 25.4
Barometric Pressure (mm Hg): 756
Relative Humidity (%): 66

Factors/Conversions

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

Reference Equipment

WTM Model: W-NK0Da-6B
WTM Serial: 646321
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 ₁) m³	Final (V ₂) m³	Initial (T ₁) °C	Final (T ₂) °C	Initial (V ₁) m³	Final (V ₂) m³		
15.00	13.0	397.7244	397.9056	25	25	289.58787	289.76942	25	25
10.00	25.0	397.9285	398.0984	25	26	289.79207	289.95984	25	25
8.00	50.0	398.1162	398.3056	26	26	289.97735	290.16549	25	25
7.00	80.0	398.3366	398.5469	26	26	290.19812	290.40517	25	25
5.00	120.0	398.5893	398.7513	26	27	290.42752	290.60906	25	25

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Calibration Factor		Flowrate		
(V ₁) m³	(Q ₁) m³/min	(V ₂) m³	(Q ₂) m³/min	Value (Y)	Variation (ΔY)	Std & Corr (V ₁) m³/min	ΔH @ (ΔH@) mm H ₂ O	Variation (ΔΔH@)
0.180	0.012	0.181	0.012	1.001	0.009	0.012	41.038	-0.731
0.189	0.017	0.167	0.017	0.986	-0.006	0.017	41.198	-0.570
0.189	0.024	0.187	0.023	0.991	-0.001	0.023	41.988	0.198
0.210	0.030	0.208	0.030	0.990	-0.002	0.030	41.881	0.112
0.182	0.036	0.180	0.036	0.991	0.001	0.036	42.759	0.991
				0.992	Average		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 ±1.0%.

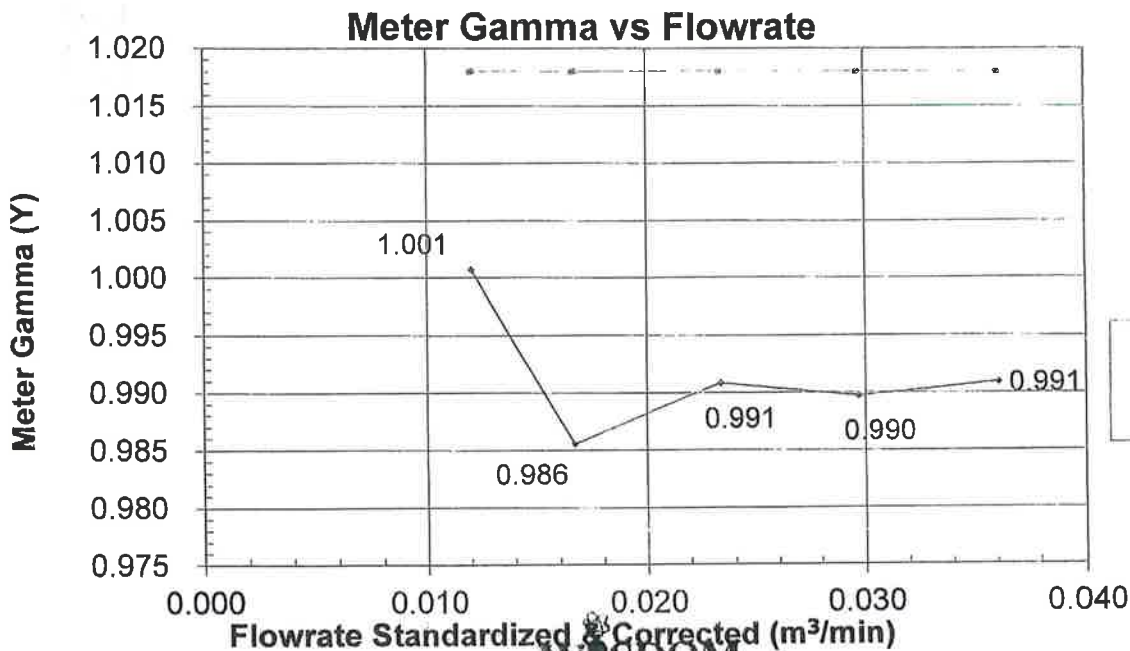
Note: For ΔH@, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.25inches (5.1mm) H₂O.

Pass/Fail Result: **Pass**

Signature

(Patpasu Chaisana)
Service Engineerบริษัท วิสโดม ไซนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 1/06/2023

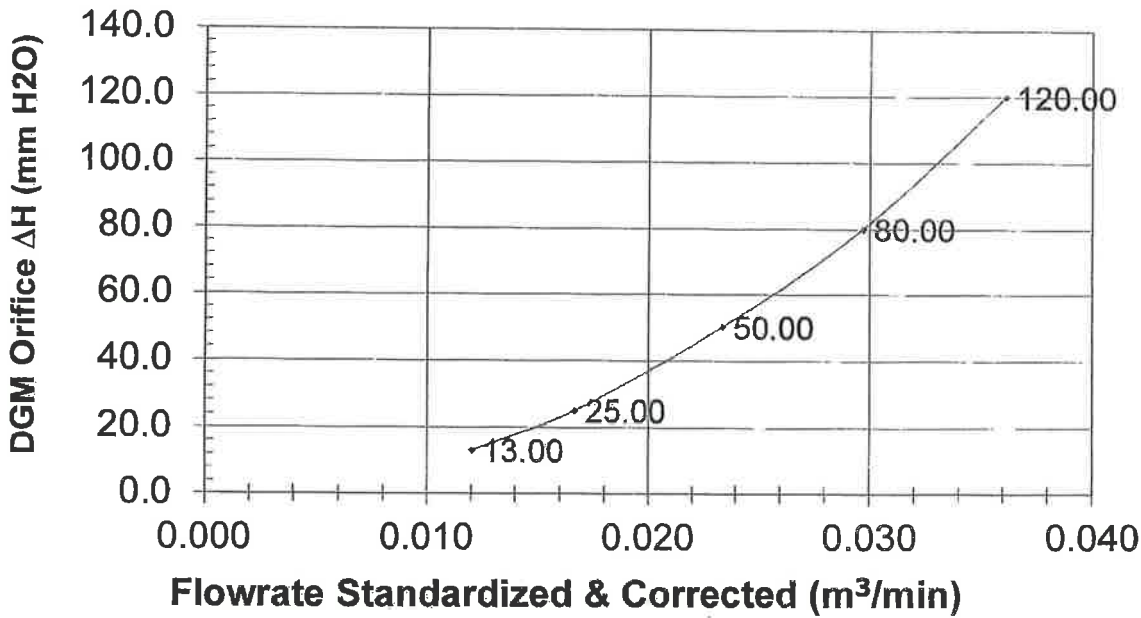


Console Serial: 1110070

Console Model: XC-572V

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

Meter Pressure vs Flowrate



Console Serial: 1110070



Console Model: XC-572V

COPY

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-SV650004
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	56 %
		Reference Thermometer	FLUKE 714
		Serial Number	9038005

