

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE

Certificate No. : AD2205-163-0001

Date Issued : 20-May-22

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

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



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Certificate No. : AD2205-163-0001

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

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

STD Reading hPa	UUC Reading (hPa)		UUC Error hPa	Uncertainty \pm hPa
	Before Adjusted	After Adjusted		
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/m^3 @ 20°C , 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial

Description of UUC :

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

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. CLJ-P210086 for Reference Pressure Monitor Serial No. 1598, Due 08-Nov-22

End of Certificate

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030



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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-402242242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
Certification Date: Oct 15, 2021
Expiration Date: Oct 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)", document EPA 000/R-12/021, using the assay procedures listed. Analytical Methodology does not require correction for analytical impurities. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Last Multipoint Calibration	
Nicolet IS50 FTIR AUP2110295 CH4			FTIR	Oct 13, 2021
Nicolet IS50 FTIR AUP2110295 C3H8			FTIR	Oct 14, 2021

Triad Data Available Upon Request

NOTES:

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



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

Do Not Use This Cylinder below 100 PSIG, i.e. 0.1 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	16060607	CC442564	Jun 27, 2020
PRM	12367	APEX1099237	Jun 02, 2017
GMS	0315201604	CC503358	Mar 15, 2019
NTRM	16011025	CC473218	Jun 07, 2022
NTRM	12060735	CC356192	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 as 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

Dana M. Morris
Approved for Release

DRY GAS METER MC-572

Serial No. : 0011024

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

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

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

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

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice	Volume	Volume	Outlet Temp	Outlet Temp	Volume	Volume	Outlet Temp	Outlet Temp
(@)	ΔH	Initial	Final	Initial	Final	Initial	Final	Initial	Final
(min)	(P _o)	(V _i)	(V _f)	(t _i)	(t _f)	(V _w)	(V _f)	(t _w)	(t _f)
	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 _w)	(Q _{std})	(V _w)	(Q _{std})	Value	Variation	Flowrate	ΔH @	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	Std & Corr	.0212 m ³ /min	(ΔH@)
						(Q _{std})	(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	40.070	0.748
				1.017	Y Average		39.321	ΔH@ Average

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

Signature

(Sirichok Sansomsup)
Service Engineer

สิริชก แซ่มสุม

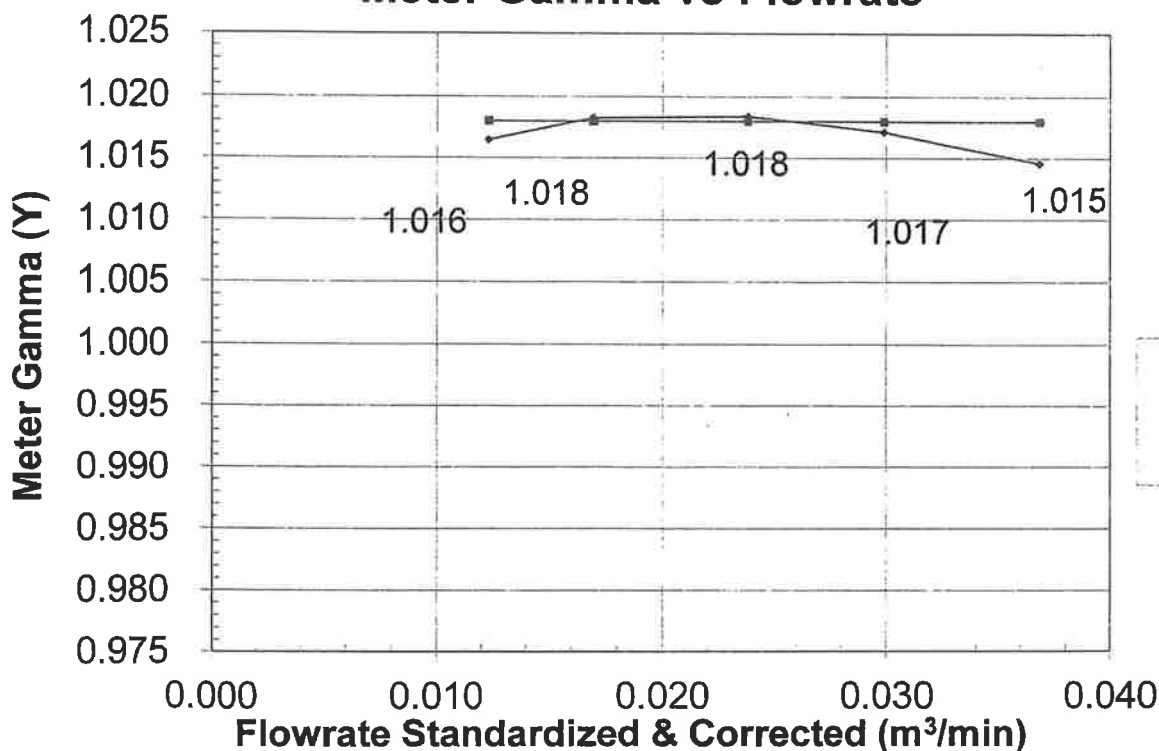
Date

07/01/2022

Calibration Date: 25-2-2014

Calibration Reference No: VO57AP0011

Meter Gamma vs Flowrate



Console Serial:

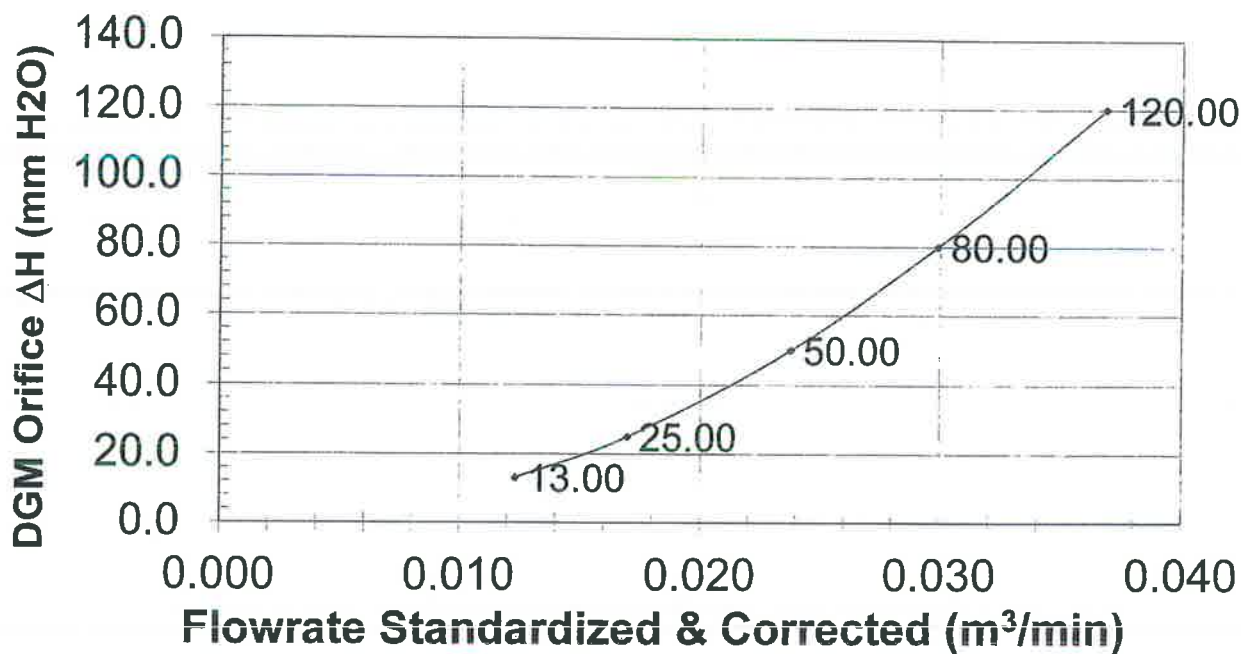
0011024

สิริชก แซ่มสุม

Console Model:

MC-572

Meter Pressure vs Flowrate



Console Serial:

0011024

Console Model:

MC-572

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SITHIPORN ASSOCIATES COMPANY LIMITED

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THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN

SA Environmental / Hygiene Products Division (EPD)

Web site : www.sithiporn.com / E-mail : service-epd@sithiporn.com

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	MC-572	Date	07-Jan-22
Console Serial Number	0011024	Calibration Reference No.	HC65APE0005
DGM Model Number	SK25EX	Barometric Pressure	759 mm Hg
DGM Serial Number	00005437	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005
Meter Box Serial Number	JC02982		

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
-18.0	25.0
-18.0	38.0
-18.0	93.0
-18.0	149.0
-18.0	260.0
-18.0	371.0
-18.0	482.0
-18.0	593.0
-18.0	816.0
-18.0	1038.0
Stack	
Probe	
Filter	
Aux	
Exit	

Stack
Probe
Filter

+ 1.50% Absolute
± 3.0 °C
± 3.0 °C

Tolerance Range

Meter Exit

± 3.0 °C
± 2.0 °C

Note: Temperature difference ≤ 1.5%

Signature

(Sirichok Sansomsup)
Service Engineer

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SITHIPORN ASSOCIATES COMPANY LIMITED

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บริษัท สิทธีพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสีลม แขวงบางนาใต้ เขตบางพลัด กรุงเทพฯ 10700 Tels. 0-2433-8331, 0-2433-8800, 0-2434-9191 แฟกซ์ : 0-2433-1679, 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 MC-572-V

Serial No. : 0504003

5-POINT METRIC UNIT

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.	HC65APE0028		
Barometric Pressure	761	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

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

Calibration Data									
Metering Console						Calibration Meter			
Run Time	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (t ₀)	(P _m)	(V _m)	(V _n)	(t _m)	(t _n)	(V _m)	(V _n)	(t _m)	(t _n)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	234.9529	235.0859	27	27	276.54575	276.67750	27	27
10.00	25.0	235.1718	235.3277	27	27	276.76357	276.91678	27	27
8.00	50.0	235.3676	235.5510	27	27	276.95578	277.13668	27	27
7.00	80.0	235.5744	235.7803	27	27	277.15828	277.36140	27	27
5.00	120.0	235.8320	236.0136	27	27	277.41235	277.59265	27	27

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

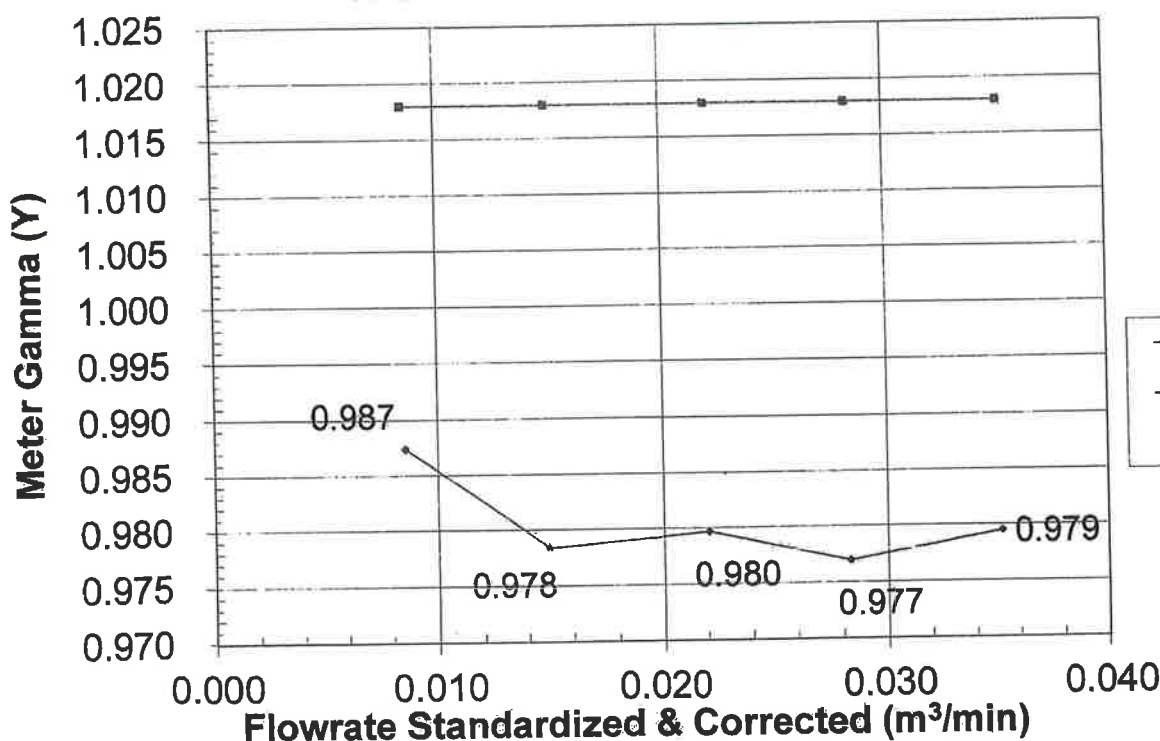
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .
Note: For ΔH_m, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable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

