

สำเนาเอกสารสอบเทียบเครื่องมือวัด

---

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX9C  
Cylinder Number: EB0062815  
Laboratory: 124 - Riverton (SAP) - NJ  
PGVP Number: B52018  
Gas Code: CO,NO,NOX,SO2,BALN  
Reference Number: 82-401135335-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
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. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16080607	CC42564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.6%	Jun 27, 2020
PRM	12367	APX1099237	9.02 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2022
NTRM	12060735	CC356192	24.98 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 14, 2026
The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.					
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration		
Nicolet 6700 APW1100391 CO	FTIR		Feb 08, 2018		
Nicolet 6700 APW1100391 NO	FTIR		Feb 15, 2018		
Nicolet 6700 APW1100391 NO2	FTIR		Feb 16, 2018		
Nicolet 6700 APW1100391 SO2	FTIR		Mar 01, 2018		

#### Triad Data Available Upon Request

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

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



TESTING CERT No. 3082.05



## Test Calibrated Report

## Sulphur Dioxide Analyzer

Date : January 16, 2024

Time : 13:00

Model: API. T100

Serial Number : 1608

Standard Gas : 51.65 PPM

## Instrument Status

RANG ( PPB )	500	DARK PMT ( <50 mV )	109.7
STABIL ( < 1 PPB )	0.124	DARK LAMP ( < 50 mV )	0.700
SAMP PRESS ( Ambient $\pm$ 2 in-HG-A )	29.1	SLOPE ( 1.0 $\pm$ 0.3 )	0.972
SAMPLE FLOW ( 650 $\pm$ 10 cc/min )	639.0	OFFSET ( <100 mV )	30.8
PMT SIGNAL ( 0 $\pm$ 100 mV )	60.0	HVPS ( 400-900 V )	627.0
NORM PMT ( 0 $\pm$ 100 mV )	58.9	RCELL TEMP ( 50 C $\pm$ 1 )	50.0
UV LAMP ( 3500-4000mV )	3372.9	BOX TEMP ( Ambient $\pm$ 5 )	34.3
UV LAMP RATIO ( % )	99.5	PMT TEMP ( 7 C $\pm$ 2 )	15.0
STR. LGT ( <60 PPB )	14.991		
ETEST PMT Reading	OK		
SO2 Reading	OK		
OTEST PMT Reading	OK		
SO2 Reading	OK		

## Calibrated Setting

Initial Reading ( Before Adj. )		
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )
Zero	0.0	-1.84
Span	400.0	409.0

Final Reading ( After Adj. )	Error %
Analyzer Response ( PPB )	
0.0	-
400.6	0.16

RECEIVED

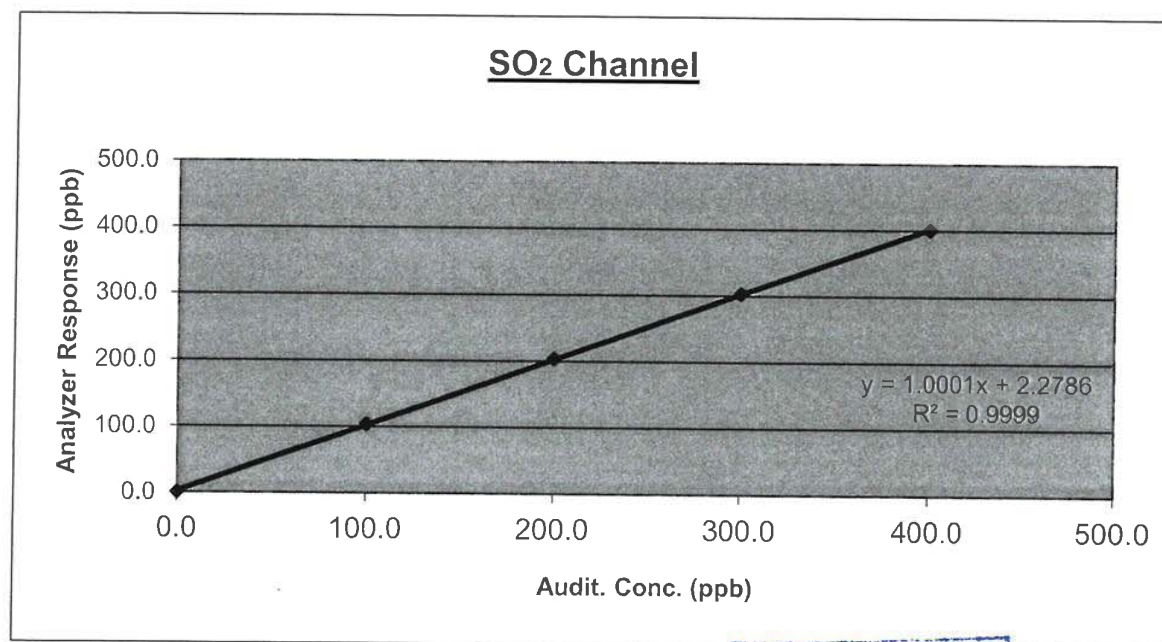
30 APR 2024

Calibrated By :

CALIBRATION MULTI-POINT OF SULFUR DIOXIDE ANALYZER

Station	ETC	Zero Setting	0
Brand	TELEDYNE API.	Span Setting	400.0
Model	T100	Start time	13:00
Rang	500 PPB	Finish Time	15:00
Serial Number	1608	Date	January 16, 2024

SO <sub>2</sub> Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	104.1	4.1	4.14
2	200.0	203.7	3.7	1.87
3	300.0	303.0	3.0	0.99
4	400.0	400.6	0.6	0.16
Average Difference ( % )				1.791
Slope = 1.0001	Intercept = 2.2786	Correlation Coefficient =	0.9999	



RECEIVED

30 APR 2024

## Test Calibrated Report

### Nitrogen Oxide Analyzer

LA 67 - 00530

Date : January 17, 2024

Time : 13:00

Model : API. T200

Serial Number : 6757

Standard Gas : 50.31 PPM

### Instrument Status

Auto-Zero (-20 to 150 mV )	164.1	NO <sub>x</sub> Offset ( mV )	-1.0
Box Temp.(Ambient Temp.plus 3-7)	33.8	NO <sub>x</sub> Slope	0.916
HVPS ( 400 to 900 V. )	607	Nox Stability ( PPB to PPM )	0.10
Moly Temp. ( 315 +/-5 )	315.8	O <sub>3</sub> Flow ( 80 +/-15 )	74.0
NO Norm Offset ( mV )	-1.7	PMT Signal ( mV )	162.8
NO Slope	0.916	PMT Temp. ( 7 +/-2 )	7.1
NO Stability ( PPB to PPM )	0.02	R <sub>x</sub> Cell Press ( 2-10 in-Hg-A )	2.2
NO <sub>2</sub> Stability ( PPB to PPM )	0.13	R <sub>x</sub> Cell Temp. ( 50 +/-1 )	50.00
Norm PMT ( mV )	35.4	Sampe Flow ( 500 +/- 50 )	473
Sample Press ( in-Hg-A, Ambient )	28.8		

	PMT Reading	OK
ETEST	NO Conc Reading	OK
	NO <sub>x</sub> Conc Reading	OK
OPTIC TEST	PMT Reading	OK
	NO Conc Reading	OK
OTEST	NO <sub>x</sub> Conc Reading	OK

RECEIVED  
 30 APR 2024

### Calibrated Setting

Initial Reading ( Before Adj. )		
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )
Zero NO	0.0	1.18
Zero NO <sub>x</sub>	0.0	0.44
Span NO	400.0	391.8
Span NO <sub>x</sub>	401.0	398.1

Final Reading ( After Adj. )	
Analyzer Response ( PPB )	Error %
0.00	-
0.00	-
399.7	0.07
400.7	0.07

Calibrated By :



LA 67 - R0530

CALIBRATION MULTI-POINT OF NITROGEN OXIDE ANALYZER

Station	ETC	Zero Setting	0
Brand	TELEDYNE API.	Span Instrument Gain	400.0
Model	T200	Start time	13:00
Range	500 PPB	Finish Time	15:00
Serial Number	6757	Date	January 17, 2024

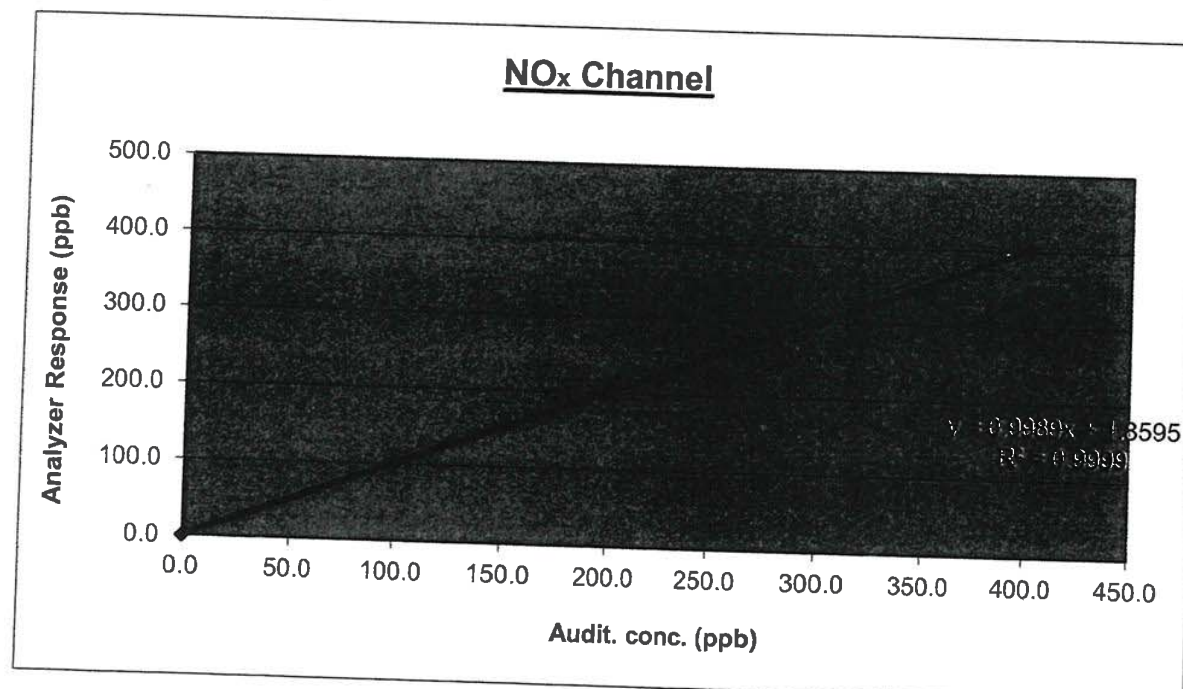
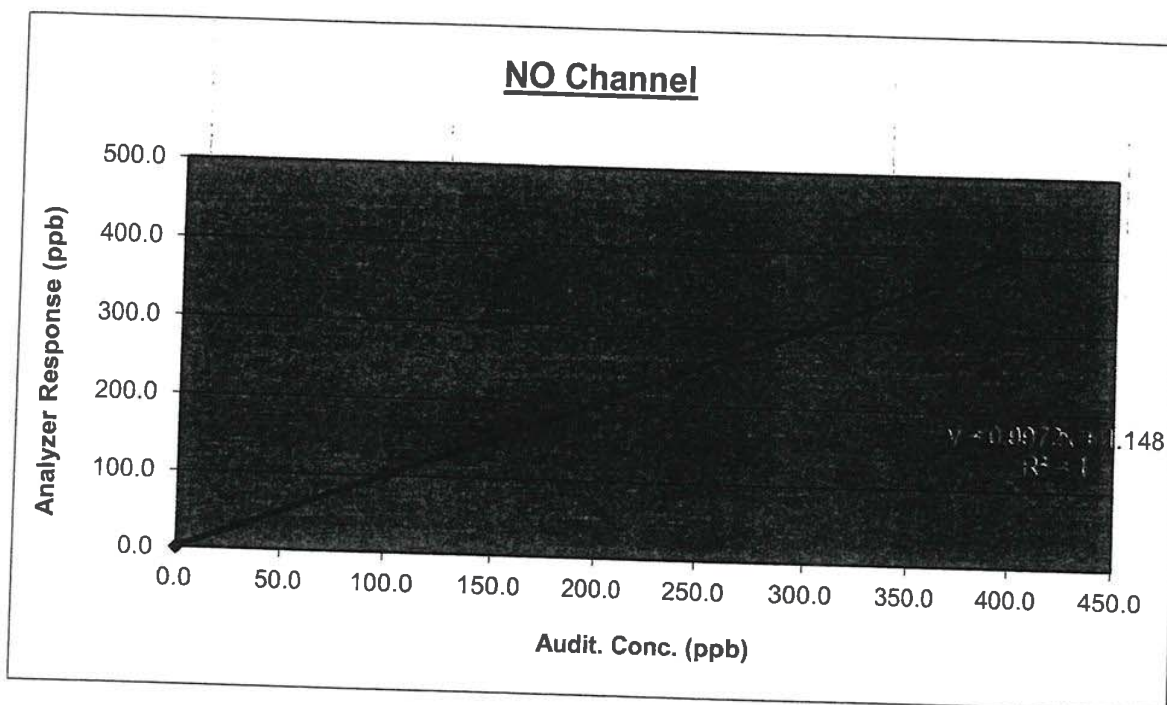
NO Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	102.0	1.984	1.98
2	200.0	201.5	1.473	0.74
3	300.0	299.8	-0.197	0.07
4	400.0	399.7	-0.3	0.07
Average Difference ( % )				0.72
Slope = 0.9972	Intercept = 1.148	Correlation Coefficient =		1.0000

NOx Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	103.2	3.16	3.16
2	200.0	202.7	2.692	1.35
3	300.0	302.6	2.6	0.87
4	401.0	400.7	-0.27	0.07
Average Difference ( % )				1.36
Slope = 0.9989	Intercept = 1.8595	Correlation Coefficient =		0.9999

RECEIVED

30 APR 2024

LA 67 - R0530



RECEIVED

30 APR 2024

## Test Calibrated Report

LA 67 - R0530

## Sulphur Dioxide Analyzer

Date : January 13, 2024

Time : 13:00

Model: API. M100E

Serial Number : 640

Standard Gas : 51.65 PPM

## Instrument Status

RANG ( PPB )	500	DARK PMT ( <50 mV )	42.1
STABIL ( < 1 PPB )	4.500	DARK LAMP ( < 50 mV )	4.200
SAMP PRESS ( Ambient $\pm$ 2 in-HG-A )	27.2	SLOPE (1.0 $\pm$ 0.3 )	1.137
SAMPLE FLOW ( 650 $\pm$ 10 cc/min )	710.0	OFFSET ( <100 mV )	78.3
PMT SIGNAL ( 0 $\pm$ 100 mV )	137.3	HVPS ( 400-900 V )	712.0
NORM PMT ( 0 $\pm$ 100 mV )	107.9	RCELL TEMP ( 50 C $\pm$ 1 )	50.0
UV LAMP ( 3500-4000mV )	3761.7	BOX TEMP ( Ambient $\pm$ 5 )	33.0
UV LAMP RATIO ( % )	101.5	PMT TEMP ( 7 C $\pm$ 2 )	8.1
STR. LGT ( <60 PPB )	44.530		
ETEST PMT Reading	OK		
SO2 Reading	OK		
OTEST PMT Reading	OK		
SO2 Reading	OK		

## Calibrated Setting

Initial Reading ( Before Adj. )		
Span Set	Concentration	Analyzer Response
Point	( PPB )	( PPB )
Zero	0.0	-2.87
Span	400.0	384.9

Final Reading ( After Adj. )	
Analyzer Response	Error
( PPB )	%
0.00	-
400.1	0.03



Calibrated By :

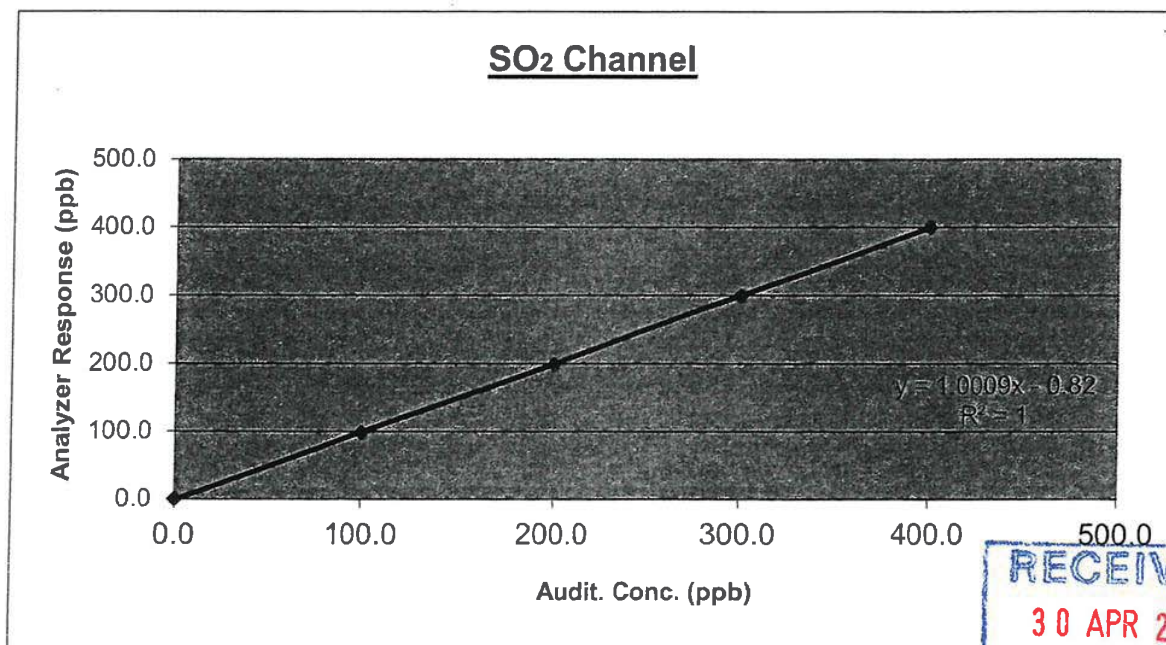


LA 67 - K0530

## CALIBRATION MULTI-POINT OF SULFUR DIOXIDE ANALYZER

Station	ETC	Zero Setting	0
Brand	TELEDYNE API.	Span Setting	400.0
Model	M100E	Start time	13:00
Rang	500 PPB	Finish Time	15:00
Serial Number	640	Date	January 13, 2024

