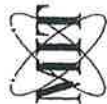


BAROMETER

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.miracle.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2106-032-0001

Date Issued : 04-Jun-21

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 : 02-Jun-21

Date Calibrated : 04-Jun-21

Calibrated by : Mr. Somjet Onbua

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by :

(Mr. Tassanai Suksakon)
Technical Manager



Page 1 of 2

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Certificate No. : AD2106-032-0001

Environment : Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

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

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium

Mounting Position

Reference Level

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

Vertical

at center of its dial

Description of UUC :

Range

Calibration Range

Scale Interval

Resolution

955 - 1075 hPa Absolute

990 - 1030 hPa Absolute

1 hPa

0.5 hPa Absolute

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

End of Certificate

Page 2 of 2

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

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

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

Equipment : Analog Barometer

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

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

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Certificate No : AD2205-163-0001

Environment : Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa) Before Adjusted	UUC Reading (hPa) After Adjusted	UUC Error hPa	Uncertainty ± hPa
990.00	990.0	-	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

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Page 2 of 2

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 000/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, Lb. 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			
Assay Dates				
				10/15/2021
				10/15/2021

CALIBRATION STANDARDS		
Type	Lot ID	Cylinder No
NTRM	08011503	K002564
NTRM	200602-06	6162860Y
		Concentration
		246.7 PPM METHANE/AIR
		243.3 PPM PROPANE/AIR
		Uncertainty
		+/- 0.5%
		+/- 0.5%
Expiration Date		
		May 15, 2025
		Mar 17, 2027

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Nicolet iS50 FTIR AUP2110295 CH4	FTIR
Nicolet iS50 FTIR AUP2110295 C3H8	FTIR
Last Multipoint Calibration	
Oct 13, 2021	
Oct 14, 2021	

Triad Data Available Upon Request

NOTES:

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



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Michael A. Huber

Approved for Release

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

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

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

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18080607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2022
NTRM	12060735	CC356192	2468 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 14, 2026
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 concentrations 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 Morris
Approved for Release

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DRY GAS METER MC-572-V

Serial No. : 1007055

METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING REFERENCE METER # WET TEST METER W-NK5A No. 540961☒ Preventive Maintenance & Check

5-POINT METRIC UNIT

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

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

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

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed (t)	DGM Orifice ΔH (P ₂)	Volume Initial (V _{in})	Volume Final (V _{out})	Outlet Temp Initial (t _{in})	Outlet Temp Final (t _{out})	Volume Initial (V _{in})	Volume Final (V _{out})	Outlet Temp Initial (t _{in})	Outlet Temp Final (t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	342.0737	342.2483	25	26	204.97437	205.17455	27	26
10.00	25.0	342.2809	342.4463	26	26	205.21227	205.39528	26	26
8.00	50.0	342.4747	342.6575	26	26	205.42618	205.62204	26	26
7.00	80.0	342.6743	342.8792	26	26	205.63987	205.85736	26	26
5.00	120.0	342.9033	343.0823	26	26	205.88266	206.07264	26	26

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

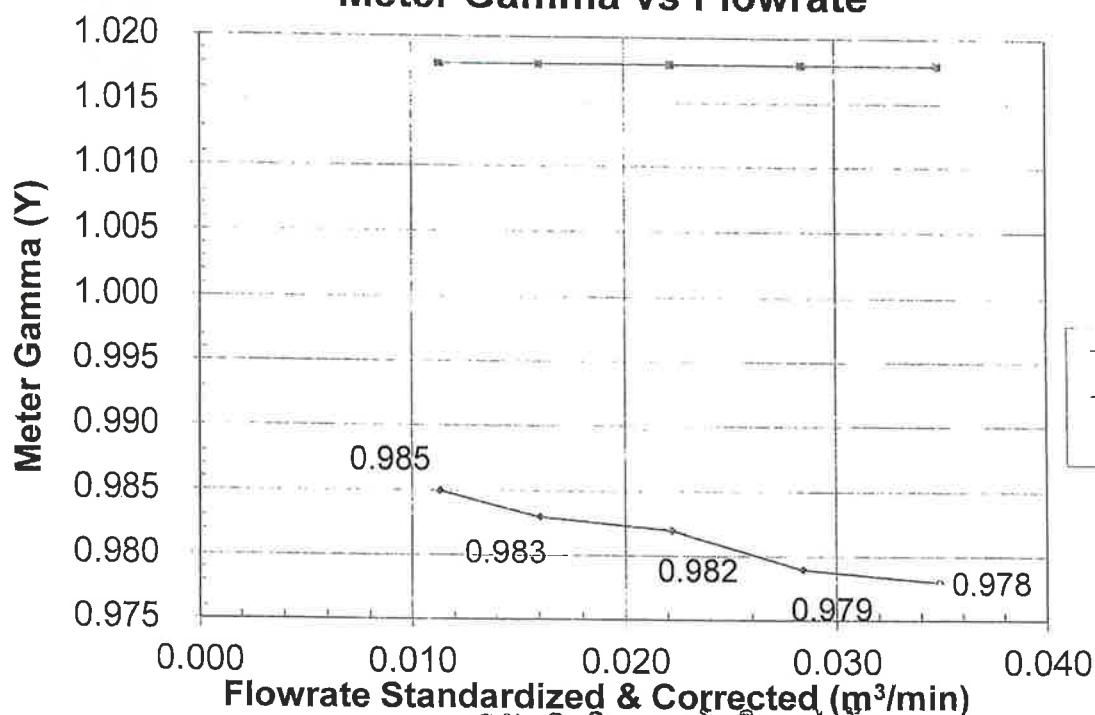
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to that of the reference meter. The difference of individual values from the average is +0.02.

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 +0.2inches (5.1mm) H₂O.Signature Surachai Chalsana
(Surachai Chalsana)
Service Engineer

Date

15/06/2021

Meter Gamma vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

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

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

Results

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

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

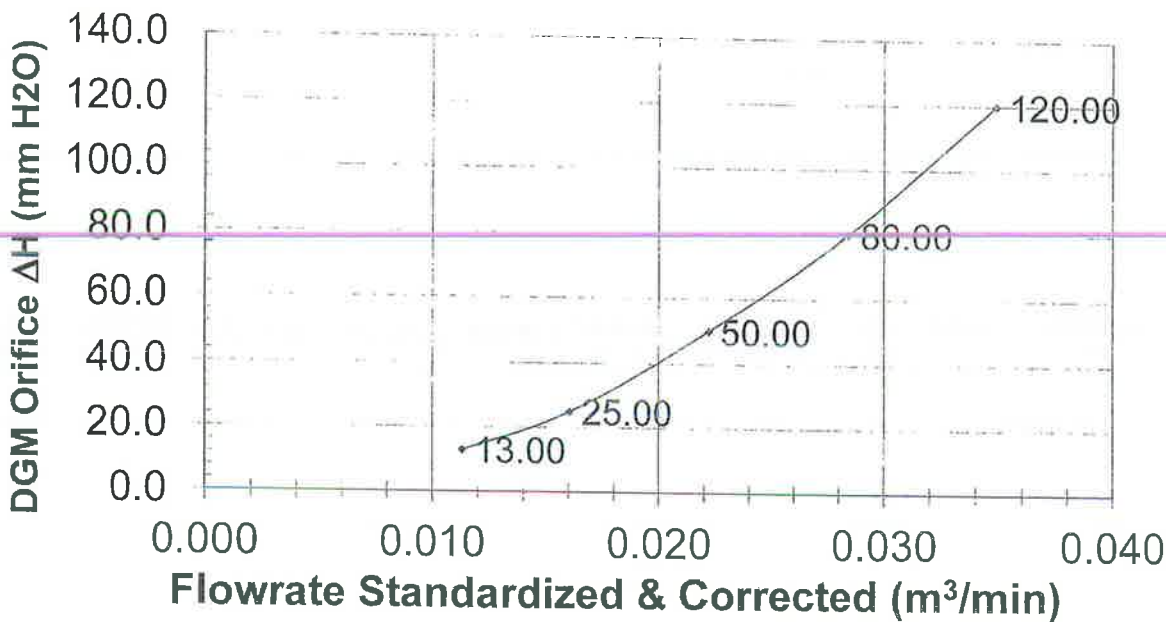
Tolerance Range

Meter
Exit+ 3.0 °C
+ 2.0 °Cบริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY

Signature

(Surachai Chaisana)
Service Engineer

Meter Pressure vs Flowrate

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Serial:

1007055

Console Model:

MC-572-V

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บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนปิ่นทอง แขวงปิ่นทอง เขตปทุมธานี 10700 โทร. 0-2435-8331, 0-2435-8800, 0-2494-9191 แฟกซ์ : 0-2435-1679, 0-2434-9510
451-451/1 Sirinthorn Road, Bangbunru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax (662) 433-1679, 434-9510

DRY GAS METER XC-572-V

Serial No. : A2007510

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

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

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

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

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

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{std})	(Q _{std})	(V _{std})	(Q _{std})	Value	Variation	Flowrate	ΔH @	
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr	.0212 m ³ /min	Variation
						(Q _{std})	(ΔH@)	(ΔΔH@)
						m ³ /min	mm H ₂ O	
0.166	0.011	0.167	0.011	1.006	-0.001	0.011	46.495	0.632
0.155	0.015	0.156	0.016	1.005	-0.002	0.016	46.005	0.141
0.178	0.022	0.177	0.022	1.006	-0.001	0.022	45.788	-0.076
0.195	0.028	0.197	0.028	1.008	0.001	0.028	45.491	-0.373
0.171	0.034	0.173	0.035	1.009	0.002	0.035	45.540	-0.324
				1.007	Y Average		45.664	ΔH@ Average

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

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

Signature

(Sirichok Sansomsup)

บริษัท สิทธีพรแอสโซซิเอต จำกัด

SITHIPORN ASSOCIATES COMPANY

Date

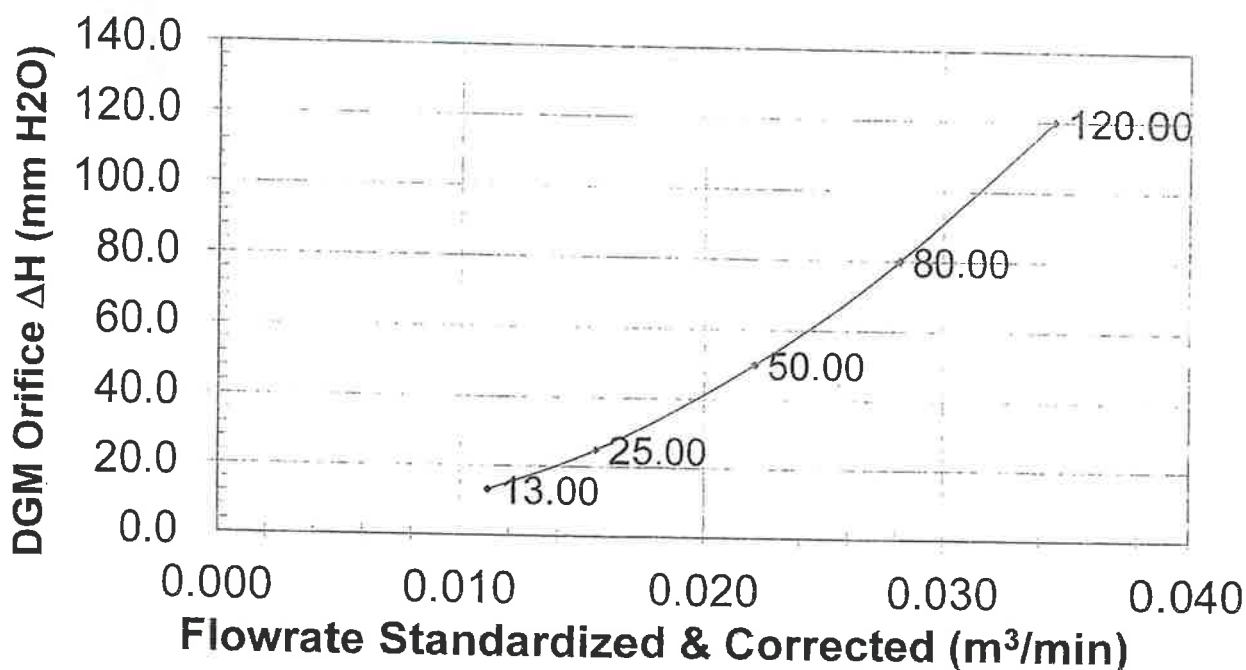
11/8/2021

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Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

Meter Pressure vs Flowrate



Console Serial:

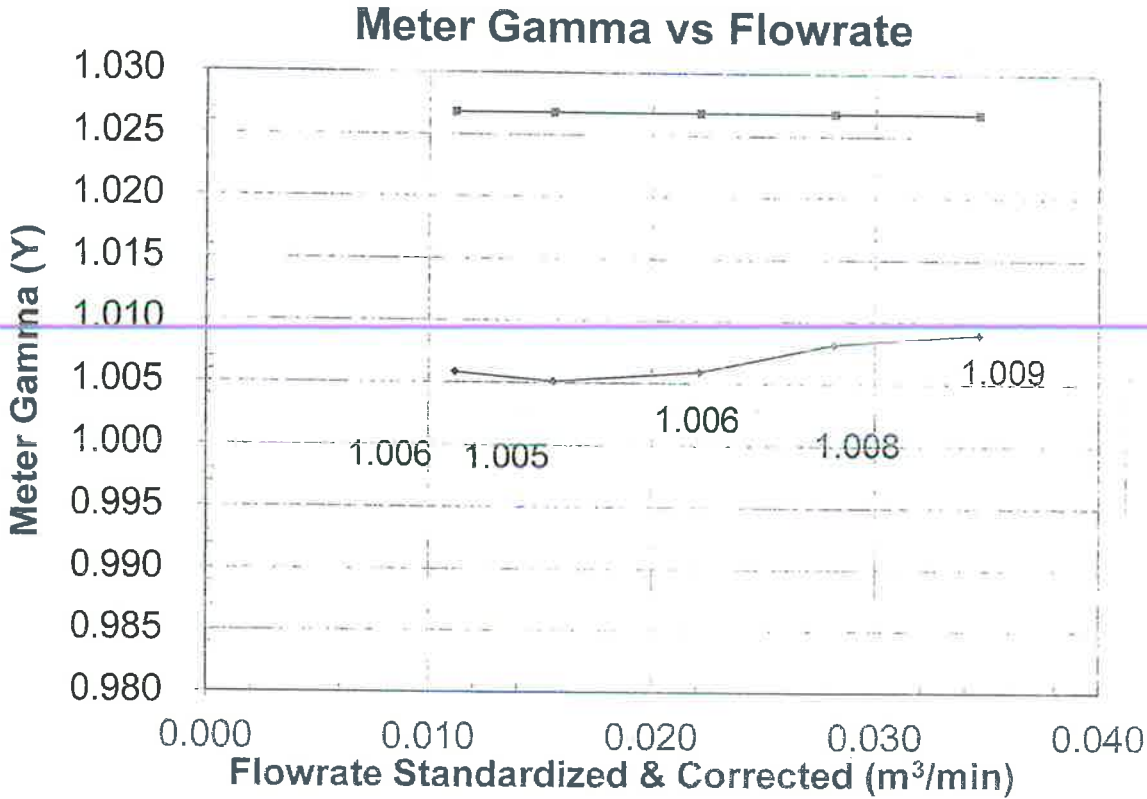
A2007510

บริษัท สิทธีพรแอสโซซิเอต จำกัด
 SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