Signature Surachai Chaisana
(Surachai Chaisana)
Service Engineer

บริษัท สกทิพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY

Date 5/4/2022

Meter Gamma vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

SITHIPORN ASSOCIATES CO., LTD.
Environmental / Hygiene Products Division (EPD)
Web site : www.sithiporn.com & E-mail: service-epd@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.	HC55APE0026
DGM Model Number	SK25EX	Barometric Pressure	761 mm Hg
DGM Serial Number	0005303	Reference Thermometer	FLUKE 714
Meter Box Model Number	JENCO 765	Serial Number	9038005

Meter Box Serial Number	JC02484
-------------------------	---------

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

Stack
Probe
Filter

± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Tolerance Range

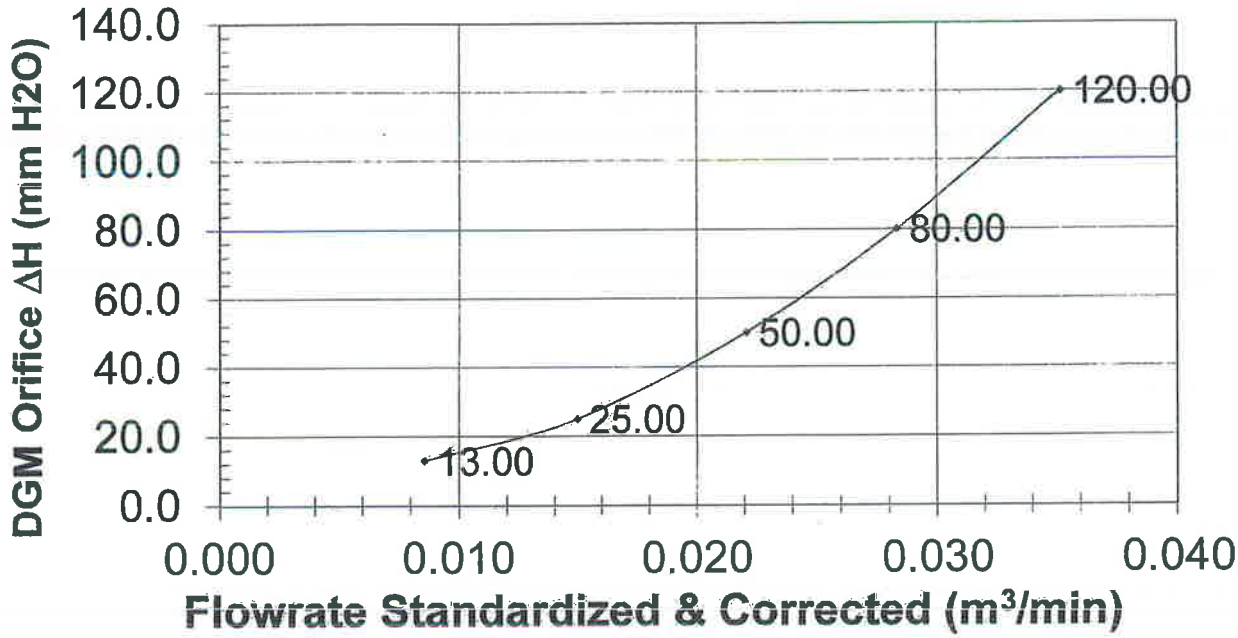
Meter
Exit

+ 3.0 °C
± 2.0 °C

Signature _____
(Surachai Chaisana)
Service Engineer

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SITHIPORN ASSOCIATES COMPANY LIMITED

Meter Pressure vs Flowrate



Console Serial:

0504003

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SITHIPORN ASSOCIATES COMPANY LIMITED

Console Model:

MC-572-V

DRY GAS METER XC-572V

Serial No. : 1110070

Certificate Of Calibration

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

Meter Console Information

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

Calibration Conditions

Calibration Reference No. WDS-SV680004
 Ambient Temp (°C) 25.4
 Barometric Pressure (mm Hg) 768
 Relative Humidity (%) 55

Factors/Conversions

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

Reference Equipment

WTM Model: W-NKOa-5B WTM Serial: 546321
 WTM Cal. Due: Mar-23 Gamma: 1.0000
 WTM Thermometer: Internal

Metering Console				Calibration Meter				Outlet Temp	
Run Time (minutes)	Orifice, ΔH (mm H ₂ O)	Volume (m³)	Outlet Temperature (°C)	Volume (m³)	Outlet Temp Initial	Outlet Temp Final		Initial	Final
(Q)	(P _{avg})	(V _{avg})	(T _{avg})	(V _{avg})	(T _{avg})	(T _{avg})		(T _{avg})	(T _{avg})
min	mm H ₂ O	m³	°C	m³	°C	°C		°C	°C
15.00	13.0	397.7244	397.9056	25	25	289.56787	289.78942	25	25
10.00	25.0	397.9285	398.0984	25	26	289.79207	289.95984	25	25
8.00	50.0	398.1162	398.3058	26	26	289.97735	290.16549	25	25
7.00	80.0	398.3386	398.5469	26	26	290.19612	290.40517	25	25
5.00	120.0	398.5693	398.7513	26	27	290.42752	290.60906	25	25

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Calibration Factor		Flowrate	
(V _{avg})	(Q _{avg})	(V _{avg})	(Q _{avg})	Value	Variation	Std & Corr	ΔH @ (mm H ₂ O)
m³	m³/min	m³	m³/min	(Y)	(ΔY)	(Q _{avg})	(ΔH@)
						m³/min	mm H ₂ O
0.180	0.012	0.181	0.012	1.001	0.009	0.012	41.038
0.169	0.017	0.167	0.017	0.988	-0.008	0.017	41.198
0.189	0.024	0.187	0.023	0.991	-0.001	0.023	41.985
0.210	0.030	0.208	0.030	0.990	-0.002	0.030	41.881
0.182	0.036	0.180	0.036	0.991	-0.001	0.036	42.759
				0.992			41.768
							= ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.001.
 Note: For ΔH_{avg}, orifice pressure differential that equates to 0.75c/in (0.0212m/min) at standard temperature and pressure, acceptable tolerance for individual values from the average is ±0.2inches (5.1mm) H₂O

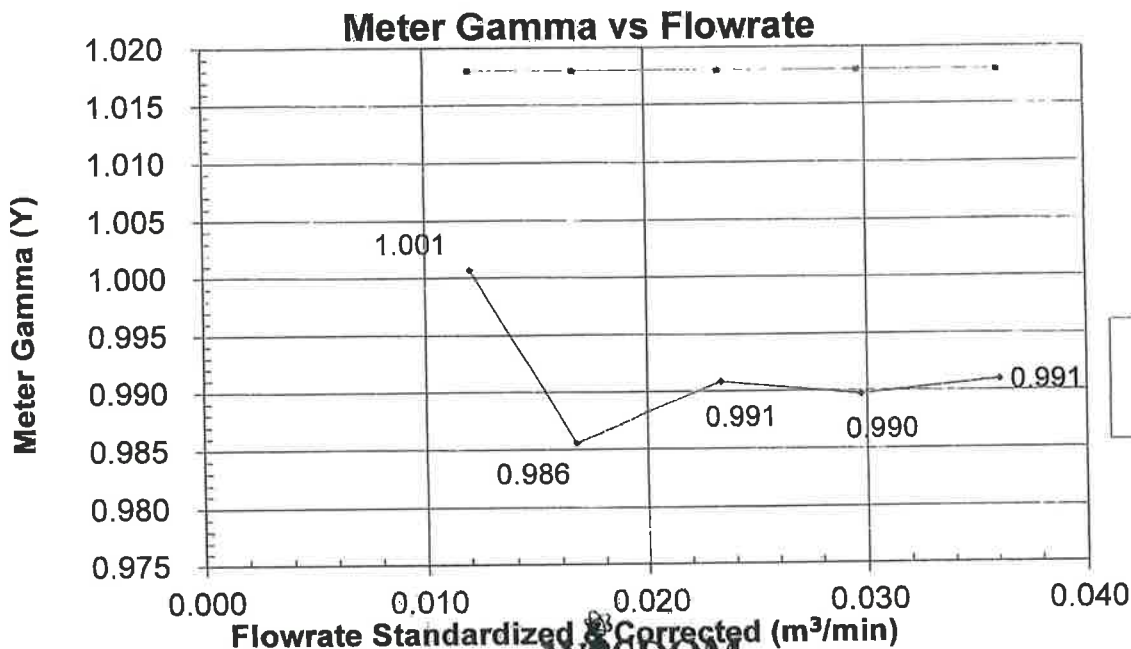
Pass/Fail Result: ☒ Pass

Signature

Patpasu Chaisana
Service EngineerWISDOM SCIENCE
บริษัท วิสโดม ซายน์แอนด์เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date

13 / 06 / 2022



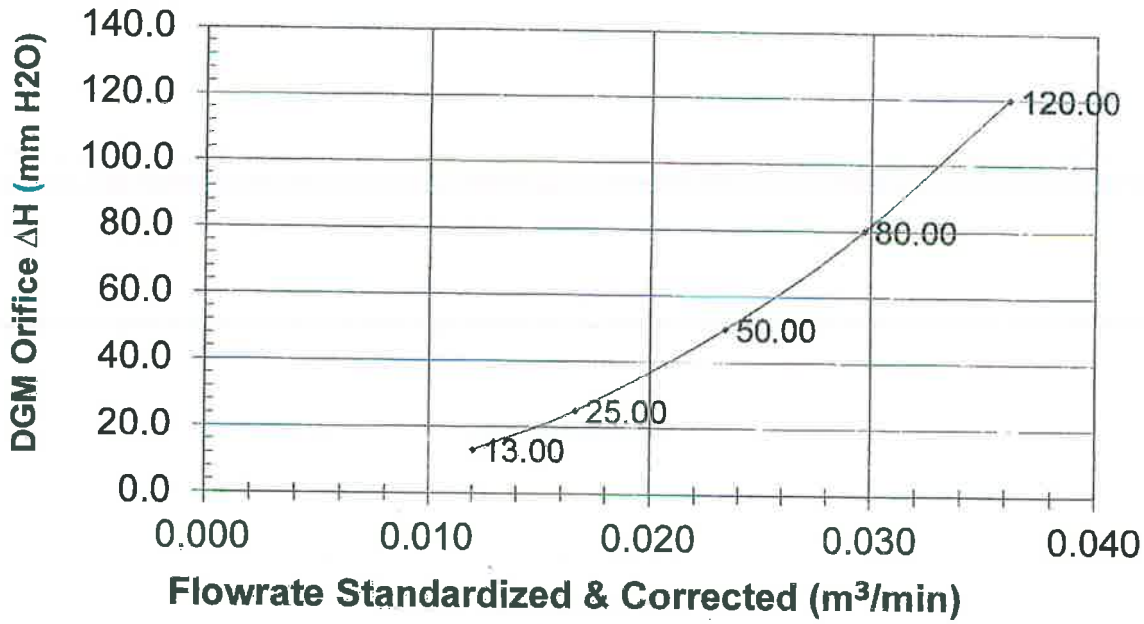
Console Serial: 1110070

Console Model: XC-572V

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

COPY

Meter Pressure vs Flowrate



Console Serial: 1110070



Console Model: XC-572V

COPY

WISDOM	
THERMOCOUPLES SYSTEM CALIBRATION	
<small>305, Rama 9 Road, Watthana, Bangkok 10110, Thailand WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED</small>	