SO <sub>2</sub> Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	98.7	-1.3	1.30
2	200.0	198.6	-1.4	0.70
3	300.0	299.4	-0.6	0.20
4	400.0	400.1	0.1	0.03
Average Difference ( % )				0.556
Slope = 1.0009		Intercept = -0.82		Correlation Coefficient = 1.0000



RECEIVED

30 APR 2024



## Test Calibrated Report

LA 67 - R0530

### Nitrogen Oxide Analyzer

Date : January 24, 2024

Time : 9:00

Model.: API. T200

Serial Number : 2004

Standard Gas : 50.31 PPM

#### Instrument Status

RANGE ( PPB )	500.0	BOX TEMP ( Ambient )	32.9
STABILITY ( <2 PPB )	0.1	PMT Temp. ( 7+/-2 )	7.1
SAMP FLW ( 500+/-50 cc/min )	489.0	MOLY TEMP ( 315+/-5 )	314.4
OZONE FL ( 80+/-15 cc/min )	81.0	RCEL ( 2-10 in-HG-A )	8.8
PMT ( 0+/-50 with zero air )	46.9	SAMP ( Ambient-1 in-HG-A )	29.1
NORM PMT ( 0+/-50 with zero air )	-4.7	NOx SLOPE	0.900
AZERO ( -20 to 150 mV )	46.8	NOx OFFS	-10.3
HVPS ( 400-900V )	630	NO SLOPE	0.972
RCELL TEMP. ( 50+/-1 )	50.0	NO OFFS	-11.9

OPTIC TEST	PMT Reading	OK
	ETEST NO Conc Reading	OK
	NOx Conc Reading	OK
	PMT Reading	OK
	OTEST NO Conc Reading	OK
	NOx Conc Reading	OK



#### Calibrated Setting

Initial Reading ( Before Adj. )		
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )
Zero NO	0.0	-4.31
Zero NOx	0.0	-2.64
Span NO	400	394.0
Span NOx	401	397.8

Final Reading ( After Adj. )	
Analyzer Response ( PPB )	Error %
0.0	-
0.0	-
401.2	0.29
401.7	0.17

Calibrated By :



LA 67 - R0530

CALIBRATION MULTI-POINT OF NITROGEN OXIDE ANALYZER

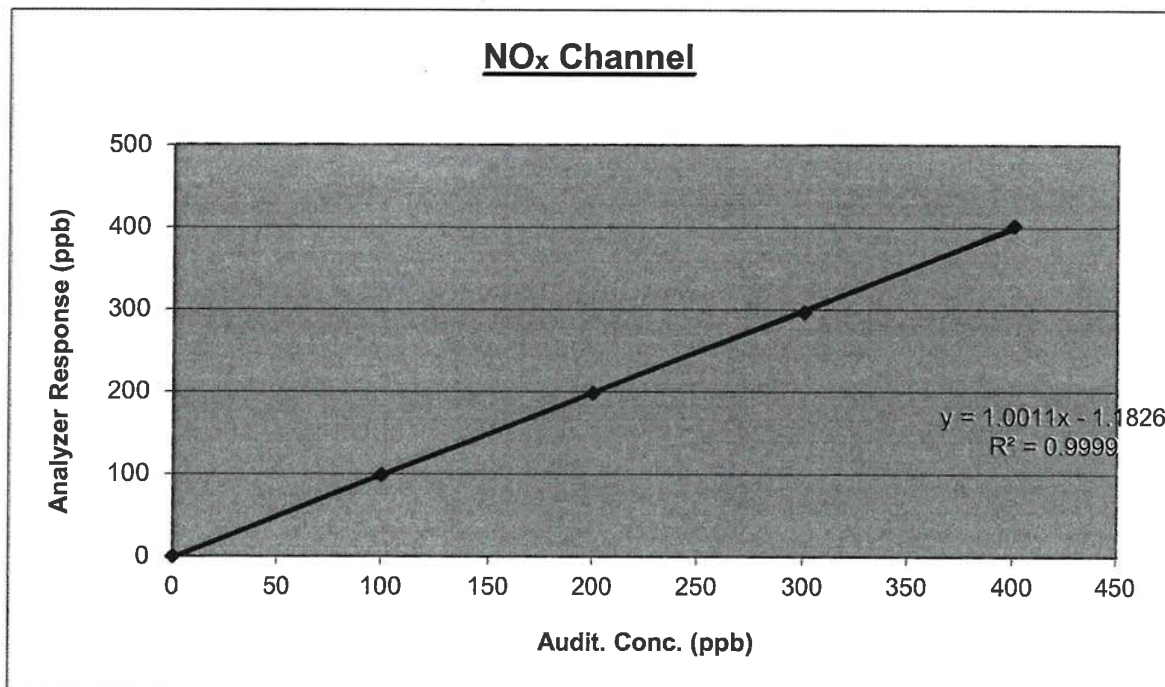
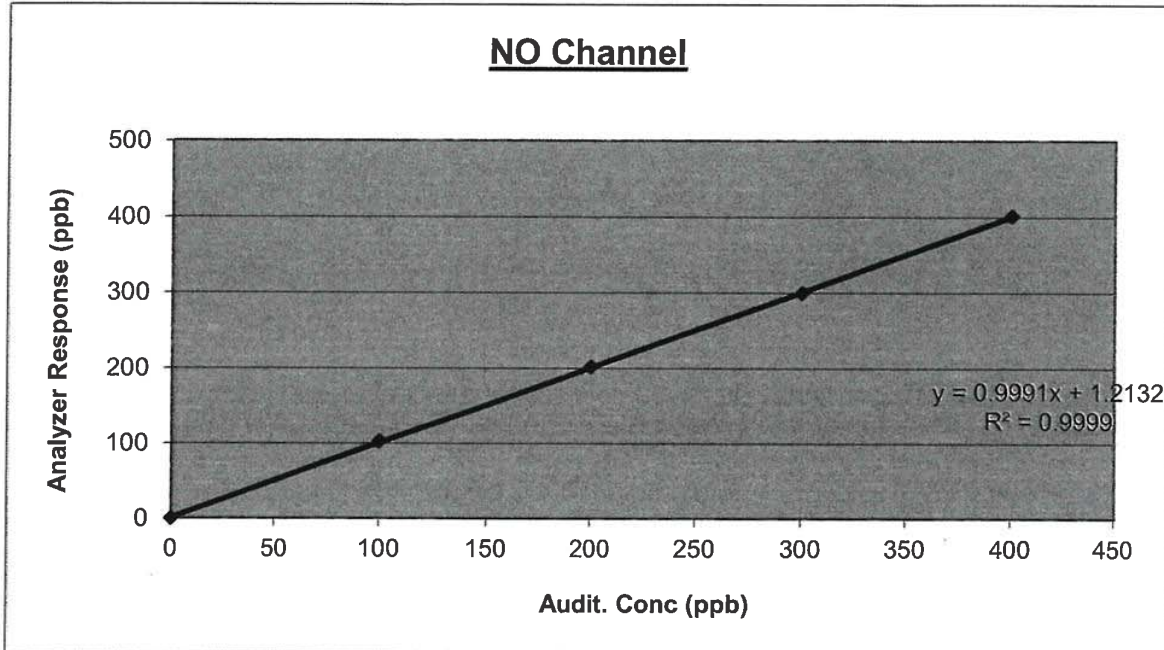
Station	ETC	Zero Setting	0
Brand	TELEDYNE API.	Span Instrument Gain	400.0
Model	T200	Start time	9:00
Range	500 PPB	Finish Time	11:00
Serial Number	2004	Date	January 24, 2024

NO Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0	0	-	-
1	100	102.8	2.81	2.81
2	200	201.6	1.606	0.80
3	300	299.6	-0.432	0.14
4	400	401.2	1.16	0.29
Average Difference ( % )				1.01
Slope = 0.9991	Intercept = 1.2132	Correlation Coefficient =		0.9999

NOx Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0	0	-	-
1	100	98.8	-1.166	1.17
2	200	198.1	-1.891	0.95
3	300	296.5	-3.459	1.15
4	400	401.7	1.69	0.42
Average Difference ( % )				0.92
Slope = 1.0011	Intercept = -1.1826	Correlation Coefficient =		0.9999



LA 67 - R0530



## รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : EASTERN THAI CONSULTING 1992 CO.,LTD.

วันที่ : 14 มีนาคม 2567

รายชื่ออุปกรณ์ / เครื่องมือ : SO<sub>2</sub> Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T100

หมายเลขอุปกรณ์ / เครื่องมือ : 5701

TEST VALUES			
API MODEL T100		BEFORE	AFTER
1	RANGE 50 - 20,000 PPB	500	500
2	SO <sub>2</sub> STABILITY ≤ 1 PPB	9.21	0.07
3	PRESSURE 25 - 35 in - Hg-A	13.5	26.4
4	SAMPLE FLOW 650 ± 10% cc/min	657.0	659
5	PMT mV	82.6	16.6
6	NORM PMT mV	89.3	15.8
7	UV LAMP 1000 - 4800 mV	2352.0	3490.0
8	LAMP RATIO 30 To 120 %	98.9	100.9
9	STRAY LIGHT ≤ 100 PPB	70.7	8.4
10	DARK PMT -50 ± 200 % mV	398.0	219.0
11	DARK LAMP -50 ± 200 % mV	3.9	2.8
12	SO <sub>2</sub> SLOPE 1.0 ± 0.3	1.277	1.054
13	SO <sub>2</sub> OFFSET < 250 mV	110.8	15.5
14	HVPS 400 - 900 V	494	569
15	RX CELL TEMP 50 ± 1 °C	50	50
16	BOX TEMP AMBIENT ± 5 °C	31.0	35.6
17	PMT TEMP 7 ± 2 °C	8.5	8.6
18	SO <sub>2</sub> SAMPLE READING PPB	8.524	1.862
19	OPTIC TEST 2000 ± 1000 mV	1147.0	1167.0
20	ELECTRICAL TEST 2000 ± 1000 mV	1314.0	1410.0
21	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.10 / 12.14 / 15.50 / -15.17	5.24 / 12.12 / 15.51 / -15.18
22	ZERO GAS 0.00 PPB	-32.241	0.749
23	SPAN GAS 400.00 PPB	487.036	400.089

### หมายเหตุ

- ค่า Pressure แกว่ง ทำการเปลี่ยน PNEU SNSR 1 BD.

- ทำการเปลี่ยน Filter Optical 214 NM. 1 ชิ้น

- ทำการเปลี่ยน SS, Filter 1 ชิ้น, O-ring 2 ชิ้น, Spring 1 ชิ้น

- ทำการ Calibrate Multi-Point

( นายธนาคม มหาอาจ )

ลงนามเจ้าหน้าที่ (Signature)



ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณธนาคม มหาอาจ

โทรศัพท์ : 0-2515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

## MULTI POINT CALIBRATION REPORT

LA 67 - R0530

CUSTOMER NAME : EASTERN THAI CONSULTING 1992 CO.,LTD.

EQUIPMENT NAME : SO<sub>2</sub> Analyzer

MANUFACTURER : Teledyne - API

MODEL : T100

SERIAL NUMBER : 5701

STANDARD GAS CONCENTRATION (PPM) : 53.79

CYLINDER NO : CC745169

CYLINDER PRESSURE (PSIG) : 1700

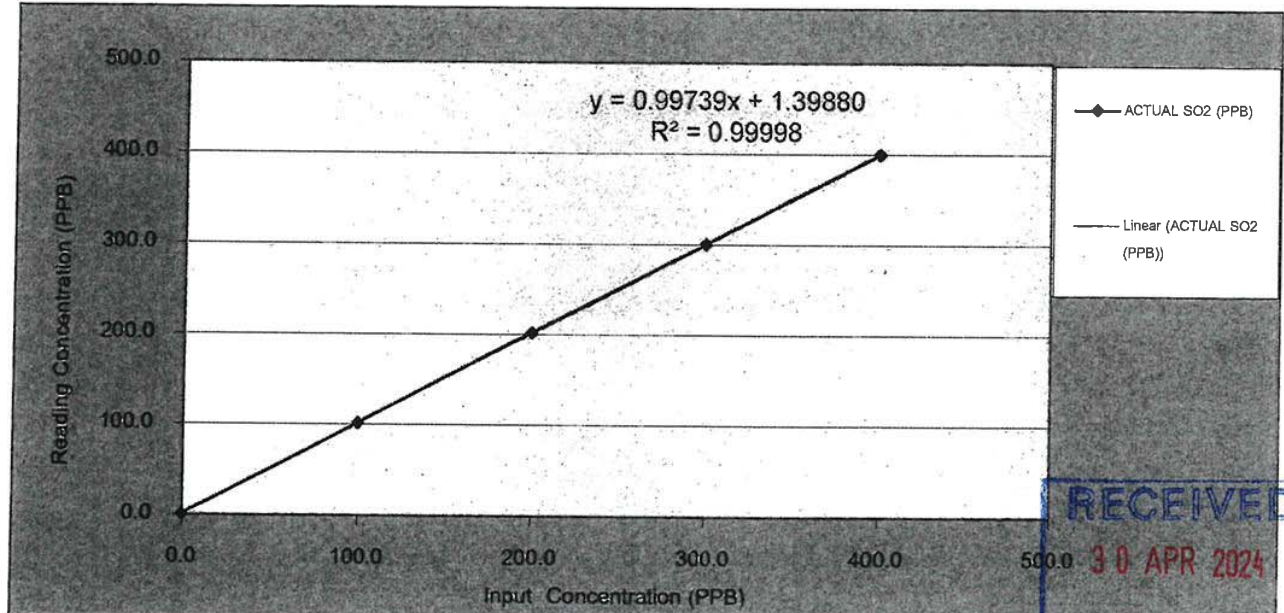
CERTIFIED DATE : Mar 10, 2021

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Mar 10, 2029

## CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPB)	ACTUAL SO <sub>2</sub> (PPB)	ERROR SO <sub>2</sub> (PPB)	% ERROR SO <sub>2</sub>
ZERO	0.00	0.75	0.75	-
1	100.00	101.37	1.4	1.4
2	200.00	201.83	1.8	0.9
3	300.00	300.62	0.6	0.2
4	400.00	399.82	-0.2	0.0
AVERAGE (%)				0.6



CALIBRATED BY : คุณธนาคม มหาอาจ

DATE : 14 มีนาคม 2567

ต้องการข้อมูลเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

## Test Calibrated Report

LA 67 - R0530

### Nitrogen Oxide Analyzer

Date : January 20, 2024

Time : 13:00

Model: API. T200

Serial Number : 2005

Standard Gas : 50.31 PPM

#### Instrument Status

RANGE ( PPB )	500.0	BOX TEMP ( Ambient )	33.9
STABILITY ( <2 PPB )	0.4	PMT Temp. ( 7+/-2 )	7.3
SAMP FLW ( 500+/-50 cc/min )	477.0	MOLY TEMP ( 315+/-5 )	314.3
OZONE FL ( 80+/-15 cc/min )	86.0	RCEL ( 2-10 in-HG-A )	1.4
PMT ( 0+/-50 with zero air )	775.1	SAMP ( Ambient-1 in-HG-A )	28.4
NORM PMT ( 0+/-50 with zero air )	356.5	NOx SLOPE	2.060
AZERO ( -20 to 150 mV )	180.7	NOx OFFS	331.9
HVPS ( 400-900V )	711	NO SLOPE	2.018
RCELL TEMP. ( 50+/-1 )	50.0	NO OFFS	330.3

	PMT Reading	OK
ETEST	NO Conc Reading	OK
OPTIC TEST	NOx Conc Reading	OK
	PMT Reading	OK
OTEST	NO Conc Reading	OK
	NOx Conc Reading	OK

#### Calibrated Setting

Initial Reading ( Before Adj. )		
Span Set Point	Concentration ( PPB )	Analyzer Response ( PPB )
Zero NO	0.0	2.11
Zero NOx	0.0	1.06
Span NO	400	403.6
Span NOx	401	406.1

Final Reading ( After Adj. )	
Analyzer Response ( PPB )	Error %
0.0	-
0.0	-
400.3	0.08
401.5	0.12

RECEIVED

30 APR 2024

Calibrated By :