XC-572-V

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Console Serial: A2007510

บริษัท สิทธีพรแอสโซซิเอตส์ จำกัด
SITHIPORN ASSOCIATES COMPANY

Console Model: XC-572-V

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THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN

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

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	11-Aug-21 1:00 PM
Console Serial Number	A2007510	Calibration Reference No.	GC64APE004-0
DGM Model Number	SK25EX	Barometric Pressure	761 mm Hg
DGM Serial Number	00005115	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005

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

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
Stack	-18.0 25.0 38.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0
Probe	-18 25 38 94 150 261 370 481 593 815 1037
Filter	-17 25 37 93 147
Aux	-17 25 37 93 148
Exit	-17 25 37 93 150

Tolerance Range

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

Note: Temperature difference ≤ 1.5%

Signature 
 (Sirichok Sansomsup)
 Service Engineer

บริษัท สิทธีพรแอสโซซิเอตส์ จำกัด
SITHIPORN ASSOCIATES COMPANY

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DRY GAS METER MC-572

Serial No. : 0011024

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

5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	MC-672
Console Serial Number	0011024
DGM Model Number	SK25EX
DGM Serial Number	00005437

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

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

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(t ₀)	(P ₀)	(V ₀)	(V ₁)	(t ₀)	(t ₁)	(V ₀)	(V ₁)	(t ₀)	(t ₁)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	519.3522	519.5372	25	25	248.31965	248.50831	25	25
10.00	25.0	519.5505	519.7196	25	25	248.52318	248.69613	25	25
8.00	50.0	519.7505	519.9399	25	25	248.72918	248.92339	25	25
7.00	80.0	519.9562	520.1641	25	25	248.94255	249.15608	25	25
5.00	120.0	520.1817	520.3645	25	25	249.17802	249.36602	25	25

Standardized Data				Results				
Dry Gas Meter		Calibration Meter		Calibration Factor		Dry Gas Meter		
(V _{std})	(Q _{std})	(V _w)	(Q _w)	Value	Variation	Flowrate	ΔH @	
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr	.0212 m ³ /min	Variation
						(Q _{std} - Q _w)	(ΔH@)	(ΔΔH@)
						m ³ /min	mm H ₂ O	
0.182	0.012	0.185	0.012	1.016	-0.001	0.012	38.004	-1.317
0.166	0.017	0.169	0.017	1.018	0.001	0.017	38.741	-0.580
0.187	0.023	0.190	0.024	1.018	0.001	0.024	39.516	0.195
0.206	0.029	0.209	0.030	1.017	0.000	0.030	40.276	0.955
0.181	0.036	0.184	0.037	1.015	-0.002	0.037	40.076	0.748
				1.017	Y Average		39.321	ΔH@ Average

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

Note: For ΔH_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 ± 0.2 inches (5.1mm) H₂O.

Signature: Sirichok Sansomsup
 (Sirichok Sansomsup)
 Service Engineer

บริษัท สิทธิพรแอสโซซิเอต จำกัด

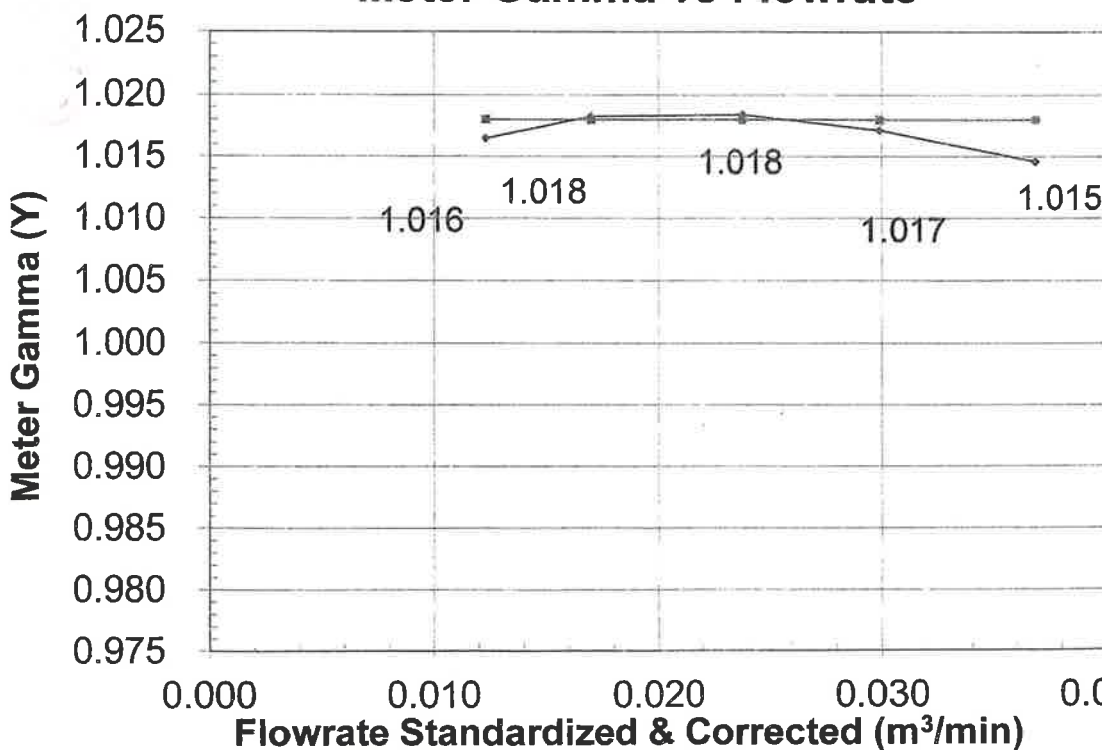
Date: 07/01/2022

COPY

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

Meter Gamma vs Flowrate



→ Gamma Y
 → Max Allow Y
 → Min Allow Y

Console Serial: 0011024

บริษัท สิทธิพรแอสโซซิเอต จำกัด

Console Model: MC-572

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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	MC-572
Console Serial Number	0011024
DGM Model Number	SK25EX
DGM Serial Number	00005437
Meter Box Model Number	JENCO 765
Meter Box Serial Number	JC02982

Calibration Conditions	
Date	07-Jan-22
Calibration Reference No.	HC65AFED0005
Barometric Pressure	759
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 94 150 261 372 483 595 817 1040
Probe	-18 25 38 94 150
Filter	-18 25 38 94 150
Aux	-18 25 38 94 150
Exit	-18 25 38

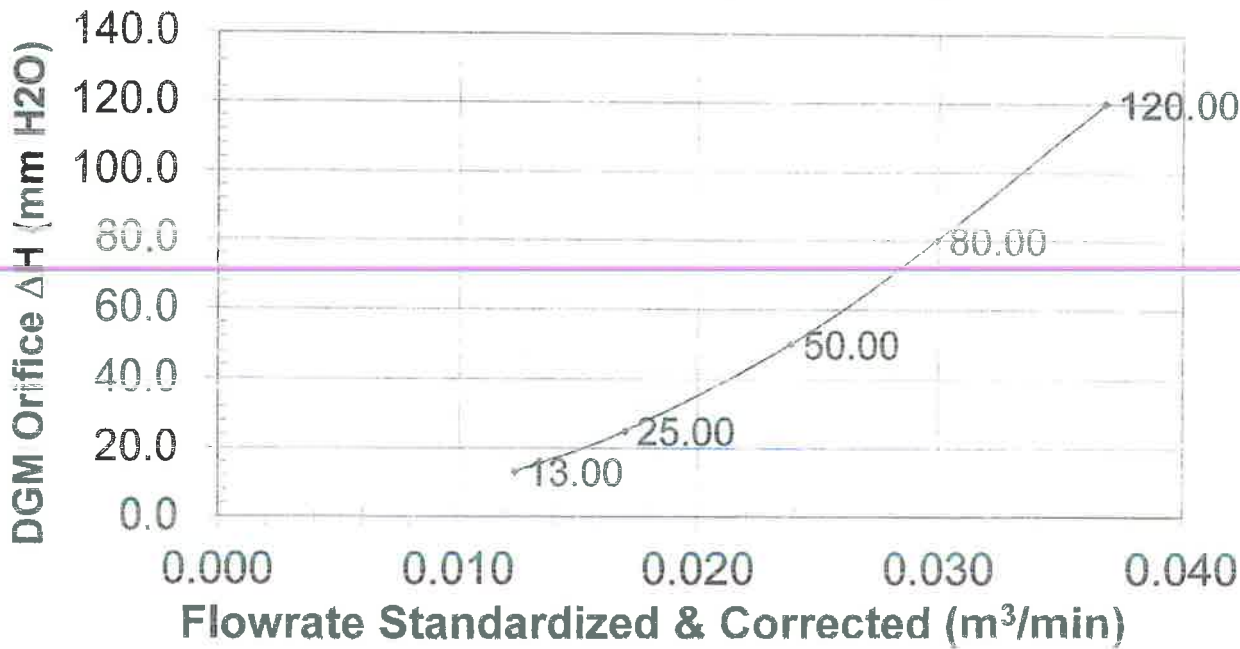
Tolerance Range	
Stack	± 1.50% Absolute
Probe	± 3.0 °C
Filter	± 3.0 °C
Meter Exit	± 3.0 °C
	± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature

(Sirchok Sansomsup)
Service Engineerบริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Meter Pressure vs Flowrate



Console Serial:

0011024

Console Model:

MC-572

บริษัท สิทธีพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

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บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

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

DRY GAS METER MC-572-V

Serial No. : 0504003

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

Calibration Conditions			
Date	Time	05-Apr-22	8:30 AM
Calibration Reference No.	HC65APE0026		
Barometric Pressure	761	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

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

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed (O) min	DGM Orifice ΔH (P _m) mm H ₂ O	Volume Initial (V _{mi}) m ³	Volume Final (V _{mf}) m ³	Outlet Temp Initial (T _{mi}) °C	Outlet Temp Final (T _{mf}) °C	Volume Initial (V _{wi}) m ³	Volume Final (V _{wf}) m ³	Outlet Temp Initial (T _{wi}) °C	Outlet Temp Final (T _{wf}) °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	278.91678	27	27
8.00	50.0	235.3676	235.5510	27	27	276.95578	277.13668	27	27
7.00	80.0	235.5744	235.7803	27	27	277.15828	277.36140	27	27
5.00	120.0	235.8320	236.0136	27	27	277.41235	277.59265	27	27

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

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

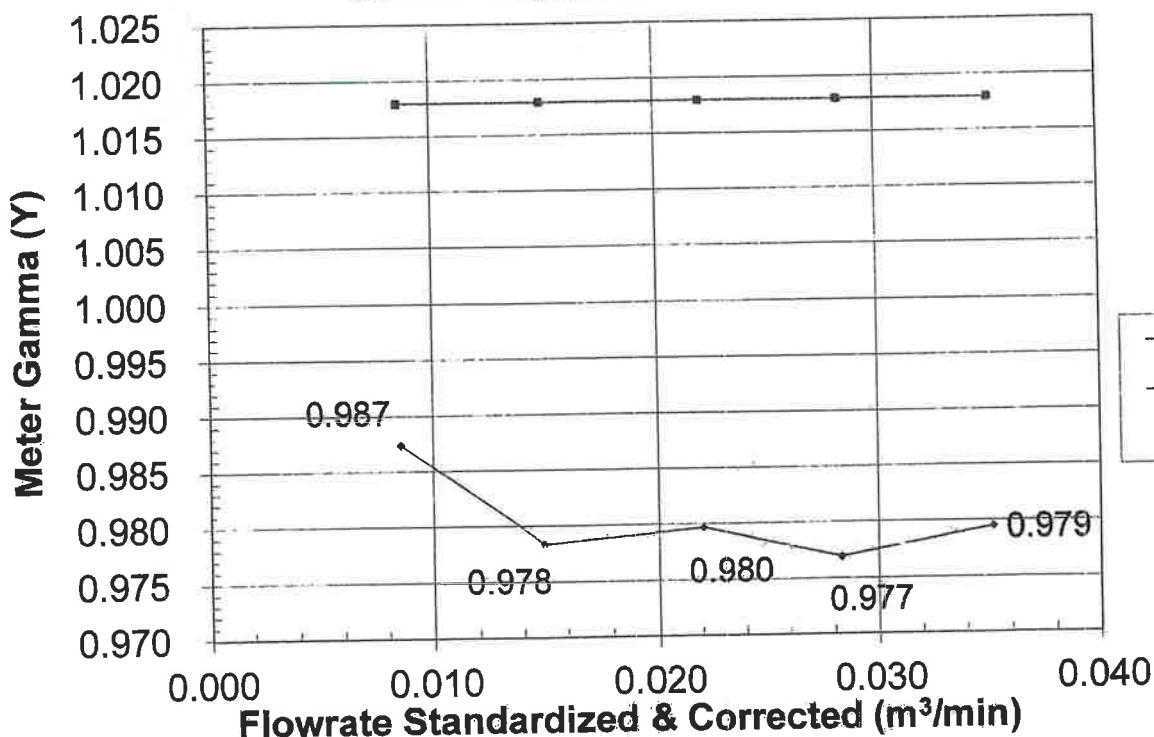
Note: For ΔH , orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Signature Surachai Chaisana
(Surachai Chaisana)
Service Engineer

บริษัท สกทิพรแอสโซซิเอตส์ จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Date 5/4/2022

Meter Gamma vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

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

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-572-V	Date	05-Apr-22
Console Serial Number	0504003	Calibration Reference No.	HC65APE0026
DGM Model Number	SK25EX	Barometric Pressure	761
DGM Serial Number	0005303	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005
Meter Box Serial Number	JC02484		