Sampling System Equipment Information	
Console Model Number	XC-572V
Console Serial Number	1110070
Meter Box Model Number	JENCO 765
Meter Box Serial Number	JC02484
Calibration Conditions	
Calibration Reference No.	WDS-SV650004
Ambient Temp	25.4 °C
Barometric Pressure	756 mm Hg
Relative Humidity	55 %
Reference Thermometer	FLUKE 714
Serial Number	9038005

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

Tolerance Range

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

Meter ± 3.0 °C
Exit ± 2.0 °C

Signature

(Patpasu Chaisana)
Service Engineer



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

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DRY GAS METER MC-572V

Serial No. : 1007055

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

חברת ויזדום סיינס סאל אנד סרביס גרופ קומפני לימיטד
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Model #:	MC-572V	Calibration Date:	27/07/2022
Serial #:	1007055	Calibration Ref.:	WDS-SV850005
DGM Model #:	SK25EX	Ambient Temp (°C):	23.5
DGM Serial #:	00006432	Pressure (mm Hg):	756
		Relative Humidity (%):	60

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

WTM Model: W-NK0a-5B TM Cal. Due Date: Feb. 2022
WTM Serial: 546258 Gamma: 0.9980

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

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma" (Y)	Variation (ΔY)	Std & Corr Q _(std+corr)	0.012 SCMM ΔH _{sc}	Variation ΔΔH _{sc}
V _(std) (m ³)	Q _(std) m ³ /min	V _(ref) (m ³)	Q _(ref) m ³ /min					
0.163	0.011	0.160	0.011	0.983	-0.005	0.011	50.685	3.735
0.156	0.010	0.154	0.015	0.986	-0.002	0.015	46.960	0.030
0.177	0.022	0.174	0.022	0.987	-0.001	0.022	46.834	-0.098
0.199	0.028	0.197	0.028	0.990	0.001	0.028	45.366	-1.564
0.175	0.035	0.174	0.035	0.998	0.008	0.035	44.824	-2.106
				0.988	= Y Avg.		46.930	= ΔH@ Avg

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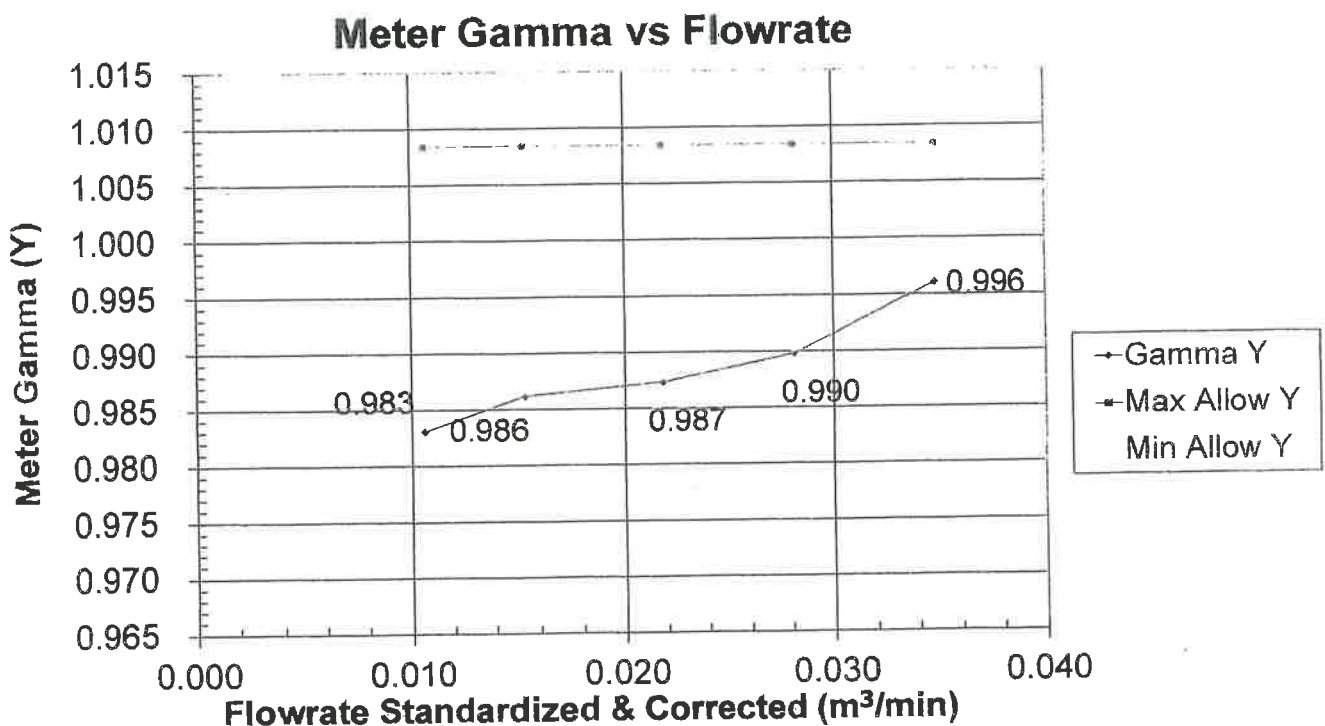
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02

Note: For Δh_g , orifice pressure differential that equates to $0.75 \text{ cm } (0.0212 \text{ m}^3/\text{min})$ at standard temperature and pressure, acceptable tolerance of individual values from the average is $\pm 0.2 \text{ inches } (5.1 \text{ mm})$

Signature _____
(Patpasu Chalsana)
Service Engineer

บริษัท วิสdom ไซแอนซ์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY (IM)

Date 27/07/2022



Console Serial: 1007055

Console Model: MC-572V

W SDOM

415, New Industrial and Commercial Park, 415,
INDUSTRIAL PARK, SINGAPORE 610000

THERMOCOUPLES SYSTEM CALIBRATION

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

Calibration Conditions	
Date	27/07/2022
Calibration Reference No.	WDS-SVF-50005
Barometric Pressure	756
Reference Thermometer	FLUKE 714
Serial Number	9038005

Results											
Console Thermocouple Simulator											
Meter Box Channel Temperature Reading (°C)											
Channel and test point	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-18	25	38	93	150	261	373	485	596	821	1045
Probe	-18	25	38	92	150						
Filter	-18	25	38	92	150						
Aux	-18	25	38	92	150						
Exit	-18	25	38								

ance Range
Stack
Probe
Filter

+ 1.50% °K
± 3.0 °C
± 3.0 °C

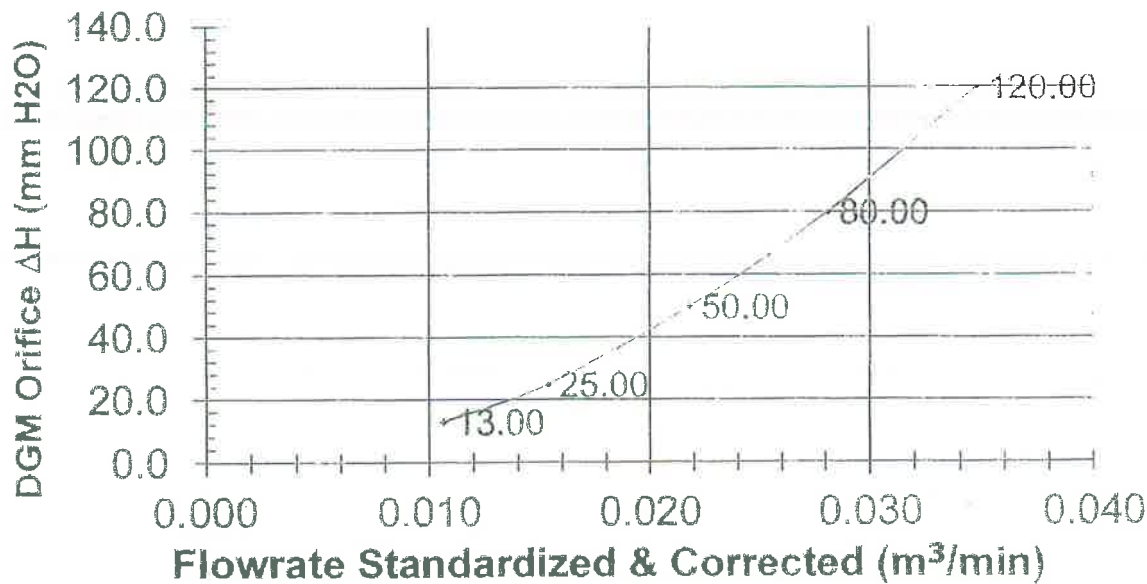
Meter
Exit

± 3.0 °C
± 2.0 °C

Signature

(Pabasu Chaisana)
Service Engineer

Meter Pressure vs Flowrate



Console Serial:

1007055

Console Model:

MC-572V

COPY

COPY

Flue gas Analyzer

Testo 350XL


Serial No. 01807527

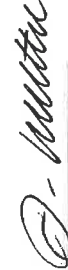
Certificate No: G 650383
Date of issue : 15-Jun-22

Certificate No.: G 650383

Instrument description : Flue gas Analyzer
Instrument model : Testo 350XL
Instrument serial no. : 01807527
ID no. or control no. : -
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial : -
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280
Total pages of certificate : 3 Pages
Receiving no. : L-222062
Receiving date. : 09-Jun-22
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.00,21.30 %vol, Carbon Monoxide 80.97,309.9,1003 ppm, Nitrogen Dioxide 10.19,80.62,202.2 ppm, Nitric Oxide 10.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.9,601.1 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakso, Bangkok 10210
Calibration procedure no. : WI-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal not valid.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*
Date of calibration : 15-Jun-22


Mr. Sedawut Nueathong
Calibration Technician


Mrs. Nongluck Wongsettee
Technical Manager

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Issued Date 16/02/16

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O2) 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 (NO2) 10.19 ppm	3372/21	Linde	02-Aug-23
Nitrogen Dioxide (NO2) 80.62 ppm	3240/21	Linde	25-Jul-23
Nitrogen Dioxide (NO2) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide (NO) 10.08 ppm	3241/21	Linde	25-Jul-23
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO2) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO2) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide (SO2) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

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

Calibration conditions

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

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.20
O2 (%Vol)	10.00	10.01	0.01	0.40
O2 (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	83	2.03	2.8
CO (ppm)	309.9	323	13.1	11
CO (ppm)	1003	1050	47	34
NO2 (ppm)	10.19	9.2	-0.99	1.5
NO2 (ppm)	80.62	77.5	-3.12	5.0
NO2 (ppm)	202.2	194.6	-7.6	5.0
NO (ppm)	10.08	8	-2.08	6.0
NO (ppm)	150.9	148	-2.9	5.0
NO (ppm)	320.6	312	-8.6	10
SO2 (ppm)	50.04	46	-4.04	5.0
SO2 (ppm)	100.9	98	-2.9	5.0
SO2 (ppm)	601.1	598	-3.1	14

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Calibration Results After Adjustment (Table 3)