Results												
Console Thermocouple Simulator												
Channel and test point		Temperature Reading (°C)										
		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack		-18	24	37	92	150	261	373	485	596	821	1045
Probe		-18	24	37	92	150						
Filter		-18	24	37	92	150						
Aux		-18	24	37	92	150						
Exit		-18	24	37								

1-14

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Exit

Signature

(Patpasu Chaisana)
Service Engineer



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

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DRY GAS METER MC-572V

Serial No. : 1007055

WSDOM

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

Method 6 Pre-Test Console Calibration - Cubic meter (m³)

Motor Console Information

Model #:	MC-572V	Calibration Date:	27/07/2022
Serial #:	1007055	Calibration Ref.:	WCS-SV650005
DGM Model #:	SK25EX	Ambient Temp (°C):	23.5
DGM Serial #:	00006432	Pressure (mm Hg):	756
		Relative Humidity (%):	60

Calibration Condition

Factors/Conversion

Std. Temp. (°K):	298
Std. Pressure (mm Hg):	760
K ₁ (K/mm Hg):	0.3857

Reference Equipment

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

UUT Meter (DGM)				Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume	
		Initial V _{ini}	Final V _{fin}	Initial T _{ini}	Final T _{fin}	Initial V _{ini}	Final V _{fin}
15.00	13.0	0.0025	0.1685	25	25	307.83244	307.99616
10.00	25.0	0.1910	0.3499	25	25	308.00127	308.15867
8.00	50.0	0.3711	0.5509	25	25	308.16244	308.34119
7.00	80.0	0.5844	0.7861	25	25	308.34877	308.55037
5.00	120.0	0.8310	1.0074	25	25	308.59261	308.77072

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Correction Factor		Flow Rate	
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 _g (mm H ₂ O)
0.163	0.011	0.160	0.011	0.983	-0.005	0.011	50.885
0.158	0.016	0.154	0.015	0.986	-0.002	0.015	46.980
0.177	0.022	0.174	0.022	0.987	-0.001	0.022	46.834
0.199	0.028	0.197	0.028	0.990	0.001	0.028	45.366
0.175	0.035	0.174	0.035	0.996	0.008	0.035	44.824
				0.988	= Y Avg.		46.930
							= ΔH _g 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 ΔH_g, 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 ±0.1inches (5.1mm) H₂O

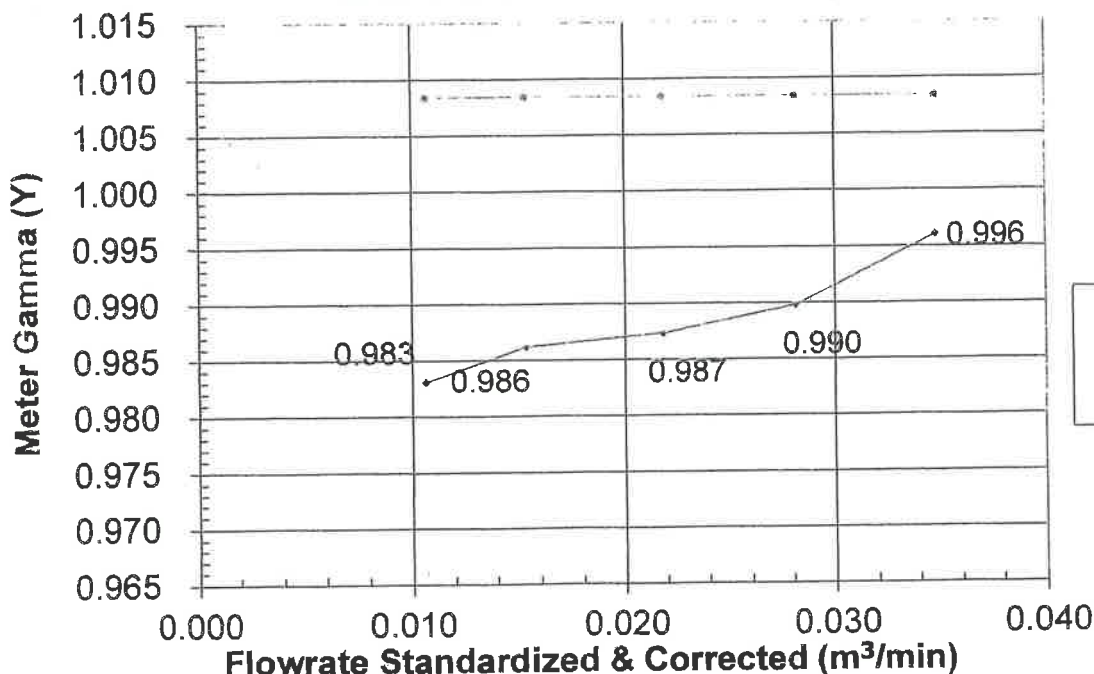
Signature: *Palpasu Chaleana*
 (Palpasu Chaleana)
 Service Engineer

WISDOM SCIENCE
 บริษัท วิสโดม ไซนส์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY (LIMITED)

Date: 27/07/2022

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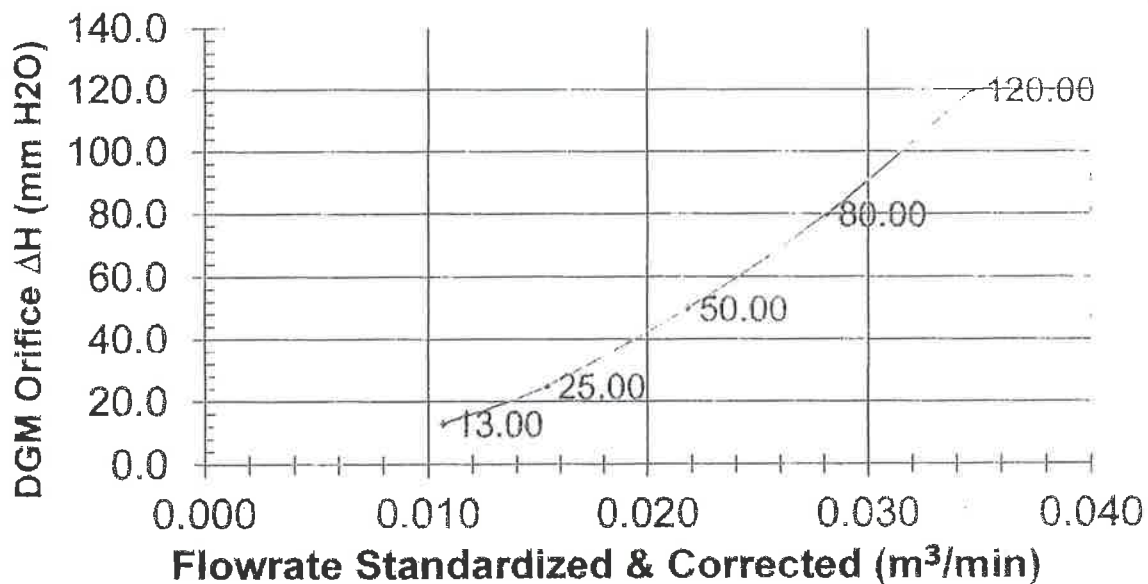
Meter Gamma vs Flowrate



→ Gamma Y
 → Max Allow Y
 Min Allow Y

COPY

Meter Pressure vs Flowrate



Console Serial:

1007055

Console Model:

MC-S72V

COPY

THERMOCOUPLES SYSTEM CALIBRATION

W SDOM

MSI, Inc. has informed me that this is a copy of the original document and is not a certified copy.