Results		Console Thermocouple Simulator	
Channel and test point		Meter Box Channel Temperature Reading (°C)	
		-18.0	25.0
Stack	-18	25	38
Probe	-18	25	38
Filter	-18	25	38
Aux	-18	25	38
Exit	-18	25	38

Stack
Probe
Filter

Tolerance Range

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Exit

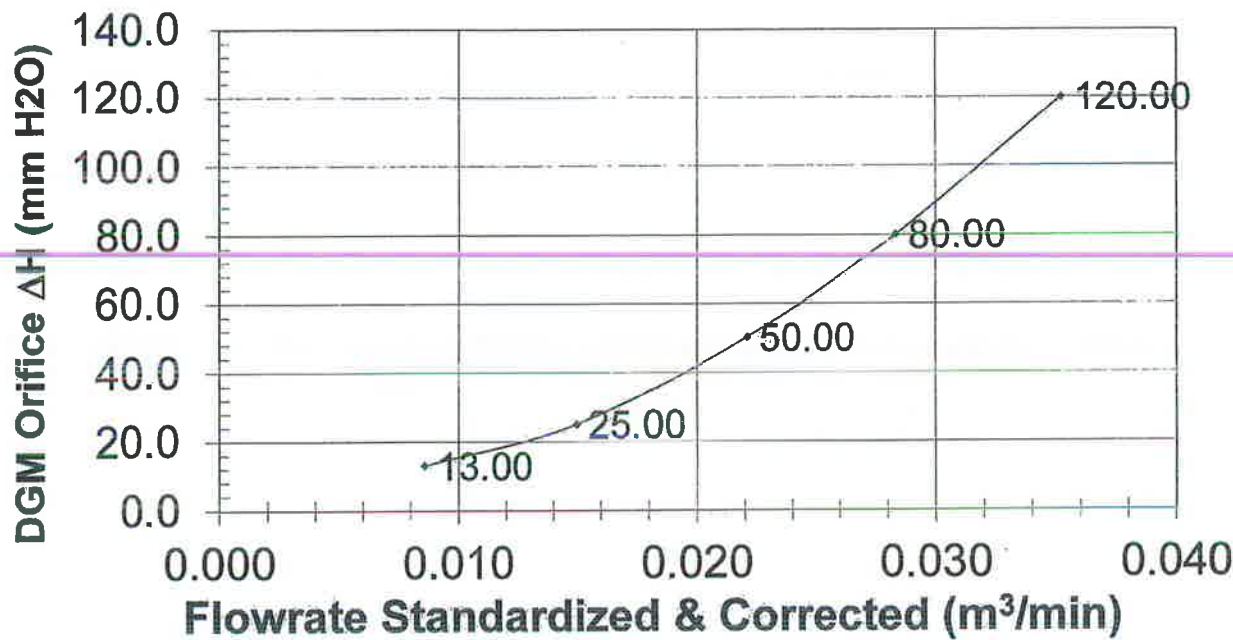
± 3.0 °C
± 2.0 °C

Signature _____
(Surachai Chaisana)
Service Engineer

บริษัท สกทิพพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

บริษัท สกทิพพร แอสโซซิเอต จำกัด
Sithiporn Associates Co., Ltd.
451-451/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700 โทร. 0-2433-8831, 0-2435-8800, 0-2434-9191 แฟกซ์ : 0-2434-9510
451-451/1 Srinthorn Road, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8831, 435-8800, 434-9191 Fax: (662) 433-1579, 434-9510
E-mail : contact@sithiporn.com www.sithiporn.com

Meter Pressure vs Flowrate



Console Serial: 0504003

บริษัท สกทิพพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model: MC-572-V

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Flue gas Analyzer

Testo 350XL

Serial No. 01859560



Calibration Certificate

ENTECH
Difference For Greater Value

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

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

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

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

Calibration place : Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : WT-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 : 29-Oct-21

Kwanchai K.

Mr. Kwanchai Kiamdoung
Calibration Technician

D. Nongluck

Mrs. Nongluck Wongsettee
Technical Manager

COPY



Calibration Certificate

Certificate No.: G 640712

Standard References (Table 1)

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

Measured room conditions

Temperature : 23.6 °C Humidity : 57.8 %RH Pressure : 1014.1 mbar
Calibration conditions
Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1023.6 mbar

Calibration Results (without adjustment) (Table 2)

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

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

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

End of Report

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GAS CHROMATOGRAPH

MODEL : GC-2010 Plus AF

S/N : C12095200986

Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

If the unit is included in the system to be inspected, place a checkmark in the "Applicable" box. If the unit is not included in the system, place a checkmark in the "Not Applicable" box. Enter a diagonal line in the Pass/Fail checkbox for "Not applicable" items. Here, inspection results are recorded along the procedure of Chapter 4 in Operational Qualification Protocol.

3-1 Gas Chromatograph GC-2010Plus

☒ Applicable ☐ Not Applicable

Component ID		Model Name		GC-2010Plus	
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.	LED	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	Screen contrast adjustment is possible.	Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Version number and build number are displayed.	Version: 2.104.0 Build No.: 267	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the program version.	Ver. 2.104.0 Build No.: 267	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Column inlet pressure test	Verify that temperature control is normal.	TEMP LED lights green.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.0 kPa Post-correction reading: 0.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): *DM* Date: 25 / 03 / 2021
Reviewer (signature): _____ Date: _____

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start 250.0 ± 5.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature.	Temp. sensor reading 51.0 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally.	Temp. sensor reading 23.1 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity.	Calculated S value 51372	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): *DM* Date: 25 / 08 / 2021
Reviewer (signature): _____ Date: _____

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Single ☐ Dual system, main injector

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 3 0 4			
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation. All LEDs light, except decimal point.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM - RAM self diagnosis	Verify that ROM and RAM memory operates normally. Display shows "000".	Display: 000	<input type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version. Version number is displayed. The version number matches the controlled version number.	3.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct. Sample injected into the GC and GC operation starts.	3.4	<input type="checkbox"/>	<input type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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

Performer (signature):

Date: 25 / 02 / 2021

Reviewer (signature):

Date: / /

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 4 1 0			
No.	Item	Criteria	Results	Pass	Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct. LED light is green, not red.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version. Version number is displayed. The version number matches the controlled version number.	3.5	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 25 / 02 / 2021

Reviewer (signature):

Date: / /

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Primary Flow Calibrator

Serial No. : 110619

Certificate of Calibration

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

Certificate No : 22-AFM-016 Rev.1
Request No : Req-2022-0122

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : BIOS
Model : Defender 510-L
Serial Number : 110619
ID : -
Sensor Model : -
Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 January 2022
Calibration Date : 27 January 2022

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

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

Traceability :

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

Units (SI)

Note :

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

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

Calibration By : Mr. Noppadon Luangart

Service Calibration Engineer

Approved By : Mr. Pait Mahavorn

Calibration Engineer Supervisor

Issue Date : 11 February 2022

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

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

Certificate No : 22-AFM-016 Rev.1
Request No : Req-2022-0122

Result of Calibration :

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

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

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

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



Bara Scientific

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



Certificate of Calibration

Number of Page(s) 1 of 3

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

Temperature (20.1-22.2) °C (On site)
Humidity (43.9-49.2) %RH (On site)
Equipment condition Good Operation
Calibration Location Analysis Department
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 87839 and 87844
Photometric Accuracy is traceable to certificate No. 87846 and 87877
Stray Light is traceable to certificate No. 87825
The above certificate are traceable to SI unit through Stama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)
Calibrated by Mr.Kanchit Choothep

Approved by

Mr.Kanchit Choothep
Technical Manager

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Bara Scientific

Bara Scientific Co., Ltd.
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Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-152/21

Calibration Results:

1.Wavelength Accuracy

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

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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Solutions & Success

Certificate of Calibration

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

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5631	0.5616	-0.0016	0.0042
	0.7390	0.7376	-0.0014	0.0042
	1.0663	1.0646	-0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5524	0.5501	-0.0023	0.0042
	0.7217	0.7199	-0.0018	0.0042
	1.0606	1.0587	-0.0019	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5124	-0.0023	0.0042
	0.6743	0.6720	-0.0023	0.0042
	0.9909	0.9882	-0.0027	0.0042
580.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5271	0.0003	0.0042
	0.6720	0.6708	-0.0012	0.0042
	0.9864	0.9854	-0.0010	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.86±0.11nm	201.05	2.0123

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

*Stray Light not NSC-ONSC Accredited.

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

End of Certificate

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COPY

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



Bara Scientific
Solutions of Success

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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-167122
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, Siraacha, Chonburi 20230.

Temperature (23.8-24.5) °C (On site)
Humidity (47.6-48.3) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department.

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 96367 and 96366
Photometric Accuracy is traceable to certificate No. 99925 and 100147
Stray Light is traceable to certificate No. 96346
The above certificate are traceable to SI unit through Siama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choothep

Approved by

Mr.Kanchit Choothep
Technical Manager

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FM-UV-708-02 Rev.01 (22/01/63)



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Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-167122

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 0.7311	0.0000 0.7321	0.0000 0.0010	0.0075 0.0075
257	CNR CNR	CNR CNR	CNR CNR	CNR CNR
313	CNR CNR	CNR CNR	CNR CNR	CNR CNR
350	0.0000 0.6306	0.0000 0.6314	0.0000 0.0008	0.0075 0.0075

*CNR = Customer not request

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Certificate of Calibration

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Number of Page(s)

Certificate No. BSCC-UV-167122

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
	1.0480	1.0487	0.0017	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
	0.7457	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6961	0.6944	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
	0.9533	0.9519	-0.0014	0.0042

*CNR = Customer not request

4. Stray Light*

Standard	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

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FM-UV-708-02 Rev.01 (23/01/63)

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



77-TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0018

MTC No. EEL. BP. 24/1064

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., 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 Keithley 2015-P S/N 4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert volume 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 : 11 Oct. 2021

Date of Calibration : 21 Oct. 2021

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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0018

MTC No. EEL. BP. 24/1064

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch B&K 4180	93.97	-0.03	± 0.10	±0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch B&K 4180	0.50	± 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 Deechaiyai)

Approved by :



(Mr. Prawate Khayapa)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 201126410110418-003

End of Certificate

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SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G300957

Request No. 21-65/0101

MTC No. EEL. BP. 62/1164

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 : Cirrus

Model : CR-172A

Serial No. : G300957 (No.28)

Microphone : Cirrus MK216 No.412415B

Preamplifier : No.9371F

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 2995571.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 17 Nov. 2021

Date of Calibration : 13-14 Dec. 2021

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Request No. 21-65/0101

MTC No. EEL. BP. 62/1164

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 : 13-14 Dec. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)	
	Measured Value (dB)		Deviation (dB)		
	Before adjust	After adjust			
	93.75	95.1			93.7

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)
16.4	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	20.0	0.10
Flat	29.5	0.10

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

Date of Calibration : 13-14 Dec. 2021

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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	0.1	0.0	-0.2	0.40	2.0
1 000	-0.6	-0.6	-0.6	0.40	1.4
4 000	0.2	0.4	0.3	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	0.2	0.2	0.20	2.5
125	0.3	0.1	0.1	0.20	2.0
250	0.2	0.1	0.1	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.0	0.20	2.6
4 000	-0.3	-0.1	0.0	0.20	3.6
8 000	-0.5	-0.3	-0.1	0.20	5.6

Date of Calibration : 13-14 Dec. 2021

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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	139.0	0.0	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 : 13-14 Dec. 2021

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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	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.1	0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.1	0.1	0.30	1.4
24	24.1	0.1	0.30	1.4

Date of Calibration : 13-14 Dec. 2021

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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, Tb (ms)	Measured		Deviated		Tolerance Limits Class 2 (dB)
		Value (dB)	Uncertainty (±dB)	Value (dB)	Uncertainty (±dB)	
Fast	200	136.0	0.0	0.0	0.20	±1.3
	2	118.9	-0.1	-0.1	0.20	+1.3; -2.8
	0.25	109.9	-0.1	-0.1	0.20	+1.8; -5.3
Slow	200	129.6	0.0	0.0	0.20	±1.3
	2	110.0	0.0	0.0	0.20	+1.3; -5.3
	0.25	109.9	-0.1	-0.1	0.20	+1.8; -5.3

Date of Calibration : 13-14 Dec. 2021

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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	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)		Tolerance Limits Class 2 (±dB)
	Positive one-half cycle	Negative one-half cycle	
139.2	139.1	1.1	0.30
			1.8

Calibrated by :

Approved by :

Panya Phasingon
(Mr. Panya Phasingon)

Tawikiat Iamsamran
(Mr. Tawikiat Iamsamran)

Date of Calibration : 13-14 Dec. 2021

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Issue : 15 Dec. 2021

Ref : 201126411704770004

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E-mail : suralee@tistr.or.th

SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301660



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0818

MTC No. EEL. BP. 14/0964

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, Srinacha, 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. : G301660 (No.34)
Microphone : Cirrus MK216 No.412814E
Preamplifier : No.10093F

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

Date of Receipt : 2 Sep. 2021
Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0818

MTC No. EEL. BP. 14/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 213300.
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 : 20-22 Sep. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test		Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	
94.06	94.2	0.1	0.50
			1.4

Note: The internal calibration display at 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.5	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	18.9	0.10
Flat	29.1	0.10

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

Date of Calibration : 20-22 Sep. 2021

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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	0.2	0.0	-1.1	0.40	2.0
1 000	0.2	0.2	-1.2	0.40	1.4
4 000	-0.2	0.0	-1.2	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	0.3	0.0	-1.1	0.20	2.5
125	0.2	0.1	-1.0	0.20	2.0
250	0.1	0.0	-1.0	0.20	1.9
500	0.1	0.0	-1.0	0.20	1.9
1 000	0.0	0.0	-1.0	0.20	1.4
2 000	-0.1	-0.1	-1.0	0.20	2.6
4 000	-0.4	-0.3	-1.1	0.20	3.6
8 000	-0.6	-0.4	-1.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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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	134.1	0.1	0.30	1.4
129	129.1	0.1	0.30	1.4
124	124.1	0.1	0.30	1.4

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.0	0.0	0.30	1.4
24	24.2	0.2	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, Tb (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	119.0	0.0	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
SEL	200	130.0	0.0	0.20	±1.3
	2	110.0	0.0	0.20	+1.3; -2.8
	0.25	100.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

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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	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	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
139.1	139.1			

Calibrated by :

Pong Phongsri

(Mr. Panya Phasingsri)

Approved by :

Ms. Panyavee Kus, Pa.

Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 4 Oct. 2021

Ref. 2011264090203654003

End of Certificate

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SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301013



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0101

MTC No. EEL. BP. 63/1164

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 : Sound Level Meter : $(23 \pm 3) ^\circ\text{C}$
Manufacturer : Cirrus : Relative Humidity : $(50 \pm 15) \%$
Model : CR-172A : Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : G301013 (No.29)

Microphone : Cirrus MK216 No.412272B

Preamplifier : No.9334F

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 2995571.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 17 Nov. 2021

Date of Calibration : 13-14 Dec. 2021

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Request No. 21-65/0101

MTC No. EEL. BP. 63/1164

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 : 13-14 Dec. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
93.75	93.9	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)
16.5	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	20.7	0.10
Flat	31.7	0.10

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

Date of Calibration : 13-14 Dec. 2021

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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	0.2	0.0	0.0	0.40	2.0
1 000	-0.7	-0.7	-0.7	0.40	1.4
4 000	0.8	1.0	1.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.5	0.1	0.2	0.20	2.5
125	0.3	0.1	0.1	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	-0.1	0.0	0.0	0.20	2.6
4 000	-0.3	-0.2	0.0	0.20	3.6
8 000	-0.5	-0.3	-0.1	0.20	5.6

Date of Calibration : 13-14 Dec. 2021

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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 (\pm dB)	Tolerance Limits Class 2 (\pm 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 (\pm dB)	Tolerance Limits Class 2 (\pm 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 (\pm dB)	Tolerance Limits Class 2 (\pm dB)
139	139.0	0.0	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 : 13-14 Dec. 2021

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm 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	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-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	64.0	0.0	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	39.1	0.1	0.30	1.4
34	34.3	0.3	0.30	1.4
29	29.3	0.3	0.30	1.4
24	24.4	0.4	0.30	1.4

Date of Calibration : 13-14 Dec. 2021

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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, Tb (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
	0.25	129.6	-0.4	0.20	±1.3
SEL	200	110.0	0.0	0.20	+1.3; -2.8
	2	110.0	0.0	0.20	+1.3; -2.8
	0.25	101.0	0.0	0.20	+1.8; -5.3

Date of Calibration : 13-14 Dec. 2021

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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	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	139.1	0.0	0.30	1.8
Negative one-half cycle	139.1	0.0	0.30	1.8

Calibrated by :

Panya Phasing Sri

(Mr. Panya Phasing Sri)

Taith 2

(Mr. Tawikiat Iamsanran)

Date of Calibration : 13-14 Dec. 2021

Date of Issue : 15 Dec. 2021

End of Certificate

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Approved by :

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 201126411704770005

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SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301638

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 28 August 2020 CERTIFICATE NUMBER 145537

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

Page 1 of 2
Approved signatory
M Berzovskis
Electronically signed:



Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:172A	
Serial number:	G301638	
Class:	2	
Firmware version:	5.4.2889	

Test summary

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 or correction data for an acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:
145537

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 101.15 kPa Temperature: 21.2 °C Humidity: 46.8 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TGA1241	439193
Attenuator	Cirrus Research	ZE:952	78134
Environmental Monitor	Comet	T7510	17963955

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV-200F

Serial number: 10085F

Microphone

Model: MK:216

Serial number: 412764E

Test results summary

Test	Result
Internal settings adjustment	Complies
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Frequency weightings	Complies
Frequency response - supplemental	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies

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CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**
DATE OF ISSUE **28/08/20** CERTIFICATE NUMBER **145542**

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

Page 1 of 2
Test engineer:
D Swalwell
Electronically signed:



Microphone

Microphone capsule

Manufacturer: Cirrus Research plc
Model: MK-216
Serial Number: 412764E

Calibration procedure

Open circuit: 53.9 mV/Pa
Sensitivity at 1 kHz: -25.4 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.20 kPa
Temperature: 23.0 °C
Humidity: 35.0 %

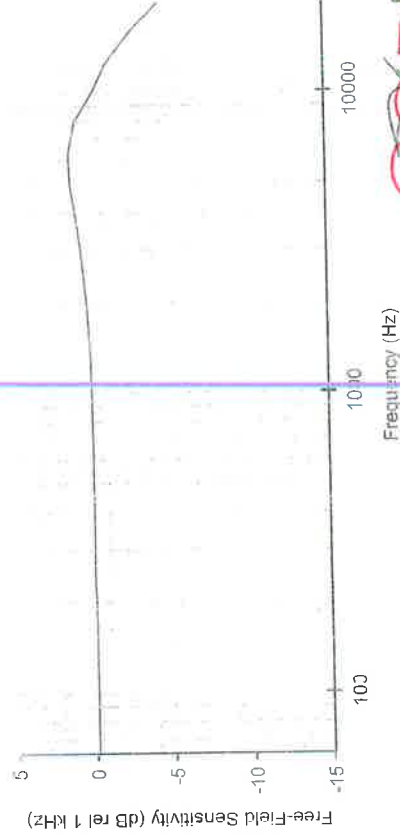
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Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	-0.14	-0.30
80	-0.15	-0.17
100	-0.14	-0.11
125	-0.12	-0.07
160	-0.11	-0.05
200	-0.09	-0.02
250	-0.04	-0.01
315	-0.05	-0.02
400	-0.06	-0.01
500	-0.04	-0.01
630	-0.05	-0.01
800	-0.01	0.00
1 000	0.00	0.01
1 250	0.04	0.01
1 600	0.13	0.03
2 000	0.24	0.04
2 500	0.42	0.08
3 150	0.63	0.08
4 000	0.90	0.02
5 000	1.20	-0.19
6 300	1.27	-0.83
8 000	0.84	-2.41
10 000	-0.33	-5.10
12 500	-1.26	-7.85
16 000	-2.80	-10.66
20 000	-4.60	-13.85

Free-Field Frequency Response : Graphical



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SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301638

Request No. 21-65/0292

MTC No. EEL. BP. 28/0265

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 : Sound Level Meter : $(23 \pm 3) ^\circ\text{C}$
 Manufacturer : Cirrus : Relative Humidity : $(50 \pm 15) \%$
 Model : CR-172A : Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$
 Serial No. : G301638
 Microphone : Cirrus MK216 No.412753E
 Preamplifier : No.10402F

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 : 1 Mar. 2022

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Request No. 21-65/0292

MTC No. EEL. BP. 28/0265

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 : 1 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)	
	Before adjust	After adjust			
93.72	93.6	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)
17.3	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	18.2	0.10
C-Weighting	25.0	0.10
Flat	31.0	0.10

Date of Calibration : 1 Mar. 2022

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Tel. (66) 0 2323 1672-80 ext. 115, 116
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E-mail : mtc@tistr.or.th

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	-0.2	-0.2	0.40	2.0
1 000	-0.5	-0.5	-0.5	0.40	1.4
4 000	0.0	0.1	0.3	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	0.7	0.1	0.2	0.20	2.5
125	0.3	0.2	0.1	0.20	2.0
250	0.2	0.1	0.0	0.20	1.9
500	0.2	0.1	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.1	0.0	0.0	0.20	2.6
4 000	0.0	-0.2	0.0	0.20	3.6
8 000	-0.2	-0.3	0.0	0.20	5.6

Date of Calibration : 1 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	134.1	0.1	0.30	1.4
129	129.1	0.1	0.30	1.4
124	124.1	0.1	0.30	1.4

Date of Calibration : 1 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	119.1	0.1	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.1	0.1	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.1	0.1	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.0	0.0	0.30	1.4
29	29.0	0.0	0.30	1.4
24	24.2	0.2	0.30	1.4

Date of Calibration : 1 Mar. 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)
20-140	135	135.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	136.0	0.0	0.20	±1.3
	2	118.8	-0.2	0.20	+1.3; -2.8
	0.25	109.8	-0.2	0.20	+1.8; -5.3
Slow	200	129.5	-0.1	0.20	±1.3
	2	109.9	-0.1	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

Date of Calibration : 1 Mar. 2022

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	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	139.1	0.30	1.8

Calibrated by :

Approved by :

Pannasit Ph.
(Mr. Pannasit Phasingst) *Wittawat Supanich*
(Mr. Wittawat Supanich)



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 1 Mar. 2022

Date of Issue : 3 Mar. 2022

Ref : 20112650200458003

End of Certificate

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Fax. (66) 0 2323 9165
E-mail : mt@tistr.or.th

NOISE DOSIMETER

MODEL : NP-DLX

SERIAL No. : NXQ070006

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-359

Request No : Req-2021-1237

Unit Under Calibration Details

Measurement item : Noise dosimeter
Manufacturer : 3M
Model : NP-DLX
Serial Number : NXQ070006
ID : -
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 September 2021
Calibrated Date : 14 September 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Microphone Class : 2
Microphone Model : -
Microphone SN : -
Preamplifier Model : -
Preamplifier SN : -
Instrument Status : Used

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svantek	Svan40J	131	30 September 2021	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

Calibrated By :

Mr. Noppadon Luangtatt
Calibration Officer

Approved By :

Mr. Pacit Mahavom
Calibration Engineer Supervisor

Issue Date :

14 September 2021

COPY

Certificate No : 21-ACT-359

Request No : Req-2021-1237

1. Absolute acoustical sensitivity

UUC Setting	Time	Exposure Measurement	UNCERTAINTY	Tolerances Limit
FAST / A / 70-140	Ref (s)	UUC (Pa ² h)	Error (%)	(%)
Calibrator Setting	Ref (s)	UUC (Pa ² h)	Error (%)	(%)
1000 Hz 114 dB	120.00	120	3.63	+0.55
			3.65	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting	UNCERTAINTY	Tolerances Limit
FAST / 70-140	A (dB)	C (dB)	(± dB)
STD Setting	(dB)	(dB)	(± dB)
*63 Hz	-0.4	-0.2	0.40
125 Hz	0.1	0.3	0.40
250 Hz	0.3	0.4	0.40
500 Hz	0.2	0.3	0.40
1000 Hz	0.0	0.0	0.40
2000 Hz	-0.3	-0.3	0.40
4000 Hz	-1.4	-1.4	0.40
8000 Hz	-1.4	-1.5	0.40
			5.0

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Certificate No : 21-ACT-359

Request No : Req-2021-1237

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High				
		Ref	70.0	80.0	90.0	100.0
1000 Hz	Level A	(dB)	70.5	80.2	90.1	100.1
	Error	(dB)	0.5	0.2	0.1	0.1
8000 Hz	Ref	(dB)	88.9	98.9	108.9	118.9
	Level A	(dB)	89.1	99.1	109.1	119.1
	Error	(dB)	0.2	0.2	0.2	0.2
63 Hz	Ref	(dB)	87.8	97.8	107.8	117.8
	Level A	(dB)	88.0	98.0	108.0	118.0
	Error	(dB)	0.2	0.2	0.2	0.2
Tolerances Limit		(±dB)	1.0			
UNCERTAINTY		(±dB)	0.27			

b. Sound exposure meter linearity of error

UUC Setting		Time UUC (s)	Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 70-140	Calibrator Setting		UUC (Pa h) ¹	Different (%)		
		6	10.12	+0.20	2.4	-21 - +26
			10.10			
	Continuous Rectangle +					
	Continuous Rectangle -					

End of Certificate

Certificate No : 21-ACT-359

Request No : Req-2021-1237

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		PAST / A / High										
1000 Hz	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
	Level A	(dB)	70.5	80.2	90.1	100.1	110.0	114.0	120.0	130.0	140.2	
	Error	(dB)	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.2	
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			89.1	99.1	109.0	112.9	118.9	128.9	138.9	
	Error	(dB)			0.2	0.2	0.1	0.0	0.0	0.0	0.0	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.7	103.7	113.7	
	Error	(dB)						0.0	-0.1	-0.1	-0.1	
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.27									

b. Sound exposure meter response for series of toneburst impulses

FAST / A / 70-140		Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)	UNCERTAINTY	Limit (%)
Calibrator Setting							(%)	
1000 Hz 110 dB		27	27	0.30	0.30	0.00	4.3	-21, +26
1000 Hz 110 dB		45	45	0.50	0.50	0.00		
1000 Hz 110 dB		90	90	1.00	1.00	0.00		
1000 Hz 110 dB		180	180	2.00	1.99	-0.50		
1000 Hz 120 dB		36	36	4.00	3.99	-0.25		
1000 Hz 120 dB		72	72	8.00	7.98	-0.25	3.8	
1000 Hz 120 dB		90	90	10.00	9.97	-0.50		
1000 Hz 120 dB		180	180	20.00	19.95	-0.25		
1000 Hz 120 dB		360	360	40.00	39.89	-0.27		
1000 Hz 120 dB		720	720	80.00	79.78	-0.27		

Certificate No : 21-ACT-359

Request No : Req-2021-1237

5. Response to unipolar pulse

UUC Setting		Time			Exposure Measurement			Tolerances Limit			
		Ref	UUC	(s)	UUC	(Pa ² h)	Error				
FAST / A / 70-140	Calibrator Setting	(s)	2846	2846	2846	2846	2846	-21 - +26	3.0		
	4000 Hz 95 dB										
Burst 1 ms, 100 dB	Ref	(s)	2846	2846	2846	2846	2846	-21 - +26	3.0		
	Level A	(dB)	87.8	97.8	107.8	117.8	127.8				
	Error	(dB)	0.2	0.2	0.2	0.2	0.2				
Tolerances Limit		(±dB)	1.0				0.27				
UNCERTAINTY		(±dB)	0.27				0.27				

b. Sound exposure meter linearity of error

UUC Setting		Time			Exposure Measurement			Tolerances Limit			
		Ref	UUC	(s)	UUC	(Pa ² h)	Error				
FAST / A / 70-140	Calibrator Setting	(s)	27	45	90	180	360	-21 - +26	3.8		
	1000 Hz 110 dB										
	1000 Hz 120 dB										
1000 Hz 110 dB	Ref	(s)	27	45	90	180	360	-21 - +26	3.8		
	Level A	(dB)	87.8	97.8	107.8	117.8	127.8				
	Error	(dB)	0.2	0.2	0.2	0.2	0.2				
Tolerances Limit		(±dB)	1.0				0.27				
UNCERTAINTY		(±dB)	0.27				0.27				

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NOISE DOSI METER

MODEL : NP-DLX

SERIAL No. : NXL060045

Certificate No : 21-ACT-420 Rev.1
Request No : Req-2021-1437

Certificate of Calibration

Customer

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


Certificate No : 21-ACT-420 Rev.1
Request No : Req-2021-1437


Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : 3M
Model : NP-DLX
Serial Number : NXL060045
ID : -
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 8 November 2021
Calibrated Date : 12 November 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic
Reference Standard
Instrument Brand Model SN Due calibration Traceability
Multifrequency Calibrator Quest Quest-cal 188272 TSI
Standard Microphone GRAS 40AN 188273 GRAS
Sine Generator Svanek Svan401 131 WK Electric
Timer EXTECH 05-ACT TPA

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.
This Certificate was issued to replace to Calibration Certificate No. 21-ACT-420

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Muthavorn
Calibration Engineer Supervisor
Issue Date : 23 November 2021

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1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h)	UUC (Pa h)		
FAST / A / 70-140	120.00	120	3.63	3.65	3.0	-21. +26
Calibrator Setting						
1000 Hz 114.21 dB						

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting			UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)			
FAST / 70-140					
STD Setting					
*63 Hz	0.2	0.6	0.40	0.40	2.0
125 Hz	0.3	0.5	0.40	0.40	1.5
250 Hz	0.2	0.4	0.40	0.40	1.5
500 Hz	0.1	0.3	0.40	0.40	1.5
1000 Hz	0.0	0.0	0.40	0.40	*
2000 Hz	-0.4	-0.4	0.40	0.40	2.0
4000 Hz	-2.0	-2.0	0.40	0.40	3.0
8000 Hz	-2.7	-2.6	0.40	0.40	5.0

COPIES

NOISE DOSI METER

MODEL : NP-DLX

SERIAL No. : NXQ070008

Certificate of Calibration

Customer

Name
: Eastern Thai Consulting 1992 Co., Ltd.