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

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

End of Report

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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 AF	
Serial Number (S/N)	Item	Criteria	Results	Pass	Fail
C12095200936	Display LED test	Verify the display and LED operation. All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. 2.1040 Build No. 244 Ver. 2.1040 Build No. 244	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green. Displayed Temperature controller actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	(Name) COL 50.0°C IN1 50.0°C IN2 50.0°C DET1 50.0°C DET2 50.0°C AUX3 50.0°C AUX4 50.0°C AUX5 50.0°C Inspection pressure gauge reading 50.0 kPa Post-correction reading 50.0 kPa Inspection pressure gauge reading 50.0 kPa Post-correction reading 50.0 kPa Inspection pressure gauge reading 50.0 kPa Post-correction reading 50.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 25 / 08 / 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 $250.0 \pm 5.0 \text{ kPa}$ Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0 \text{ kPa}$	250.0 kPa 250.0 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 $3.0 \pm 1.0 \text{ mL/min}$ Total of septum purge and split vent flow rate values $10.0 \pm 3.0 \text{ mL/min}$ Total of septum purge and split vent flow rate values $20.0 \pm 20.0 \text{ mL/min}$	Septum purge 9.1 mL/min Split vent 7.6 mL/min Total 16.7 mL/min Septum purge 20.2 mL/min Split vent 20.2 mL/min Total 40.4 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature. Inspection temperature sensor displayed value $50.0 \pm 3.2^{\circ}\text{C}$ Inspection temperature sensor displayed value $50.0 \pm 4.2^{\circ}\text{C}$ Inspection temperature sensor displayed value $50.0 \pm 5.5^{\circ}\text{C}$ Inspection temperature sensor displayed value $50.0 \pm 6.4^{\circ}\text{C}$	Temp. correction value 51.0 mL/min Temp. sensor reading 51.0°C Corrected temp. value 50.7°C Temp. sensor reading 51.1°C Corrected temp. value 50.4°C Temp. sensor reading 51.2°C Corrected temp. value 50.3°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally. Monitored temperature 6 minutes after start $200 \pm 1^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start $200.0 \pm 4.7^{\circ}\text{C}$ Using a temperature sensor with 1°C minimum display increment $200 \pm 3^{\circ}\text{C}$	200.0°C 200.0°C 200.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity. FID <input checked="" type="checkbox"/> Applicable Not Applicable Calculated S value $51372 \mu\text{V}\cdot\text{s}$ Make-up gas: N_2 Flow rate: $10.0 \times 10^{-3} \text{ mL/min}$ Make-up gas: H_2 Flow rate: $7.00 \times 10^{-3} \text{ mL/min}$ FID <input checked="" type="checkbox"/> Applicable Not Applicable Calculated S value $1.1 \times 10^{-3} \text{ mV}\cdot\text{min}$ Flow rate at vent $4.00 \times 10^{-3} \text{ mL/min}$	CinAREA value 51372 Calculated S value 1.1 CinAREA value 1.1 Flowrate at vent 4.00	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 25 / 08 / 2021

Reviewer (signature):

Date: / /

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

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

Model Name AOC-20i					
Component ID					
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.	Display: 000 3.4 3.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		<input type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Basic operation test	Verify that the injector basic operation is correct.		<input type="checkbox"/>	<input type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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

Performer (signature):

Date: 25 / 03 / 2021

Reviewer (signature):

Date: / /

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Model Name AOC-20s					
Component ID					
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.	Version No. 3.5 The version number matches the controlled version number.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version.		<input checked="" type="checkbox"/>	<input type="checkbox"/>

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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

Model Name GC-2010Plus AE									
Component ID		Gas Chromatograph LABE 09/13							
Serial Number (S/N)		C 1 2 0 9 5 2 0 0 9 8 6							
No.	Item	Criteria				Results		Pass/Fail	
1	Display, LED test	Verify the display and LED operation.	All LEDs light.		LED	<div></div>	<div></div>	<div></div>	<div></div>
			Screen contrast adjustment is possible.	Display					
2	Standard self-diagnostic test	Verify the status and operation of all parts.	*Good* displayed as the result of the self-diagnostic test.			Good		<div></div>	<div></div>
3	Firmware version check	Verify the program version.	Version number and build number are displayed.		Ver.	Version: 2.1040 Build No.: 263		<div></div>	<div></div>
			The version No. and build No. matches the controlled version number.		Controlled Ver. No.	Version: 2.1040 Build No.: 262			
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green.					<div></div>	<div></div>
			Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$.	Temperature controller	(Name)	Set value	Measured value		
			<input checked="" type="checkbox"/> COL	90.0	50.0	50.0	50.0	50.0	<div></div>
			<input checked="" type="checkbox"/> IN1	90.1	50.0	50.0	50.0	50.0	
			<input checked="" type="checkbox"/> IN2	90.1	50.0	50.0	50.0	50.0	
			<input checked="" type="checkbox"/> DET1	90.1	50.0	50.0	50.0	50.0	
			<input type="checkbox"/> DET2		50.0	50.0	50.0	50.0	
			<input type="checkbox"/> AUX3		50.0	50.0	50.0	50.0	
			<input type="checkbox"/> AUX4		50.0	50.0	50.0	50.0	<div></div>
			<input type="checkbox"/> AUX5		50.0	50.0	50.0	50.0	
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading $\varnothing 10.0 \pm 3.0 \text{ kPa}$		Pressure gauge correction value	0.1 kPa		<div></div>	
			Inspection pressure gauge reading $\varnothing 200.0 \pm 20.0 \text{ kPa}$		Pressure gauge correction value	0.3 kPa			
			Inspection pressure gauge reading $\varnothing 200.0 \pm 20.0 \text{ kPa}$		Pressure gauge correction value	0.2 kPa			
			Inspection pressure gauge reading $\varnothing 200.0 \pm 20.0 \text{ kPa}$		Pressure gauge correction value	0.1 kPa			
			Inspection pressure gauge reading $\varnothing 200.0 \pm 20.0 \text{ kPa}$		Pressure gauge correction value	0.1 kPa			
			Inspection pressure gauge reading $\varnothing 200.0 \pm 20.0 \text{ kPa}$		Pressure gauge correction value	0.1 kPa			

Performer (signature): Jim Jax Date: 25 / 03 / 2022
Reviewer (signature): Tommy Date: 25 / 8 / 22

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Monitored pressure 6 minutes after start 250.0 ± 5.0 kPa Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa	2 4 9 . 1 kPa 2 4 9 . 3 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min Total of septum purge and split vent flow rate values 10.0 ± 3.0 mL/min	Septum purge 3 . 1 mL/min Split vent 7 . 6 mL/min Total 10 . 7 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Temp. correction value Temp. sensor reading Corrected temp. value Temp. correction value Temp. sensor reading Corrected temp. value Temp. correction value Temp. sensor reading Corrected temp. value Temp. correction value Temp. sensor reading Corrected temp. value	Temp. correction value 4 9 . 3 °C 4 9 . 9 °C Temp. correction value 0 . 1 °C 1 5 2 . 4 °C 1 5 2 . 0 °C Temp. correction value 0 . 5 °C 2 9 . 3 °C 2 9 . 1 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Monitored temperature 6 minutes after start 200 ± 1 °C Inspection temperature reading 8 minutes after start 200.0 ± 4.7 °C Using a temperature sensor with 1 °C minimum display increment 200 ± 3 °C	2 0 0 . 0 °C 2 0 0 . 4 °C 2 0 0 . 0 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	FID () Not Applicable Calculated S value Inj. unit () Make-up gas: N ₂ 10.0 × 10 ⁻³ C/g min. Make-up gas: He 7.00 × 10 ⁻³ C/g min. TCD () Not Applicable Calculated S value Inj. unit () 4.00 × 10 ⁻³ mV·mL/mg min.	CisAREA value 6 1 4 6 2 Calculated S value 1 5 6 0 × 10 ⁻³ C/g CisAREA value Flowrate at vent Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): Jim Jax Date: 25 / 03 / 2022
Reviewer (signature): Tommy Date: 25 / 8 / 22

Operational Qualification

Operational Qualification Record

3-2 AOC-201 Auto Injector

☒ Applicable
 ☐ Not Applicable

☒ Single
 ☐ Dual system, main injector

Component ID		Model Name		AOC-201	
Serial No. (SN)		C 1 2 1 9 5 4 1 0 8 0 9			
No.	Item	Criteria		Results	Pass Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.			<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display: 000	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.		Version No. 3.4.0	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4.0	<input checked="" type="checkbox"/>

☒ Not Applicable
 ☐ Dual system, sub injector

Component ID		Model Name		AOC-201	
Serial No. (SN)					
No.	Item	Criteria		Results	Pass Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.			<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display:	<input type="checkbox"/>
3	Firmware version check	Verify the program version.		Version No. 3.4.0	<input type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.		Version No. 3.4.0	<input type="checkbox"/>

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 02 / 2022

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable
 ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (SN)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria		Results	Pass Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	<input checked="" type="checkbox"/>
2	Firmware version check	Verify the program version.		Version No. 3.4.0	<input checked="" type="checkbox"/>

Performer (signature):

Date: 25 / 02 / 2022

Reviewer (signature):

Date: 25 / 02 / 2022

Primary Flow Calibrator

Serial No. : 110619

Certificate of Calibration

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11, Sukhapham 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 S10-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	1850 010006	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 : *[Signature]*

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : *[Signature]*

Mr. Paet Madhavorn
Calibration Engineer Supervisor

Issue Date :

11 February 2022

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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-16722
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 Thal Consulting 1992 Co., Ltd.
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230.

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

Equipment condition Good Operation
Calibration Location Analysis Department
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 96367 and 96366
Photometric Accuracy is traceable to certificate No. 99925 and 100147
Stray Light is traceable to certificate No. 96346
The above certificate are traceable to SI unit through Siam 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 (2301/63)



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



Certificate of Calibration

Number of Page(s) 2 of 3

BSCC-UV-16722

Calibration Results:
1.Wavelength Accuracy

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

2.Photometric Accuracy (UV)

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

*CNR = Customer not request

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



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968 U Chu Liang Building Floor7 Rama4 Road
Sliom Bangkok Bangkok Thailand, 10500
Tel : 02-6324300 Fax : 02-6376496-7
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-167/22 Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

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

*CNR = Customer not request

4. Stray Light*

Standard	Wavelength (nm)	Transmission (%)	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 base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

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Rev.01 (23/01/63)

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34302326



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11 Sukaphibal 8 Rd., Nongkham, 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. : 34302326
Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier 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 Brüel&Kjær 4180 S/N 2889871.

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

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

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

Date of Receipt : 6 May 2022

Date of Calibration : 10 May 2022

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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Nuttapong Niljrusvanti)

(Mr. Tawikiat Iamsamran)

Approved by :



TISTR

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 10 May 2022

Date of Issue : 10 May 2022

Ref : 2011265050601965005

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End of Certificate

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
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FM.BLMTC.002 Rev.4

SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 00443359

Request No. 21-65/0624

MTC No. EEL. BP. 15/0765

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.
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter : $(23 \pm 3) ^\circ\text{C}$
Manufacturer : Rion : $(50 \pm 15) \%$
Model : NL-21 : $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : 00443359 (No.14)
Microphone : UC-52 No.191370
Preamplifier : NH-19 No.76773

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 12 Jul. 2022

Date of Calibration : 8 Aug. 2022

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Head Office
15 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office
196 Phahonyothin Road, Chatuchak Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.

Request No. 21-65/0624

MTC No. EEL. BP. 15/0765

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

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 8 Aug. 2022

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Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.91	113.8	113.9	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
20.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
A-Weight	13.4	0.10	N/A
C-Weight	20.3	0.10	N/A
Flat	26.7	0.10	N/A

Date of Calibration : 8 Aug. 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)		Acceptance limit (dB)	Uncertainty (±dB)	Maximum permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.2	0.2	±1.5	0.40	0.6
1 000	0.1	0.2	±1.0	0.40	0.6
8 000	-1.0	-1.1	±5.0	0.40	0.7

4. Electrical signal test of frequency weightings

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

Date of Calibration : 8 Aug. 2022

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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

Date of Calibration : 8 Aug. 2022

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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak Bangkok 10900
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.