LA 67 - R0530

CALIBRATION MULTI-POINT OF NITROGEN OXIDE ANALYZER

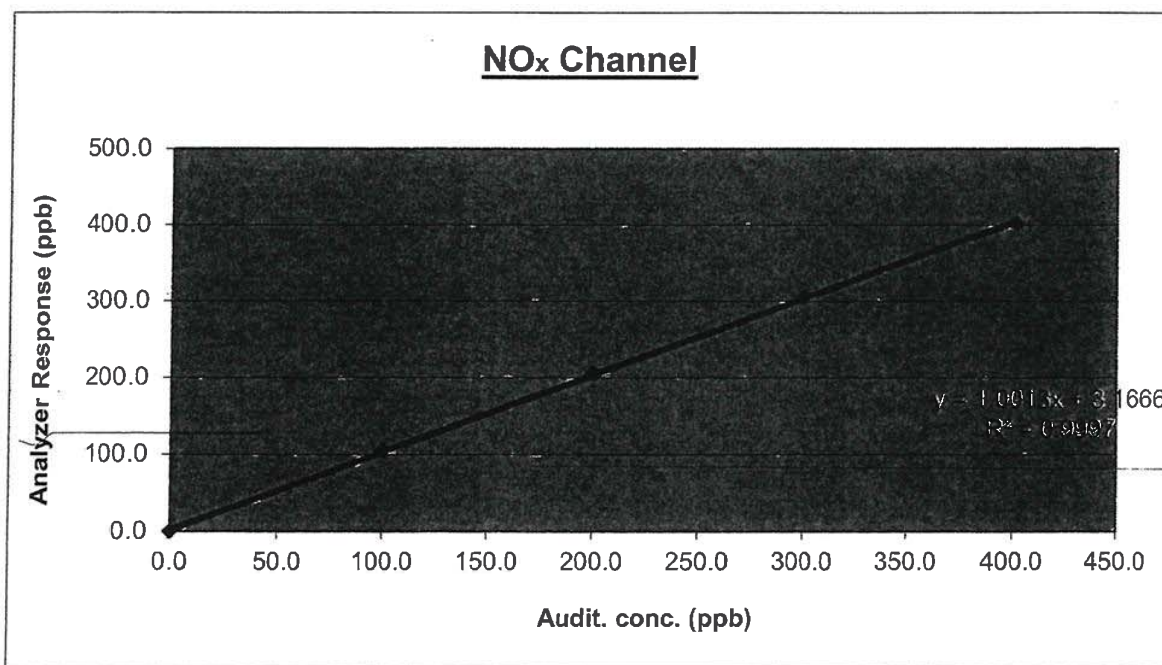
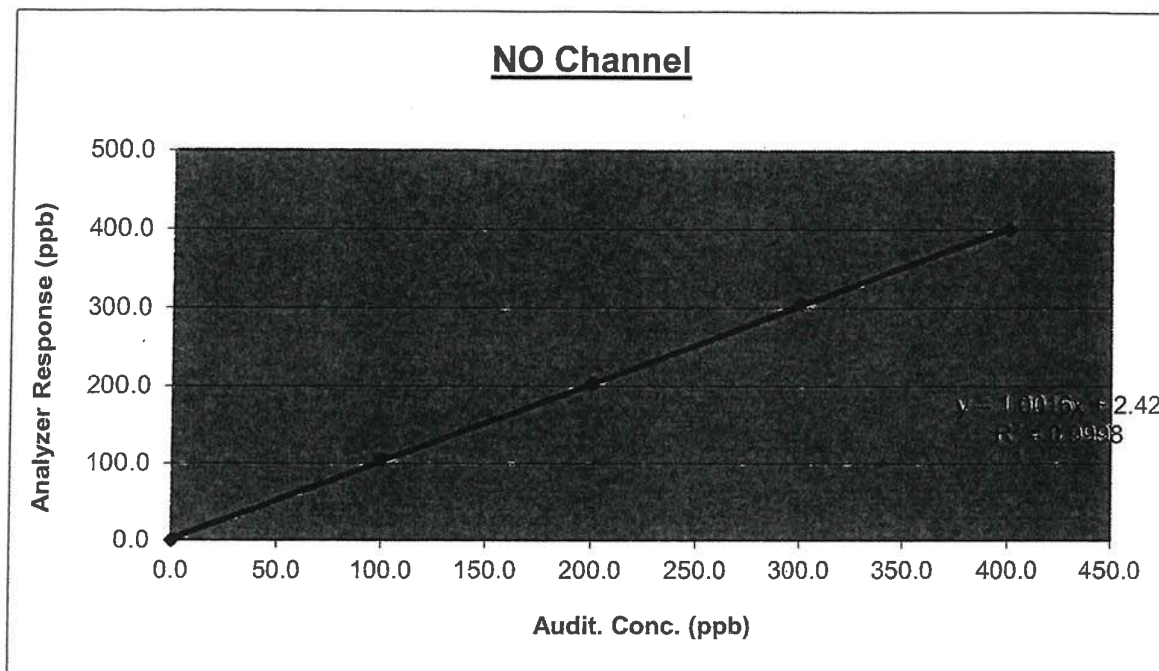
Station	ETC	Zero Setting	0
Brand	TELEDYNE API.	Span Instrument Gain	400.0
Model	T200	Start time	13:00
Range	500 PPB	Finish Time	15:00
Serial Number	2005	Date	January 20, 2024

NO Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	104.6	4.6	4.60
2	200.0	203.2	3.2	1.60
3	300.0	305.6	5.6	1.87
4	400.0	400.3	0.3	0.08
Average Difference ( % )				2.04
Slope = 1.0016	Intercept = 2.42	Correlation Coefficient =		0.9998

NOx Channel				
Point Number	Audit Concentration (PPB)	Analyzer Response (PPB)	Difference	
			(PPB)	(Percent)
ZERO	0.0	0.0	-	-
1	100.0	105.3	5.3	5.30
2	200.0	205.7	5.7	2.85
3	300.0	305.6	5.6	1.87
4	401.0	401.5	0.5	0.12
Average Difference ( % )				2.54
Slope = 1.0013	Intercept = 3.1666	Correlation Coefficient =		0.9997

30 APR 2024

LA67-R0530





Certificate No. : 23-148799  
Sample Code : 23-56200-001

Certificate No. : 23-148799  
Sample Code : 23-56200-001

## CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 25 December 2023

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).

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE  
Manufacturer : METTLER TOLEDO  
Model : XS205DU  
Capacity : Max 81 g / 220 g  
Resolution : 0.01 mg / 0.1 mg  
Serial No. : 1126323724  
ID No. : LABE 05/1

### 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 : 80	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	40 80 40	80
<input checked="" type="checkbox"/> Adjustment	Standard weight	40.000054 80.000048 40.000054	80.000048
	Average reading of indicator	40.000026 80.000037 40.000017	80.000017
	Standard deviation	0.000015 0.000016 0.000008	0.000009

Unit : g	Range : 200	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100 200 100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042 200.000041 100.000042	200.000041
	Average reading of indicator	100.00003 200.00004 100.00001	200.00001
	Standard deviation	0.000005 0.000005 0.000003	0.000003

COPY

Certificate No. : 23-148799  
Sample Code : 23-56200-001

## 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 : 80 200

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	1.00748	0	1.0274
40	0.98753	100	0.9975
80	0.99751	200	0.9975

## 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	0.00000	0.00000	0.000012	2.05
0.01	0.0100025	0.01000	0.00000	0.000012	2.05
0.1	0.1000019	0.10001	-0.00001	0.000013	2.03
1	1.0000125	1.00001	0.00000	0.000015	2.02
5	5.0000208	5.00004	-0.00002	0.000021	2.00
10	10.0000004	10.00008	-0.00008	0.000026	2.00
20	20.0000030	20.00011	-0.00008	0.000036	2.00
50	50.0000014	50.00014	-0.00013	0.000068	2.00
100	100.0000042	100.0001	-0.0001	0.00016	2.00
150	150.0000056	150.0001	0.0000	0.00022	2.00
200	200.0000041	200.0002	-0.0002	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.

COPY

Certificate No. : 23-148799  
Sample Code : 23-56200-001

## 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.

Weighing pan ☐ Circle  
☐ Triangular  
☒ RectangularTest weight : 50 and 100  
Unit : g

Range	Position	Reading of indicator	Reading of indicator
1	50.00015	100.0001	200
2	50.00022	100.0001	
3	50.00008	100.0001	
4	50.00002	100.0000	
5	50.00016	100.0002	
6	50.00014	100.0001	
Maximum difference	0.00013	0.0001	

## Condition of Calibration

6. Ambient conditions	Min	Max
Temperature (°C)	22.8	23.0
Relative Humidity (%rh)	43.5	51.1
Air pressure (hPa)	1012.5	1014.5

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 ID.No. Certificate No.

E2 LB-WF-79 23-105642

- End of Report -

COPY



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: E03NI99E15ACQU4  
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 800/R-12/01, using the assay procedures listed. Analytical Metrology does not require correction for analytical interference. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig. Lx 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	6162860Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Last Multipoint Calibration	
Nicolet IS50 FTIR AUP2110295 CH4			Oct 13, 2021	
Nicolet IS50 FTIR AUP2110295 C3H8			Oct 14, 2021	

#### Triad Data Available Upon Request

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





WISDOM SCIENCE

## Certificate Of Calibration

Method: S Pre-Test Console Calibration - Cubic meter (m)

## Meter Console Information

Console Model : XC-572-OV  
 Console serial : A2204323  
 DGM Model #: SK25EX  
 DGM Serial #: 00008294

## Calibration Condition

Calibration Date: 2-May-2023  
 Due Date: 1-May-2024  
 Cal. Report No.: WDS-SV660066  
 Ambient Temp (°C): 25  
 Pressure (mm Hg): 758  
 Relative Humidity (%): 55

## Factors/Conversion

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

## Reference Equipment

WTM Model: W-NKoDa-5B  
 WTM Serial: 600245  
 WTM Cal. Date: 22-Nov-2022  
 Gamma: 1.0000

UUT Meter (DGM)						Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
0	P <sub>mbat</sub>	V <sub>mi</sub>	V <sub>mf</sub>	t <sub>mi</sub>	t <sub>mf</sub>	V <sub>wi</sub>	V <sub>wf</sub>	t <sub>wi</sub>	t <sub>wf</sub>
15.00	13.0	18.0885	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H <sub>2</sub> O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V <sub>std</sub> (m <sup>3</sup> )	Q <sub>std</sub> m <sup>3</sup> /min	V <sub>std</sub> (m <sup>3</sup> )	Q <sub>std</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>std</sub> (corr)	ΔH <sub>e</sub>	ΔΔH <sub>e</sub>
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403
				1.001	= Y Avg.		51.144	= ΔH@ Avg.

Pass/Fail Result: PASS

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance is ±0.02  
 Note: For ΔH<sub>e</sub>, orifice pressure differential that is standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.

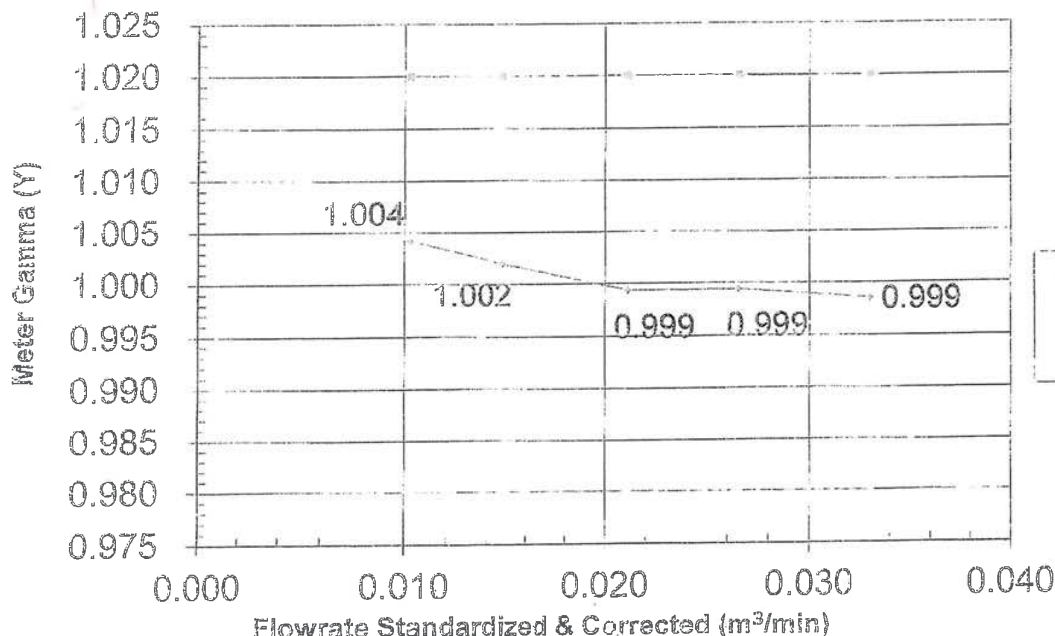
Approved By:

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

Date: 2-May-2023

COPY

## Meter Gamma vs Flowrate



Console Serial: A2204323

Console Model: XC-572-OV

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

COPY



WISDOM SCIENCE

## TEMPERATURE DISPLAY CALIBRATION

### Meter Console Information

Console Model : XC-572-OV  
Console Serial : A2204323  
Temp. Indicator Model : 765-KF  
Temp. Indicator Serial : JC19022

### Calibration Conditions

Cal. Date : 2-May-2023  
Due Date : 1-May-2024  
Cal. Report No. : WDS-SV600066  
Ambient Temp. (°C) : 25  
Pressure (mm Hg) : 758  
Humidity (%) : 55

### Reference Equipment

Temp. Simulator Model : FLUKE 714B  
Serial No. : 60590035  
Calibration Date : 14-Feb-2023

### Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	350.0	350.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
Maximum <sup>1</sup>			1.0

### Note

<sup>1</sup> For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8). Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

### DGM Out Temperature Sensor Calibration

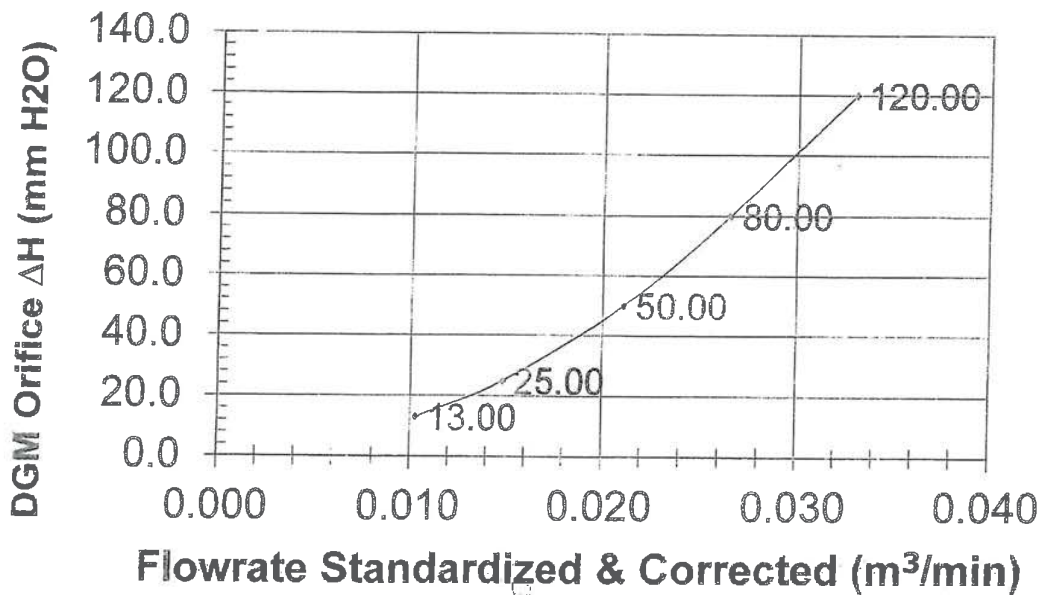
Temperature point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

DGM Out Temp. Diff.  $\pm 3^{\circ}\text{C}$

Approved By :

WISDOM SCIENCE

## Meter Pressure vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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

COPY

COPY

## Certificate Of Calibration

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

## Meter Console Information

Console Model XC572V  
Console Serial 1110070  
DGM Model # SK25EX  
DGM Serial # 0005413

## Calibration Condition

Calibration Date 3-Jul-23  
Due Date 2-Jul-24  
Cal Report No. WDS-SV660107  
Ambient Temp (°C) 25  
Pressure (mm Hg) 758  
Relative Humidity (%) 60

## Factors/Conversion

Std Temp (°K) 298  
Std. Pressure (mm Hg) 760  
K<sub>1</sub> (K/mm Hg) 0.3857

## Reference Equipment

WTM Model W-NK0Da-5B WTM Cal Due Date Nov. 2022  
WTM Serial 600245 Gamma 1.0000

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

Standardized Data				Calibration Results			
Test Meter		Reference Meter		Correction Factor		Flow Rate	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM
V <sub>std</sub> (m <sup>3</sup> )	Q <sub>std</sub> (m <sup>3</sup> /min)	V <sub>ref</sub> (m <sup>3</sup> )	Q <sub>ref</sub> (m <sup>3</sup> /min)	(Y)	(ΔY)	Q <sub>std/corr</sub>	ΔH <sub>0</sub>
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.096
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602
				0.996	= Y Avg	47.434	= ΔH <sub>0</sub> Avg

Pass/Fail Result:

Pass

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

Note: For ΔH<sub>0</sub>: orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure - individual values from the average is ±0.2inches (5.1mm) H<sub>2</sub>O

Approved By:

(Palpasu Chaisana)  
Service Manager

Date 3-Jul-23

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

COPY

## TEMPERATURE DISPLAY CALIBRATION

## Meter Console Information

Console Model XC572V  
Console Serial 1110070  
Temp Indicator Model 765-KF  
Temp Indicator Serial JC17852

## Calibration Conditions

Cal Date 3-Jul-23  
Due Date 2-Jul-24  
Cal Report No. WDS-SV660107  
Ambient Temp (°C) 25  
Pressure (mm Hg) 758  
Humidity (%) 60

## Reference Equipment

Temp Simulator Model FLUKE 714B  
Serial No 60590035

## Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
Maximum			1.0

PASS

## Note

\* For valid test results, the maximum difference between temperature readings should ≤1.0°C (EPA Method 5, Section 6.1.1.8)  
Perform all TC Channel calibrations. Except meter (DGM) channel

## DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ambient	26.5	27.0	-0.5
Heat	100.5	102.5	-2.0

## Difference Range

DGM Out Temp. Diff. ±3 °C

PASS

Approved By:

(Palpasu Chaisana)  
Service Manager

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

COPY

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED  
Address 9/115 Lumpini Town Ville Ratchaphruek-Pinkkiao Village No. 4 Bang Kruai, Nonthaburi 11130 Thailand  
Tel 090-660 1392 084-598-1944 084-704-1620



ELAPSED TIMER CALIBRATION

Meter Console Information

Model #: XG572V  
Serial #: 1110070  
Elapsed Timer Model #: C342-1484  
Elapsed Timer Serial #

Calibration Conditions

Cal Date : 03-Jul-23  
Due Date : 02-Jul-24  
Cal Report No.: WDS-SV660107  
Ambient Temp. (°C) : 25  
Pressure (mm Hg) : 758  
Humidity (%) : 60

Reference Equipment

Calibration Standard: JS-307  
Method Reference: Compare

Run Time Elapsed Time	Calibration Results			
	Elapsed Timer		Average Time	
Minute	1	2	3	4
2.00	Minute	Minute	Minute	Minute
3.00	2.00	2.00	2.00	2.000
5.00	3.00	3.00	3.00	3.000
7.00	5.00	5.00	5.00	5.000
9.00	7.00	7.00	7.00	7.000
	9.00	9.00	9.00	9.000
				0.000
				0.000
				0.000