Certificate No : 21-ACT-360

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

Request No : Rcq-2021-1238

Unit Under Calibration Details

Measurement item : : Noise dosimeter

Microphone Class: 2

Manufacturer : 3M

Microphone Model : -

Model : NP-

Microphone S/N: -

Serial Number : NX0070008

Preamplifier Model: -

•
•

E

Preamplifier S/N: -

Resolution . 01

Instrument Status: Used

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Humidity : 50% RH + 20%

Barometric Pressure : 1013.0 hPa + 10.1 Pa

Received Date: 14 September 2021

[illegible][illegible]

Location of Candidates : was a constant

Reference Standard

Reference standard		Brand	Model	SN	Duc calibration	Traceability
	Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
	Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
	Sine Generator	Svaniek	Svan401	131	30 September 2021	Wk Electric
	Timer	EXTECH	-	05-AC7	29 March 2022	TPA

Note

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

Calibrated By :

me

Mr. Noppadon Luangart

Mr. Pacit Mathavorn

Calibration Officer

Calibration Engineer Supervisor

Issue Date: 14 September 2021

14 September 2021

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

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time	Ref	UUC	1 σ	UUC	Error	UNCERTAINTY	Tolerances
		(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	Limit
FAST / A / 70-140								(Pa ² h)
Calibrator Setting								(Pa ² h)
4000 Hz 95 dB	2846	2846		1.00	0.99	-0.01	0.01	-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

UUC Setting	Time	Ref	UUC	1 σ	UUC	Different	UNCERTAINTY	Tolerances
		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit
FAST / A / 70-140								(%)
Calibrator Setting								(%)
Continuous Rectangle +	6				10.25			-21 - +26
Continuous Rectangle -					10.30	+0.49	2.4	

End of Certificate

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

3. Linearity of response to steady signals

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

UUC Setting	Ref	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0
	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz	Level A	70.1	80.0	90.0	100.0	110.0	120.1	130.2	140.5
	Error	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.5
8000 Hz	Ref			88.9	98.9	108.9	118.9	128.9	138.9
	Level A			89.0	99.0	108.9	118.8	128.9	139.1
	Error			0.1	0.1	0.0	0.0	-0.1	0.0
63 Hz	Ref					87.8	93.8	103.8	113.8
	Level A					87.8	93.8	103.8	113.8
	Error					0.0	0.0	0.0	0.0
Tolerances Limit	(\pm dB)				1.0				
UNCERTAINTY	(\pm dB)				0.27				

b. Sound exposure meter linearity of error

UUC Setting	Time	Ref	UUC	Ref	UUC	Error	UNCERTAINTY	Tolerances
		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit
FAST / A / 70-140								(%)
Calibrator Setting								(%)
1000 Hz 110 dB	27	27		0.30	0.30	0.00		
1000 Hz 110 dB	45	45		0.50	0.50	0.00		
1000 Hz 110 dB	90	90		1.00	0.99	-1.00	4.3	
1000 Hz 110 dB	180	180		2.00	1.99	-0.50		-21, -26
1000 Hz 120 dB	36	36		4.00	4.00	0.00		
1000 Hz 120 dB	72	72		8.00	8.00	0.00		
1000 Hz 120 dB	90	90		10.00	10.01	+0.10	3.8	
1000 Hz 120 dB	180	180		20.00	20.02	+0.10		
1000 Hz 120 dB	360	360		40.00	40.04	+0.10		
1000 Hz 120 dB	720	720		80.00	80.09	+0.11		

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SHEET No.: 143_0121

Analyzer Performance Test



Date: 22 Jan 21

Temp: (°C)

25

Barometric Pressure: Pb (mmHg)

760

Analyzer Type:	Co2
Brand:	Teledyne
Model:	360E
S/N:	143

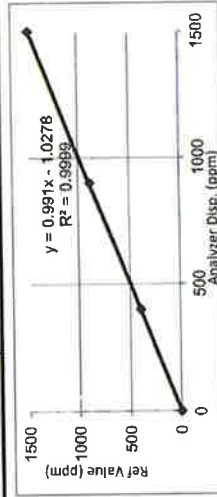
Dilutor:	Teledyne T 700 1367
Zero Air:	M701 S/N 1039
STD GAS:	S472767

Single Point Calibration

Supply Gas	Ref Value	Analyzer Disp.	Zero-Span Error %	Slope - Offset
Zero	0.00	1.00	-	-
Span	1500.00	1490.00	-0.67	0.993

MultiPoint Calibration

Ref Value	Analyzer Disp.	Output Difference	
		Diff	Percent Diff abs.
0.0	2.00	2.00	-
400.0	395.30	-4.70	1.18
900.0	883.50	-16.50	1.83
1500.0	1490.00	-10.00	0.67
		Average Diff (%)	1.23



Transfer Function Test results:

$$Y = 0.991x + 1.0278$$

Calibrated by: Wilhann K.

Approved by:

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. For more information about Agilent Technologies GC Support please visit our web site using the following URL:

<http://www.agilent.com/en-us/products/gas-chromatography/gc-systems/7890b-gc#support>

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Only complete sections that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "+" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM Service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

Guidance

- Check this box if an instrument configuration report is attached instead of completing the table.

Instrument system name and ID	6C 7840 B
Instrument system site and location	1 N 57. 2
List system component product numbers	
1. 65440 B	List the serial numbers of each component
2. 6 4513 A	1. CN 15843147
3. 6 4514 A	2. CN 14350133
4.	3. CN 13080006
5.	4.
6.	5.
7.	6.
8.	7.
9.	8.
10.	9.
	10.

Preparation

- Discuss any specific issues with the customer prior to starting.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Perform general inspection of system for cleanliness
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware updates and verify with customers if they would like it installed.
- Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Clean and inspect GC

- Unplug power cord from the power source.
- Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- Inspect internal connectors for proper contact and placement.
- Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- Verify operation of all other fans - the inlet and EPC cooling fans.
- Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- Replace the split vent trap cartridge filter: on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMD), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- Record if test passed or failed in the results table.

ALS Maintenance

- Section NOT applicable
- Check all cabling and configuration settings between GC, tray, and injectors.
- Vacuum or removed any dust, especially around fans.
- Check operation of all fans.
- Check syringe for smooth plunger operation.
- Check for smooth operation of the needle support - clean if necessary
- Check for correct operation of syringe volume settings.



7890 GC
Preventive Maintenance Checklist – Standard

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Keyboard or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values.
- ☒ Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Guidance

If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.



7890 GC
Preventive Maintenance Checklist – Standard

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the PM service activity in the customer's instrument records/logbook
- ☒ Update/reset instrument maintenance counters as appropriate
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Review Comments section below if there are additional comments
- ☒ Review the service and any test results with the customer.
- ☐ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.
- ☐ Please ask the customer if they would like to have Smart Alerts installed on their computer.

7890 GC Test Results Table

Detector Signal Outputs	Before PM service	After PM service
Front detector output	N/A	290.4
Back detector output	N/A	16.8
AUX detector output	N/A	N/A
Pressure decay test	Expected result	Actual result or N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass



7890 GC Preventive Maintenance Checklist - Standard

7890 GC Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part Description	Part Number	Model# where used	Quantity Consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	-
PP Inlet PM kit	5188-6498	7890A/B	-
Split vent trap PM kit, single cartridge (for MMI, PTV & VT)	5188-6495	7890A/B	-
MMI Cleaning Kit	G3510-60820	7890A/B	-
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	-
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	-
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	-
FID Collector Replacement Kit	G1531-67001	7890A/B	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560*	7890A/B	-
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620*	7890A/B	-
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119*	7890A/B	-
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560*	7890A/B	1
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620*	7890A/B	-

* The jets (G1531-80560, G1531-80620, 18710-20119, 19244-80560 and 19244-80620) are recommended for 7890A/B PM. Please refer to the service note "COLUMNS/SUPPLIES-197A" for detailed information.



7890 GC Preventive Maintenance Checklist - Standard

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write in this box.

N/A

Other Important Customer Web Links

- ☐ 7890 GC manual "Maintaining Your GC" - http://www.agilent.com/cs/library/usermanuals/public/G3430-900529297890B_Maintaining%20Guide.pdf
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6004647191 Date service completed 13 Jan 2021

Agilent signature Samuel T.

Customer signature Navin Kananamullu

Document part number: G3430-90004



Certificate of Calibration

ICS-1000 : Cation & Anion (ID#057)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

ICS-1000 S/N : 04090295

RFC-30 S/N : 04100666

for

SECOT Co.,Ltd.



บริษัท ซีเคที จำกัด
ARCHEMICA LAB

Date : Dec 16, 2021

Operator Signature : _____

(Mr.Channarong Khiao-un)

Test Engineer

ANALYTICAL BALANCE (DU)

Model : XS205 DU

Serial No. : 1126323724


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



KCP-THS-115 11025
CALIBRATION 0862

Accuracy Calibration Certificate

Customer

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

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	0.00001 g
2	220 g	0.0001 g

Procedure



Calibration Guideline:
METTLER TOLEDO Work Instruction:
EURAMET cg-18 v. 4.0 (11/2015)
CP/W002/20

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

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

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

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

As Found Calibration Date: 22-Jul-2021
As Left Calibration Date: N/A
Issue Date: 23-Jul-2021
Calibrator: 
Approved Signatory: 
Patipat Sweatpanuwat
☒ Kasakorn Tassanachaisakul
☐ Santi Jitnyom
☐ Surachet Sukkate

Measurement Results

Repeatability

Test Load: 70 g		As Found	As Left
1	69.99988 g	N/A	N/A
2	69.99987 g	N/A	N/A
3	69.99987 g	N/A	N/A
4	69.99988 g	N/A	N/A
5	69.99987 g	N/A	N/A
6	69.99988 g	N/A	N/A
7	69.99989 g	N/A	N/A
8	69.99988 g	N/A	N/A
9	69.99987 g	N/A	N/A
10	69.99989 g	N/A	N/A
Standard Deviation	0.000008 g	N/A	N/A

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

Eccentricity

Test Load: 100 g		As Found	As Left
1	99.9998 g	N/A	N/A
2	99.9998 g	N/A	N/A
3	99.9998 g	N/A	N/A
4	100.0000 g	N/A	N/A
5	100.0000 g	N/A	N/A
Maximum Deviation	0.0001 g	N/A	N/A

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

Error of Indication

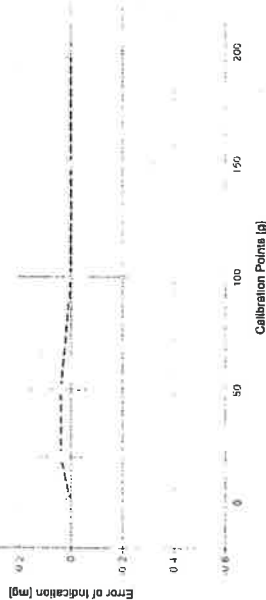
As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.019 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg	2
6	9.99999 g	10.00001 g	0.00002 g	0.061 mg	2
7	20.00001 g	20.00005 g	0.00004 g	0.082 mg	2
8*	49.99993 g	49.99997 g	0.00004 g	0.12 mg	2
9	99.99999 g	99.99999 g	0.00000 g	0.21 mg	2
10	149.9998 g	149.9998 g	0.00000 g	0.32 mg	2
11	199.9998 g	199.9998 g	0.00000 g	0.37 mg	2

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

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

Weight Set No.: WS28 Date of Issue: 17-Nov-2020
Certificate Number: 170241 Calibration Due Date: 15-May-2022

Thermo Hygrometer

Equipment No.: INS1 Date of Issue: 02-Mar-2021
Certificate Number: 211403 Calibration Due Date: 23-Feb-2022

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. This 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

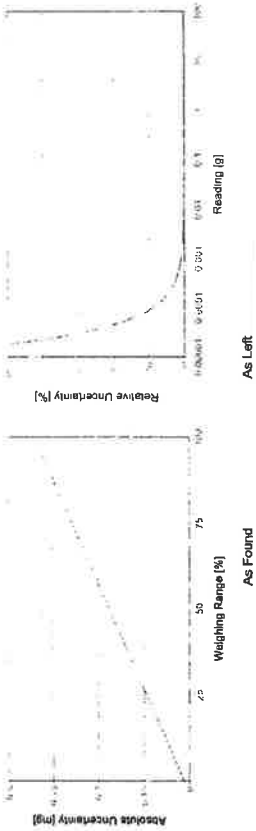
Linearization of Uncertainty Equation

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

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

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

Net Indication		As Found	As Left
0.00220 g	0.018 mg	0.82%	N/A
0.02200 g	0.018 mg	0.082%	N/A
0.22000 g	0.019 mg	0.0086%	N/A
2.20000 g	0.031 mg	0.014%	N/A
220.0000 g	1.4 mg	0.0063%	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.