7. Level linearity on the reference level range

Anticipate value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	125.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
123	123.0	0.0	0.8	0.30	0.3
122	122.0	0.0	0.8	0.30	0.3
121	121.0	0.0	0.8	0.30	0.3
120	120.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.1	0.1	0.8	0.30	0.3
84	84.1	0.1	0.8	0.30	0.3
79	79.1	0.1	0.8	0.30	0.3
74	74.1	0.1	0.8	0.30	0.3
69	69.1	0.1	0.8	0.30	0.3
64	64.0	0.0	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3
54	54.0	0.0	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3

Date of Calibration : 8 Aug. 2022

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15 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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Office
196 Phahonyothin Road, Chatuchak Bangkok 10900
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.

7. Level linearity on the reference level range cont.

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	44.0	0.0	0.8	0.30	0.3
39	39.0	0.0	0.8	0.30	0.3
34	33.9	0.0	0.8	0.30	0.3
33	33.0	0.0	0.8	0.30	0.3
32	31.9	0.0	0.8	0.30	0.3
31	30.9	0.0	0.8	0.30	0.3
30	29.9	0.0	0.8	0.30	0.3
29	28.9	0.0	0.8	0.30	0.3
28	27.8	0.0	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	0.8	0.30	0.3
30-120	94.0	94.0	0.0	0.8	0.30	0.3
20-110	94.0	94.0	0.0	0.8	0.30	0.3
20-100	94.0	94.0	0.0	0.8	0.30	0.3
20-90	94.0	94.0	0.0	0.8	0.30	0.3

Date of Calibration : 8 Aug. 2022

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Head Office
35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2575 1121-30 ext. 5219, 5225, 5217
Fax (66) 0 2575 8592
E-mail : sumalee@tistr.or.th

8. Level linearity including the level range control

At reference level ±1.5 dB greater than the signal level that first cause an indication of under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	44.9	-0.1	0.8	0.30	0.3
30-120	35	35.0	0.0	0.8	0.30	0.3
20-110	25	25.0	0.0	0.8	0.30	0.3
20-100	25	25.1	0.1	0.8	0.30	0.3
20-90	25	25.1	0.1	0.8	0.30	0.3
20-80	25	25.2	0.2	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -5.0	0.20	0.3
	200	110.0	0.0	±1.0	0.20	0.3
SEL	2	89.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	80.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 8 Aug. 2022

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35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10260, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Request N 21-65/0624

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.1	-0.3	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

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

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by: *Pannasit R.* Approved by:

(Mr. Pannasit Phasingrui)

Wittawat Supanich Electrical and Electronic Standards Laboratory

(Mr. Wittawat Supanich)

Industrial Metrology and Testing Service Centre

Ref : 2011265071203134001

Date of Calibration : 8 Aug. 2022

Date of Issue : 9 Aug. 2022

End of Certificate

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Head Office
35 Mu. 3 Tambon Khong Ha, Amphoe Khong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukh Jmit Road,
Amphoe Muang, Changwat Samutprakan 12280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10901
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 00310456

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial No. : 00310456 (No.10)

Microphone : Type UC-52 No.153489

Preamplifier : Type NH-21 No.34625

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 30 Jun. 2022

Date of Calibration : 26 Jul. 2022

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Lead Office
5 Mu, 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Bangwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : mtctr@tistr.or.th

Office
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtctr@tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : mtctr@tistr.or.th

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 : 26 Jul. 2022

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5 Mu, 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Bangwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : mtctr@tistr.or.th

Office
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtctr@tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : mtctr@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance L.mit Class 2 (±dB)	
	Measured Value (dB)		Deviation (dB)		
	Before adjust	After adjust			
	113.92	113.8	113.9		0.0
					1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 117.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
21.0	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	20.0	0.10
C-Weighting	31.7	0.10
Flat	32.5	0.10

Date of Calibration : 26 Jul. 2022

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
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	-0.2	0.0	-0.1	0.40	2.0
1 000	0.4	0.3	0.4	0.40	1.4
4 000	0.1	0.2	0.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	-0.1	-0.1	0.20	2.5
125	0.0	0.0	-0.1	0.20	2.0
250	0.0	0.0	-0.1	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	0.1	0.1	0.1	0.20	2.6
4 000	0.1	0.0	0.1	0.20	3.6
8 000	0.2	0.2	0.1	0.20	5.6

Date of Calibration : 26 Jul. 2022

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weightings at 1 kHz

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

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
125	125.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
123	123.0	0.0	0.30	1.4
122	121.9	-0.1	0.30	1.4
121	122.0	1.0	0.30	1.4
120	119.9	-0.1	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	108.9	-0.1	0.30	1.4

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	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	38.9	-0.1	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	32.9	-0.1	0.30	1.4
32	31.9	-0.1	0.30	1.4
31	30.9	-0.1	0.30	1.4
30	29.9	-0.1	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	27.8	-0.2	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.1	0.1	0.30	1.4
20-80	75	75.1	0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	116.0	0.0	0.20	±1.3
	2	99.0	0.0	0.20	+1.3; -2.8
	0.25	89.9	-0.1	0.20	+1.8; -5.3
Slow	200	109.6	0.0	0.20	±1.3
	2	90.0	0.0	0.20	+1.3; -5.3
	200	110.0	0.0	0.20	±1.3
SEL	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 26 Jul. 2022

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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtrc@tistr.or.th

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.1	-0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-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
134.4	134.4			

Calibrated by :

Pamaisit Phasingst

(Mr. Pamaisit Phasingst)

Approved by :



Wittawat Supanich

(Mr. Wittawat Supanich)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265063002974002

Date of Calibration : 26 Jul. 2022

Date of Issue : 26 Jul. 2022

End of Certificate

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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtrc@tistr.or.th

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, Siracha, 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.41241.5B
Preamplifier : No.9371F

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

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 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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Head Office
 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
 Changwat Pathumthani 12120, Thailand
 Tel. (66) 0 2577 9000
 Fax. (66) 0 2577 9009
 E-mail : rumpal@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
 Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

Office
 196 Phahonyothin Road, Chatuchak, Bangkok 10900,
 Thailand
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
 Fax. (66) 0 2579 8592
 E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.4

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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Head Office
 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
 Changwat Pathumthani 12120, Thailand
 Tel. (66) 0 2577 9000
 Fax. (66) 0 2577 9009
 E-mail : rumpal@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
 Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

Office
 196 Phahonyothin Road, Chatuchak, Bangkok 10900,
 Thailand
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
 Fax. (66) 0 2579 8592
 E-mail : sumalee@tistr.or.th

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance Limit Class 2 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.75	Before adjust 95.1	After adjust 93.7	0.0	0.50
				1.4

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.4	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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Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakarn 10280, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 3592
E-mail : sumalee@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	0.1	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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Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakarn 10280, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 3592
E-mail : sumalee@tistr.or.th

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

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35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang, Thailand
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9099
E-mail : rumpa@tistr.or.th Website:www.tistr.or.th

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Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtcc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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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

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Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9099
E-mail : rumpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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E-mail : mtcc@tistr.or.th

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196 Phahonyothin Road, Chatuchak Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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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
	200	129.6	-0.4	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 : 13-14 Dec. 2021

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Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

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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	0.1	0.30	1.8
139.2	139.1			

Calibrated by :

Panya Phasing Sri

(Mr. Panya Phasing Sri)

To: Mr. A.

(Mr. Tawikiat Iamsamran)

Date of Calibration : 13-14 Dec. 2021

Date of Issue : 15 Dec. 2021

Ref : 2011264111704770004

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Approved by :



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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
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Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

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SOUND LEVEL METER

MODEL : CR:172A

SERIAL No. : G301660



NSC-TISIR-TIS 17025
CALIBRATION 0037

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, 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. : G301660 (No.34)
Microphone : Cirrus MK216 No.412814E
Preamplifier : No.10093F

Standards used :
1. Band Pass Filter Stamford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY4402668.
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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Tel. (66) 0 2577 9000
Office/Laboratory : Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
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CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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. 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 : 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	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	Measured Value (dB)	Uncertainty (±dB)
Weighting	under-range	-
A-Weighting	18.9	0.10
C-Weighting	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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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
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Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165

Office
196 Phahonyothin Road, Chatuchak Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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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	-0.1	0.40	2.0
1 000	0.2	0.2	0.2	0.40	1.4
4 000	-0.2	0.0	0.2	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	0.1	0.20	2.5
125	0.2	0.1	0.0	0.20	2.0
250	0.1	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	-0.1	0.0	0.20	2.6
4 000	-0.4	-0.3	-0.1	0.20	3.6
8 000	-0.6	-0.4	-0.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakarn 10280, Thailand
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Office
196 Phahonyothin Road, Chatuchak Bangkok 10900,
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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

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
	200	130.0	0.0	0.20	±1.3
SEL	2	110.0	0.0	0.20	+1.3; -2.8
	0.25	100.9	-0.1	0.20	+1.8; -5.3

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Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
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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 :

Approved by :

(Mr. Penya Phasingrui)
TISTR

(Mr. Tawikiat Iamsamran)

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 4 Oct. 2021

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264090203654003

End of Certificate

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Fax. (66) 0 2577 9009

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165

FM.BLMTC.002 Rev.4

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0640

CERTIFICATE OF CALIBRATION

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



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

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

Dosemeter

Instrument information

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

Test summary

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

Test equipment

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

Notes

COPY

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0641

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168446

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

Page 1 of 1

Approved signatory
N.Smith
Electronically signed:



Dosimeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR:110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CB0641 20230
Firmware version: 504

Test summary

Date of calibration: 14/01/22

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

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

The dosimeter submitted for testing conforms to the specifications in IEC 6-252-1993+A1:2000.

Test equipment

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

Notes

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0643

CERTIFICATE OF CALIBRATION

Cirrus Research plc

DATE OF ISSUE 12/11/21

CERTIFICATE NUMBER 165840



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

Page 1 of 1

Approved signatory
N.Smith

Electronically signed:

Page 1 of 1

Approved signatory

N. Smith

Electronically signed:

2. A. 1.

Dosemeter

Instrument information

Manufacturer: Cirrus Research plc

Model: CR-110A

Serial number: CR0643

Firmware version: 504

Notes: Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukaphibal 8 Rd., Nongkham, Siriracha,
Chonburi 20230

Test summary

Date of calibration: 12/11/21

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

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

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

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

Test equipment

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

Notes

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NOISE DOSI METER

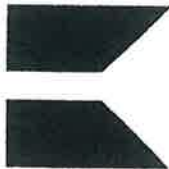
MODEL : CR:110A

SERIAL No. : CB0644

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 14/01/22 CERTIFICATE NUMBER 168440



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

Page 1 of 1

Approved signatory
N. Smith
Electronically signed:

Dosimeter

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd. 683 Moo 11
Model: CR-110A Sukaphibal 8 Rd., Nongkham, Sriracha, Chonburi
Serial number: CB0844 20230
Firmware version: 504

Test summary

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

Test equipment

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

Notes

COPY

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Introduction

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 extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – Visit our **Support Home page** <http://www.agilent.com/search/support>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- **7890B Manuals** are also available on **Agilent.com**:
 - **Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - **Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/public/7890B_Installation.pdf
 - **Operation Manual** https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - **Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90057-207890B_Maintaining%20GCguide.pdf

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the **Service Completion section including the customer's and your signature.**

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

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

Instrument System Name and ID 6678408
 Instrument System Site and Location SECT / INST. 2

List System Component Product Numbers	List the Serial Numbers of each Component
1. <u>654408</u>	<u>CN 15345147</u>
2. <u>64513A</u>	<u>CN 11356133</u>
3. <u>64544A</u>	<u>CN 15090006</u>
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
9. _____	_____
10. _____	_____

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them 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.