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-S72V	Date	27/07/2022
Console Serial Number	1007055	Calibration Reference No.	WDS-SV650005
Meter Box Model Number	DIGICON	Barometric Pressure	756
Meter Box Serial Number	N/A	Reference Thermometer	FLUKE 714
		Serial Number	9038005

Results												
Console Thermocouple Simulator												
Channel and test point		Meter Box Channel Temperature Reading (°C)										
		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack		-18	25	38	93	150	261	373	485	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
Stack
Probe
Filter

+ 1.50% °K
+ 3.0 °C
+ 3.0 °C

Meter
Exit

Signature

(Patpasu Chaisana)
Service Engineer

COPY

Flue gas Analyzer

Testo 350XL

Serial No. 01807527

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, Sukhapbarn 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, Laksi, 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

Mr. Sedawut Nueathong
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

COPY
Issued Date: 26/02/16



Certificate No.: G 650383

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-Jul-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		Mean of		Uncertainty (±)
	Values	UUC	Error		
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

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Issued Date 26/02/16

Page 2 of 3

Calibration Results After Adjustment (Table 3)

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	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	194.5	-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 µmol/mol = 1 ppm.

End of Report

COPY

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

NSC-TIS1-TS17025
CALIBRATION 0152

Page 1 of 3

Certificate No. : 22-01766

Sample Code : 22-04498-003

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siiracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert Model : UFE 500

Serial No. : G511.0182 ID No. : LABE 17/4

Date of Receipt : 03 February 2022 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

TAS-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-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)

Scientist

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,

Phlabphla, Wang Thonglang, Bangkok 10310

TEL 02-516-2422

FAX 02-516-6949

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Rev.01

Effective Date: 15/01/21

NSC-TIS1-TS17025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-01766

Sample Code : 22-04498-003

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# g ^{ind}
104	103.5	103.5	104.46	104.45	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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Phlabphla, Wang Thonglang, Bangkok 10310

TEL 02-516-2422

FAX 02-516-6949

Rev.09

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/01/21

REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 22-011766

Sample Code : 22-04498-003

Results of Calibration

Notes

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

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

- End of Report -

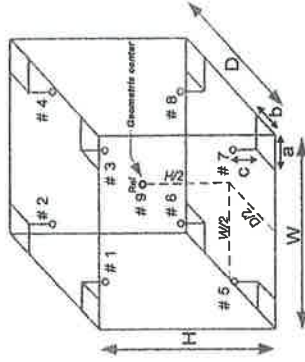


Figure: Example of sensor
installation Positions

COPY

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



Bara Scientific
Source of Success
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-167/22
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. 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, Sistracha, 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 Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choolthep

Approved by

Mr.Kanchit Choolthep
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-708-02 Rev.01 (2301/63)



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



Certificate of Calibration

Number of Page(s) 2 of 3

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

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



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor 7 Rama4 Road
Siam Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375466-7
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 0.5472 0.7637 1.0480	0.0000 0.5481 0.7636 1.0487	0.0000 0.0009 -0.0001 0.0017	0.0042 0.0042 0.0042 0.0042
440.0	0.0000 0.5371 0.7457 1.0233	0.0000 0.5377 0.7451 1.0240	0.0000 0.0006 -0.0006 0.0016	0.0042 0.0042 0.0042 0.0042
465.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
546.1	0.0000 0.5006 0.6961 0.9563	0.0000 0.5006 0.6944 0.9550	0.0000 0.0000 -0.0017 -0.0013	0.0042 0.0042 0.0042 0.0042
590.0	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR	CNR CNR CNR CNR
635.0	0.0000 0.5137 0.6907 0.9533	0.0000 0.5137 0.6891 0.9519	0.0000 0.0000 -0.0016 -0.0014	0.0042 0.0042 0.0042 0.0042

*CNR = Customer not request

4. Stray Light*

Standard	Wavelength (nm)	Transmission (%T)	Absorbance (A)
cut-off wavelength (nm)	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 based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

End of Certificate

Signature

The above results are valid exclusively for the calibrated item(s) as mentioned 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.

FW-UV-708-02 Rev 01 (23/01/63)

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724

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



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 663 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha
Zip / Postal: 20730
State / Province: Chonburi
Order Number: 

Contact: Sasipon Nakhin

Weighing Device

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

Range	Max Capacity	Readability (d)
1	81 g	0.0001 g
2	220 g	0.001 g

Procedure

Calibration Guidelines: EURAMET cp-18 v. 4.0 (11/2015)
CPW002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cp-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Start: 24.9 °C	End: 25.7 °C	Start: 54.0 %	End: 51.3 %

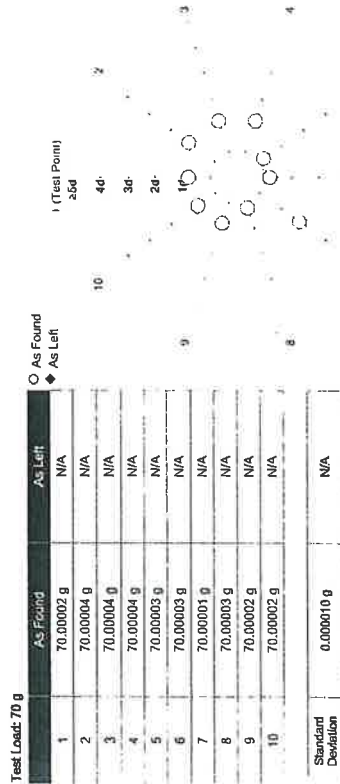
As Found Calibration Date: 07-Feb-2022
As Left Calibration Date: N/A
Issue Date: 08-Feb-2022
Calibrator: Sathaporn Tahsen
Approved Signatory: 

☒ Kassakorn Tassaraichaisakul
☐ Santil Jirinyom
☐ Surachet Sukkale



Measurement Results

Repeatability

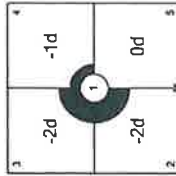


The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9996 g	N/A
3	99.9998 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0002 g	N/A