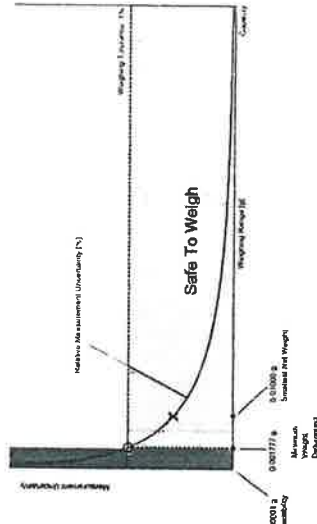
Process Requirements

Weighing Tolerance: 1 %

Smallest Net Weight: 0.01 000 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.

COPY

Minimum Weight

As Found Minimum Weight Table

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045905 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002687 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

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

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

As Left Minimum Weight Table

Tolerance	Minimum weights for different weighing tolerances and safety factors				
	Safety Factor				
	1	2	3	5	10
0.1%	0.017873 g	0.035965 g	0.054282 g	0.091605 g	0.189140 g
0.2%	0.008909 g	0.017873 g	0.026891 g	0.045905 g	0.091605 g
0.5%	0.003557 g	0.007123 g	0.010697 g	0.017873 g	0.035965 g
1%	0.001777 g	0.003557 g	0.005339 g	0.008909 g	0.017873 g
2%	0.000888 g	0.001777 g	0.002687 g	0.004448 g	0.008909 g
5%	0.000355 g	0.000711 g	0.001066 g	0.001777 g	0.003557 g

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

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

Repeatability		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	Std. Deviation	Result	As Left	Std. Deviation	Result
0.1%	0.000005 g			✗			✗
0.2%	0.000010 g			✓			✓
0.5%	0.000025 g			✓			✓
1%	0.000050 g		0.000008 g	✓		0.000008 g	✓
2%	0.000100 g			✓			✓
5%	0.000250 g			✓			✓

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

Eccentricity

Test Load: 100 g

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

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

Error of Indication

As Found

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

As Left

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

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

METTLER TOLEDO Service

METTLER TOLEDO

Service Date: 2021-07-22

Document Number: TH2046-542-072221-JABBalanceHR

EASTERN THAI CONSULTING 1992 CO., LTD.

883 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriacha, Chonburi 20230

Sasiporn Nakin

Balance Health Report

Device Details

System Details	
Manufacturer:	Mettler Toledo
Model:	XS205DU
Serial number:	1126323724
Firmware:	4.00 / 5.61
Weight set for routine testing:	Yes /

History

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

Check List

Environmental Conditions		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	✓
Static	✓	Other - objections noted as additional remarks	—
Mechanical Component Checks		Electrical Component Checks	
Draft shield	✓	Power supply	✓
Weighting pan position	✓	Sliding door drive	✓
Housing	✓	Internal weight drive	✓
Other - objections noted as additional remarks	—	Display	✓
Other - objections noted as additional remarks	—	Other - objections noted as additional remarks	—

Recommendations

Measurement Result Quality		Process Efficiency	
Instrument calibration		Initial instrument	
Identify safe weighing range		Replace instrument	
GWP verification / risk assessment	Yes	Replace / add parts (see additional remarks)	
Preventive maintenance		Onsite repair	
Perform routine testing with test weights		Depot repair	
User training		Use of accessories (see additional remarks)	

Contact:	Name:	Sasiporn Nakin	Position:	Printer:	0960513303	Email:	dc.jab@et1992.com
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Additional Remarks & Recommendations

Engineer Details	
Date:	22-Jul-2021
Name:	Palpat Sweatpanuwat
Signature:	

This is not a certificate.

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

Lentend: ✓ Good/Pass ▲ Needs Attention X Bad/Fail — Not Applicable

8494 - 8465 Lachan Rd., Bangna Tai Sub-District, Bangna District, Bangkok 10260, +66 2723 0382
MT-TH ServiceSupport@mt.com
www.mt.com

METTLER TOLEDO Service

Report Version: 1.12, Software Version 4.28 0.3, Page: 1/1, © METTLER TOLEDO

ANALYTICAL BALANCE

Model : SECURA224-1S

Serial No. : 0036707137



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 1 of 4

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURAZ224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 03 February 2022

Date of Calibration : 03 February 2022

Calibrated by : Mr. Thanadol Pholthep
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date : 07 February 2022

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

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

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



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 2 of 4

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE
Manufacturer : SARTORIUS
Model : SECURAZ224-1S
Capacity : Max 220 g
Resolution : 0.0001 g
Serial No. : 0036707137
ID No. : LABE 05/2

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 220	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	100
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000022	100.000022
	Average reading of indicator	99.9998	100.0000
	Standard deviation	0.00009	0.00005

Unit : -	Range : -	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	-	-
<input type="checkbox"/> Adjustment	Standard weight	-	-
	Average reading of indicator	-	-
	Standard deviation	-	-

COPY



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 3 of 4

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

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

Unit : g

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.7981	-	-
100	0.9576	-	-
200	0.9576	-	-

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100045	0.0100	0.0000	0.000094	2.01
0.1	0.1000102	0.1000	0.0000	0.000094	2.01
1	1.0000055	1.0000	0.0000	0.000095	2.01
2	2.0000144	1.9999	0.0001	0.000095	2.01
5	5.0000060	5.0000	0.0000	0.000096	2.01
10	10.000017	9.9999	0.0001	0.000097	2.01
20	20.000022	20.0000	0.0000	0.00010	2.01
50	50.000038	50.0000	0.0000	0.00012	2.01
100	100.000022	99.9999	0.0001	0.00016	2.00
200	200.000141	200.0000	0.0001	0.00027	2.00

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



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 4 of 4

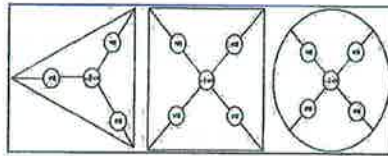
REPORT OF CALIBRATION

Result of Calibration:

4. Eccentric or off-centre loading

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

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



Condition of Calibration

- Calibration Method : VI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- This certification is traceable to the International System of Unit maintained at : -

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

Instrument	Class	ID.No.
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-5

Certificate No.

21-055481

Due Date

28 June 2022

- End of Report -

ATOMIC ABSORPTION SPECTROPHOTOMETER

Varian Model : Spectr AA-240FS

Serial No. : EL07053792

CERTIFICATE OF INTERNAL CALIBRATION

NOMENCLATURE:

- Atomic Absorption Spectrophotometer "VARIAN"
Model Speer AA – 240FS S/N EL07053792
- Working standard solution "MERCCK"

Chromium	Lot No.	HC99974679	Expire date	June 2022
Copper	Lot No.	HC90773586	Expire date	December 2022
Nickel	Lot No.	HC90700592	Expire date	September 2022
Iron	Lot No.	HC02468981	Expire date	June 2024
Lead	Lot No.	HC91308676	Expire date	December 2022

CALIBRATION PROCEDURE:

Reference Material traceable to NIST "AcuStandard"

Copper	Lot No.	220115154	Expire date	December 2022
Nickel	Lot No.	220115154	Expire date	December 2022
Iron	Lot No.	220115154	Expire date	December 2022
Chromium	Lot No.	220115154	Expire date	December 2022
Lead	Lot No.	220115154	Expire date	December 2022

CALIBRATION RANGE:

0.10, 0.25, 0.50, 1.00, 2.00 mg/l at 217.0, 232.0, 248.3, 324.8 and 357.9 nm

AMBIENT CONDITION:

Temperature 25.0 ± 5.0 °C
Relative Humidity 60.0 ± 15 %RH

The Testing Laboratory has calibrated Atomic Absorption Spectrophotometer set against Reference Material (RM) traceable to National Institute of Standard and Technology (NIST). The result are attached herewith

Examined by

(MR. CHANNARONG TANGTHAMMARAK)
SCIENTIST

Approved by

(MR. KAWEE SUTHASUB)
TESTING DEPARTMENT MANAGER
Issue Date: January 05, 2022

The above result are valid exclusively for the calibrated item (s) as mention in this certificate

Advertising the Certificate and publicity of the result except in full are prohibited unless written permission is obtained from Laboratory Manager of ETC

FM-LAB-088 / 1 / 24-08-47

INTERNAL CALIBRATION REPORT

- Atomic Absorption Spectrophotometer "VARIAN"
Model Spectra AA – 240FS S/N EL07053792
- Working standard solution "MERCCK"

Chromium	Lot No.	HC99974679	Expire date	June 2022
Copper	Lot No.	HC90773586	Expire date	December 2022
Nickel	Lot No.	HC90700592	Expire date	September 2022
Iron	Lot No.	HC02468981	Expire date	June 2024
Lead	Lot No.	HC91308676	Expire date	December 2022

CALIBRATED DATE:

January 05, 2022

CALIBRATE BY:

Mr.Channarong Tungthammarak

CALIBRATION PROCEDURE:

WI-LAB-020 Internal Calibration Method of AAS

CALIBRATION RANGE:

0.10, 0.25, 0.50, 1.00, 2.00 mg/l at 217.0, 232.0, 248.3, 324.8 and 357.9 nm

AMBIENT CONDITION:

Temperature 25.0 ± 5.0 °C
Relative Humidity 60.0 ± 15 %RH

CALIBRATION DATA

1. Noise Level in term of Standard Deviation

Standard Deviation	Chromium	Copper	Nickel	Iron	Lead
	0.00025	0.00006	0.00041	0.00057	0.00020

2. Repeatability

	Concentration of Standard (mg/l)					
	Chromium		Copper		Nickel	
	0.10	0.50	2.00	0.10	0.50	2.00
Standard Deviation	0.00015	0.00014	0.00137	0.00011	0.08000	0.00053
Average Absorbance	0.0078	0.0389	0.1484	0.0133	0.0654	0.2530

	Concentration of Standard (mg/l)			
	Iron		Lead	
	0.10	0.50	2.00	0.10
Standard Deviation	0.00028	0.00058	0.00101	0.00020
Average Absorbance	0.0078	0.0389	0.1531	0.0042

The above result are valid exclusively for the calibrated item (s) as mention in this certificate

Advertising the Certificate and publicity of the result except in full are prohibited unless written permission is obtained from Laboratory Manager of ETC

FM-LAB-088 / 1 / 24-08-47

3. Reading on Wavelength – Chromium at 357.9 nm

Standard Value of RM (mg/l)	Reading (mg/l)	Error of measurement (mg/l)	Uncertainty (mg/l)
Cr	0.100	0.081	-0.019
	0.500	0.468	-0.032
	2.000	1.874	-0.126
			± 0.006
			± 0.025
			± 0.106

4. Reading on Wavelength – Copper at 324.8 nm

Standard Value of RM (mg/l)	Reading (mg/l)	Error of measurement (mg/l)	Uncertainty (mg/l)
Cu	0.100	0.096	-0.004
	0.500	0.514	+0.014
	2.000	2.048	+0.048
			± 0.005
			± 0.026
			± 0.104

5. Reading on Wavelength – Nickel at 232.0 nm

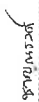
Standard Value of RM (mg/l)	Reading (mg/l)	Error of measurement (mg/l)	Uncertainty (mg/l)
Ni	0.100	0.092	-0.008
	0.500	0.511	+0.011
	2.000	1.962	-0.038
			± 0.016
			± 0.032
			± 0.099

6. Reading on Wavelength – Iron at 248.3 nm

Standard Value of RM (mg/l)	Reading (mg/l)	Error of measurement (mg/l)	Uncertainty (mg/l)
Fe	0.100	0.099	-0.001
	0.500	0.510	+0.010
	2.000	1.996	-0.004
			± 0.014
			± 0.029
			± 0.105

7. Reading on Wavelength – Lead at 217.0 nm

Standard Value of RM (mg/l)	Reading (mg/l)	Error of measurement (mg/l)	Uncertainty (mg/l)
Pb	0.100	0.097	-0.003
	0.500	0.519	+0.019
	2.000	2.084	+0.084
			± 0.013
			± 0.031
			± 0.114

Examined by 

(Mr. CHANNARONG TANGTHAMARAK)

SCIENTIST

Approved by 

(MR. KAWEE SUTHASUB)

TESTING DEPARTMENT MANAGER

Issue Date: January 05, 2022

The above result are valid exclusively for the calibrated item (s) as mention in this certificate

Advertising the Certificate and publicity of the result except in full are prohibited unless written permission is obtained from Laboratory Manager of ETC

FM-LAB-088 / 1 / 24-08-47



BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

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

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukchapibarn 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. Saruth 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

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Certificate No : AD2205-163-0001
Environment : Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

STD Reading hPa	UUC Reading (hPa)		UUC Error		Uncertainty ± hPa
	Before Adjusted	After Adjusted	hPa	hPa	
990.00	990.0	*	0.00	0.00	0.59
1000.00	1000.0	*	0.00	0.00	0.59
1010.00	1010.0	*	0.00	0.00	0.59
1020.00	1020.0	*	0.00	0.00	0.59
1030.00	1030.0	*	0.00	0.00	0.59

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :
Pressure Medium : Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial

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

Condition As-Received : Used Item
The measurement results and statements of conformity with specification only relate to the item calibrated.
Measurement Standards Used & Traceability :

The International System of Units (SI) through
IRPC Certificate No. CL1-P210086 for Reference Pressure Monitor Serial No. 1598, Due 08-Nov-22

End of Certificate

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Page 2 of 2

BOD INCUBATOR

ID No. : LABE 19/1



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-011764
Sample Code : 22-04498-001

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

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

Equipment : Temperature controlled enclosures (Incubator)
Manufacturer : N/A
Serial No. : N/A
Date of Receipt : 03 February 2022
Model : E811.0306
ID No. : LABE19/1
Date of Calibration : 03 February 2022

Condition of Calibration

1. Environment 1.1 Ambient temperature : Maximum 30.5 °C ; Minimum 29.5 °C
1.2 Relative humidity : Maximum 50.8 % ; Minimum 48.4 %
1.3 Line voltage supplied : Maximum 224.3 VAC ; Minimum 222.5 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-PH00)	LB-DA-11 (RTD-138 to RTD-146)	21-035792	18 May 2022

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Pattarakorn Penklong

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date

11 February 2022

The uncertainties are for a confidence probability of approximately 65%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

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

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Effective Date: 15/10/21



REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 22-011764
Sample Code : 22-04498-001

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# g ^{ref}
20	20.0	20.0	20.61	20.09	19.46	19.73	20.22	20.37	20.12	20.19	20.28	0.29	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.09	0.88	1.28

Notes

- UUC* = Unit Under Calibration

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REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 22-011764

Sample Code : 22-04498-001

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 = 70 cm ; D = 60 cm ; H = 124 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

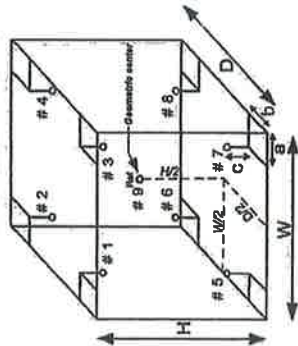


Figure: Example of sensor
Installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UMAS M9003.