Preventive Maintenance Procedure

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 (MMI), 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 remove 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

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the 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.

Note: 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.

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's 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 Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	NA	295.4
Back detector output	NA	17.6
AUX detector output	NA	NA
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

7890 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	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	-
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	2
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 & V)	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	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
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	-
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	-
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	-
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	-
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	-
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	-

Service Engineer Comments

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 include them in this box.

etc

Service Completion

Service request number 600521593 Date service completed 17-June-2022

Agilent signature Samir T Customer signature M. Alim

Total number of pages in this document 4

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

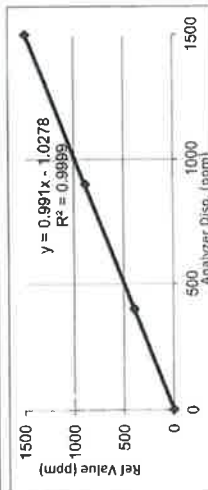
Dilutor	: Teledyne T 700 1367
Zero Air	: M701 S/N 1039
STD GAS	: S472767

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



Transfer Function Test results:

$$Y = 0.991x + 1.0278$$

Calibrated by: Witaya K.Approved by: [Signature]

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.



Operator Signature: _____ Date: Dec 16, 2021

(Mr.Channarong Khiao-un)

Test Engineer

ANALYTICAL BALANCE (DU)

Model : XS205 DU

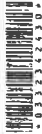
Serial No. : 1126323724

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



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha Contact: Sasiyorn Nakin
Zip / Postal: 20230
State / Province: Chonburi
Order Number:  0332324303

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	Repeatability (g)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

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

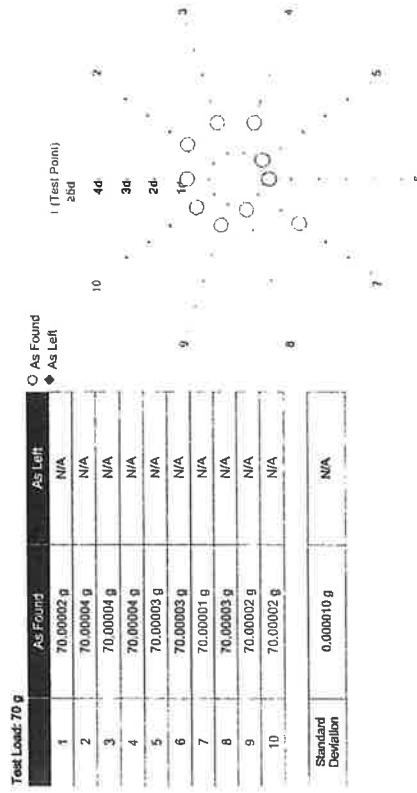
As Found	Start: 24.9 °C	End: 26.7 °C	Start: 54.0 %	End: 51.3 %
Temperature				
Humidity				

As Found Calibration Date: 07-Feb-2022
As Left Calibration Date: N/A
Issue Date: 08-Feb-2022
Calibrator: Sasiyorn T.
Sasiyorn Taibeen
Approved Signature: 
Kassakorn Tassanachalsakul
☒ Santi Jirinyom
☐ Surachet Sukkate

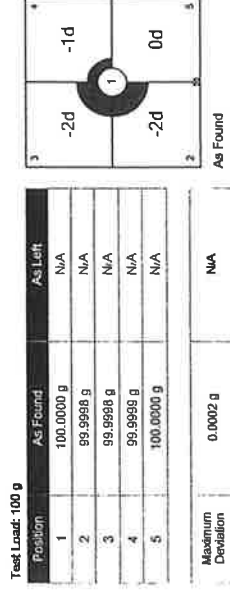
COPY

Measurement Results

Repeatability



Eccentricity



COPY

Calibration Certificate ID
TH-004-018-020722-ACC-TH

Remarks

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

End of Accredited Section

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

Calibration Certificate ID
TH-004-018-020722-ACC-TH

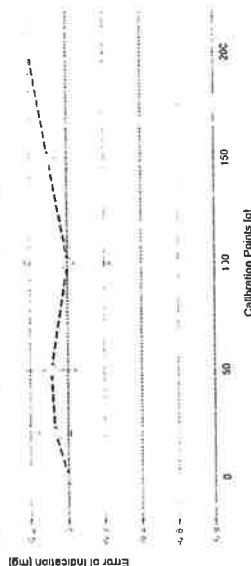
Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.021 mg	2
2	0.01000 g	0.01002 g	0.00002 g	0.023 mg	2
3	0.10000 g	0.10002 g	0.00002 g	0.026 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.035 mg	2
5	4.99999 g	4.99999 g	0.00000 g	0.050 mg	2
6	10.00002 g	10.00005 g	0.00003 g	0.063 mg	2
7	19.99994 g	20.00001 g	0.00007 g	0.085 mg	2
8	49.99987 g	50.00006 g	0.00009 g	0.13 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.23 mg	2
10	149.99999 g	150.00000 g	0.00001 g	0.35 mg	2
11	200.00000 g	200.0002 g	0.0002 g	0.42 mg	2

As Found

As Left

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



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

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

Test Equipment

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

Weight Set 1: OIML E2	WS32	Date of Issue:	15-Sep-2020
Weight Set No.:	169521	Calibration Due Date:	13-Mar-2022
Certificate Number:			
Thermo Baro Hygrometer	INT4	Date of Issue:	09-Jul-2021
Equipment No.:	21H1470	Calibration Due Date:	28-Jun-2022
Certificate Number:			

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

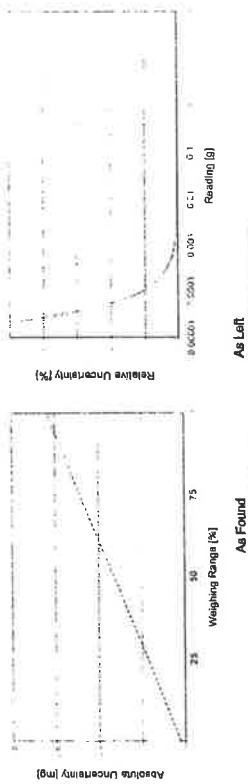
Linearization of Uncertainty Equation

Range	g	Max	As Found	As Left
1	0.00001 g	81 g	$U_1 = 0.022 \text{ mg} + 0.00763 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00782 \text{ mg/g} \cdot R$	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	0.022 mg	1.0%
0.02200 g	0.022 mg	0.10%
0.22000 g	0.024 mg	0.011%
2.20000 g	0.039 mg	0.0018%
220.0000 g	1.7 mg	0.00079%



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

COPY

GWP® Certificate



As Found

As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

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

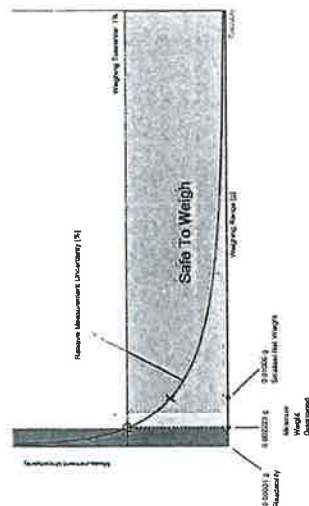
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



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

COPY

Minimum Weight

As Found Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.022382 g	0.045110 g	0.068193 g	0.115457 g	0.210445 g
0.2%	0.011148 g	0.022382 g	0.033702 g	0.056607 g	0.115457 g
0.5%	0.004449 g	0.008912 g	0.013368 g	0.022382 g	0.045110 g
1%	0.002223 g	0.004449 g	0.006679 g	0.011148 g	0.022382 g
2%	0.001111 g	0.002223 g	0.003335 g	0.005563 g	0.011148 g
5%	0.000444 g	0.000889 g	0.001333 g	0.002223 g	0.004449 g

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

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

As Left Minimum Weight Table

Range 1					
Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.022382 g	0.045110 g	0.068193 g	0.115457 g	0.210445 g
0.2%	0.011148 g	0.022382 g	0.033702 g	0.056607 g	0.115457 g
0.5%	0.004449 g	0.008912 g	0.013368 g	0.022382 g	0.045110 g
1%	0.002223 g	0.004449 g	0.006679 g	0.011148 g	0.022382 g
2%	0.001111 g	0.002223 g	0.003335 g	0.005563 g	0.011148 g
5%	0.000444 g	0.000889 g	0.001333 g	0.002223 g	0.004449 g

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

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 70 g

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

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

Eccentricity

Test Load: 100 g

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

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

Error of Indication

As Found

Reference Value	Error	Control limit 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
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
100.00000 g	0.00005 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99999 g	0.00011 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
200.00000 g	0.00022 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
19.99994 g	0.00007 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.50000 g
49.99987 g	0.00009 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
100.00000 g	0.00005 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
149.99999 g	0.00011 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
200.00000 g	0.00022 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓

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

Service Date: 2022-02-07
Document Number: TH4004-020722-LABBalanceHR
EASTERN THAI CONSULTING 1982 CO., LTD.
683 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha, Chonburi 20230
Khun Sasoporn Nakin

METTLER TOLEDO

Balance Health Report

System Details			
Manufacturer:	Mettler Toledo	Accessory 1:	Other
Model:	XS205DU	Accessory 2:	
Serial number:	1126323724	Weight set for routine testing:	No
Firmware:	4.0		

Device History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	< 1 year
Instrument age:	3-10 years	Last instrument calibration:	< 1 year
Spare parts available:	Yes	Last minimum weight determination:	Never
Regulations:	ISO		
Process tolerance in %:	1 %	Routine testing performed:	Don't know
Smallest sample net weight:	0.0100 g		

Check List

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

Recommendations

Maintenance Period: Quarterly		Process Frequency	
Instrument calibration		Uninstall instrument	
Identify safe weighing range		Replace instrument	
GWP verification / risk assessment	Yes	Replace / add parts (see additional remarks)	
Preventive maintenance		Onsite repair	
Perform routine testing with test weights		Depot repair	
User training		Use of accessories (see additional remarks)	
Contact	Name: Khun Sasoporn Nakin	Position: Document Control	Phone: 096-051-3303
			Email: oc.lab@mc1992.com
Additional Remarks & Recommendations			
Engineer Details			
Date:		07-Feb-2022	
Name:		Sathaporn Tabson	
Signature:			

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

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

ANALYTICAL BALANCE

Model : SECURA224-1S

Serial No. : 0036707137



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 1 of 4

NSC-TIS-17517025
CALIBRATION 0152

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE**Manufacturer** : SARTORIUS**Model** : SECURA224-1S**Serial No.** : 0036707137**ID No.** : LABE 05/2**Date of Receipt** : 03 February 2022**Date of Calibration** : 03 February 2022

Calibrated by Mr. Thanadol Pholthep
Scientist

Issue date : 07 February 2022

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

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

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



Certificate No. : 22-011768

Sample Code : 22-04498-005

Page 2 of 4

NSC-TIS-17517025
CALIBRATION 0152

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 220				
<input type="checkbox"/> No adjustment	Nominal value	100	200	100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000022	200.000141	100.000022	200.000141
	Average reading of indicator	99.9998	199.9998	100.0000	200.0000
	Standard deviation	0.00009	0.00005	0.00005	0.00004

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

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

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.000094	2.01
0.01	0.0100045	0.0100	0.0000	0.000094	2.01
0.1	0.1000102	0.1000	0.0000	0.000094	2.01
1	1.0000055	1.0000	0.0000	0.000095	2.01
2	2.0000144	1.9999	0.0001	0.000095	2.01
5	5.0000060	5.0000	0.0000	0.000096	2.01
10	10.000017	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

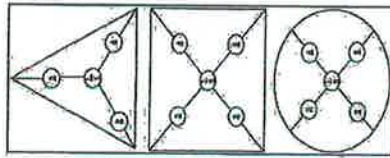
Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