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



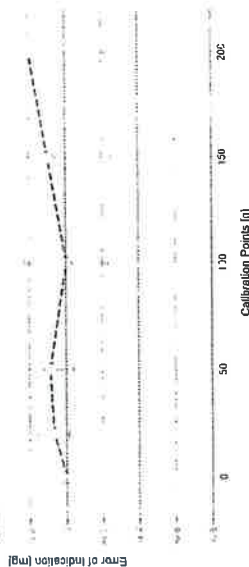
Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.021 mg	2
2	0.01000 g	0.01002 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	19.99994 g	20.00001 g	0.00007 g	0.085 mg	2
8	49.99987 g	50.00006 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 are shown and measurement points close to zero are not displayed.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor $k = 2$ - 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

Weight Set No.:	WS32	Date of Issue:	15-Sep-2020
Certificate Number:	169521	Calibration Due Date:	13-Mar-2022

Thermo Baro Hygrometer

Equipment No.:	INT4	Date of Issue:	09-Jul-2021
Certificate Number:	2111470	Calibration Due Date:	28-Jun-2022

Remarks

FACT adjustment functionally activated

Equipment condition: Good

Next calibration according to customer's procedure

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

Temperature range on site for the evaluation of the measurement uncertainty in use: $5 K$

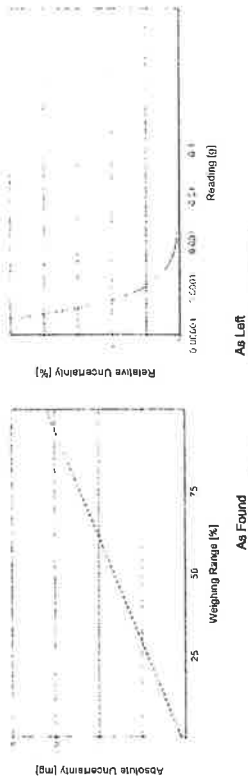
Uncertainty of Uncertainty Equation

Range	As Found		As Left
	g	Max.	
1	0.00001 g	81 g	N/A
2	0.0001 g	220 g	N/A

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

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

Net Indication		As Found		As Left	
0.00220 g		0.022 mg	1.0%	N/A	N/A
0.02200 g		0.022 mg	0.10%	N/A	N/A
0.22000 g		0.024 mg	0.011%	N/A	N/A
2.20000 g		0.039 mg	0.0018%	N/A	N/A
22.0000 g		1.7 mg	0.0079%	N/A	N/A



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



GWP® Certificate

As Found ✓ As Left ✓

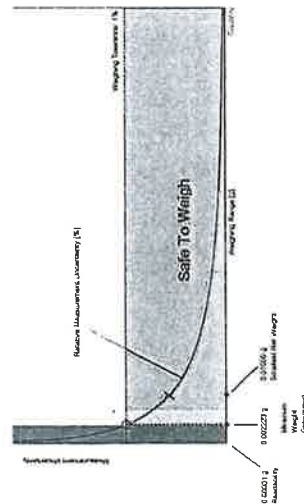
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.01000 g | Safety Factor: 2

Safe Weighing Range



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

TH4004-018-020722-ACC-TH

GWP® Certificate

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.022382 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	0.115457 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

Range 1

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	0.115457 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 unit test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

A = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance		Control Limit		As Found		As Left	
Tolerance	Control Limit	Std Deviation	Result	Std Deviation	Result	Std Deviation	Result
0.1%	0.000095 g		✗		✗		✗
0.2%	0.00010 g		✓		✓		✓
0.5%	0.000025 g		✓		✓		✓
1%	0.000050 g	0.000010 g	✓	0.000010 g	✓	0.000010 g	✓
2%	0.000100 g		✓		✓		✓
5%	0.000250 g		✓		✓		✓

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

Eccentricity

Test Load: 100 g

Tolerance		Control Limit		As Found		As Left	
Tolerance	Control Limit	Std Deviation	Result	Std Deviation	Result	Std Deviation	Result
0.1%	0.0500 g		✓		✓		✓
0.2%	0.1000 g		✓		✓		✓
0.5%	0.2500 g		✓		✓		✓
1%	0.5000 g	0.0002 g	✓	0.0002 g	✓	0.0002 g	✓
2%	1.0000 g		✓		✓		✓
5%	2.5000 g		✓		✓		✓

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

Software Version: 1.23.0.260

Report Version: 2.16.9

Form Number: F103C

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Software Version: 1.23.0.260

Report Version: 2.16.9

Form Number: F103C

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Error of Indication

As Found

Control limits for various weighing tolerances						
Reference Value	Error	0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99999 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
200.00000 g	0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

As Left

Control limits for various weighing tolerances						
Reference Value	Error	0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
100.00000 g	0.00000 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99999 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
200.00000 g	0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

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

Service Date: 2022-02-07
Document Number: TH4004-529-020722-LABBalanceHR
EASTERN THAI CONSULTING 1992 CO., LTD.
603 Moo 11, Sukaphitani 8 Rd., Nong Kham, Sriracha, Chonburi 20230
Khun Sasiporn Nakin

Balance Health Report

Device Details			
System Details			
Manufacturer:	Mettler Toledo	Accessory 1:	Other
Model:	XS205DU	Accessory 2:	
Serial number:	112632374	Weight set for routine testing:	No
Firmware:	4.0		
History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	< 1 year
Instrument age:	3-10 years	Last instrument calibration:	< 1 year
Spare parts available:	Yes	Last minimum weight determination:	Never
Regulations:	ISO		
Process tolerance in %:	1 %	Routine testing performed:	Don't know
Smallest sample net weight:	0.0100 g		
Check List			
Environmental Conditions		General & Functional Checks	
Room temperature fluctuation	✓	Leveling	✓
Exposure to direct sun	✓	Cleanliness	✓
Vibrations	✓	Completeness - missing parts see additional remarks	✓
Draft	✓	Settings optimized for operating environment	✓
Dirt or dust	✓	Other - objections noted as additional remarks	—
Static	✓	Electrical Component Checks	
Mechanical Component Checks		Power supply	✓
Draft shield	✓	Sliding door drive	—
Weighing pan position	✓	Internal weight drive	✓
Housing	✓	Display	✓
Other - objections noted as additional remarks	—	Other - objections noted as additional remarks	—
Recommendations			
Instrument Ready to Use			
Instrument calibration		Uninstall instrument	
Identify safe weighing range		Replace instrument	
GMP verification / risk assessment	Yes	Replace / add parts (see additional remarks)	
Preventive maintenance		Onsite repair	
Perform routine testing with test weights		Depot repair	
User training		Use of accessories (see additional remarks)	
Contact	Name: Khun Sasiporn Nakin	Position: Document Control	Phone: 086-051-3503
			Email: dr.jag@ec182.com
Additional Remarks & Recommendations			
Engineer Details			
		Date:	07-Feb-2022
		Name:	Sathaporn 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