Approved By

WISDOM SCIENCE

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED  
Address: 9/115 Lumpini Town Ville Ratchaphruek-Pinklao Village No. 4, Bang Khanun, Bang Kruai, Nonthaburi 11130 Thailand  
Tel: (090-660-1392, 084-598-1944, 084-704-1620)

COPY

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED  
Address: 9/115 Lumpini Town Ville Ratchaphruek-Pinklao Village No. 4, Bang Khanun, Bang Kruai, Nonthaburi 11130 Thailand  
Tel: (090-660-1392, 084-598-1944, 084-704-1620)

**Certificate No.:** G 660488  
**Date of issue :** 17-Aug-23



**Instrument description** : Flue Gas Analyzer  
**Instrument model** : Testo 350 New  
**Instrument serial no.** : 63455658/0722  
**Control unit serial no.** : 03601409/0722  
**ID no. or control no.** :  
**Manufacturer** : Testo SE & Co. KGaA  
**Probe description** :  
**Probe model** :  
**Probe serial** :  
**Customer name** : Eastern Thai Consulting .992 Company Limited  
**Customer address** : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

**Total pages of certificate** : 2 Pages  
**Receiving no.** : L-237624  
**Receiving date.** : 10-Aug-23

**Parameter of calibration** : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 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, Laksa, Bangkok 10210

**Calibration procedure no.:** This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

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

**Date of calibration** : 17-Aug-23



Mrs. Nongluck Wongsettee  
Technical Manager



**Certificate No.:** G 660488



**Standard References (Table 1)**

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimit	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimit	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimit	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24

**Measured room conditions**

Temperature : 23.5 °C Humidity : 61.2 %RH Pressure : 1009.5 mbar  
Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.4 mbar

**Calibration Results (Without adjustment) (Table 2)**

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( ± )
O2 (%Vol)	2.498	2.58	0.082	0.15
O2 (%Vol)	10.04	10.10	0.06	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	997	-6	12
*NO2 (ppm)	80.96	80.3	-0.66	8.0
*NO (ppm)	151.5	153	1.5	8.0
*SO2 (ppm)	100.8	101	0.2	6.0

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

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

**End of Report**



Mrs. Nongluck Wongsettee  
Technical Manager





## CERTIFICATE OF CALIBRATION

Page 1 of 3  
Certificate No. : 23-148804  
Sample Code : 23-56200-006Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhaphibarn 8 Rd., Nongkham,  
Sriacha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert Model : UFE 500

Serial No. : GS11.0182 ID No. : LABE 17/4

Date of Receipt : 22 December 2023 Date of Calibration : 22 December 2023

## Condition of Calibration

1. Environment 1.1 Ambient temperature : Maximum 30.9 °C : Minimum 29.6 °C  
1.2 Relative humidity : Maximum 54.5 % : Minimum 46.8 %  
1.3 Line voltage supplied : Maximum 227.6 VAC : Minimum 224.2 VAC

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P100)	LB-DA-08 (RTD-248 to RTD-256)	23-084070	06 August 2024

## 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. Pisek Into Approved by (Mr. Somchai Neampunt)  
Scientist Signed for Director

Issue date 25 December 2023

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 succeeded the measurement capability of the laboratory and its traceability to recognised national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

361 Soi Ladprao 122, Ladprao Road,  
Phialapha, Wang Thonglang, Bangkok 10310  
PM CLM  
TEL 02-515-5949  
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. : 23-148804  
Sample Code : 23-56200-006

## Results of Calibration

Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	UUC*	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>opt</sup>	# 10		
104	103.5	103.5	104.11	103.94	103.85	103.84	103.97	103.93	103.64	103.51	104.23		0.47	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.04	0.78	0.81

## Notes

UUC\* = Unit U

361 Soi Ladprao 122, Ladprao Road,  
Phialapha, Wang Thonglang, Bangkok 10310  
PM CLM  
TEL 02-515-5949  
FAX 02-516-6949  
Rev 08  
CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date 15/10/21



NSC-TIS-TS17025  
CALIBRATION 0152

Page 3 of 3

## REPORT OF CALIBRATION

Certificate No. : 23-148804

Sample Code : 23-56200-006

### 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 = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC<sup>\*</sup> reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

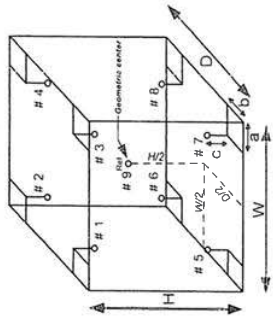


Figure: Example of sensor installation Positions

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 ISO 17025:2017.

- End of Report -

**COPY**



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



# Certificate of Calibration

Certificate No. BSCC-UV-152/23  
Number of Page(s) 1 of 3

**Certificate No.** BSCC-UV-152/23  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635101643 CD  
**ID No.** N/A  
**Date of receipt** 25 April 2023  
**Date of calibration** 25 April 2023  
**Date of issue** 27 April 2023  
**Customer name** Eastern Thai Consulting 1992 Co.,Ltd  
**Address** 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

**Temperature** (22.4-23.1) °C (On site)  
**Humidity** (44.5-45.2) %RH (On site)

**Equipment condition** Good Operation

**Calibration Location** Analysis Department

**Calibration Procedure** In-house method WI-JUV-702-01 based on ASTM E275-01  
**Traceability** Wavelength Accuracy is traceable to certificate No. 94780 and 94775  
Photometric Accuracy is traceable to certificate No. 94808 and 100147  
Stray Light is traceable to certificate No. 94791  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by** Mr.Pamaphong Phannmekakul

**Approved by**

Technical Manager

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



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



# Certificate of Calibration

Certificate No. BSCC-UV-152/23  
Number of Page(s) 2 of 3

**Calibration Results:**  
**1.Wavelength Accuracy**

Wavelength (nm)	Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
235	287.71	287.65	-0.06	0.18
257	445.82	445.80	-0.02	0.18
313	536.52	536.35	-0.17	0.18
350	741.02	740.99	-0.03	0.18
	879.41	879.27	-0.14	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
257	0.7311	0.7313	0.0002	0.0075
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR
	0.0000	0.0000	0.0000	0.0075
	0.6306	0.6314	0.0008	0.0075

\*CNR = Customer not request



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



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



# Certificate of Calibration

Certificate No.

BSCC-UV-152/23

Calibration Results:

3. Photometric Accuracy (Visible)

Number of Page(s)

3 of 3

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5488	0.5508	0.0020	0.0042
	0.7527	0.7535	0.0008	0.0042
440.0	1.0756	1.0758	0.0002	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5391	0.5406	0.0015	0.0042
465.0	0.7355	0.7360	0.0005	0.0042
	1.0509	1.0501	-0.0008	0.0042
	CNR	CNR	CNR	CNR
546.1	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
590.0	0.0000	0.0000	0.0000	0.0042
	0.5045	0.5044	-0.0001	0.0042
	0.6884	0.6885	0.0001	0.0042
635.0	0.9616	0.9608	-0.0008	0.0042
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5183	0.5178	-0.0005	0.0042
	0.6864	0.6868	0.0004	0.0042
*CNR = Customer not request				0.0042

4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75±0.11nm	200.72	2.0164

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor K=2 providing a level of confidence of approximately 95%  
\*\*\*End of Certificate\*\*\*

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

COPY



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Sicom 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-146/24  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11635101643 CD  
ID No. LABE 03/2  
Date of receipt 22 April 2024  
Date of calibration 22 April 2024  
Date of issue 29 April 2024  
Customer name Eastern Thai Consulting 1992 Co., Ltd.  
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.9-24.1) °C (On site)  
Humidity (41.7-46.9) %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. 116614 and 116613  
Photometric Accuracy is traceable to certificate No. 116210 and 116224  
Stray Light is traceable to certificate No. 116616  
The above certificate are traceable to SI unit through Sarna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Poomjai Korsawalvorakul

Approved by

Service Manager

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

COPY



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Sicom 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-146/24

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
287.71	287.75	0.04	0.18
445.82	445.89	0.07	0.18
536.52	536.50	-0.02	0.18
741.02	741.01	-0.01	0.18
879.41	879.33	-0.08	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
	0.7415	0.7387	-0.0028	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
	0.6406	0.6395	-0.0011	0.0075

\*CNR = Customer not request

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

COPY



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375486-7  
www.barascientific.com



# Certificate of Calibration

Certificate No. BSCC-UV-146/24 Number of Page(s) 3 of 3

Calibration Results:

## 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5715	0.5729	0.0014	0.0042
	0.7087	0.7087	0.0000	0.0042
	1.0987	1.1005	0.0018	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5661	0.5678	0.0017	0.0042
	0.6966	0.6969	0.0001	0.0042
	1.0757	1.0774	0.0017	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5193	0.5213	0.0020	0.0042
	0.6937	0.6940	0.0003	0.0042
	1.0411	1.0428	0.0017	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5605	0.5624	0.0019	0.0042
	0.7579	0.7583	0.0004	0.0042
	1.1131	1.1138	0.0007	0.0042

\*CNR = Customer not request

## 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
201.33±0.11nm	200.80	2.0111

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

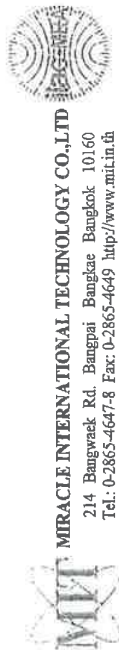
\*Stray Light not NSC-ONSC Accredited

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

\*\*\*End of Certificate\*\*\*

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

COPY



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



## CALIBRATION CERTIFICATE

Certificate No. : L202307241-0002

Date Issued : 24-Jul-23

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : QUEST TECHNOLOGY

**Model** : QUESTEMP 34

**Serial No.** : TEU080014

**ID No./Tag No.** : No.13

**Date Received** : 21-Jul-23

**Date Calibrated** : 22-Jul-23

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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



Page 1 of 2

COPY

Certificate No. : L202307241-0002

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

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

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 38.2	-	0.20	0.35
38.00	GLOBE 38.0	-	0.00	0.35
44.99	WET 45.0	-	0.01	0.35
44.99	DRY 45.1	-	0.11	0.35
44.99	GLOBE 44.9	-	-0.09	0.35

STD = Standard

UUC = Unit Under Calibration

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

Condition As-Received : Used Item

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

**Measurement Standards Used & Traceability :**

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 3856603, Due 10-Nov-23

End of Certificate

Page 2 of 2

COPY



## CALIBRATION CERTIFICATE

Certificate No. : L202306315-002  
 Date Issued : 04-Jul-23

**Customer** : Eastern Thai Consulting 1992 Co., Ltd.  
 683 Moo 11 Sukhapiabarn 8 Rd., Nongkharn, Sriracha, Chonburi 20230

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI  
**Model** : QUESTemp 34  
**Serial No.** : TEU080012  
**ID No./Tag No.** : NO.11  
**Date Received** : 30-Jun-23  
**Date Calibrated** : 02-Jul-23

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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:



Page 1 of 2

**COPY**

Certificate No. : L202306315-002  
 Environment : Ambient Temperature :  $(25 \pm 2) ^\circ\text{C}$   
 Relative Humidity :  $(50 \pm 15)\%\text{RH}$

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
37.99	WET 37.9	-	-0.09	0.35
37.99	DRY 37.9	-	-0.09	0.35
37.99	GLOBE 37.9	-	-0.09	0.35
45.01	WET 45.3	-	0.29	0.35
45.01	DRY 45.2	-	0.19	0.35
45.01	GLOBE 45.1	-	0.09	0.35

STD = Standard

UUC = Unit Under Calibration

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

Condition As-Received : Used Item

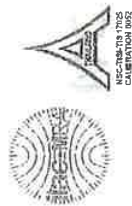
The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

End of Certificate



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



## CALIBRATION CERTIFICATE

Certificate No. : L202307241-0001  
Date Issued : 24-Jul-23

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : QUEST TECHNOLOGY  
**Model** : QUESTEMP 34  
**Serial No.** : TEU080015  
**ID No./Tag No.** : No.14  
**Date Received** : 21-Jul-23  
**Date Calibrated** : 22-Jul-23

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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:



Page 1 of 2

COPY

Certificate No. : L202307241-0001

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

STD	Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm^\circ\text{C}$ )
		Before Adjusted	After Adjusted		
38.00	WET	38.0	-	0.00	0.35
		38.1	-	0.10	0.35
		37.9	-	-0.10	0.35
44.99	WET	44.7	-	-0.29	0.35
		44.8	-	-0.19	0.35
		44.6	-	-0.39	0.35

STD = Standard

UUC = Unit Under Calibration

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

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

End of Certificate

COPY



# IN

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



*[Faint handwritten notes]*

Certificate No.: L202307241-0001

Date Issued : 24-Jul-23

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

Equipment : Area Heat Stress Monitor

**Manufacturer** : OUEST TECHNOLOGY

Model : QUESTEMP 34

Serial No.: TEU080015

ID No./Tag No. : No.14

Date Received : 21-Jul-23

Date Calibrated : 22-11-23

Calibrated by : Mr. Apiwat Pearnungrot

## Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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:



Page 1 of 2

**COPY**

Certificate No.: L202307241-0001

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

Relative Humidity: (50 + 15)%RH

STD	UUC Reading (°C)	UUC Error	Measurement
Reading (°C)	Before Adjusted	After Adjusted	Uncertainty (±°C)
38.00	WET 38.0	-	0.35
38.00	DRY 38.1	-	0.35
38.00	GLOBE 37.9	-	0.35
44.99	WET 44.7	-	0.35
44.99	DRY 44.8	-	0.35
44.99	GLOBE 44.6	-	0.35

STD = Standard

**UUC = Unit Under Calibration**

Description of UUC:

Range 0 to 100 °C

## Resolution

0.75

Condition As-Received : Used Item

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

### Measurement Standards Used & Traceability :

## The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

**End of Certificate**

Page 2 of 2



## CALIBRATION CERTIFICATE

Certificate No. : L202306315-003  
 Date Issued : 04-Jul-23

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : TSI  
**Model** : QUESTemp 34  
**Serial No.** : TEU080013  
**ID No./Tag No.** : NO.12  
**Date Received** : 30-Jun-23  
**Date Calibrated** : 02-Jul-23

**Calibrated by** : Mr. Apiwat Peanrungrat

### Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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:

Page 1 of 2



**COPY**

Certificate No. : L202306315-003

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

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

STD Reading ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm ^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
37.99	WET 37.8	-	-0.19	0.35
37.99	DRY 38.0	-	0.01	0.35
37.99	GLOBE 38.2	-	0.21	0.35
45.01	WET 45.1	-	0.09	0.35
45.01	DRY 45.3	-	0.29	0.35
45.01	GLOBE 45.1	-	0.09	0.35

STD = Standard

UUC = Unit Under Calibration

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

Condition As-Received : Used Item

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

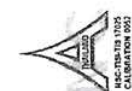
Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

End of Certificate

**COPY**



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



CALIBRATION CERTIFICATE

Certificate No. : L202307241-0002  
Date Issued : 24-Jul-23

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

**Equipment** : Area Heat Stress Monitor

**Manufacturer** : QUEST TECHNOLOGY  
**Model** : QUESTEMP 34  
**Serial No.** : TEU080014  
**ID No./Tag No.** : No.13  
**Date Received** : 21-Jul-23  
**Date Calibrated** : 22-Jul-23

**Calibrated by** : Mr. Apiwat Peanrungrat

**Calibration Method or Calibration Procedure Used**

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

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

**Result of Calibration**

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

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



Page 1 of 2

COPY

Certificate No. : L202307241-0002

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

STD	UUC Reading ( $^\circ\text{C}$ )		UUC Error ( $^\circ\text{C}$ )	Measurement Uncertainty ( $\pm ^\circ\text{C}$ )
	Before Adjusted	After Adjusted		
38.00	WET 38.1	-	0.10	0.35
38.00	DRY 38.2	-	0.20	0.35
38.00	GLOBE 38.0	-	0.00	0.35
44.99	WET 45.0	-	0.01	0.35
44.99	DRY 45.1	-	0.11	0.35
44.99	GLOBE 44.9	-	-0.09	0.35

STD = Standard

UUC = Unit Under Calibration

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

Condition As-Received : Used Item

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

**Measurement Standards Used & Traceability :**

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

End of Certificate

Page 2 of 2

COPY



Iranatree Associates Co., Ltd.  
63/14-15, 97/35-36  
Petchkasem 72/1, Rd Wattana, Bangkok 10600 (Thailand)  
Tel: +6688888812  
Mobile: +6683994153  
Email: [iracalibration@iranatree.com](mailto:iracalibration@iranatree.com)  
Web site: [www.iranatree.com](http://www.iranatree.com)

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department



NSC-TISI-TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-041-67

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 22004318  
ID NUMBER :  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo 11, Sukhaphitum 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

RECEIVED DATE : 08 Feb 2024  
MEASUREMENT DATE : 12 Feb 2024  
ISSUE DATE : 16 Feb 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Page 1 of 2 Pages

Calibration procedure:  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: EN-0101-23

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 AS100, Serial No.: 667682-09,  
Due date: 28 Mar 2024  
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591  
Due date: 14 Sep 2024

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data Guide to the expression of uncertainty in measurement

### Calibrated by:

- ☐ Mr. Sarwit Thachalad  
☐ Miss Jitraporn Lersomphol  
☒ Miss Ruangrump Phoommit

### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager



THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



Continuation of Certificate of Calibration Number CDT-041-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22010215.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.052	20.0	-0.1	0.099
80	25.057	25.0	-0.1	0.099
80	30.042	30.0	0.0	0.099
80	35.031	35.0	0.0	0.099
80	40.017	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP32716.2 S/N: 22014940.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.1	0.0	0.099
110	25.057	25.1	0.0	0.099
110	30.042	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.017	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22003554.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.052	20.1	0.0	0.099
75	25.057	25.0	-0.1	0.16
75	30.041	29.8	-0.2	0.099
75	35.031	34.7	-0.3	0.099
75	40.017	39.6	-0.4	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor  $k=2.21$  providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*





Jirapatee Associates Co. Ltd.  
67/14-15, 67/15-16  
Bangkok 10600 (Thailand)  
Tel: +668689812  
Mobile: +6686939453  
E-mail: nac-calibration@iranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department.