④ Circle

Weighing pan ☐ Triangular ☐ Rectangular Test weight : 100 Unit : g

Range	Reading of Indicator	Reading of Indicator
220	99.9999	-
100.0000	99.9999	-
99.9999	99.9999	-
99.9997	99.9997	-
100.0000	99.9999	-
99.9999	99.9999	-
0.0002	0.0002	-

Maximum difference



Condition of Calibration

Ambient conditions	Min	Max
Temperature (°C)	24.9	26.7
Relative Humidity (%RH)	40.3	55.6
Air pressure (hPa)	1008.3	1010.7

1. Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. Condition of Calibration item: Normal
4. 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

1) STANDARD WEIGHT 1 mg to 1 kg

Class E2

Certificate No. 21-055461

Due Date 29 June 2022

- End of Report -

ATOMIC ABSORPTION SPECTROPHOTOMETER

Varian Model : Spectr AA-240FS

Serial No. : EL07053792

CERTIFICATE OF INTERNAL CALIBRATION

NOMENCLATURE: 1. Atomic Absorption Spectrophotometer "VARIAN"
Model Spectra AA – 240FS SN EL07053792
2. Working standard solution "MERCK"

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: WI-LAB-020 Internal Calibration Method of AAS
REFERENCE STANDARD Reference Material traceable to NIST "AcquaStandard"

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

COPY

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

NOMENCLATURE: 1. Atomic Absorption Spectrophotometer "VARIAN"
Model Spectra AA – 240FS SN EL07053792
2. Working standard solution "MERCK"

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		
	0.10	0.50	2.00	0.10	0.50	2.00
Standard Deviation	0.00015	0.00014	0.00137	0.00011	0.00041	0.00049
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	0.50	2.00
Standard Deviation	0.00028	0.00058	0.00101	0.00020	0.00018	0.00064
Average Absorbance	0.0078	0.0389	0.1531	0.0042	0.0188	0.0698

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	± 0.006
0.500	0.468	-0.032	± 0.025
2.000	1.874	-0.126	± 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	± 0.005
0.500	0.514	+0.014	± 0.026
2.000	2.048	+0.048	± 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	± 0.016
0.500	0.511	+0.011	± 0.032
2.000	1.962	-0.038	± 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	± 0.014
0.500	0.510	+0.010	± 0.029
2.000	1.996	-0.004	± 0.105

7. Reading on Wavelength – Lead at 217.9 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	± 0.013
0.500	0.519	+0.019	± 0.031
2.000	2.084	+0.084	± 0.114

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 ETC

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

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.mif.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 Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by: K. Nathong

(Mr. Nathapong Krudaum)



Page 1 of 2

COPY

Certificate No : AD2205-163-0001

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

Relative Humidity : (50 ± 15)%RH

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

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

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

Description of UUC :

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

Resolution : 0.5 hPa Absolute

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

End of Certificate

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Page 2 of 2

BOD INCUBATOR

ID No. : LABE 19/1



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 22-011784
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 Model : E811.0306
Serial No. : N/A ID No. : LABE 19/1
Date of Receipt : 03 February 2022 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. Pattrakorn Panklong Approved by : (Mr. Somchai Neampunt)

Scientist

11 February 2022

Issue date

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

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to 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 222, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-114
TEL 02-516-2422
FAX 02-516-6949
Rev.01

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



REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 22-011784
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			# 9 ^{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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WWW.AMARC.CO.TH
Effective Date: 15/10/21

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.

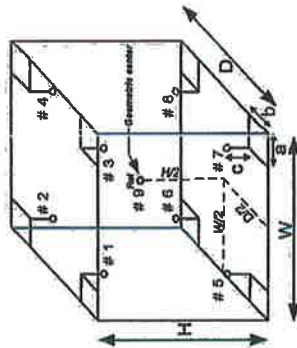


Figure: Example of sensor
Installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty 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 M3002.

- 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, Sukhapiban 8 Rd., Nongkham,
Sriacha, Chonburi 20230

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

Equipment : Temperature controlled enclosure (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 31.2 % ; 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-PH00)	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. Patterakorn Penklong
Scientist
Issue date : 28 January 2022
Approved by : (Mr. Somchai Neampunt)
Signed for Director

Rev.01

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

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

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Phialapha, Wang Thonglang, Bangkok 10310
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REPORT OF CALIBRATION

Page 2 of 3

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

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor <i>k</i>
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{ref}		
20	20.0	20.0	19.61	19.35	19.81	19.37	20.15	20.34	20.14	20.45	19.61	0.30	2.00

2. Characterization results

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

Notes

- UUC* = Unit Under Calibration

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



REPORT OF CALIBRATION

NSC-TS1-TS17025
CALIBRATION0352

Page 3 of 3

Certificate No. : 22-007487

Sample Code : 22-02978-006

Results of Calibration

Notes

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

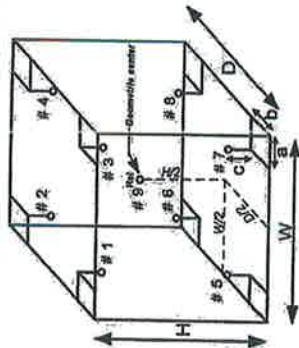


Figure: Example of sensor
Installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS MSC03.

- 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.

663 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. Natthanen Phosri

Scientist

14 March 2022

(Mr. Somchai Neampunt)

Signed for Director

Issue date

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

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

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FAX 02-516-6949

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Effective Date: 15/10/21

ASIA MEDICAL AND
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AND RESEARCH CENTER
CALIBRATION 0152

REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 22-025399

Sample Code : 22-09604-002

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{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

Page 3 of 3

Certificate No. : 22-025399

Sample Code : 22-09604-002

Results of Calibration

Notes

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

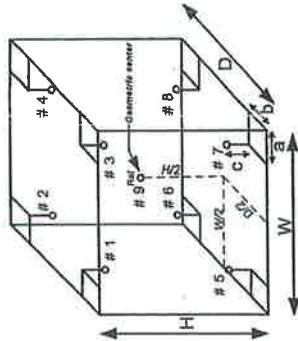


Figure: Example of sensor
Installation Positions

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 UKAS M3003.

- End of Report -

Handwritten signature

INDUCTIBELY COUPLED PLASMA SPECTROMETER

Model : Prodigy 7

Serial No. : P70177



บริษัท แอปพลิเคชัน ดีฟายน์ จำกัด
Application Define Company Limited
84 ซอย บางนาใต้ ถนน 9 แขวง บางนา เขต คลองเตย กรุงเทพมหานคร 10170
8/4 Soi Bangna Subroad 9 Bangna Bangna Subroad, Bangkok 10170
Tel: (66) 2864 7137 E-mail: support@addefine.co.th Web site: http://www.addefine.co.th
เลขประจำตัวผู้เสียภาษี 010555032491

CERTIFICATE OF INSTRUMENT PERFORMANCE

INSTRUMENT: INDUCTIVELY COUPLED PLASMA SPECTROMETER
BRAND: Teledyne Leeman Labs
MODEL: Prodigy 7
SERIAL NO.: P70177
CUSTOMER: Eastern Thai Consulting 1992 Co., Ltd

CHECKING:
SPECTROMETER
Wavelength Accuracy check by use emission line of Hg Lamp
Mercury line 253.652 nm. STATUS
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 OK
Particulate pump & Tubing OK

EXHAUSTING & COOLING SYSTEM
Safety Interlock Switch (Door, Argon pressure, Water pressure) OK
Cooling System, water flowrate & low pressure switch OK
Flowrate of Air blower OK

COMPUTER & SOFTWARE
Plasma Ignition software & Analytical Software OK

ANALYTICAL TEST
Full Frame Capture & Echellogram check OK
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 อีทีคอนซัลติง 1992 จำกัด
Instrument: ICP-OES
Date: December 21, 2021
S/N: P70177
Model: Prodigy 7

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

Gas system: ตรวจสอบแรงดันแก๊สและการรั่วซึม Argon Pressure: 85 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 2556 เปลี่ยนตัวทำความสะอาดทุก 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 เปลี่ยนน้ำ Temperature -34 °C ตรวจสอบอุณหภูมิ	
Exhaust Hood Flow rate 650 CFM (system request > 150)	

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีสเทิร์นไทย คอมมูนิคส์ 1992 จำกัด	Date: December 21, 2021
Instrument: ICP-OES	Model: Prodigy 7
	SN: 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-Calculation	OK
(✓) Print Report	OK

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

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

3. Instrument Control

Description	Status
Optical view position: ตรวจสอบตำแหน่งที่คนใช้ทดสอบในเครื่อง	
Hg Lamp Delta	
X -1 Y -6	OK
XUV 0	OK
Axial peak positions X3325 Y1205	OK
Radial peak positions X4111 Y1135	OK
Hg lamp peak positions X2215 Y2615	OK
Plasma Control ตรวจสอบการทำงานของเครื่องและดับลาสมา	
(✓) Auto Start	OK
(✓) Extinguish	OK
(✓) RF power setting	OK
(✓) Igniter	OK
(✓) Air Knife	OK
Torch Gas ตรวจสอบการทำงานของเครื่องและดับลาสมา	
(✓) 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

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท สยามฟาร์ม 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
✓ 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

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

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

6. Hardware Check with SALS.EXE Diagnostics

Power Supply	Value	Status
-12 VDC (11 - 14.5 VDC)	-13.7 V	OK
+12 VDC (11 - 14.5 VDC)	14.01 V	OK
+3.3 VDC	3.28 V	OK
+5.0 VDC	4.95 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	OK
Air Knife Pres. (0.00V) OFF	0	OK
Air Knife Pres. (3.0 - 7.0 V) ON	3.87 V	OK
Neb 2.5 @ setting of 25 PSI	2.5	OK
Cool 18 @ setting of 18 LPM	18	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	12.5 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

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

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

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	Seaspray, Conical, Meinhard	Conical	ok
Intensity first performance	1 ppm ≥ 4,000,000 5 ppm ≥ 15,000,000 10 ppm ≥ 50,000,000	65,345,926	ok

Engineer Sign		TELEDYNE LEEMAN LABS Everywhere you look
---------------	---	--

COPY

LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksoeng, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (562) 809-4584
www.qcalibration.com



CERTIFICATE No : 21T10802
REFERENCE No : 62916-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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

F-G010 REV 02



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

CERTIFICATE No : 21T10802

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	21T3033	08-Mar-22
2) SPRT PROBE	5614	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

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F-G010 REV02

LIQUID IN GLASS THERMOMETER

Model : Total immersion

Serial No. : 43560

Calibration Certificate

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

Page 1 of 3

Equipment: Liquid-in-Glass Thermometer

Manufacturer: Precision

Model / Type: Total Immersion

Serial No.: 43560

ID No.: LABE 16/1

Order No.: 2300368

Operation No.: 2300368-001

Date of Receipt: 7 November 2022

Date of Calibration: 15 November 2022

Calibrated by Mr.Nuttapol Niyomchat
Specialist

Date of Issue: 18 November 2022

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

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

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

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

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

Page 2 of 3

Location: Temperature Calibration Laboratory, National Food Institute

Environment Condition:
Ambient Temperature 23 °C ± 3 °C
Relative Humidity 55 % ± 15 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

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

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

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

3. This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

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

6. Condition of Calibrated item : Good

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

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

Page 3 of 3

Calibration point: 3.0, 25.0 and 50.0 °C
Calibration result:

Reporting of ice-point or reference point

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

Reporting of temperature calibration point

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

Note

* UUC* : Unit Under Calibration

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

End



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pH Meter

Model : SevenCompactTM pH/Ion Meter S220

Serial No. : B448305208

Certificate Number CCP-1416-22

Certification Tools

Certified digital voltmeter

Manufacturer GOSSEN METRAWATT
Control No. ANA77

Manufacturer METTLER TOLEDO / ME-51302410

Control No. **ANA137**

Serial number	A424
Certificate number	31344
Due date	August

Designation	Temperature, °C
NTC 30 kΩ, 0.1%	-55 to +125
NTC 30 kΩ, 2%	-55 to +125
NTC 30 kΩ, 5%	-55 to +125
NTC 30 kΩ, 7%	-55 to +125
NTC 30 kΩ, 1%	-55 to +125
PT1000, 0.1%	-55 to +125
PT1000, 2%	-55 to +125
PT1000, 5%	-55 to +125
PT1000, 7%	-55 to +125
PT1000, 1%	-55 to +125

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94 980 kΩ	94 9556 kΩ
NTC 30 kΩ, 25 °C	30 000 kΩ	30 0137 kΩ
NTC 30 kΩ, 50 °C	10 969 kΩ	10 9649 kΩ
NTC 30 kΩ, 75 °C	4 526 kΩ	4 5267 kΩ
NTC 30 kΩ, 100 °C	2 070 kΩ	2 06849 kΩ
PT1000, 0 °C	1 000 kΩ	1 000158 kΩ
PT1000, 25 °C	1 0974 kΩ	1 097484 kΩ
PT1000, 50 °C	1 1940 kΩ	1 194202 kΩ
PT1000, 75 °C	1 2899 kΩ	1 290136 kΩ
PT1000, 100 °C	1 3851 kΩ	1 385061 kΩ

Technical specifications

Measuring Range	-1999.9 ... 1999.9 mV	-2.000 ... 20.000 pH
Resolution	0.1 mV	0.001 pH
Limit of Error	± 0.2 mV	± 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 Certification SOP (Doc. No. ME-3002757TB) 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.