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD

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



ISO 9001:2015
CALIBRATION 002



CALIBRATION CERTIFICATE

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

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

Equipment : Analog Barometer

Manufacturer : Barigo
Model : -
Serial No. : -
ID No./Tag No. : BM001/41
Date Received : 12-May-22
Date Calibrated : 20-May-22

Calibrated by : Mr. Sanuth Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

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



Page 1 of 2

COPY

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	*	0.00	0.59
1000.00	1000.0	*	0.00	0.59
1010.00	1010.0	*	0.00	0.59
1020.00	1020.0	*	0.00	0.59
1030.00	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

COPY

Page 2 of 2

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N99E15ACX9C Reference Number: 82-401135335-1
Cylinder Number: EB0062815 Cylinder Volume: 144.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PCVP Number: B52018 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA-600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This document is a true 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.

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
NLSM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR
GMS	0315201604	CC503386	4.975 PPM NITROGEN DIOXIDE/NITROGEN
NCRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN
NTRM	12060735	CC356192	2498 PPM CARBON MONOXIDE/NITROGEN

The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 CO	FTIR	Feb 08, 2018
Nicolet 6700 APW1100391 NO	FTIR	Feb 15, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Feb 16, 2018
Nicolet 6700 APW1100391 SO2	FTIR	Mar 01, 2018

Triad Data Available Upon Request

NOTES: NET WEIGHT: 10.43lbs
GROSS WEIGHT: 60.93lbs
PO# 5218000763

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



TESTING CERT No. 3082.05

Don Morin
Approved for Release

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-011766

Sample Code : 22-04498-003

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.

(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert Model : UFE 500

Serial No. : G511.0182 ID No. : LABE 17/4

Date of Receipt : 03 February 2022 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-P100)	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)

Scientist

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,

Phlabphla, Wang Thonglang, Bangkok 10310

FW-CL-114

TEL 02-516-2422

FAX 02-516-6949

Rev.01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21



REPORT OF CALIBRATION

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			# g ^{ref}
104	103.5	103.5	104.46	104.45	#####	104.07	104.46	104.42	104.34	104.07	104.30	0.53	2.00

2. Characterization results

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

Notes

- UUC* = Unit Under Calibration

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REPORT OF CALIBRATION

Page 3 of 3
Certificate No. : 22-011766
Sample Code : 22-04498-003

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 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.

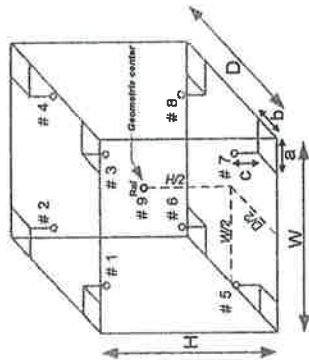


Figure: Example of sensor installation Positions

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%. This standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

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ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
45002
613.467.9000
877.263.7810 TOLL FREE
613.467.9009 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		ORIFICE DIFF H2O (in.)
					DIFF (mm)	Hg (mm)	
1	NA	NA	1.00	1.3400	3.2	2.00	
2	NA	NA	1.00	0.9510	6.3	4.00	
3	NA	NA	1.00	0.8510	7.8	5.00	
4	NA	NA	1.00	0.8130	8.6	5.50	
5	NA	NA	1.00	0.6690	12.6	8.00	

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
Qstd slope (m) =	1.96262		Qa slope (m) =	1.22856	
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}

COPY

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

Page 1 of 2
Certificate No. : 22-068062
Sample Code : 22-24591-002

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 : Digital thermo-hygrometer

Manufacturer : testo

Model : 608-H1

ID No. : LABE 09/7

Date of Receipt : 22 June 2022

Date of Calibration : 24 June 2022

Condition of Calibration : 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-CL-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.

2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in 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 34972A 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

Approved by : (Mr. Somchai Neampunt)

Issue date : 27 June 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

Rev 01

Effective Date 15/10/21

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date 15/10/21



REPORT OF CALIBRATION

Page 2 of 2
Certificate No. : 22-068062
Sample Code : 22-24591-002

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 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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Signed for Director

(Mr. Somchai Neampunt)

CONTACT@AMARC.CO.TH

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Effective Date 15/10/21

TEL 02-516-2422

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Rev 09

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

Rev 09

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



NSC-TISTR
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021 MTC No. EEL. BP. 35/1065

Submitted by : Eastern Thai Consulting 1992 Co.,Ltd.
Address : 683 Moo 11 Sukaphibal8 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., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Rion
Model : NC-75
Serial No. : 34802645

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 Brüel&Kjær 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level 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 : 10 Oct. 2022

Date of Calibration : 18 Oct. 2022

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, 196 Phahonyothin Road, Chabuchak, Bangkok 10900, Thailand
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592

FM.BLMTC.002 Re



NSC-TISTR
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021 MTC No. EEL. BP. 35/1065

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	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
Type				
1/2 inch Brüel&Kjær 4180	93.98	-0.02	± 0.10	±0.40 dB

2. Frequency

Standard Microphone	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
Type				
1/2 inch Brüel&Kjær 4180	1000.0	0.0	± 1.5	±1.0%

3. Total distortion

Standard Microphone	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit
Type			
1/2 inch Brüel&Kjær 4180	0.30	± 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. Weerachai Deechaiyae)

Date of Calibration : 18 Oct. 2022

Date of Issue : 19 Oct. 2022

End of Certificate

Ref : 2011265 1010043 75001

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The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 Rev.

SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : G301661

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 44/0965

Request No. 21-65/0774

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphitai 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
Manufacturer	: Cirrus
Model	: CR-172A
Serial No.	: G301661
Microphone	: Cirrus MK216 No.412971E
Preamplifier	: No.12349F

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
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. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 19 Sep. 2022

Date of Calibration : 6-7 Oct. 2022

The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 R

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0774

MTC No. EEL. BP. 44/0965

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 (2013). 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 : 6-7 Oct. 2022

The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 Re

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.87	94.3	93.7	-0.2	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.2	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	under-range	-	N/A
C-Weight	19.2	0.10	N/A
Flat	30.4	0.10	N/A

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140 dB.