NSC-TISI-TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-040-67

### MEASUREMENT ITEM

: Heat Stress Monitor  
: Delta OHM  
: HD32.2  
: 22004316  
: -  
: Used Item  
: Eastern Thai Consulting 1992 Co., Ltd.  
: 683 Moo 11, Sukhaphiban 8 Rd,  
Nongkham, Sriracha, Chonburi 20230

### CONDITION AS-RECEIVED

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

### RECEIVED DATE

: 08 Feb 2024

### MEASUREMENT DATE

: 12 Feb 2024

### ISSUE DATE

: 16 Feb 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C

Relative Humidity :  $55.0 \pm 15.0$  %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol  
☒ Miss Ruangrumpai Phoornmit



Approved by



Page 1 of 2 Pages

### Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

### Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-09,  
Due date: 28 Mar 2024
2. Digital Temperature Indicator  
Model: DTI-1000-A MK-II, Serial No.: 671407-  
00591 Due date: 14 Sep 2024

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'



Continuation of Certificate of Calibration Number CDT-040-67

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22010713.  
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.052	20.1	0.0	0.099
80	25.057	25.1	0.0	0.099
80	30.042	30.1	0.1	0.099
80	35.032	35.1	0.1	0.099
80	40.018	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22014923.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.1	0.0	0.099
110	25.057	25.1	0.0	0.099
110	30.042	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.018	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22015193.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.052	20.0	-0.1	0.099
75	25.057	25.0	-0.1	0.099
75	30.043	29.9	-0.1	0.099
75	35.032	34.9	-0.1	0.099
75	40.017	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



COPY

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



Jirante Associates Co., Ltd.  
63/14-15, 67/35-36  
Pecharoen 7/71, Rd. Wathapara, Bangkokkai,  
Bangkok 10500 (Thailand)  
Tel : +6628809322  
Fax : +6628809323  
E-mail: jiracalibration@jirante.com  
Web site: www.jirante.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
RSC-164/15.17025  
CALIBRATION 0367



NSC - TISI - TIS 17025  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department,  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-043-67

### MEASUREMENT ITEM

: Heat Stress Monitor  
: Delta OHM  
: HD32.2  
: 22004320  
: -  
: Used item  
: Eastern Thai Consulting 1992 Co., Ltd.,  
683 Moo 11, Sukhaplarn 8 Rd,  
Nongkham, Srisracha, Chonburi 20230

### CONDITION AS-RECEIVED

### CUSTOMER

### RECEIVED DATE

### MEASUREMENT DATE

### ISSUE DATE

: 08 Feb 2024  
: 12 Feb 2024  
: 16 Feb 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☐ Miss Jittaporn Lertsomphol  
☒ Miss Ruangumpai Phoornmit

### Approved signat



Calibration Department Manager  
COPY

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED  
IN WRITING FROM THE LABORATORY

Calibration procedure:  
The temperature calibration was done by  
In-House calibration method as WI-CL-001  
according to comparison method with standard  
digital temperature indicator and standard  
temperature probe. The temperature scale use  
was based on ITS-90.

### Traceability:

The measurement results are traceable to the  
international system of units (SI) through  
National Institute of Metrology (NIMT)  
Certificate number: TT-0038-23, Certificate  
number: ER-0101-23

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-09,  
Due date: 28 Mar 2024
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-  
00591 Due date: 14 Sep 2024

### Uncertainty of Measurement:

The reported uncertainty of measurement is  
based on the standard uncertainty multiplied by  
a coverage factor  $k=2$ , which for a normal  
distribution corresponds to a coverage  
probability of approximately 95%. The standard  
uncertainty has been determined in accordance  
with the GUM 'Evaluation of measurement data  
- Guide to the expression of uncertainty in  
measurement'



Continuation of Certificate of Calibration Number CDT-043-67

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: Z2010220.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.066	20.1	0.0	0.099
80	25.056	25.1	0.0	0.099
80	30.045	30.1	0.1	0.099
80	35.035	35.1	0.1	0.099
80	40.025	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: Z2014931.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	20.1	0.0	0.099
110	25.057	25.1	0.0	0.099
110	30.045	30.1	0.1	0.099
110	35.035	35.1	0.1	0.099
110	40.025	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: Z2015196.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.066	20.2	0.1	0.099
75	25.056	25.1	0.0	0.099
75	30.045	30.1	0.1	0.099
75	35.035	35.1	0.0	0.16
75	40.026	40.0	0.0	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor  $k=2.21$  providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



COPY

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



NSC-TIS-17025  
CALIBRATION 0394

Cert. No. : ACC23037  
Pages : 1 of 3

## Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-75  
**Serial No.:** 34802645  
**ID No.:**

**Condition As Found :** GOOD

**Customer :** EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

**Location :**  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 06 SEPTEMBER 2023  
**Calibration Date :** 12 OCTOBER 2023  
**Date of Issue :** 16 OCTOBER 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

COPY

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACC23037  
Job No. : VC66AC0097  
Pages : 2 of 3

**Calibration Procedure :** CP-AC-03

### Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0766	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0767	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0766	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

COPY

J. Retha

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : AC23037  
Job No. : VC66AC0097  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.94	-0.06	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.24	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

\_\_\_\_\_ End of Calibration Certificate

COPY



SITHIPORN  
ASSOCIATES  
CO., LTD.

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24043  
Pages : 1 of 8

Cert. No. : ACL24043  
Job No. : VC67AC0042  
Pages : 2 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No. : 01120948 / 21962 / 22337  
ID No. : \*

Condition As Found : GOOD  
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SURACHA, CHONBURI 20230 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 11 JANUARY 2024  
Calibration Date : 16 - 17 JANUARY 2024  
Date of Issue : 18 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with A-weighting and Reference Standard Instruments.

For tests results of each items were made by observation of each instruments display and also with SLM's display.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	UJ-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	UJL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MA3-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
- 3.1 National Institute of Metrology (Thailand).
  - 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

COPY

COPY

**Summary of Measurement Result :**

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

**Result of calibration :****1. Absolute sensitivity**

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	0.0	±0.3

**2. Self-generated noise****2.1 Normal test**

Measured Value ( dB )
13.8

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	15.6
Flat	21.0

**3. Acoustical signal tests of frequency weightings**

Meter free-field acoustic response at a level of 84 dB

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	0.0	0.0	0.0
8000	0.5	0.6	0.6
			± 1.5, -2.5

COPY

COPY

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	0.0	0.0
125	0.0	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
16000	0.0	-1.2	-1.2

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits
A - weight	94.0	94.0	0.0	

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 0.8
136.0	136.0	0.0	± 0.8
135.0	135.0	0.0	± 0.8
134.0	134.0	0.0	± 0.8
133.0	133.0	0.0	± 0.8
132.0	132.0	0.0	± 0.8
131.0	131.0	0.0	± 0.8
129.0	129.0	0.0	± 0.8
124.0	124.0	0.0	± 0.8
119.0	119.0	0.0	± 0.8
114.0	114.0	0.0	± 0.8
109.0	109.0	0.0	± 0.8
104.0	104.0	0.0	± 0.8
99.0	99.0	0.0	± 0.8
94.0	94.0	0.0	± 0.8
89.0	89.0	0.0	± 0.8
84.0	84.0	0.0	± 0.8
79.0	79.0	0.0	± 0.8
74.0	74.0	0.0	± 0.8
69.0	69.0	0.0	± 0.8
64.0	64.0	0.0	± 0.8
59.0	59.0	0.0	± 0.8
54.0	53.9	-0.1	± 0.8
49.0	49.0	0.0	± 0.8
44.0	43.9	-0.1	± 0.8
39.0	38.9	-0.1	± 0.8
34.0	34.0	0.0	± 0.8
30.0	29.9	-0.1	± 0.8
29.0	28.9	-0.1	± 0.8
28.0	28.0	0.0	± 0.8
27.0	26.9	-0.1	± 0.8
26.0	25.9	-0.1	± 0.8
25.0	24.9	-0.1	± 0.8

**8. Level linearity including the level range control**

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

**9. Tone burst response**

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

**11. Overload indication**

Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle		
89.6	89.6	0.0
		±1.5

**12. High level stability**

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

**End of Calibration Certificate**

**COPY**

**COPY**



SITHIPORN

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthon Road, Bangbunru, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com

Cert. No. : ACL24045  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No. : 011210052 / 22709 / 22127  
ID No. :

Condition As Found : GOOD  
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

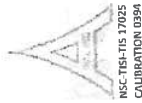
Received Date : 11 JANUARY 2024  
Calibration Date : 16-17 JANUARY 2024  
Date of Issue : 18 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

COPY



SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthon Road, Bangbunru, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com

Cert. No. : ACL24045  
Job No. : VC67AC0042  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	FF-0011-23	08-11-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

COPY



SITHIPORN

Cert. No. : ACL24045  
Job No. : VC37AC0012  
Pages : 3 of 3

SITHIPORN

Cert. No. : ACL24045  
Job No. : VC67AC0042  
Pages : 4 of 8

## Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.5
1600 Hz	0.3	0.6
3000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 30 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
13.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.2
C - weight	14.3
Flat	20.0

## 3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.2	0.2
1000	0.1	0.1	0.1
8000	0.6	0.7	0.7
			± 1.0
			± 0.7
			+ 1.5, - 2.5

COPY

COPY

S. P. P. P.

S. P. P. P.

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	-0.1	0.0
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
15000	0.0	-1.2	-1.2

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.1

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 0.8
136.0	136.0	0.0	± 0.8
135.0	135.0	0.0	± 0.8
134.0	134.0	0.0	± 0.8
133.0	133.0	0.0	± 0.8
132.0	132.0	0.0	± 0.8
131.0	131.0	0.0	± 0.8
129.0	129.0	0.0	± 0.8
124.0	124.0	0.0	± 0.8
119.0	119.0	0.0	± 0.8
114.0	114.0	0.0	± 0.8
109.0	109.0	0.0	± 0.8
104.0	104.0	0.0	± 0.8
99.0	99.0	0.0	± 0.8
94.0	94.0	0.0	± 0.8
89.0	89.0	0.0	± 0.8
84.0	84.0	0.0	± 0.8
79.0	79.0	0.0	± 0.8
74.0	74.0	0.0	± 0.8
69.0	69.0	0.0	± 0.8
64.0	64.0	0.0	± 0.8
59.0	59.0	0.0	± 0.8
54.0	54.0	0.0	± 0.8
49.0	49.0	0.0	± 0.8
44.0	44.0	0.0	± 0.8
39.0	39.0	0.0	± 0.8
34.0	34.0	0.0	± 0.8
30.0	30.0	0.0	± 0.8
29.0	29.0	0.0	± 0.8
28.0	28.0	0.0	± 0.8
27.0	27.0	0.0	± 0.8
26.0	26.0	0.0	± 0.8
23.0	23.0	0.0	± 0.8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	99.0	99.0	0.0	$\pm 0.8$

## 9. Tone burst response

Time Weighting	Tone burst duration, $T_b$ (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	106.0	107.0	-0.1	$1.0; -3.0$
	2	8	117.0	117.0	0.0	$1.0; -1.5$
	200	800	135.0	134.0	0.0	$\pm 0.5$
Slow	2	8	108.0	108.0	0.0	$1.0; -3.0$
	200	800	127.6	127.6	0.0	$\pm 0.5$
SEL	0.25	1	99.0	98.0	-0.1	$1.0; -3.0$
	2	8	108.0	108.0	0.0	$1.0; -1.5$
	200	800	123.0	123.0	0.0	$\pm 0.5$

## 10. Peak off sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, $L_{peak}$ (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	$\pm 2.0$
One	136.4	136.2	-0.1	$\pm 2.0$

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	$\pm 1.0$
Positive half cycle	135.4	135.1	-0.3	$\pm 1.0$
Negative half cycle	135.4	135.1	-0.3	$\pm 1.0$

COPY

P. P. P.

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.6	89.5	$\pm 1.5$
Negative one-half cycle		-0.1	

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	$\pm 0.1$

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

COPY

P. P. P.



# QUALITY CALIBRATION CO.,LTD.

235 Petekhem 63/2 Road, Laksong, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584



CERTIFICATE No : 23E8494  
REFERENCE No : 70413-1

PAGE : 1 OF 3

## Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
MODEL : HI 3512  
SERIAL No : TH118035  
ID No : pH04/56  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 06-Sep-23

APPROVED BY :   
ISSUED DATE : 06-Sep-23  
RECEIVED DATE : 31-Aug-23

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

F-G010 REV 03



# QUALITY CALIBRATION CO.,LTD.

235 Petekhem 63/2 Road, Laksong, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
ID No : pH04/56  
RECEIVED DATE : 31-Aug-23  
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C  
MODEL : HI 3512  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 06-Sep-23  
RELATIVE HUMIDITY : 50 % RH ± 10% RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE  
DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED  
WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	2219870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	2219904	13-Sep-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-  
- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

### RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR  $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT ( $\pm \text{mV}$ )	COVERAGE FACTOR k
414.11	414.6	-0.49	-0.290	0.15	2.00
354.95	355.4	-0.45	0.741	0.15	2.00
295.80	296.3	-0.50	1.773	0.15	2.00
236.64	237.1	-0.46	2.804	0.15	2.00
177.48	177.9	-0.42	3.835	0.15	2.00
118.32	118.7	-0.38	4.867	0.15	2.00
59.16	59.6	-0.44	5.898	0.15	2.00
0.00	0.4	-0.40	6.930	0.15	2.00
-59.16	-58.8	-0.36	7.961	0.15	2.00
-118.32	-117.9	-0.42	8.992	0.15	2.00
-177.48	-177.1	-0.38	10.024	0.15	2.00
-236.64	-236.3	-0.34	11.055	0.15	2.00
-295.80	-295.5	-0.30	12.087	0.15	2.00
-354.95	-354.6	-0.35	13.118	0.15	2.00
-414.11	-413.8	-0.31	14.149	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



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

CERTIFICATE No : 23E8494

PAGE : 3 OF 3

## Calibration Report

### RESULT OF CALIBRATION (CONTINUE):

#### 2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT ( $\pm$ pH)	COVERAGE FACTOR k
4.006	4.006	0.000	4.015	0.012	2.00
7.000	7.000	0.000	6.914	0.012	2.00
10.008	10.010	-0.002	9.996	0.014	2.00

#### 3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ( $^{\circ}$ C)	UUC READING ( $^{\circ}$ C)	CORRECTION ( $^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT ( $\pm$ $^{\circ}$ C)	COVERAGE FACTOR k
25.005	25.0	0.005	---	0.0085	2.00

#### 4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%  
END OF CALIBRATION REPORT



## MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

**Customer :** S.P.S.Consulting Service Co.,Ltd      **Date Tested:** January 4, 2024  
**Address :** 7 Soi Phaholyothin 24      **Recommendation Recertification**  
Phaholyothin Road      **Period** 6 Months  
Jompol Chatuchak, Bangkok 1090      **Recertification Due:** July 4, 2024  
**User Name:** K.Phenpha Viphasathawat      **Visit Number:** July 6, 2023  
**Phone:** 083-9268252      **PerkinElmer Phone:** 2 of 2  
**Fax:** 02-513-4221      **PerkinElmer Fax:** 02-719-6420 ext 206  
02-318-5697

### CONFIGURATION TESTED

**MODEL**  
OPTIMA 5300DV

**TESTED EQUIPMENT**  
IPV Methods

**TEST STANDARD USED**  
Multielement Standard  
Wavecal Solution  
VIS Wavecal solution  
Instrument Cal. STD4

**CUSTOMER SUPPLIED**  
2 % HNO3  
10 % HNO3

### ACCESSORIES/COMPONENT NOT INCLUDED

**SERIAL NUMBER**  
077C7042401

**CALIBRATION NUMBER**

**PART NUMBER**  
N069-1579  
N058-2152  
N930-2946  
N930-0221

**EXPIRATION DATE**  
December 30, 2024  
March 30, 2024  
February 28, 2024  
November 30, 2024

**CUSTOMER INITIALS**



MAINTENANCE AND TEST CERTIFICATE MODEL  
OPTIMA 5300DV



MAINTENANCE AND TEST CERTIFICATE MODEL  
OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	January 4, 2024
<b>1. MECHANICAL CHECKS</b>			
A. Inspect and clean all fans and filters.			
B. Inspect and replace as necessary, all torch components including the RF coil.			
C. Inspect all tubing for sign of clacking or leaking.			
D. Adjust water and gas pressure regulator settings.			
E. Inspect and leak check pneumatics drawers.			
F. Clean the exterior of the instrument.			
<b>2. OPTICAL CHECKS</b>			
A. Inspect and clean all optical components.			
B. As required, check and replace all purge filters.			
C. Recheck optical alignment.			
<b>3. COOLING SYSTEM CHECKS</b>			
A. Perform preventive maintenance on chiller.			
B. Flush out the chiller every year.			
<b>4. PERFORMANCE CHECKS</b>			
A. Torch View Alignment.			
B. Wavelength Calibration.			

SERIAL NUMBER : 077C7042401		DATE TESTED : January 4, 2024	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV			
As	193.696 nm	≤ 0.007	0.00529
Ni	231.604 nm	≤ 0.008	0.00672
Ni	341.476 nm	≤ 0.012	0.00793
Spectral Resolution : VIS			
La	408.672 nm	≤ 0.020	0.01588
Ba	455.403 nm	≤ 0.025	0.02280
Precision			
As	193.656 nm	% RSD < 1.0	0.92
Zn	213.856 nm	% RSD < 1.0	0.95
Mn	257.610 nm	% RSD < 1.0	0.75
La	379.478 nm	% RSD < 1.0	0.44
Ba	455.403 nm	% RSD < 1.0	0.46
Ba	493.408 nm	% RSD < 1.0	0.37
Detection Limits : Axial			
Ti	190.080 nm	3(sσ)	19.99
As	193.696 nm	3(sσ)	26.66
Pb	220.353 nm	3(sσ)	1.81
Detection Limits : Radial			
As	193.696 nm	3(sσ)	38.21
Zn	213.856 nm	3(sσ)	2.48
Mn	257.610 nm	3(sσ)	0.59
La	379.478 nm	3(sσ)	5.52
Ba	455.403 nm	3(sσ)	0.13
Ba	493.408 nm	3(sσ)	1.08
BEC : Axial (IB X 500)/(IS-IB)			
Cd	226.502 nm	≤ 150 ppb	141.47
BEC : Radial (IB X 1000)/(S-IB)			
Mn	257.610 nm	≤ 45 ppb	29.04



**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

WO-02612424/2024

**SERIAL NUMBER** 077C7042401 **DATE TESTED** January 4, 2024

**Remarks :**  
Commissioning follow as commissioning performance sheets.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

This is to certify that the above tests have been performed and the configuration tested

☒ meets  
☐ does not meet

the PerkinElmer Specifications listed on this certificate.  
This certificate does not modify PerkinElmer's standard terms and condition of sale,  
including warranty terms.