Page 1 of 3

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Printed by Mettler-Toledo TH 14 Jul 2021 ME-30027576TH

Page 2 of 9

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Performance Test

Certificate Number CCP-1416-22

Control No. CCE-1416-22/1

Company:

EASTERN THAI CONSULTING 1992 CO., LTD.

Address:

663 Moo 11, Sukhaphiban 8 Rd., Nong KhamSiraacha

Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
pHmV Sensor Input				
-1900 mV	-1899.0 mV	-1899.0 mV	0.2 mV	Passed
-1000 mV	-999.0 mV	-999.0 mV	0.2 mV	Passed
-500 mV	-499.0 mV	-499.0 mV	0.2 mV	Passed
-100 mV	-99.0 mV	-99.0 mV	0.2 mV	Passed
0 mV	0.0 mV	0.1 mV	0.2 mV	Passed
100 mV	99.0 mV	100.0 mV	0.2 mV	Passed
500 mV	499.0 mV	499.0 mV	0.2 mV	Passed
1000 mV	999.0 mV	999.0 mV	0.2 mV	Passed
1900 mV	1899.0 mV	1899.0 mV	0.2 mV	Passed

pHmV Sensor Input at high Impedance

Designation	Measured low Imp.	Measured high Imp.	Max. Tolerance	Passed / Failed
1900 mV	1899.0 mV	1899.0 mV	0.6 mV	Passed

Temperature Sensor Input

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

Digital sensor Input with pH Sensor

Sensor recognition	This sensor was recognized correctly by the meter	Passed
		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 Palpat Saeapannawat

Function Service Engineer

Place Laboratory room

Calibration Date: February 7, 2022

Signature

ELECTRONIC SIGNATURE

pH Electrode

Type: Inlab Expert Pro-ISM

S/N:

1976465

Certified standards used

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

Standard 2:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Dec-22
	Nominal value:	pH (25.00 °C):	7.00		Lot No.:	1F351M

Standard 3:	Type:	pH Buffer	Manufacturer:	METTLER TOLEDO	Exp. date:	Jan-23
	Nominal value:	pH (25.00 °C):	9.21		Lot No.:	1G012G

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

Adjustment

Set Calibration Buffer						B2: (25 °C) 7.00, 4.01, 9.21					
Select Calibration Mode						2-Point calibration					
3-Point Calibration						2-Point calibration					
Cal 1						Cal 1					
ATC						ATC					
25.0						25.0					
ATC						ATC					
24.9						24.9					
ATC						ATC					
3.4						3.4					
Offset (mV)						Offset (mV)					
Slope % (or mV/pH)						Slope % (or mV/pH)					
Cal 3						Cal 3					
ATC						ATC					
24.7						24.7					
Slope % (or mV/pH)						Slope % (or mV/pH)					
98.2						98.2					

Measurements

Before adjustment						After adjustment					
Buffer Values						Buffer Values					
pH						pH					
4.01						4.01					
ATC						ATC					
25.0						25.0					
ATC						ATC					
7.00						7.00					
ATC						ATC					
9.21						9.21					
ATC						ATC					
24.6						24.6					
ATC						ATC					
8.20						8.20					
Difference						Difference					
pH						pH					
-0.08						-0.01					
ATC						ATC					
24.9						24.9					
ATC						ATC					
24.8						24.8					
ATC						ATC					
7.01						7.01					
ATC						ATC					
0.01						0.01					
ATC						ATC					
24.7						24.7					
ATC						ATC					
0.00						0.00					

Remarks: The difference result of calibrated electrode should be within +/- 0.05 pH

Place:

Laboratory room

Calibration Date:

February 7, 2022

Service Specialist:

Palpat Saeapannawat

Signature:

Electronic Signature

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STANDARD WEIGHT 50 g



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

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

(Mr. Somchai Neampunt)
Signed for Director

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

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

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

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-007

TEL 02-516-2422
FAX 02-516-6945
Rev.05

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



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

Page 2 of 3

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)	± (mg)	
50 g	-0.324	49.999676 g	0.10	0.30	LABE 10/1

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

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

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

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



Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration:

1. Ambient Conditions : Temperature $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$, 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	21-0793566	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,

Sriracha, Chonburi 20230

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

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

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards used 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	
100 g	(mg)		(mg)	± (mg)	
	-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

Signature

Signature



Certificate No. : 22-052239

Sample Code : 22-19150-004

Page 3 of 3

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 1.18 kg/m^3
 2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)
 3. Reference standard instrument
- | Instrument | Class | ID.No. | Certificate No. | Due Date |
|---------------------------------|-------|----------|-----------------|-------------------|
| 1) Standard Weight 1 mg to 1 kg | E2 | LB-WE-79 | 21-078366 | 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 -

Signature

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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,
Sriacha, 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_0) 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

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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**



Merck Ltd. Thailand
19th Floor, Emporium Tower, 622 Sukhumvit Road
Klongton, Klongtoey, Bangkok 10110
Tel. : +66 (0) 2667 8000
Fax : +66 (0) 2667 8399
Customer Care Center : +66 (0) 2667 8313

1 of 4



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-grey 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



Merck Ltd. Thailand
19th Floor, Emporium Tower, 622 Sukhumvit Road
Klongton, Klongtoey, Bangkok 10110
Tel. : +66 (0) 2667 8000
Fax : +66 (0) 2667 8399
Customer Care Center : +66 (0) 2667 8313

2 of 4



CERTIFICATE OF CALIBRATION

Software version: 1.5.1

Wavelength Accuracy*

Equipment	Nominal value	Tolerance limit**	Actual value	Result
Holmium Oxide Liquid	361.30 nm	360.1 - 362.5 nm	360.8 nm	P
Filler	536.60 nm	535.4 - 539.3 nm	536.8 nm	P
Hellma 667-UV5	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	361.30 nm	50.20 nm	0.02 nm	P
Filler	536.60 nm	50.20 nm	0.05 nm	P
Hellma 667-UV5	640.55 nm	50.20 nm	0.06 nm	P

Photometric Accuracy*

Equipment	Wavelength	Nominal value	Tolerance limit**	Actual value	Result
Neutral Density 1.00 Abs.	440 nm	1.065 A	1.053 - 1.077 A	1.068 A	P
Hellma 666-F4	546 nm	1.012 A	1.003 - 1.020 A	1.017 A	P
	635 nm	1.054 A	1.042 - 1.068 A	1.060 A	P
	440 nm	2.217 A	2.200 - 2.234 A	2.220 A	P
Neutral Density 2.00 Abs.	546 nm	1.998 A	1.986 - 2.011 A	2.005 A	P
Hellma 666-F203	635 nm	1.914 A	1.901 - 1.927 A	1.918 A	P

Photometric Precision / Reproducibility* @ 1.0 A

Equipment	Wavelength	Nominal value	Actual value	Result
Neutral Density 1.00 Abs.	440 nm	50.003 A	0.001 A	P
Hellma 666-F4	546 nm	50.003 A	0.000 A	P
	635 nm	50.003 A	0.000 A	P

Stray Light*

Equipment	Wavelength	Nominal value	Actual value	Result
Sodium Nitrite	340 nm	50.10 %T	0.00 %T	P
Hellma 667-UV11				

Selftest Hardware

No visual flaws, no burrs, no loose parts and fastenings				P
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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 Rattanachetthakul
(SERVICE ENGINEER)

SIGNATURE :

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CERTIFICATE No. **WO-02118723**



Merck Ltd. Thailand
19th Floor, Emporium Tower, 622 Sukhumvit Road
Klongton, Nongtoey, Bangkok 10110
Tel : +66 (0) 2667 8000
Fax : +66 (0) 2667 8399
Customer Care Center : +66 (0) 2667 8333

Merck Ltd. Thailand
19th Floor, Emporium Tower, 622 Sukhumvit Road
Klongton, Nongtoey, Bangkok 10110
Tel : +66 (0) 2667 8000
Fax : +66 (0) 2667 8399
Customer Care Center : +66 (0) 2667 8333

www.merck.co.th



THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 22-068062
Sample Code : 22-24591-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

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

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

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1

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

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

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-01 & LB-DP-01 (DP)	TH-0014-22	16 February 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-01 & LB-DP-01 (Temp.)	22-029549	14 March 2023
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	21-072473	13 September 2022

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

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

- 4.2 Instrument No. 3.2 and 3.3 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by Miss Pornsuda Lohabal

Scientist

Approved by (Mr. Somchai Neampunt)

Signed for Director

Issue date 27 June 2022

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

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

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

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
PM-CL-114
TEL 02-516-2422
FAX 02-516-6949
Rev 01
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date 15/10/21



REPORT OF CALIBRATION

Page 2 of 2

Certificate No. : 22-068062
Sample Code : 22-24591-002

Results of Calibration

Temperature measurement

Resolution : 0.1 °C
Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	20.2	- 0.20	± 0.39
25	50	25.00	24.9	+ 0.10	± 0.39
30	50	30.00	29.8	+ 0.20	± 0.39

Humidity measurement

Resolution : 0.1 %RH
Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.13	51.4	- 6.27	± 1.3
60	25.00	60.03	66.5	- 6.47	± 1.5
75	25.00	75.20	81.5	- 6.30	± 1.7

Notes

- Calibration results without adjustment.

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

- End of Report -

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361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
PM-CL-018
TEL 02-516-2422
FAX 02-516-6949
Rev 08
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date 15/10/21

UV/VIS SPECTROPHOTOMETER

Model : UV – 1800

Serial No. : A11635101643CD



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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-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 1982 Co., Ltd.
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230.

Temperature (23.8-24.5) °C (On site)
Humidity (47.8-48.3) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department

Calibration Procedure In-house method WI-LUV-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 Starna 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 (23/01/63)



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



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-167/22

Calibration Results:
1. Wavelength Accuracy

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

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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



Certificate of Calibration

Certificate No. BSCC-UV-167122 Number of Page(s) 3 of 3

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
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
	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5006	0.0000	0.0042
590.0	0.6961	0.6944	-0.0017	0.0042
	0.9563	0.9550	-0.0013	0.0042
	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	CNR	CNR	CNR
	CNR	CNR	CNR	CNR

*CNR = Customer not request

4. Stray Light*

Unit Under Calibration(UUC)			
Standard	Wavelength (nm)	Transmission (%)	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 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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