Date of Calibration : 6-7 Oct. 2022

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FM.BLMTC-002.1

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.6	0.4	±1.5	0.45	0.6
1 000	-0.1	-0.2	±1.0	0.45	0.6
8 000	-2.2	-2.0	±5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.5	0.1	±2.0	0.20	0.6
125	0.3	0.1	±1.5	0.20	0.6
250	0.1	0.0	±1.5	0.20	0.6
500	0.1	0.0	±1.5	0.20	0.6
1 000	0.0	0.0	±1.0	0.20	0.6
2 000	-0.1	0.0	±2.0	0.20	0.6
4 000	-0.4	-0.2	±3.0	0.20	0.6
8 000	-0.5	-0.4	±5.0	0.20	0.7

Date of Calibration : 6-7 Oct. 2022

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FM.BLMTC-002 Rev

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5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	114.0	0.0	0.3	0.10	0.1
End	114.0				

6. Frequency and time weightings at 1 kHz

Frequency	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Weighting					
A-weight	114.0	0.0	0.2	0.20	0.2
C-weight	114.0	0.0	0.2	0.20	0.2
Flat	114.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Weighting					
Fast	114.0	0.0	0.1	0.20	0.2
Slow	114.0	0.0	0.1	0.20	0.2
Leq	114.0	0.0	0.1	0.20	0.2

Date of Calibration : 6-7 Oct. 2022

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FMBL-MTC.002 Re

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
140	140.0	0.0	0.8	0.30	0.3
139	139.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	93.9	-0.1	0.8	0.30	0.3
49	48.9	-0.1	0.8	0.30	0.3
44	43.9	-0.1	0.8	0.30	0.3
39	39.0	0.0	0.8	0.30	0.3
34	33.9	-0.1	0.8	0.30	0.3
29	29.0	0.0	0.8	0.30	0.3
24	24.0	0.0	0.8	0.30	0.3

Date of Calibration : 6-7 Oct. 2022

The results relate only to the items tested/calibrated or value assigned.

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8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	114.0	115.0	1.0	0.8	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-140	25	115.0	90.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	136.0	0.0	±1.0	0.20	0.3
	2	119.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	109.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	129.6	0.0	±1.0	0.20	0.3
	2	110.0	0.0	+1.0; -5.0	0.20	0.3
	200	130.0	0.0	±1.0	0.20	0.3
SEL	2	110.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	100.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 6-7 Oct. 2022

Date of Calibration : 6-7 Oct. 2022

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.6	0.2	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive one-half cycle	Negative one-half cycle			
139.1	139.1	0.0	2.0	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by: *Pannasit Phasingri*

(Mr. Pannasit Phasingri)

Approved by:

(Mr. Prawant Subpa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 6-7 Oct. 2022

Date of Issue : 12 Oct. 2022

Ref : 2011265091904119002

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E-mail : sumalee@tistr.or.th

SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301039

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0292

MTC No. EEL. BP. 27/0265

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 :

Ambient Environment	
Description	: (23 ± 3) °C
Manufacturer	: (50 ± 15) %
Model	: (101.325±1.5) kPa
Serial No.	
Microphone	: Cirrus MK216 No.413374B
Preamplifier	: No.9548F

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. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.
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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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0292

MTC No. EEL. BP. 27/0265

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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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.73	Before adjust 93.6	After adjust 93.7	0.0	0.50
				1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 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	under-range	-
C-Weighting	19.8	0.10
Flat	28.8	0.10

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140

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	0.0	0.0	-0.1	0.40	2.0
1 000	-0.3	-0.4	-0.4	0.40	1.4
4 000	-0.1	0.2	0.4	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	0.4	0.1	0.2	0.20	2.5
125	0.2	0.1	0.0	0.20	2.0
250	0.2	0.0	0.0	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	-0.2	-0.1	0.0	0.20	2.6
4 000	-0.4	-0.2	-0.1	0.20	3.6
8 000	-0.5	-0.3	-0.2	0.20	5.6

Date of Calibration : 3 Mar. 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	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	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	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	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)
139	139.1	0.1	0.30	1.4
134	134.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4

Date of Calibration : 3 Mar. 2022

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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)
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	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	93.9	-0.1	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	83.8	-0.2	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.8	-0.2	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.8	-0.2	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
29	28.9	-0.1	0.30	1.4
24	24.0	0.0	0.30	1.4

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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)
20-140	135	135.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	136.0	0.0	0.20	±1.3
	2	118.9	-0.1	0.20	+1.3; -2.8
	0.25	109.9	-0.1	0.20	+1.8; -5.3
Slow	200	129.6	0.0	0.20	±1.3
	2	110.0	0.0	0.20	+1.3; -5.3
	200	130.0	0.0	0.20	±1.3
SEL	2	110.0	0.0	0.20	+1.3; -2.8
	0.25	100.9	-0.1	0.20	+1.8; -5.3

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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	135.4	135.7	0.3	0.20	2.4
Positive half cycle	134.4	134.3	-0.1	0.20	1.4
Negative half cycle	134.4	134.3	-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	Negative one-half cycle			
139.1	139.1	0.0	0.30	1.8

Calibrated by :

Pannasit Phasingst

(Mr. Pannasit Phasingst)

Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by :



TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 3 Mar. 2022

Date of Issue : 4 Mar. 2022

Ref : 20112650200458002

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Area Heat Stress Monitor

Model : QUESTemp 34

Serial No. : TEU080012



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



REC-100-01-2005
CALIBRATION ISO2



CALIBRATION CERTIFICATE

Certificate No. : AD2207-309-0003

Date Issued : 03-Aug-22

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

Equipment : Area Heat Stress Monitor

Manufacturer : TSI
Model : QUESTemp 34

Serial No. : TEU080012

ID No./Tag No. : NO.11

Date Received : 27-Jul-22

Date Calibrated : 31-Jul-22

Calibrated by : Mr. Apiwat Peanrungrat

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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



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Certificate No. : AD2207-309-0003

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15)\%\text{RH}$

STD Reading ($^\circ\text{C}$)	UUC Reading ($^\circ\text{C}$)		UUC Error ($^\circ\text{C}$)	Measurement Uncertainty ($\pm^\circ\text{C}$)
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 38.1	-	0.10	0.35
38.00	GLOBE 37.9	-	-0.10	0.35
44.98	WET 45.2	-	0.22	0.35
44.98	DRY 45.2	-	0.22	0.35
44.98	GLOBE 44.9	-	-0.08	0.35

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range Resolution $(-5) \text{ to } 100 \text{ } ^\circ\text{C}$ $0.1 \text{ } ^\circ\text{C}$

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

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

End of Certificate

Page 2 of 2

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Area Heat Stress Monitor

Model : QUESTemp34

Serial No. : TEU080013



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



CALIBRATION CERTIFICATE

Certificate No. : AD2206-362-0001
Date Issued : 06-Jul-22

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

Equipment : Area Heat Stress Monitor

Manufacturer : TSI

Model : Questemp 34

Serial No. : TEU 080013

ID No./Tag No. : No.12

Date Received : 30-Jun-22

Date Calibrated : 04-Jul-22

Calibrated by : Mr. Apiwat Peanrungrat

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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



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Certificate No. : AD2206-362-0001