**Service Department-PerkinElmer Ltd.**

**Authorized Representative:** \_\_\_\_\_  
(  )

**Certificate of System Qualification**

GC-OQ + GCMS-OQ

**System ID:** GC\_MS\_03\_52\_CN10925102  
**Organization Name:** S.P.S Consulting service  
**Organization Location:** 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900

**Date:** March 31, 2023 1:21:52 PM  
**EQP Name:** AgilentRecommended , AgilentRecommended  
**EQP Revision:** GC.02.50, GCMS.02.50  
**Overall Qualification Status:** Pass

**System Inspection and Basic Safety and Operation**

**Name:** 7890  
**Setpoint Status:** Pass

**Overall System Inspection and Basic Safety and Operation Test Status**

Pass

**Inlet Pressure Decay**

**Name:** 7890  
**Front** **SSL**

**Setpoint Status:**

Pass  
Pressure: 25.0 psi

**Pressure Change:** -0.1 psi /5 minutes  
**Agilent Recommended:** >= -2.0 and <= 0.5

**Overall Inlet Pressure Decay Test Status**

Pass

**Inlet Pressure Accuracy**

**Name:** 7890  
**Front** **SSL**

**Date:** March 31, 2023 1:21:52 PM  
**System ID:** GC\_MS\_03\_52\_CN10925102

## Setpoint Status:

Setpoint: 25.0 psi Actual: 25.0 psi  
Inlet Pressure: 25.0 psi  
Accuracy: 0.0 psi  
Agilent Recommended: <= 1.2 psi

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890 Back SSL  
Setpoint Status: Pass

Setpoint: 25.0 psi Actual: 25.2 psi  
Inlet Pressure: 25.0 psi  
Accuracy: 0.2 psi  
Agilent Recommended: <= 1.2 psi

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890 Front FID

## Setpoint Status:

Flow Type: Fuel  
Setpoint: 30.0 mL/min Measured Flow: 30.3 mL/min  
Accuracy: 0.3 mL/min  
Agilent Recommended: <= 10.0 mL/min  
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status:

Flow Type: Oxidizer  
Setpoint: 400.0 mL/min Measured Flow: 396.2 mL/min  
Accuracy: 3.8 mL/min  
Agilent Recommended: <= 10.0 mL/min  
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status:

Flow Type: Makeup  
Setpoint: 25.0 mL/min Measured Flow: 25.1 mL/min  
Accuracy: 0.1 mL/min  
Agilent Recommended: <= 10.0 mL/min  
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890  
Setpoint Status: Pass  
Zone: Oven

Setpoint/Actual: 230.0 230.6 °C  
Temperature: 230.0 230.6 °C  
Accuracy: 0.6 °C  
Agilent Recommended: >= -1.0 °C setpoint in K  
<= 1.0 °C setpoint in K

**Setpoint Status:** **Pass**

Zone: **Oven**

Temperature: **100.0** **100.4** °C

Accuracy: **0.4** °C

Agilent Recommended: **>= -1.0** % setpoint in K **( -3.7 )** °C  
**<= 1.0** % setpoint in K **( 3.7 )** °C

**Overall GC Oven Temperature Accuracy Test Status****Pass****GC Oven Temperature Stability**

**Setpoint Status:** **Pass**

Name: **7890**

Temperature: **100.0** **100.3833** °C

Stability: **0.1** °C

Agilent Recommended: **<= 0.5** °C

**Overall GC Oven Temperature Stability Test Status****Pass****Scouting Run**

**Tested Combination1** Front SSL / Front FID

Name: **Not applicable**

**Setpoint Status:** **Completed**

Injection Volume on Column: **1.0** µL

**Overall Scouting Run Status****Completed****Noise and Drift**

**Tested Combination1** Front SSL / Front FID

Name: **7890**

**Setpoint Status:** **Pass**

Base Signal: **89800** **Ab**

ASTM Noise counts **285.31**

Agilent Recommended: **<= 768.00**

Status: **Pass**

Drift counts/Hr **96.04**

Agilent Recommended: **<= 19200.00**

Status: **Pass**

**Overall Noise and Drift Test Status****Pass****Signal to Noise**

**Tested Combination1** Front SSL / Front FID

Name: **7890**

**Setpoint Status:** **Pass**

Signal to Noise: **3814254**

Agilent Recommended: **>= 300000**

**Overall Signal to Noise Test Status****Pass****Log Amp**

**Tested Combination2** Back SSL / External SQ

Name: **5975C**

**Setpoint Status:** **Pass**

**Overall Log Amp Test Status****Pass****RFPA**

Tested Combination2	Back	SSL	/	External	SQ
Name:	5975C				
Setpoint Status:	Pass				
Amu:	1050	m/z			
Drift After Five Minutes:	1	mV			
Agilent Recommended:	>=	-100	and	<=	100
RPA Voltage:	479	mV			
	<=	1100			

## Overall RPPA Test Status

Pass

## Tune EI

Tested Combination2	Back	SSL	/	External	SQ
Name:	5975C				
Setpoint Status:	Pass				
Filament:	1				
Setpoint Status:	Pass				
Filament:	2				

## Overall Tune EI Test Status

Pass

## Signal to Noise EI

Tested Combination2	Back	SSL	/	External	SQ
Name:	5975C				
Source:	EI - Inert			Filament:	1
Setpoint Status:	Pass				
Signal to Noise:	425				
Agilent Recommended:	>=	160			

Source:	EI - Inert		Filament:	2
Setpoint Status:	Pass			
Signal to Noise:	566			
Agilent Recommended:	>=	160		

## Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose  
This section describes the as found system configuration.

Details	
System	GC_MS_03_52_CN10925102
Manufacturer	Agilent Technologies
Name	7890
Tested Combination1	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No
Tested Combination2	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Back
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10
Sampler 2	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10925120
Firmware Revision	A.01.10.3
Oven Type	Standard
Inlet 1	
Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes
Inlet 2	
Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes
Detector 1	
Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adaptor	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External
Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer: Saenguthai Tarak  
Logged On User Name: saenguthai.tarak@non.agilent.com  
Signature Creation Date: March 31, 2023  
Reason for Signature: Executed protocol and published this original version of document

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

User Name: saanguthal@rock  
Hostname: LAPTOP-CQ3B9K0WV

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:53 PM

GC\_MS\_03\_52\_CN10925150 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:26 AM Audit	SessionCreated		Session	None
March 31, 2023 9:12:26 AM Start	Configuration		Session	None
March 31, 2023 9:12:26 AM Audit	Entitlement		Licensing	User is Notpaying and does not require an unlock code
March 31, 2023 9:20:14 AM Audit	Exp/leased		Session	EQP details for primary technique [GC] - File path: [Protocol]Picks/Gc/Configurations/02.50/Gc.02.50.eqp] EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended]Protocol Revision [Gc.02.50] EQP details for supplemental technique [GCMS] - File path: [Protocol]Picks/Gc/Configurations/02.50/GcMS.02.50.eqp], EQP File Name: [GcMS.02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM End	Configuration		Session	None
March 31, 2023 9:20:27 AM Start	Qualification		Session	OQ
March 31, 2023 9:20:27 AM Start	Execution		System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No segments associated	None
March 31, 2023 9:21:35 AM End	Execution		System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No segments associated	Run Count: 1

Page 11/8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 12/19

User Name: saanguthal@rock  
Hostname: LAPTOP-CQ3B9K0WV

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:53 PM

GC\_MS\_03\_52\_CN10925150 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:21:35 AM Start	Execution		Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 31, 2023 9:21:51 AM End	Execution		Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count: 1
March 31, 2023 9:21:54 AM Start	Execution		Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:21:59 AM End	Execution		Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
March 31, 2023 9:22:02 AM Start	Execution		Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:22:07 AM End	Execution		Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
March 31, 2023 9:22:09 AM Start	Execution		Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:29 AM End	Execution		Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
March 31, 2023 9:22:30 AM Start	Execution		Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:41 AM End	Execution		Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count: 1

Page 2/8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 13/19

User Name: sangipathal.tarek  
Host Name: LAPTOP-QQ38K0MY

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 1:21:53 PM

GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:46 AM	End	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 220.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 220.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:23:34 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 220.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:23:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:26:00 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:26:03 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:26:05 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

Page 3 / 8

Date: March 31, 2023 1:21:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 14 / 19

User Name: sangipathal.tarek  
Host Name: LAPTOP-QQ38K0MY

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 1:21:53 PM

GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 31, 2023 9:27:36 AM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID; - Part of System Preparation - No limits associated	None
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ - Source: None EI - Inert	None
March 31, 2023 9:55:09 AM	Start	Execution	RPPA - 5975C SQ - Source: EI None - Inert	None
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Flammat 1 - L: >= 150	None
March 31, 2023 10:37:53 AM	Start	Execution	Tune EI - 5975C SQ - Source: None EI - Inert Flammat 1 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:04 AM	Start	Execution	Tune EI - 5975C SQ - Source: None EI - Inert Flammat 2 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:11 AM	Start	Execution	Tune EI - 5975C SQ - Source: None EI - Inert Flammat 1 (Qualitative - No setpoints associated)	None

Page 4 / 8

Date: March 31, 2023 1:21:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 15 / 19

User Name: sainguthal.sank  
Host Name: LAPTOP-CQ3IKOMV

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:3 PM

## GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:36:14 AM	Start	Execution	Noise and Drift - Front FID -> Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:36:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID; - Part of System Preparation -	None
March 31, 2023 10:46:28 AM	Audit	Data	No leaks associated GC Scouting Run - Manual Injection, Front SSL, Front FID; - Part of System Preparation - No leaks associated	Data file Path : F:\Data\GC_FID\FID1A.ch
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID; - Part of System Preparation - No leaks associated	Run Count : 1
March 31, 2023 10:58:27 AM	Start	Execution	Noise and Drift - Front FID -> Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID -> Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data file Path : F:\Data\NO_FID\FID1A.ch
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID -> Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID; - Detector FID - L -> 300000	None
March 31, 2023 11:14:32 AM	Audit	AsxClosed	Session	None

Page 6 / 8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 16 / 19

User Name: sainguthal.sank  
Host Name: LAPTOP-CQ3IKOMV

System Id: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:3 PM

## GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:15:13 AM	Audit	AsxClosed	Session	None
March 31, 2023 11:15:14 AM	Audit	Session/Reloaded	Session	None
March 31, 2023 11:15:19 AM	Start	Qualification	Session	OQ
March 31, 2023 11:15:19 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID; - Detector FID - L -> 300000	None
March 31, 2023 11:16:23 AM	Audit	AsxClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AsxClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	Session/Reloaded	Session	None
March 31, 2023 11:21:09 AM	Start	Qualification	Session	OQ
March 31, 2023 11:21:09 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID; - Detector FID - L -> 300000	None
March 31, 2023 11:22:16 AM	Audit	Data	Signal to Noise - Manual Injection, Front SSL, Front FID; - Detector FID - L -> 300000	Data file Path : F:\SN_FID\FID1A.ch
March 31, 2023 11:24:02 AM	End	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID; - Detector FID - L -> 300000	Run Count : 1
March 31, 2023 11:24:17 AM	Start	Execution	Log Amp - 59750 SQ - Source: El - Inert	None
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 59750 SQ - Source: El - Inert	Run Count : 1

Page 6 / 8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 17 / 19

User Name: wangjialin@bruker  
Hostname: LAPTOP-CQ3J9K0NV

System ID: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:53 PM

GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:53 AM	Start	Execution	RFPA - 5975C SQ - Source: EI - Inert	RFPA - 5975C SQ - Source: EI - None
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 5975C SQ - Source: EI - Inert	RFPA - 5975C SQ - Source: EI - Run Count : 1
March 31, 2023 11:27:26 AM	Start	Execution	Tune EI - 5975C SQ - Source: EI - Inert Filament 1 (Qualitative) - No septoria associated	Tune EI - 5975C SQ - Source: EI - None
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ - Source: EI - Inert Filament 1 (Qualitative) - No septoria associated	Tune EI - 5975C SQ - Source: EI - Run Count : 1
March 31, 2023 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ - Source: EI - Inert Filament 2 (Qualitative) - No septoria associated	Tune EI - 5975C SQ - Source: EI - None
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ - Source: EI - Inert Filament 2 (Qualitative) - No septoria associated	Tune EI - 5975C SQ - Source: EI - Run Count : 1
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160
March 31, 2023 12:39:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160
March 31, 2023 1:00:09 PM Audit		Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160	Data files Path : F:\SN_F1_01\DATA\SNIM S
March 31, 2023 1:00:41 PM End		Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L >= 160	Run Count : 1

Page 7 / 8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 18 / 19

User Name: wangjialin@bruker  
Hostname: LAPTOP-CQ3J9K0NV

System ID: GC\_MS\_03\_52\_CN10925102  
Print Date: March 31, 2023 12:15:53 PM

GC\_MS\_03\_52\_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM Start		Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 2 - L >= 160	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 2 - L >= 160
March 31, 2023 1:01:52 PM Audit		Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 2 - L >= 160	Data files Path : F:\SN_F2_01\DATA\SNIM S
March 31, 2023 1:02:59 PM End		Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 2 - L >= 160	Run Count : 1
March 31, 2023 1:02:13 PM End		Qualification	Session	OQ
March 31, 2023 1:02:13 PM Start		Reporting	Session	None
March 31, 2023 1:20:27 PM Audit		Reporting	Session	Report Generated : Certificate

Page 8 / 8

Date: March 31, 2023 12:15:52 PM  
System ID: GC\_MS\_03\_52\_CN10925102

Page 19 / 19

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044  
 Instrument Type : GC  
 Model : CP-3800  
 Serial Number : 00734  
 Organization : S.P.S. Consulting Service Co., Ltd.  
 Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900  
 Date : 09/08/2023

ELECTRONIC TEST

- CPU  
 LCD TEST  
 VENT TEST  
 KEY ECHO TEST  
 DESTRUCTION RAM TEST
- ☒ PASS  
☒ PASS  
☒ PASS  
☒ PASS  
☒ PASS
- ☐ FAIL  
☐ FAIL  
☐ FAIL  
☐ FAIL  
☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector ( FID Channel Front)  
 INJECTOR : Capillary Injector Model 1079

GC CONDITION:

- Column  
 Injector  
 Detector  
 Column flow  
 Makeup flow  
 Air flow  
 Hydrogen flow
- 80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.  
 220 °C  
 300 °C  
 5 mL/min  
 25 mL/min  
 300 mL/min  
 30 mL/min

Column:Capillary Column CP sil 5 CB 0.25 ID x 15 M  
 Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane  
 SENSITIVITY TEST: C15. ( Area count ) = 362,972 Counts.

Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise (µV)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity ( S/N for C15)	19,600	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ( ° C )	80	80	± 5
Injector ( ° C )	220	220	± 5
Detector ( ° C )	300	300	± 5
Incubator ( ° C )	60	N/A	± 5

Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area C15 ( % )	1.52	≤ 5
Retention Time C15( % )	0.01	≤ 0.5





บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkokhuphrom, Pranakorn, Bangkok 10200  
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawati@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD ( < 5 % )	1.52

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Sawat	
Date	09/08/2023	



Comments	
Reviewed by	
Date	09/08/2023



1/1

SERVICE DEPARTMENT



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkokhuphrom, Pranakorn, Bangkok 10200  
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawati@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD ( < 0.5 % )	0.01

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Sawat	
Date	09/08/2023	



Comments	
Reviewed by	
Date	09/08/2023



1/1

SERVICE DEPARTMENT

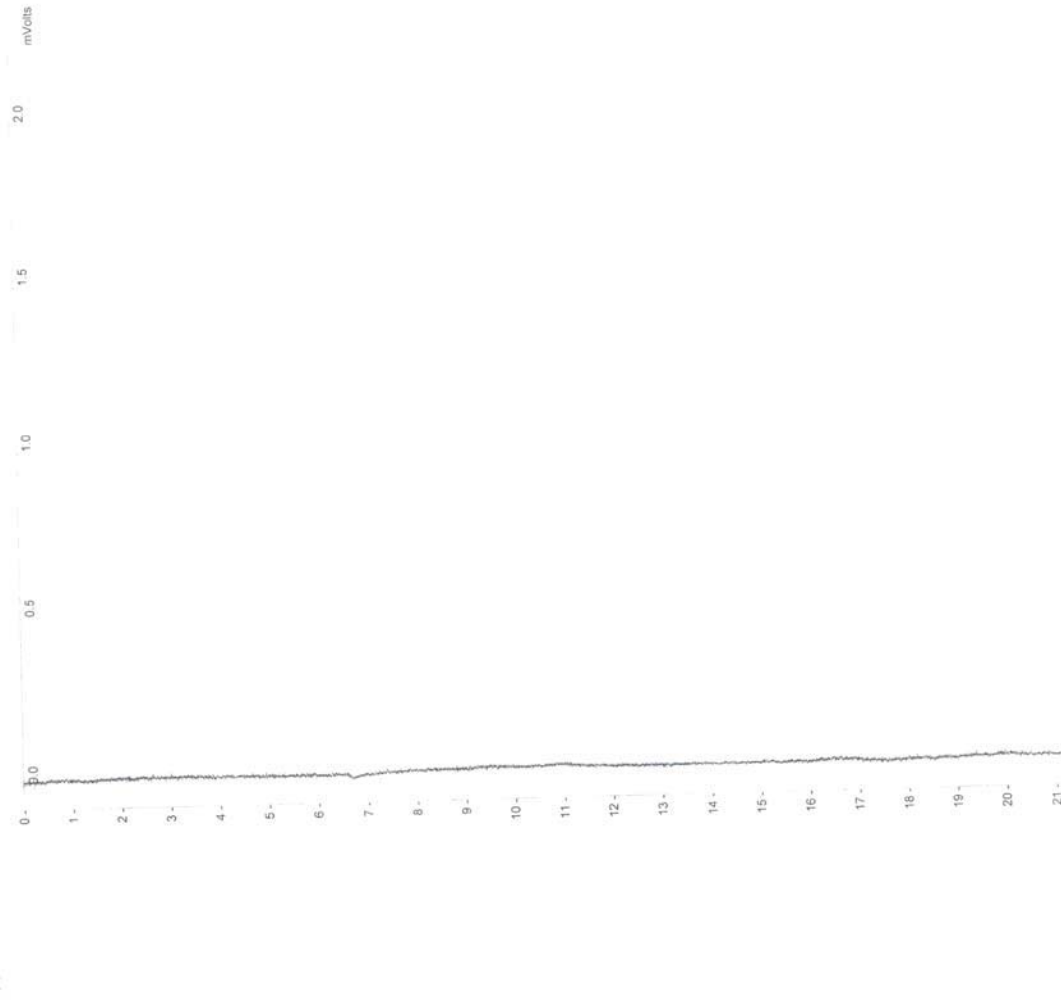
Title : d:\ceia0A gc\ceia0A.N66EA\drive-d\2017\2023\08\blk2023.run  
Run File : C:\star\data\NU\cal2023\baseline FID.mth  
Method File : C:\star\data\NU\cal2023\baseline FID.mth  
Sample ID : BLK2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon  
Workstation: GC-LAB  
Instrument :  
Channel : Front = FID  
Detector Type: 3800 (10 Volts)  
Bus Address : 44  
Sample Rate : 10.00 Hz  
Run Time : 21.208 min