- End of Report -

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BOD INCUBATOR

ID No. : LABE 19/2



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-007487

Sample Code : 22-02978-006

Customer

: EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhaphan 8 Rd., Nongkham,

Sriracha, Chonburi 20230

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

(Laboratory)

Equipment : Temperature controlled enclosures (incubator)

Manufacturer : N/A Model : N/A

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

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

Condition of Calibration

1. Environment
- 1.1 Ambient temperature : Maximum 30.4 °C ; Minimum 30.0 °C
- 1.2 Relative humidity : Maximum 51.2 % ; Minimum 46.2 %
- 1.3 Line voltage supplied : Maximum 225.3 VAC ; Minimum 224.1 VAC

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-PT100)	LB-DA-12 (RTD-158 to RTD-166)	21-038920	10 May 2022

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Pattarakom Panklong

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date

28 January 2022

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

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

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

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Effective Date: 15/10/21

NSC-TSI-TS17025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-007487

Sample Code : 22-02978-006

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# g ₉₅
20	20.0	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	0.30	2.00

2. Characterization results

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

Notes

- UUC* = Unit Under Calibration

[Signature]

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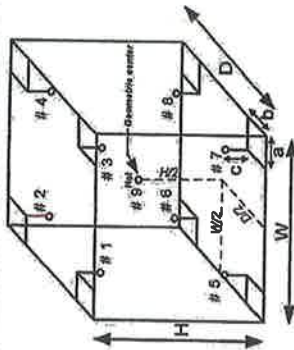
REPORT OF CALIBRATION

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

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 60 cm ; D = 70 cm ; H = 124 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes: Stability of chamber and loading effect in chamber at 20% of uniformity.
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.



Figures: Example of sensor
Installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with ISO 9003.

- End of Report -

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Hot Air Oven

Model : UM 400

Serial No. : 900982



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-025399
Sample Code : 22-09604-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

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

Equipment : Temperature controlled enclosures (Hot air oven)
Manufacturer : Memmert
Model : UM 400
Serial No. : 900982
ID No. : LABE 17/1
Date of Receipt : 11 March 2022
Date of Calibration : 11 March 2022

Condition of Calibration

1. Environment 1.1 Ambient temperature : Maximum 28.7 °C : Minimum 27.4 °C
1.2 Relative humidity : Maximum 61.5 % : Minimum 55.8 %
1.3 Line voltage supplied : Maximum 226.5 VAC : Minimum 224.7 VAC

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P1100)	LB-DA-11 (RTD-138 to RTD-146)	21-035792	18 May 2022

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Natthan Phosri

Approved by

(Mr. Somchai Neampunt)

Issue date

14 March 2022

Signed for Director

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

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

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

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Effective Date: 15/10/21



NSC-TSL-TS17025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 22-025399

Sample Code : 22-09604-002

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{ref}		
85	85.0	85.0	85.05	84.99	84.66	84.71	84.85	84.92	84.96	84.86	84.98	0.25	2.00

2. Characterization results

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

Notes

- UUC* = Unit Under Calibration

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Effective Date: 15/10/21

REPORT OF CALIBRATION

NSC-TSI-TSI7025
CALIBRATION 0152

Page 3 of 3

Certificate No.: 72-075399

Sample Code : 22-09604-002

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 40 cm ; D = 28 cm ; H = 39 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

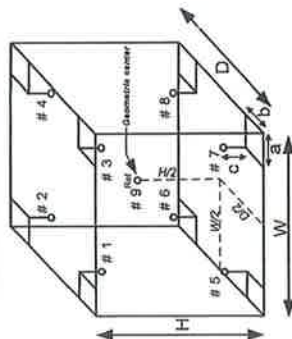


Figure: Example of sensor
installation Positions

- End of Report -

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

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INDUCTIBELY COUPLED PLASMA SPECTROMETER

Model : Prodigy 7

Serial No. : P70177



บริษัท แอปพลิเคชัน ดีไซน์ จำกัด
Application Define Company Limited
8/4 ซอย บางซื่อพัฒนา 9 แขวง บางพรหม เขต คลองจั่น กรุงเทพมหานคร 10170
8/4 Soi Bangchuekphong 9 Bangprom Talangchan, Bangkok 10170
Tel: (66) 2864 7137 E-mail: support@apdefine.co.th Website : http://www.apdefine.co.th
เลขประจำตัวผู้เสียภาษี 010558032491

CERTIFICATE OF INSTRUMENT PERFORMANCE

INSTRUMENT: INDUCTIVELY COUPLED PLASMA SPECTROMETER		
BRAND: Telendyne Leeman Labs		
MODEL: Prodigy 7		
SERIAL NO. P70177		
CUSTOMER: Eastern Thai Consulting 1992 Co., Ltd		
CHECKING: Wavelength Accuracy check by use emission line of Hg Lamp		STATUS
Mercury line 253.652 nm.		OK
Plasma View (Dual View)		OK
CMOS Detector check		OK
Align View by Mn line 257.610 nm.		OK
RF GENERATOR Incident Power 1,200 ±10 Watt Reading = ...1.2... Watt		OK
SAMPLE INTRODUCTION Plasma Torch, Injector, Spray chamber, Nebulizer Paristaltic pump & Tubing		OK
EXHAUSTING & COOLING SYSTEM Safety Interlock Switch (Door, Argon pressure, Water pressure) Cooling System, water flowrate & low pressure switch Flowrate of Air blower		OK
COMPUTER & SOFTWARE Plasma Ignition software & Analytical Software		OK
ANALYTICAL TEST Full Frame Capture & Echellegram check Calibration Curve & QC Test		OK

DATE : December 21, 2021

Mr. Somchai Chumyung
Engineer Sign

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีสเทิร์นไทย คอนซัลติง 1992 จำกัด
Instrument: ICP-OES
Date: December 21, 2021
Model: Prodigy 7
SN: P70177

1. Gas Supply /Water Re-circulator/Exhaust Hood Check:

Gas system: ตรวจสอบแรงดันแก๊สและทำการรั่วซึม Argon Pressure: 45 psi Leak inspected (✓) No leak Nitrogen Pressure: - psi Leak inspected (✓) No leak Oxygen Pressure: - psi Leak inspected (✓) No leak	
(✓) Change camera purge gas Dehydrator (1 times /years) Next time replacement 24-01-22 เปลี่ยนตัวดูดความชื้นดีไฮเดรต ทุก 1 ปี	
Water Chiller: RF generator flow rate 444 LPM Temperature 26 C ตรวจสอบอุณหภูมิ Leak inspected (✓) No leak ตรวจสอบการรั่วซึม	
Water Chiller: Camera (✓) check water level and refill ตรวจสอบระดับน้ำและเติมน้ำ (✓) change water เปลี่ยนถ่ายน้ำ Temperature 34 °C ตรวจสอบอุณหภูมิ	
Exhaust Hood Flow rate 650 CFM (system request > 150)	

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY 7

Customer: บริษัท อีทีที เทคโนโลยี จำกัด	Date: December 21, 2021
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

2. Computer & Software Check

Description	Status
Interface Cable USB (✓) No broken	OK
Software Version	OK
(✓) Operation function check :	OK
(✓) Open /Save /Edit method	OK
(✓) Instrument Control	OK
(✓) Sequence	OK
(✓) Full Frame Capture (Echelle Mode)	OK
(✓) Auto alignment /Hg alignment	OK
(✓) Calibration Curve	OK
(✓) Re-Calculatation	OK
(✓) Print Report	OK

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY 7

Customer: บริษัท อีทีที เทคโนโลยี จำกัด	Date: December 21, 2021
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

3. Instrument Control

Description	Status
Optical view position: ตรวจดูตำแหน่งที่มองเห็นหลอดไฟและเลนส์	
Hg Lamp Deltas	
X -1 Y -2	OK
XUV 0	OK
Axial peak positions X3325 Y1205	OK
Radial peak positions X4114 Y1185	OK
Hg lamp peak positions X2245 Y2815	OK
Plasma Control ตรวจดูการทำงานของพลาสมา	
(✓) Auto Start	OK
(✓) Extinguish	OK
(✓) RF power setting	OK
(✓) Igniter	OK
(✓) Air Knife	OK
Torch Gas ตรวจดูการทำงานของแก๊สในเตาเผา	
(✓) Coolant /Plasma Flow control	OK
(✓) Aux Flow	OK
(✓) Nebulizer Flow	OK
(✓) Optimize sample introduction function	OK
(✓) Peristaltic pump control	OK
(✓) Auto sampler Control	OK
(✓) Camera Support Module	OK
(✓) Diagnostic	OK

COPY

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีลิคฟาร์ม จำกัด 1992 จำกัด	Date: December 21, 2021
Instrument: ICP-OES	Model: Prodigy 7
	SN: P70177

4. Cleaning & Replacement

Description	Status
✓ O-Ring Torch replacement	OK
✓ Pump Tubing replacement	OK
✓ Glassware cleaning (Torch, Nebulizer, Spray chamber)	OK
✓ O-Lube the roll peristaltic pump	OK
✓ Optical windows cleaning	OK
✓ Camera Water Re-circulator (water change/ refilled)	OK
✓ RF Generator Water Re-circulator (water change/ refilled)	OK
✓ Cleaning Electronics Board with spray cleaner	OK
✓ Cleaning dust inside Unit	OK
✓ Cleaning dust filter	OK

5. Safety Interlock

Description	Status
✓ Door switch	OK
✓ RF Water Re-circulator	OK
✓ Camera Water Re-circulator	OK
✓ Camera purge gas	OK
✓ Argon pressure	OK
✓ Nitrogen pressure	OK

COPY

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีลิคฟาร์ม จำกัด 1992 จำกัด	Date: December 21, 2021
Instrument: ICP-OES	Model: Prodigy 7
	SN: P70177

6. Hardware Check with SALSA.EXE Diagnostics

Power Supply	Value	Status
-12 VDC (11 - 14.5 VDC)	-13.7 V	OK
+12 VDC (11 - 14.5 VDC)	12.01 V	OK
+3.3 VDC	3.28 V	OK
+5.0 VDC	4.99 V	OK
+13.5 VDC	13.46 V	OK

Plasma Generator	Value	Status
ICP Current 0.500A = 1kW	0.50 A	OK
ICP Ref 5.0Vdc = 1kW	5.47 V	OK
ICP Current 0.00 Vdc = 0kW	0	OK
ICP Ref 0.00Vdc = 0kW	0	OK
RF Water (Hz) OFF	0	OK
RF Water (Hz) ON	0.5	OK
Air Knife Pres. (0.00V) OFF	0	OK
Air Knife Pres. (3.0 - 7.0 V) ON	3.57 V	OK
Neb 25 @ setting of 25 PSI	2.5	OK
Cool 18 @ setting of 18 LPM	1.8	OK
Aux 0.6 @ setting of 6 LPM	0.6	OK
Pump Current (0.000 A) OFF	0	OK
Pump Voltage (0.000 V) OFF	0	OK
Pump Current (0.8 to 4.0A) ON	1.0 A	OK
Pump Voltage (8 to 13 V) ON	10.5 V	OK

Set Points	Value	Status
Air In Set Point 32°C	32	OK
Cam Tec Temperature -32°C	-32	OK
Op Purge Low 0.77 LPM	0.77	OK
Op Purge High 15.50 LPM	15.5	OK
Cam Wtr T 28°C	28.02	OK

COPY

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท สยามทรีฟ พลาซ่า จำกัด 1997 จำกัด

Instrument: CP-QES	Model: Prodigy 7	S/N: P70177
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7. Mn Check for performance Test

	Condition for performance Test	Condition Test	Status
Standard	1 ppm, 5 ppm, 10 ppm	10 ppm	ok
Power plasma	1.20 kw	1.2	ok
Plasma gas	16.0 LPM	16	ok
Auxiliary Gas	0.8 LPM	0.8	ok
Nebulizer	1.2 LPM	25 psi	ok
Pump Speed	25 RPM	25	ok
Integration time	15 s Axial, 5 s Radial	10 s, 5 s	ok
Nebulizer Type	Sespray, Conikal, Mainhard	Conikal	ok
Intensity first performance	1 ppm \geq 4,000,000 5 ppm \geq 15,000,000 10 ppm \geq 50,000,000	64,343,928	ok

Engineer Sign

TELEDYNE LEEMAN LABS
Everywhere you look™

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LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



CERTIFICATE No : 21T10802
REFERENCE No : 62916-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : 0 °C TO 100 °C

SERIAL No : 43560

ID No : LABE 16/1

RESOLUTION : 0.1 °C

TYPE : TOTAL IMMERSION

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY

EASTERN THAI CONSULTING 1992 COMPANY LIMITED
999 MOO.11 NONGKHAM, SRIRACHA, CHONBURI
20230

CALIBRATED BY

CHARUKIT L.

CALIBRATION DATE

27-Oct-21

APPROVED BY

PONGSAK J.

ISSUED DATE

27-Oct-21

RECEIVED DATE

21-Oct-21

COPY

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



CERTIFICATE No : 21T10802

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	21T3033	08-Mar-22
2) SPRT PROBE	5614	636626	21T3033	08-Mar-22
3) PRECISION BATH	7320	A21105	20T12163	16-Dec-21
4) PRECISION BATH	CTR-40	A68155	20T12164	22-Dec-21

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

UUC* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

COPY

pH Meter

Model : SevenCompactTM pH/Ion Meter S220

Serial No. : B448305208

Certificate Number CCP-1416-22

Certificate Number CCP-1416-22

Calibration Certificate SevenCompact™ pH/Ion Meter S220

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.
Address 683 Moo 11, Sukhaphan 8 Rd., Nong Khum
Sriacha
Chonburi 20230
Customer ID number 301608441
Customer representative Sasiporn Nakh

Assignment ID



Instrument

Type SevenCompact™ S220 Instrument Serial Number B449305208
Internal Identification LABE 11/4 Firmware version 1.20.06

Technical specifications

Measuring Range -1999.9 ... 1999.9 mV
Resolution 0.1 mV
Limit of Error ± 0.2 mV
Measuring Range -2.000 ... 20.000 pH
Resolution 0.001 pH
Limit of Error ± 0.002 pH
Temperature range MTC -30.0 ... 130.0 °C
Temperature range ATC -5.0 ... 130.0 °C
Resolution 0.1 °C
Limit of Error ± 0.1 °C

Procedure Statement

METTLER TOLEDO Calibration SOP (Doc. No. ME-30027516TH) will be used as referring documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" section. The measurement results of this certification were obtained at ambient conditions.