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15)\%\text{RH}$

STD Reading ($^\circ\text{C}$)	UUC Before Adjusted	UUC After Adjusted	UUC Error ($^\circ\text{C}$)	Measurement Uncertainty ($^\circ\text{C}$)
37.97	WET 37.9	-	-0.07	0.35
37.97	DRY 37.8	-	-0.17	0.35
37.97	GLOBE 38.1	-	0.13	0.35
44.97	WET 44.9	-	-0.07	0.35
44.97	DRY 44.8	-	-0.17	0.35
44.97	GLOBE 45.2	-	0.23	0.35

STD = Standard

UUC = Unit Under Calibration

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

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

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

End of Certificate

Page 2 of 2

COPY

DIGITAL LIGHT METER

Model : LX-72

Serial No. : Q 606371



CALIBRATION CERTIFICATE

Issued date : 4 August 2022

Client Name : **EASTERN THAI CONSULTING 1992 CO., LTD.**

Address : 683 Moo. 11, Sukhaphibal Rd., Nongkham, Siracha , Chonburi 20230.

Request No : C-2208 - 381

Laboratory No.: CAL- 381

Date of Request : 1 August 2022.

Date of Calibration : 3 August 2022.

1. Unit Under Calibration (UUC) :

Nomenclature : Digital Light Meter

Maker : DIGICON

Serial No.: Q 606371

Model : LX - 72

2. Place of Calibration : Photometry Standard Laboratory, INTERNATIONAL TESTING SERVICE CO., LTD.

3. Range of Calibration : 3 Range

4. Condition of Laboratory : Ambient temperature : (25 ± 2) °C and relative humidity (60 ± 20) %.

5. Reference Standard : Standard Tungsten Halogen Lamp , Serial No.: 504011, which was calibrated on

2 April 2022, can be traceable to International System of Unit (SI) through Electrical and Electronics

Institute Foundation for Industrial development, Certificate No.: CO20220052EA.

6. Support Equipment :

1. Photometric bench , 6.3 meter long.

2. DC. power supply, Serial No.: EJ 19A 009, Model : GPR-25H 300 , Maker : GW INSTR.

3. Digital Multimeter , Model : 34401A , S/N : MY44011212 and MY44011215.

4. Foot Candle / Lux Meter , Model : 407026, S/N : Q 558437, Maker : EXTECH.

7. Calibration Procedure :

The measurement was done in accordance with WI-CP-01. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

The Results shown in this certification report refer only to the equipment(s) calibrated unless otherwise stated
This Calibration Certificate cannot be reproduced, except in full, without permission of company.



Request No : C-2207 - 381

Laboratory No.: CAL - 381

Serial No. : Q 606371

Results :

UUC Range	Standard (lx)	Unit Under Calibration Reading (lx)	Correction (lx)	Uncertainty of Measurement (± lx)
400	0	---	---	---
	50	51.1	- 1.1	2.1 % of Reading
	100	102.7	- 2.7	
	200	202.8	- 2.8	
	300	300.5	- 0.5	
	400	397.4	+ 2.6	
4000	500	498	+ 2	2.1 % of Reading
	1000	996	+ 4	
	2000	1985	+ 15	
	3000	2959	+ 41	
X10	4000	3905	+ 95	
	5000	488	+ 120	

Note : 1. The results relate only to the items calibrated.
2. The UUC is not read out at zero lux.
3. The UUC is calibrate at 5000 lx is not NSC-ONSC Accredited.

Calibration result approved by

Approved on behalf of
International Testing Service Co., Ltd

(Mr. Yutana Tholueng)

(Mr. Pichit Vivat-Anant)

Managing Director

Page 2 of 2

The Results shown in this certification report refer only to the equipment(s) calibrated unless otherwise stated
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SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021 **MTC No. EEL. BP.** 35/1065

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co.,Ltd.
Address : 683 Moo 11 Sukaphibal8 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., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Rion
Model : NC-75
Serial No. : 34802645

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 DP-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level 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 : 10 Oct. 2022

Date of Calibration : 18 Oct. 2022

Ref : 2011705100437200

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0021 **MTC No. EEL. BP.** 35/1065

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	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
Type				
1/2 inch Brüel&Kjær 4180	93.98	-0.02	± 0.10	±0.40 dB

2. Frequency

Standard Microphone	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
Type				
1/2 inch Brüel&Kjær 4180	1000.0	0.0	± 1.5	±1.0%

3. Total distortion

Standard Microphone	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit
Type			
1/2 inch Brüel&Kjær 4180	0.30	± 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 :

(Mr. Weerachai Deechaiyae)

Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Oct. 2022

Date of Issue : 19 Oct. 2022

End of Certificate

Ref : 2011705100437200

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FM.BLMTC.002 Rev.

SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 01209914

Request No. 21-65/0581

MTC No. EEL. BP. 54/0665

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
Manufacturer : Rion
Model : NL-21
Serial No. : 01209914 (No.19)
Microphone : Type UC-52 No.191368
Preamplifier : Type NH-21 No.32088

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
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 : 17 Jun. 2022

Date of Calibration : 12 Jul. 2022

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FM.BL.MTC.002 Rev.

Request No. 21-65/0581

MTC No. EEL. BP. 54/0665

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 : 12 Jul. 2022

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FM.BL.MTC.002 Rev.

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)	
	Measured Value (dB)		Deviation (dB)		
	Before adjust	After adjust			
	113.8	113.9			
113.92			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 115.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
18.5	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		
A-Weighting	15.0	0.10
C-Weighting	24.2	0.10
Flat	25.8	0.10

Date of Calibration : 12 Jul. 2022

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FM.BL.MTC.002 Rev.4

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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	0.5	0.3	0.40	2.0
1 000	0.3	0.3	0.4	0.40	1.4
4 000	-0.1	-0.1	-0.1	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	-0.1	-0.1	-0.2	0.20	2.5
125	-0.2	-0.1	0.0	0.20	2.0
250	0.0	-0.1	0.0	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	0.1	0.1	0.20	2.6
4 000	0.0	0.0	0.1	0.20	3.6
8 000	0.2	0.2	0.1	0.20	5.6

Date of Calibration : 12 Jul. 2022

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FM.BL.MTC.002 Rev.