\*\* GC Workstation Version 6.41 \*\* 03334-6390-826-0764 \*\*

Chart Speed = 1.03 cm/min Attenuation = 1 Zero Offset = 3%  
Start Time = 0.000 min End Time = 21.208 min Min / Tick = 1.00



Print Date: Wed Aug 09 13:35:26 2023 Page 1 of 1  
Title : d:\ceia0A gc\ceia0A.N66EA\drive-d\2017\2023\08\blk2023.run  
Run File : C:\star\data\NU\cal2023\baseline FID.mth  
Method File : C:\star\data\NU\cal2023\baseline FID.mth  
Sample ID : BLK2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon  
Workstation: GC-LAB  
Instrument :  
Channel : Front = FID  
Detector Type: 3800 (10 Volts)  
Bus Address : 10.00 Hz  
Sample Rate : 21.208 min  
Run Time

\*\* GC Workstation Version 6.41 \*\* 03334-6390-826-0764 \*\*

Run Mode : Blank Baseline  
Peak Measurement: Peak Area  
Calculation Type: External Standard

Peak No.	Peak Name	Result ( )	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code (sec)	Width 1/2	Status Codes
----	-----	-----	-----	-----	-----	-----	-----	-----
Totals:		0.0000		0.000			0	

Total Unidentified Counts : 0 counts

Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -14 microVolts LSB: 1 microVolts

Noise (used): 19 microVolts - monitored before this run

Manual Injection

\*\*\*\*\*

Title : c:\star\data\tu\cal2023\fid\calfid2023003.run  
Run File : c:\star\data\tu\cal2023\fid\calfid2023003.run  
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth  
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon  
Workstation: Local Disk  
Bus Address : 44  
Sample Rate : 10.00 Hz  
Run Time : 7.993 min  
Detector Type: 3800 (10 Volts)

\*\* GC Workstation Version 6.41 \*\* 03334-6390-826-0764 \*\*

Run Mode : Analysis  
Peak Measurement: Peak Area  
Calculation Type: External Standard

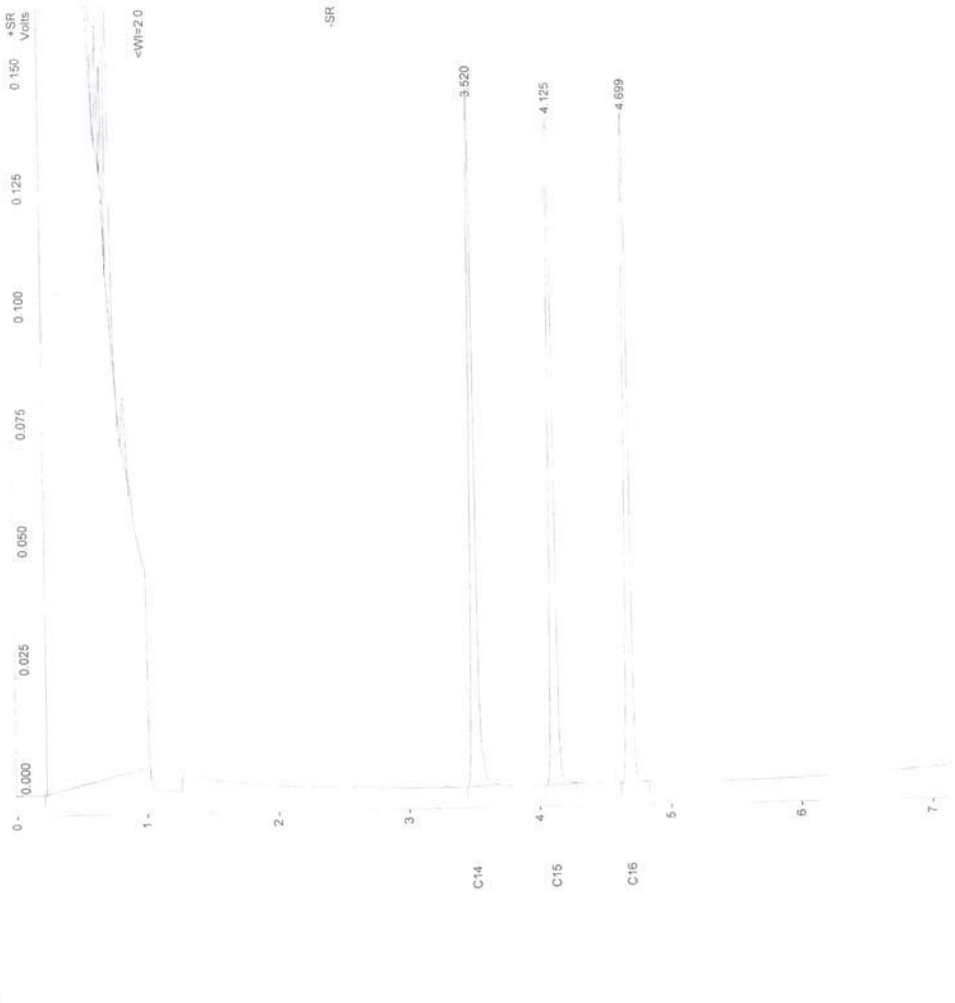
Peak	Peak	Result	Ret. Time	Area	Width
No.	Name	( )	(min)	(counts)	Sec. 1/2
1	C14	33.8385	3.520	362495	2.2
2	C15	33.4804	4.125	357824	2.3
3	C16	32.6143	4.699	344951	2.2
Totals:					
		99.9332	-0.010	1065270	

Status Codes:  
C - Out of calibration range  
Total Unidentified Counts : 0 counts  
Detected Peaks: 3  
Rejected Peaks: 0  
Identified Peaks: 3  
Multiplier: 1  
Divisor: 1  
Unidentified Peak Factor: 0

Baseline Offset: 28 microVolts  
LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual Injection  
Calib. out of range; No Recovery Action Specified



Title : c:\star\data\tu\cal2023\fid\calfid2023003.run  
Run File : c:\star\data\tu\cal2023\fid\calfid2023003.run  
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth  
Sample ID : Manual Sample  
Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40  
Operator : watsamon  
Workstation: Local Disk  
Bus Address : 44  
Sample Rate : 10.00 Hz  
Run Time : 7.993 min  
Channel : Front = FID  
Detector Type: 3800 (10 Volts)  
Chart Speed = 2.73 cm/min Attenuation = 70 Zero Offset = 2%  
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00  
\*\* GC Workstation Version 6.41 \*\* 03334-6390-826-0764 \*\*

Sample ID: fid std

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):

**VARIAN**

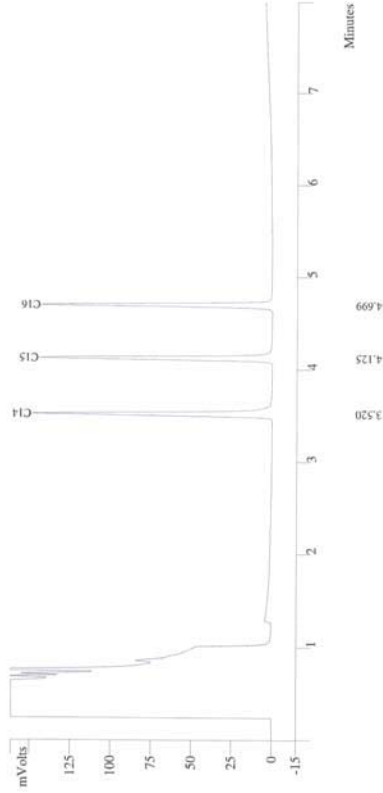
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\cal\2023\fid\cal\fid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		



THAI UNIQUE CO.,LTD.

1 Of 1

Sample ID: fid std

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):

**VARIAN**

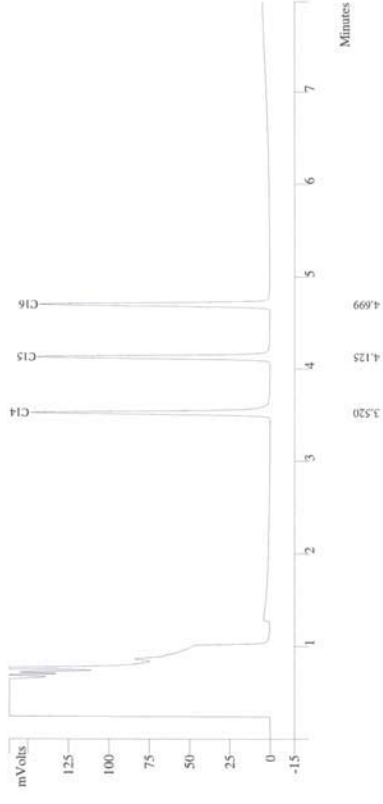
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\cal\2023\fid\cal\fid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9332		1065270		



THAI UNIQUE CO.,LTD.

1 Of 1

Sample ID: fid std

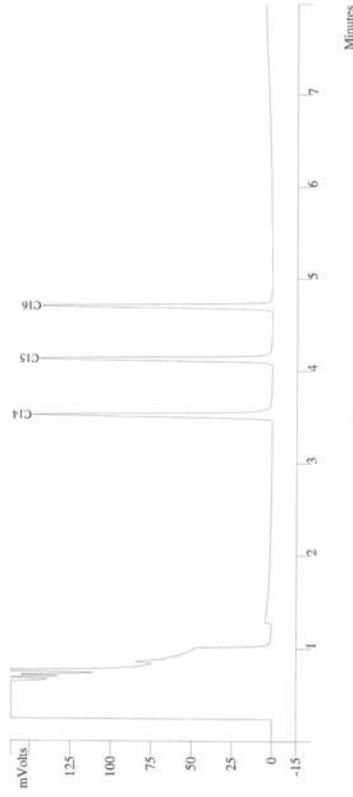
Operator (Inj): Suwarot  
Injection Date: 09/08/2023  
Calc Date: 09/08/2023  
Run Time (min): 7.993  
Workstation: Local Disk  
Instrument (Inj):



Run Mode: Analysis  
Peak Measurement: Peak Area  
Calculation Type: External Std.

c:\star\data\cal\2023\fid\cal\fid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



THAI UNIQUE CO.,LTD.

Sample ID: fid std

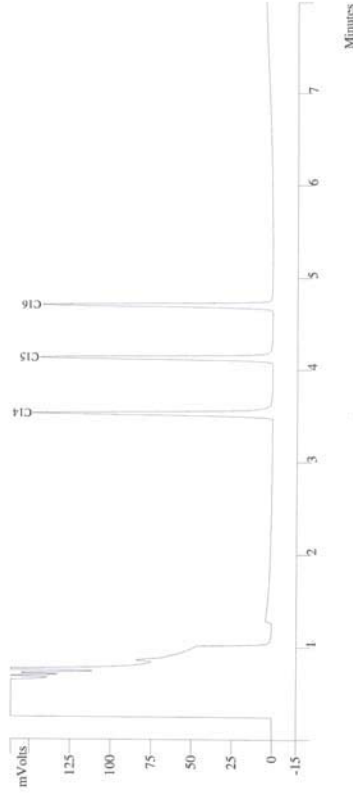
Operator (Inj): Suwarot  
Injection Date: 09/08/2023  
Calc Date: 09/08/2023  
Run Time (min): 7.993  
Workstation: Local Disk  
Instrument (Inj):



Run Mode: Analysis  
Peak Measurement: Peak Area  
Calculation Type: External Std.

c:\star\data\cal\2023\fid\cal\fid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		



THAI UNIQUE CO.,LTD.

Sample ID: fid std

Operator (Inj): Suwarot  
Injection Date: 09/08/2023  
Calc Date: 09/08/2023  
Run Time (min): 7.993  
Workstation: Local Disk  
Instrument (Inj):

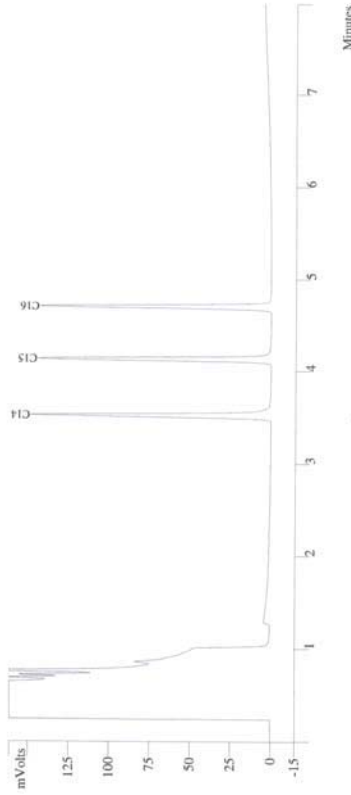


**VARIAN**

Run Mode: Analysis  
Peak Measurement: Peak Area  
Calculation Type: External Std.

c:\star\data\cal\2023\fid\cal\fid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
Totals		99.9552		1087210		



THAI UNIQUE CO., LTD.



Agilent Technologies

## Certificate of Analysis

### FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170  
Sample Lot Number: 0006637856

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

#### Concentrations:

n-tetradecane 0.218 g/L ( $\pm 0.5\%$ ) 0.033 w/w %  
n-pentadecane 0.218 g/L ( $\pm 0.5\%$ ) 0.033 w/w %  
n-hexadecane 0.218 g/L ( $\pm 0.5\%$ ) 0.033 w/w %

#### Solvent: hexane

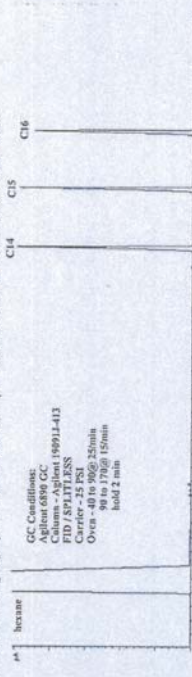
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCCL Z-540-1 and ISO 9001.

#### Purities:

n-tetradecane 99.6%  
n-pentadecane 99%  
n-hexadecane 99%  
hexane 99%

#### Typical Analytical Spectrum or Chromatography

GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 September 2021  
Date of expiration: 31 October 2023

# *Certificate*

It is hereby certified that

**Suwarot Trikinut**

Has successfully completed the Application Training for

**Basic Gas Chromatography and Sampler**

Training Contents were:

**Hardware Operation, Software Operation, Data analysis and**

**Troubleshooting : Model**

**CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC**

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15<sup>th</sup> March, 2019

  
S. Pohitongkam

Service Manager



Certificate No. : 23-148799

Sample Code : 23-56200-001

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkham,  
Siriracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee  
Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date : 25 December 2023

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. : 23-148799

Sample Code : 23-56200-001

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Capacity : Max 81 g / 220 g

Resolution : 0.01 mg / 0.1 mg

Serial No. : 1126323724

ID No. : LABE 05/1

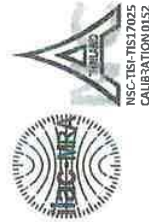
## Result of Calibration

## 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 : 80	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	40 80 40 80	80
<input checked="" type="checkbox"/> Adjustment	Standard weight	40.000054 80.000048 40.000054 80.000048	80.000048
	Average reading of indicator	40.000026 80.000037 40.000017 80.000017	80.000017
	Standard deviation	0.000015 0.000016 0.000008 0.000009	0.000009
Unit : g	Range : 200	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100 200 100 200	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042 200.000041 100.000042 200.000041	200.000041
	Average reading of indicator	100.00003 200.00004 100.00001 200.00001	200.00001
	Standard deviation	0.00005 0.00005 0.00003 0.00003	0.00003

COPY



Certificate No. : 23-148799  
Sample Code : 23-56200-001

## 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 : 80      Range : 200

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	1.00748	0	1.0274
40	0.98753	100	0.9975
80	0.99751	200	0.9975

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	0.000000	0.000000	0.000012	2.05
0.01	0.0100025	0.010000	0.000000	0.000012	2.05
0.1	0.1000019	0.100001	-0.000001	0.000013	2.03
1	1.0000125	1.000001	0.000000	0.000015	2.02
5	5.0000208	5.000004	-0.000002	0.000021	2.00
10	10.0000004	10.000008	-0.000008	0.000026	2.00
20	20.0000030	20.000011	-0.000008	0.000036	2.00
50	50.0000014	50.000014	-0.000013	0.000068	2.00
100	100.0000042	100.000001	-0.000001	0.00016	2.00
150	150.0000056	150.000001	0.000000	0.00022	2.00
200	200.0000041	200.000002	-0.000002	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.