Certification Tools

Certified digital voltmeter
Manufacturer GOSSEN METRAWATT
Control No. ANA77

Serial number ZD1740
Certificate number E1U213196
Due date August 8, 2022

Certified Temperature Resistors

Manufacturer METTLER TOLEDO / ME-S1802410
Control No. ANA137

Serial number A424
Certificate number 31344
Due date August 25, 2023

Designation	Nominal value	Certified value
NTC 30 k Ω , 0 °C	94.980 k Ω	94.9556 k Ω
NTC 30 k Ω , 25 °C	30.000 k Ω	30.0137 k Ω
NTC 30 k Ω , 50 °C	10.969 k Ω	10.9649 k Ω
NTC 30 k Ω , 75 °C	4.528 k Ω	4.5257 k Ω
NTC 30 k Ω , 100 °C	2.070 k Ω	2.06949 k Ω
PT 1000, 0 °C	1.000 k Ω	1.000156 k Ω
PT 1000, 25 °C	1.0974 k Ω	1.097464 k Ω
PT 1000, 50 °C	1.1940 k Ω	1.194202 k Ω
PT 1000, 75 °C	1.2899 k Ω	1.290138 k Ω
PT 1000, 100 °C	1.3851 k Ω	1.385061 k Ω

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Certificate Number CCP-1416-22

Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
pH/mV Sensor Input				
NTC 30 kΩ, 0 °C	-1900.0 mV	-1899.9 mV	0.2 mV	Passed
NTC 30 kΩ, 25 °C	-1000.0 mV	-999.9 mV	0.2 mV	Passed
NTC 30 kΩ, 50 °C	-500.0 mV	-499.9 mV	0.2 mV	Passed
NTC 30 kΩ, 75 °C	-180.0 mV	-180.0 mV	0.2 mV	Passed
NTC 30 kΩ, 100 °C	0.0 mV	0.1 mV	0.2 mV	Passed
PT1000, 0 °C	1800.0 mV	1800.0 mV	0.2 mV	Passed
PT1000, 25 °C	500.0 mV	499.9 mV	0.2 mV	Passed
PT1000, 50 °C	1000.0 mV	999.9 mV	0.2 mV	Passed
PT1000, 75 °C	1800.0 mV	1800.0 mV	0.2 mV	Passed
PT1000, 100 °C	1900.0 mV	1899.9 mV	0.2 mV	Passed

Designation	Measured low Imp.	Measured high Imp.	Max. Tolerance	Passed / Failed
pH/mV Sensor Input at high impedance	1900.0 mV	1899.6 mV	0.6 mV	Passed

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

Sensor recognition	The sensor was recognized correctly by the meter	Passed
--------------------	--	--------

Summary of Certification

Certification of Instrument

Passed

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

Remarks

Certification of the instrument was performed by

Name

Place

Function

Service Engineer

Calibration Date: February 7, 2022

Signature

ELECTRONIC SIGNATURE

Performance Test

Control No. CCE-1416-22/1

Company:

EASTERN THAI CONSULTING 1992 CO., LTD.

Address:

683 Moo 11, Sukdaphiban 8 Rd., Nong KhamSitracha

pH Electrode

Type:

Inlab Expert Pro-ISM

SN:

1978465

Certified standards used

Standard 1:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Dec-22
	Nominal value:	pH (25.00 °C):		01	Lot No.:	1F351C

Standard 2:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Dec-22
	Nominal value:	pH (25.00 °C):		20	Lot No.:	1F351M

Standard 3:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Jan-23
	Nominal value:	pH (25.00 °C):		21	Lot No.:	1G012G

Test equipment:	Type:	pH Meter	Manufacturer:	METTLER TOLEDO	Cal date:	7-Feb-22
	S/N:	B44B305208	No. of certificate:	CCP-1416-22	Model:	S220

Adjustment

Set Calibration Buffer	82: (25 °C) 7.00, 4.01, 9.21									
Select Calibration Mode	3-Point calibration			2-Point calibration			2-Point calibration			
3-Point Calibration	°C	pH	ion	°C	pH	ion	°C	pH	ion	
Cal 1	ATC	25.0	7.00	ATC	—	—	ATC	—	—	
Cal 2	ATC	24.9	4.01	ATC	—	—	ATC	—	—	
Offset (mV)	3.4			—			—			
Slope % (or mV/pH)	97.6			—			—			
Cal 3	ATC	24.7	9.21							
Slope % (or mV/pH)	98.2									

Measurements

Before adjustment					After adjustment				
Buffer Values		Measured		Difference	Buffer Values		Measured		Difference
pH	°C	pH	°C	pH	pH	°C	pH	°C	pH
4.01	25.0	ATC	3.95	-0.06	4.01	24.9	ATC	24.00	0.01
7.00	25.0	ATC	7.03	0.03	7.00	24.8	ATC	24.01	0.01
9.21	24.8	ATC	9.20	-0.01	9.21	24.7	ATC	24.00	0.01

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

Place:

Laboratory room

Calibration Date:

February 7, 2022

Service Specialist:

Palpat Srisaengnual

Signature:

Electronic Signature

This is an original document, copies are not valid for METTLER TOLEDO

COPY

STANDARD WEIGHT 50 g



Certificate No. : 22-052238
Sample Code : 22-19150-003

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

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

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

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

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-017

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

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



Certificate No. : 22-052238
Sample Code : 22-19150-003

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g
Manufacturer : METTLER TOLEDO
Class : F1
Serial No. : N/A
ID No. : LABE 10/1

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	\pm (mg)	
50 g	-0.324	49.998676 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

Signature

COPY

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-064

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

TEL 02-516-2422
FAX 02-516-6949
Rev.03



Certificate No. : 22-052238

Sample Code : 22-19150-003

REPORT OF CALIBRATION

Condition of Calibration:

1. Ambient Conditions : Temperature $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.20 kg/m^3
2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

End of Report -

COPY

STANDARD WEIGHT 100 g



Certificate No. : 22-052239

Sample Code : 22-19150-004

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Siracha, Chonburi 20230

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee

Scientist

Approved by

Signed for Director

Issue date : 31 May 2022

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

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

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



Certificate No. : 22-052239

Sample Code : 22-19150-004

REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

COPY



Certificate No. : 22-052239

Sample Code : 22-19150-004

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

- End of Report -

COPY

STANDARD WEIGHT 50 g



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date : 31 May 2022

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

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

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



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

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

[Signature]

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NSC-TS1-TS17025
CALIBRATION 0152

Page 3 of 3

Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :	
Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

COPY

SPECTROPHOTOMETER

Model : PROVE 100

Serial No. : 1613110857



CERTIFICATE OF CALIBRATION

Instrument : SPECTROPHOTOMETER
Model : PROVE 100
Date of Calibration : February 15, 2022
Customer Name : Eastern Thai Consulting 1992 Co., Ltd.

Procedure used

The wavelength accuracy and the linearity of the absorbance measurement of photometers are checked using Check solutions according to Merck calibration laboratory work instruction.

Measurements results

Function : Absorbance measurement.
All data shown below as received values of blank solution before adjustment.

Check Solution (Abs.)	Wavelength (nm)	Desired Absorbance (Abs.)	Measured Absorbance (Abs.)	Error (Abs)
0.000	445	0.000 ± 0.005	0.000	0.000
0.000	525	0.000 ± 0.005	0.000	0.000
0.000	690	0.000 ± 0.005	0.000	0.000

CERTIFICATE No. **WO-02118723**



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Function : Absorbance measurement.
All data shown below were final value of standard solution after adjustment.

Check Solution* (Abs.)	Desired Absorbance (Abs.)	Allowed Tolerance (Abs.)	Actual Absorbance (Abs.)	Assessment Yes/No
445-1	0.193	± 0.020	0.191	Yes
445-2	0.494	± 0.030	0.495	Yes
445-3	0.995	± 0.040	0.990	Yes
445-4	1.488	± 0.050	1.484	Yes
525-1	0.192	± 0.020	0.195	Yes
525-2	0.494	± 0.030	0.499	Yes
525-3	0.988	± 0.040	0.986	Yes
525-4	1.486	± 0.050	1.484	Yes
690-1	0.202	± 0.020	0.206	Yes
690-2	0.495	± 0.030	0.495	Yes
690-3	0.984	± 0.040	0.993	Yes
690-4	1.486	± 0.050	1.490	Yes

* Spectroquant Photocheck (Check Solution) Lot : HC996035

- Check solution for this certification is traceable to : Reference Photometer Agilent Cary 4000 checked and calibrated using NIST-glass filter SRM 1930 and Holmiumoxide Solution NIST SRM 2034
- Desired absorbance round cell has been calculated from the absorbance of the 1 cm cell using the path length of the round cell and is entered as the desired

CERTIFICATE OF CALIBRATION

Software version: 1.5.1

Wavelength Accuracy*				
Equipment	Nominal value	Tolerance limit**	Actual value	Result
Holmium Oxide Liquid Filler Helima 667-UV5	361.30 nm	360.1 - 362.5 nm	360.8 nm	P
	536.80 nm	535.4 - 539.3 nm	536.8 nm	P
	640.55 nm	639.4 - 642.8 nm	641.1 nm	P
Wavelength Precision / Reproducibility*				
Equipment	Wavelength	Nominal value	Actual value	Result
Holmium Oxide Liquid Filler Helima 667-UV5	361.30 nm	±0.20 nm	0.02 nm	P
	536.80 nm	±0.20 nm	0.05 nm	P
	640.55 nm	±0.20 nm	0.06 nm	P
Photometric Accuracy*				
Equipment	Wavelength	Nominal value	Actual value	Result
Neutral Density 1.00 Abs. Helima 668-F4	440 nm	1.065 A	1.053 - 1.077 A	P
	546 nm	1.012 A	1.003 - 1.020 A	P
	635 nm	1.054 A	1.042 - 1.068 A	P
Neutral Density 2.00 Abs. Helima 668-F203	440 nm	2.217 A	2.200 - 2.234 A	P
	546 nm	1.988 A	1.986 - 2.011 A	P
	635 nm	1.914 A	1.901 - 1.927 A	P
Photometric Precision / Reproducibility* @ 1.0 A				
Equipment	Wavelength	Nominal value	Actual value	Result
Neutral Density 1.00 Abs. Helima 668-F4	440 nm	±0.003 A	0.001 A	P
	546 nm	±0.003 A	0.000 A	P
	635 nm	±0.003 A	0.000 A	P
Stray Light*				
Equipment	Wavelength	Nominal value	Actual value	Result
Sodium Nitrite Helima 667-UV11	340 nm	±0.10 %T	0.00 %T	P
				P
Selftest Hardware				
No visual flaws, no burrs, no loose parts and fastenings				



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CERTIFICATE OF CALIBRATION

INSTRUMENT : SPECTROPHOTOMETER

MANUFACTURER : Merck KGaA, Darmstadt, Germany

MODEL : PROVE 100

SERIAL No. : 1613110857

CLIENT : Eastern Thai Consulting 1992 Co., Ltd.

DATE OF ISSUE : February 15, 2022

APPROVED SIGNATORY

NAME : Mr. Rawat Rattanacheththakul
(SERVICE ENGINEER)

SIGNATURE :

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CERTIFICATE No. WO-02118723



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THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



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

361/361/1-4 Soi Ladprao 122, (Mahadithai 1), Ladprao Road, Phibabphla,
Wangphonglang, Bangkok, Thailand 10310, Head Office
Tel (66) 2-934-2381-3 Fax (66) 2-934-0661
http://www.amarc.co.th Email: d@amarc.co.th



NSC-TSI-TS 17025
CALIBRATION 0152

Certificate No. : 21-062722

Sample code : 21-24788-002

Page 1 of 2

CERTIFICATE OF CALIBRATION

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

Location of calibration : Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.
(Calibration laboratory)

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

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

2 Calibration method

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

3 Reference standard instrument

Instrument	Model	Code No.	Certificate No.	Due date
3.1 Chilled Mirror	Optidew Vision	LB-DP-02 & LB-DP-02 (DP)	TH-0018-21	10 March 2022
3.2 Digital Thermometer	Optidew Vision	LB-DP-02 & LB-DP-02 (Temp.)	21-032217	06 April 2022
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	20-085967	17 September 2021

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

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

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

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

6 Condition of calibration item : Normal

Calibrated by : Miss Pornsuda Lohabai

Date of issue : 11 August 2021

Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

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

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

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



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NSC-TSI-TS 17025
CALIBRATION 0152

Certificate No. : 21-062722

Sample code : 21-24788-002

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REPORT OF CALIBRATION

Results of calibration

Temperature measurement

Resolution of unit under calibration : 0.1 °C

Range : 0 °C to 50 °C

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

Humidity measurement

Resolution of unit under calibration : 0.1 %RH

Range : 10 %RH to 95 %RH

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

Note

- Calibration results without adjustment

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

End of report

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UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Ramat Road
Sliom 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 663 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sirachak, 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 WJ-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
Siray Light is traceable to certificate No. 96346
The above certificate are traceable to SI unit through Siama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choolthep

Approved by

Mr.Kanchit Choolthep
Technical Manager

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Sliom Bangkok Bangkok Thailand 10500
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www.barascientific.com



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-167/22

Calibration Results:
1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.80	0.09	0.18
445.82	445.95	0.13	0.18
536.52	536.60	0.08	0.18
741.02	741.00	-0.02	0.18
879.41	879.40	-0.01	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000 0.7311	0.0000 0.7321	0.0000 0.0010	0.0075 0.0075
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	0.0000 0.6306	0.0000 0.6314	0.0000 0.0008	0.0075 0.0075

*CNR = Customer not request

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Certificate of Calibration

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Number of Page(s)

BSCC-UV-16722

Certificate No.

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7636	-0.0001	0.0042
440.0	1.0480	1.0497	0.0017	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5377	0.0006	0.0042
465.0	0.7457	0.7451	-0.0006	0.0042
	1.0233	1.0240	0.0016	0.0042
	CNR	CNR	CNR	CNR
546.1	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
590.0	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
	0.6961	0.6944	-0.0017	0.0042
635.0	0.9563	0.9550	-0.0013	0.0042
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5137	0.0000	0.0042
	0.6907	0.6891	-0.0016	0.0042
635.0	0.9533	0.9519	-0.0014	0.0042
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.91±0.11nm	201.10	2.0204

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

*Stray Light not NSC-ONSC Accredited.

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

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