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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)
125	125.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
123	123.0	0.0	0.30	1.4
122	121.9	-0.1	0.30	1.4
121	121.0	0.0	0.30	1.4
120	119.9	-0.1	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

Date of Calibration : 12 Jul. 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)
104	103.9	-0.1	0.30	1.4
99	98.9	-0.1	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	68.9	-0.1	0.30	1.4
64	63.9	-0.1	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	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	32.9	-0.1	0.30	1.4
32	31.8	-0.2	0.30	1.4
31	30.9	-0.1	0.30	1.4
30	29.8	-0.2	0.30	1.4
29	28.8	-0.2	0.30	1.4
28	27.7	-0.3	0.30	1.4

Date of Calibration : 12 Jul. 2022

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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	85.1	0.1	0.30	1.4
20-80	75	75.1	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	116.0	0.0	0.20	±1.3
	2	99.0	0.0	0.20	+1.3; -2.8
	0.25	89.9	-0.1	0.20	+1.8; -5.3
Slow	200	109.6	0.0	0.20	±1.3
	2	90.0	0.0	0.20	+1.3; -5.3
SEL	200	110.0	0.0	0.20	±1.3
	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 : 12 Jul. 2022

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FM.BLMTC.002 Re

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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	0.0	0.30	1.8
135.6	135.6			

Calibrated by :

Pannasit Ph. (Mr. Pannasit Phasingri)

Approved by :



Withawat Supanich (Mr. Wittawat Supanich)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 12 Jul. 2022

Ref : 2011265061702752002

Date of Issue : 18 Jul. 2022

End of Certificate

8 / 8

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FM.BLMTC.002 Re

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SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 00310455

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
Manufacturer : Rion
Model : NL-21
Serial No. : 00310455 (No.9)
Microphone : Type UC-52 No.191026
Preamplifier : Type NH-21 No.32095

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
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 : 22 Sep. 2022

Date of Calibration : 6-7 Oct. 2022

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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 (2013). 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 : 6-7 Oct. 2022

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.87	114.0	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14.8	0.10	N/A
C-Weight	21.6	0.10	N/A
Flat	26.4	0.10	N/A

Date of Calibration : 6-7 Oct. 2022

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FM.BLMTC.002 Rk

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.1	0.1	±1.5	0.45	0.6
1 000	-0.1	-0.1	±1.0	0.45	0.6
8 000	-2.5	-2.4	±5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	-0.1	-0.1	±2.0	0.20	0.6
125	-0.1	-0.1	±1.5	0.20	0.6
250	-0.1	-0.1	±1.5	0.20	0.6
500	-0.3	0.0	±1.5	0.20	0.6
1 000	0.0	0.0	±1.0	0.20	0.6
2 000	0.1	0.2	±2.0	0.20	0.6
4 000	0.1	0.1	±3.0	0.20	0.6
8 000	0.1	0.2	±5.0	0.20	0.7

Date of Calibration : 6-7 Oct. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0787 MTC No. EEL. BP. 63/0965

Request No. 21-65/0787 MTC No. EEL. BP. 63/0965

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 6-7 Oct. 2022

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8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	0.8	0.30	0.3
30-120	94.0	94.0	0.0	0.8	0.30	0.3
20-110	94.0	94.0	0.0	0.8	0.30	0.3
20-100	94.0	94.1	0.1	0.8	0.30	0.3

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	44.9	-0.1	0.8	0.30	0.3
30-120	35	35.0	0.0	0.8	0.30	0.3
20-110	25	25.4	0.4	0.8	0.30	0.3
20-100	25	25.3	0.3	0.8	0.30	0.3
20-90	25	25.4	0.4	0.8	0.30	0.3
20-80	25	25.4	0.4	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -5.0	0.20	0.3
	200	110.0	0.0	±1.0	0.20	0.3
SEL	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 6-7 Oct. 2022

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Date of Calibration : 6-7 Oct. 2022

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MTC No. EEL. BP. 63/0965

Request No. 21-65/0787

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	124.8	-0.6	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Positive one-half cycle	Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive one-half cycle	Negative one-half cycle	value (dB)	value (dB)	value (dB)	value (dB)
135.7	135.7	135.7	0.0	2.0	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	119.0	0.0	0.3	0.10	0.1
End	119.0				

Calibrated by : *Pannasit Phasingst*

(Mr. Pannasit Phasingst)

Approved by :

Electrical and Electronics Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 6-7 Oct. 2022

Date of Issue : 7 Oct. 2022

Ref : 2011265092204165001

End of Certificate

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SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 01209917



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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0677

MTC No. EEL. BP. 28/0865

MTC No. EEL. BP. 28/0865

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
Manufacturer : Rion
Model : NL-21
Serial No. : 01209917 (No.22)
Microphone : UC-52 No.147768
Preamplifier : NH-21 No.34627

Ambient Environment
Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
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 : 8 Aug. 2022

Date of Calibration : 2 Sep. 2022

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Date of Calibration : 2 Sep. 2022 2 / 9

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.90	114.1	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 116.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
23.4	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting			
A-Weight	18.3	0.10	N/A
C-Weight	23.1	0.10	N/A
Flat	28.6	0.10	N/A

Date of Calibration : 2 Sep. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.3	0.5	0.3	1.5	0.45	0.6
1 000	0.2	0.1	0.2	1.0	0.45	0.6
8 000	-2.0	-1.9	-2.1	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	-0.1	-0.1	2.0	0.15	0.6
125	-0.1	0.0	-0.1	1.5	0.15	0.6
250	-0.1	0.0	-0.1	1.5	0.16	0.6
500	-0.1	0.0	0.0	1.5	0.15	0.6
1 000	0.0	0.0	0.0	1.0	0.15	0.6
2 000	0.1	0.2	0.1	2.0	0.15	0.6
4 000	0.1	0.1	0.1	3.0	0.15	0.6
8 000	0.2	0.2	0.1	5.0	0.15	0.7

Date of Calibration : 2 Sep. 2022

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Request No. 21-65/0677

MTC No. EEL. BP. 28/0865

5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	125.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
123	123.0	0.0	1.1	0.30	0.3
122	122.0	0.0	1.1	0.30	0.3
121	121.0	0.0	1.1	0.30	0.3
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	103.9	-0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3

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7. Level linearity on the reference level range cont.

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	43.9	0.0	1.1	0.30	0.3
39	38.9	0.0	1.1	0.30	0.3
34	33.9	0.0	1.1	0.30	0.3
33	33.0	0.0	1.1	0.30	0.3
32	31.9	0.0	1.1	0.30	0.3
31	31.0	0.0	1.1	0.30	0.3
30	30.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the signal level that first clause an indication of under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.4	0.4	1.1	0.30	0.3
20-100	25	25.4	0.4	1.1	0.30	0.3
20-90	25	25.4	0.4	1.1	0.30	0.3
20-80	25	25.5	0.5	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	99.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -5.0	0.20	0.3
	200	110.0	0.0	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Complete cycle	125.4	125	-0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication


Positive one-half cycle	Measured value (dB)		Deviated value	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Positive	Negative				
135.6		135.6	0.0	2.0	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
	Begin	End			
	119.0	0.0	0.3	0.10	0.1
	119.0				

Calibrated by :  Approved by :

(Mr. Pannasit Phasingri)



(Mr. Witawat Supanich)

Electrical and  Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265080803470002

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End of Certificate

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