COPY

100

Certificate No. : 23-148799  
Sample Code : 23-56200-001

## REPORT OF CALIBRATION

### Result of Calibration :

#### 4. Eccentric or off-centre loading

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

Weighting pan : ☐ Circle  
☐ Triangular  
☒ Rectangular

Test weight : 50 and 100  
Unit : g

Range	Position	Reading of indicator	Reading of indicator	Unit : g
1	50.00015	50.00022	100.00001	200
2	50.00008	50.00002	100.00001	100.0001
3	50.00016	50.00014	100.00002	100.0000
4	50.00014	0.00013	100.00001	100.0001
5	0.00013		0.0001	
6				

### Condition of Calibration

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

Instrument : STANDARD WEIGHT 1 kg to 1 kg  
Class : E2  
ID No. : LB-WE-79  
Certificate No. : 23-105642  
Due Date : 10 September 2024

- End of Report -

COPY



Certificate No. : 23-148800

Sample Code : 23-56200-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 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 : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 25 December 2023

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. : 23-148800

Sample Code : 23-56200-002

## 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

☐ No adjustment☒ Adjustment☒ Before adjustment☒ After adjustment

Nominal value 100 200 100 200

Standard weight

100.000042 200.000041 100.000042 200.000041

Average reading of indicator

99.9998 199.9998 100.0000 200.0000

Standard deviation

0.00006 0.00007 0.00003 0.00007

Unit :

Range :

☐ Before adjustment☐ After adjustment

Nominal value

Standard weight

Average reading of indicator

Standard deviation



Certificate No. : 23-148800

Sample Code : 23-56200-002

## 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	0.7980		
100	0.8978		
200	0.8978		

## 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	0.000086	2.00
0.01	0.0100025	0.0100	0.0000	0.000086	2.00
0.1	0.1000019	0.1000	0.0000	0.000087	2.00
1	1.0000025	1.0000	0.0000	0.000087	2.00
2	2.0000089	2.0000	0.0000	0.000087	2.00
5	5.0000208	5.0001	-0.0001	0.000088	2.00
10	10.0000004	10.0000	0.0000	0.000090	2.00
20	20.0000030	20.0000	0.0000	0.000093	2.00
50	50.0000014	50.0000	0.0000	0.00011	2.00
100	100.0000042	100.0000	0.0000	0.00016	2.00
200	200.0000041	200.0000	0.0000	0.00028	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

COPY

June



Certificate No. : 23-148800

Sample Code : 23-56200-002

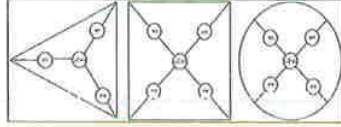
## REPORT OF CALIBRATION

## 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.

Weighing pan		<input checked="" type="radio"/> Circle <input type="radio"/> Triangular <input type="radio"/> Rectangular	Test weight : 100 Unit : g
Range	±20		
Position	Reading of Indicator	Reading of Indicator	
1	100.0000		
2	100.0000		
3	100.0000		
4	99.9999		
5	100.0000		
6	100.0000		
Maximum difference		0.0001	



## Condition of Calibration

1. Calibration Method : W1-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

ID.No.

LB-WE-79

Certificate No.

23-105642

Due Date

10 September 2024

End of Report -

COPY

June

**SK**

S K SALES AND SERVICE CO.,LTD.  
194/56, 194/57 Thakham Rd. Somae Dam  
Bang Khun Thien Bangkok 10150  
Tel.: 02-417-2144 Fax: 02-417-2155



# Certificate of Calibration

Reference No. : C03190/2309-025  
Customer : Eastern Thai Consulting 1992 Co.,Ltd.  
Equipment : 683 Moo 11, Sukhaphiban 8, Tambol Nongkham,  
Manufacturer : Siracha District, Chonburi 20230, Thailand  
Model : Incubator  
Serial No. : Lovibond  
ID No. : TC445S  
Received Date : 0223/007275  
Calibrated Date : 15 September 2023  
Issued Date : 15 September 2023  
Environment : 18 September 2023

Certificate No. : S2309-3014  
Page 1 of 2

	Minimum Value	Maximum Value
Ambient Temperature (°C)	27.5	28.1
Relative Humidity (% RH)	57	58
AC Line Voltage (VAC)	224	226

Place Of Calibration : Production Line  
Calibrated by : Mr. Teerasak Chaiyaporn

Calibration Method :  
In-house method : SK-WI-23 base on Thai Laboratory Accreditation Scheme Publication Reference G-20

## Condition of this result of calibration

- Reference standard instrument
 

Instrument	Serial No.	Certificate No.	Due Date
1) Data acquisition/Switch unit	MY44047397	L2305-268	4 November 2023
2) Multiplexer Module	MY41105123	L2305-268	4 November 2023
- This result of calibration was found accurate as shown on date and place of calibration only
- This certificate can be traceable to International System of Unit :  
Through Thailand Institute of Scientific And Technological Research (TISTR)

Approve :   
Yayak Toolit ☐ Miss Tanlaraporn Petpong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2.0 ,providing a level of confidence level of approximately 95 %

This certificate may not be reproduced other than in full except with the prior written approval of the S K Sales And Service Company Limited

**COPY**

Certificate No.: S2309-3014

Table1 General Information

Working Area (W*L*H) Fresh Air	60 *56 *145 cm OFF
-----------------------------------	-----------------------

Table2 Chamber Performance

Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)									Uncertainty (± °C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
20.0	19.52	19.40	19.70	19.43	19.33	19.39	19.45	19.58	19.67	0.55

Resolution : 0.1 °C

\* Probe No. 9 is Reference Probe



- Notes :
- The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
  - The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
  - Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
  - The reported uncertainty of measurement were excluded Uniformity and Stability

\*\* End of Calibration Report \*\*

**COPY**



## CERTIFICATE OF CALIBRATION

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

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

Equipment : Temperature controlled enclosures (Incubator)  
Manufacturer : Lovibond Model : Tc445S  
Serial No. : 0520/005227 ID No. : LABE 19/5  
Date of Receipt : 21 April 2023 Date of Calibration : 21 April 2023

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : Maximum 36.1 °C Minimum 34.5 °C  
1.2 Relative humidity : Maximum 51.8 % Minimum 49.3 %  
1.3 Line voltage supplied : Maximum 224.7 VAC Minimum 221.9 VAC

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P100)	LB-DA-08 (RTD-239 to RTD-247)	22-077888	09 August 2023

## 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. Sarawoot Thammo

Approved by

(Mr. Somchai Neampunt)

Scientist

24 April 2023

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 is 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-114

TEL 02-516-2422

FAX 02-516-6949

Rev 01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

(Effective date: 15/1/21)



## REPORT OF CALIBRATION

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8		
20	20.0	20.06	19.92	19.96	19.89	19.93	20.08	19.97	19.79	19.86	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.32	0.37	0.85

## Notes

UUC\* = Unit Under Calibration

COPY

TEL 02-516-2422  
FAX 02-516-6949  
Rev 09361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-016CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective date: 15/1/21



## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkham,  
Siracha, Chonburi 20230Location 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 : 09 January 2024  
Date of Calibration : 09 January 2024

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : Maximum 30.6 °C : Minimum 29.2 °C  
1.2 Relative humidity : Maximum 57.5 % : Minimum 46.4 %  
1.3 Line voltage supplied : Maximum 229.5 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 LB-DA-10 (RTD-257 to RTD-265) 23-066256 29 June 2024  
(RTD-PT100)

## 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. Sarawoot Thamno

Approved by

(Mr. Somchai Nearpunt)

Issue date

09 January 2024

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,

Phaholapha, Wang Thonglang, Bangkok 10310

FM-QC-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

Certificate No. : 24-001944  
Sample Code : 24-00963-001

## Results of Calibration

Resolution : 0.1 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	UUC*	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>Ref</sup>	
60	60.0	60.0	60.04	59.90	59.81	59.84	59.47	59.91	60.08	59.98	59.87	2.00
85	85.0	85.0	86.07	85.75	85.58	85.62	84.69	85.63	86.28	85.94	85.77	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
60	0.11	0.49	0.80
85	0.09	1.13	1.72

## Notes

UUC\* = Unit Under Calibration

COPY

361 Soi Ladprao 122, Ladprao Road,  
Phaholapha, Wang Thonglang, Bangkok 10310  
FM-QC-018TEL 02-516-2422  
FAX 02-516-6949  
Rev.09CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective Date: 15/10/21



## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 24-001944

Sample Code : 24-00963-001

### 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 :  
 $W = 40 \text{ cm}$  ;  $D = 28 \text{ cm}$  ;  $H = 39 \text{ cm}$
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

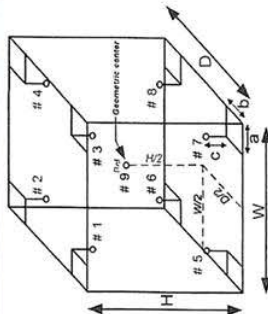


Figure: Example of sensor installation Positions

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

- End of Report -

**COPY**



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




NSC-TB-TS 1925  
CALIBRATION

CERTIFICATE No : 23T10864  
REFERENCE No : 71117-1

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 CO., LTD.  
683 MOO 11, SUKHAPIBAN 8 ROAD, NONGKHAM,  
SRIRACHA, CHONBURI 20230

**CALIBRATED BY** : CHARUKIT L.  
**CALIBRATION DATE** : 09-Nov-23  
**APPROVED BY** :   
**ISSUED DATE** : 09-Nov-23  
**RECEIVED DATE** : 02-Nov-23

**COPY**

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

F-G010 REV 03



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

CERTIFICATE No : 23T10864

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** : 02-Nov-23  
**AMBIENT TEMPERATURE** : 23 °C ± 3 °C  
**SERIAL NUMBER** : 43560  
**TYPE** : TOTAL IMMERSION  
**CALIBRATION DATE** : 09-Nov-23  
**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	23T3927	08-Mar-24
2) SPRT PROBE	5614	636636	23T3927	08-Mar-24
3) PRECISION BATH	7320	A21105	22T13199	14-Dec-23
4) PRECISION BATH	CTR-40	A68155	22T13198	09-Dec-23
5) PRECISION BATH	6045	3C023	22T13200	19-Dec-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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)
0.009	0.0	60	0.0090	N/A	0.26
25.01	25.0	165	0.0050	N/A	0.26
50.00	50.0	275	0.0040	N/A	0.26
99.991	100.0	360	-0.009	29.3	0.26

### UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**COPY**

**COPY**

F-G010 REV

NSC-TIS-7517025  
CALIBRATION0152

Page 1 of 3

## CERTIFICATE OF CALIBRATION

Supersedes to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

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

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

Equipment : pH Meter

Manufacturer : METTLER TOLEDO

Serial No. : B448305208

Date of Receipt : 09 January 2024

Condition of Calibration : SevenCompact S220

ID No. : LABE 11/4

Date of Calibration : 09 January 2024

1. Environment

1.1 Ambient temperature : 22.4 ± 0.2 °C

1.2 Relative humidity : 56.4 % ± 2.1 %

2. Calibration method

In house method WI-CL-019: based on direct measurement by using standard voltage calibrator and using certified reference material (CRM).

## 3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-AMC-01	23E3244	03 October 2024
3.2 Digital Thermometer	LB-TH-33	23-098974	25 August 2024
Certified Reference Material			
3.3 Buffer Solution pH 4.008	919273	PH276L5	24 September 2025
3.4 Buffer Solution pH 6.986	941727	PH107L5	06 November 2024
3.5 Buffer Solution pH 9.997	919278	PH220L5	24 September 2024

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

- 4.1 Instrument No. 3.1 through Technology Promotion Association (Thailand-Japan).
- 4.2 Instrument No. 3.2 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.
- 4.3 Buffer Solution No. 3.3 and No. 3.5 traceable to CPA chem (through primary measurement method-Harned cell using calibrated thermometer, barometer, and nanovoltmeter Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).
- 4.4 Buffer Solution No. 3.4 traceable to CPA chem (CPA RefN HARNED CELL LoIN 61275737; CPA RefN HARNED CELL LoIN 61273866 Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).

5. This result of calibration was found accurate as shown on date and place of calibration
6. Condition of calibration item : Normal

Calibrated by : Mr. Nuttaput Timula

Scientist

Issue date : 31 January 2024

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

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

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310

FM-CL-11-1

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

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH

Rev 01

Effective Date: 15/10/21

NSC-TIS-7517025  
CALIBRATION0152

Page 2 of 3

## REPORT OF CALIBRATION

Supersedes to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

Equipment : pH Meter

Manufacturer : METTLER TOLEDO

Serial No. : B448305208

Range : -2.000 pH to 20.000 pH ; ± 2000.0 mV ; -5.0°C to 130.0°C

Resolution : 0.01 pH ; 0.1 mV ; 0.1 °C

Model : SevenCompact S220

ID No. : LABE 11/4

## Results of Calibration

Part 1. DC Voltage measurement

pH Meter Serial No. : B448305208

Nominal Value	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	413.9	0.00	± 0.083	2.00
4	177.477	177.4	4.00	± 0.083	2.00
7	0.000	0.1	7.00	± 0.083	2.00
10	-177.477	-177.3	10.00	± 0.083	2.00
14	-414.113	-413.8	14.00	± 0.083	2.00

## Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO

Electrode Serial No. : 2453982

Model : InLab Expert Pro-ISM

Three-Point Calibration at pH4, pH7 and pH10

Percent Slope : 98.3

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.01	182.1	0.002	± 0.010	2.00
6.986	7.00	7.8	0.014	± 0.011	2.00
9.997	10.01	-167.2	0.013	± 0.011	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.



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-11-1

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

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH

Rev 01

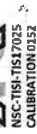
Effective Date: 15/10/21

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

CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH

Rev 09

Effective Date: 15/10/21



## REPORT OF CALIBRATION

Supersede to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

Equipment : pH Meter (Digital Thermometer with sensor)

## Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220  
Serial No. : 8448305208 ID No. : LABE11/4  
Resolution : 0.1 °C Range : -5.0 °C to 130.0 °C

Thermometer sensor  
Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM  
Serial No. : 2453982 ID No. : N/A

## Condition of Calibration

1. Environment  
1.1 Ambient temperature : 22.6 °C ± 0.1 °C  
1.2 Relative humidity : 55.1 % ± 3.3 %

## 2. Calibration method

- 2.1 The calibration use in house method WI-CL-021 : by comparison with standard thermometer  
2.2 The calibration by comparison unit under calibration (UUC) to the standard thermometer in a calibration bath at the controlled temperature.  
2.3 The temperature scale in use of this laboratory is the international temperature scale of 1990 (ITS-90).

## 3. Reference standard instrument

Instrument	Model	ID. No.	Certificate No.	Due date
3.1 Resistance Thermometer	PT-100	RTD-90	23-098974	25 August 2024
3.2 Thermometer Readout	GT-11	LB-TH-33	23-098974	25 August 2024

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Accreditation Under TLAS Laboratory Calibration No.0152)

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

## 6. Condition of Calibration item : Normal

## Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration		Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C		
25	25.000	120	25.0	± 0.14	2.00

## Notes

- Calibration results without adjustment

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M0003

- End of report -



Page 1 of 3

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

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapitban 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 : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 31 May 2022

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

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

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

361 Soi Ladprao 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-007  
TEL 02-516-2422  
FAX 02-516-6949  
Rev.05  
CONTACT@AMARC.CO.TH  
WWW.AMARC.CO.TH  
Effective date: 15/10/21



Page 2 of 3

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

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

### Result of Calibration :

☒ Without adjustment

☐ 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 ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation (mg)	Conventional Mass	Expanded Uncertainty (mg)	Maximum Permissible Error $\pm$ (mg)	ID No.
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 multiplied by the coverage factor  $k = 2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

**COPY**

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



NSC-TSI-TSI 7025  
CALIBRATION 0152

Page 3 of 3

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

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature  $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ , Relative humidity  $50\% \pm 10\%$  and air density  $1.20 \text{ kg/m}^3$
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-WF-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**



Certificate No. : 22-052239

Sample Code : 22-19150-004

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 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 31 May 2022

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

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

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

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

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

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

Page 2 of 3

Certificate No. : 22-052239

Sample Code : 22-19150-004

## REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

## Result of Calibration :

☒ Without adjustment☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M5003

COPY

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

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

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

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

## 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  $1.18 \text{ kg/m}^3$
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-WF-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

### 6. Description of Calibrated Item :

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

- End of Report -

*Lamhai*

**COPY**



Certificate No. : 22-052237

Sample Code : 22-19150-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapiban 8 Rd., Nongkham,

Sriracha, Chonburi 20230

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee

Scientist

31 May 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 122, Ladprao Road,  
Phlabphla, Wang Thonglang, Bangkok 10310  
FM-CL-017

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

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



Certificate No. : 22-052237

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 ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

Description	Deviation (mg)	Conventional Mass	Expanded Uncertainty (mg)	Maximum Permissible Error $\pm$ (mg)	ID No.
50 g	-0.111	49.998889 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

COPY

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. : 22-052237  
Sample Code : 22-19150-002

Page 3 of 3

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m<sup>3</sup>
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 -

*Signature*

**COPY**

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23037  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No. : 34802645

ID No. :

Condition As Found : GOOD

Customer :

EASTERN THAI CONSULTING 1992 CO., LTD.  
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,  
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

Location :

Ambient Temperature : ( 23.0  $\pm$  3 ) °C

Pressure : ( 101.3  $\pm$  3 ) kPa

Relative Humidity : ( 50.0  $\pm$  20 ) %

Received Date : 06 SEPTEMBER 2023

Calibration Date : 12 OCTOBER 2023

Date of Issue : 16 OCTOBER 2023

Calibrated by :

Natthakorn Pisutpaisan

Approved by :

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

COPY

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23037  
Job No. : VC66AC0097  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL.BP 31/0268	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

COPY

7. Peth.

Continuation of Calibration Certificate

Cert. No. : ACC23037  
Job No. : VC66AC0097  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.94	-0.06	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.24	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

\_\_\_\_\_ End of Calibration Certificate

**COPY**

*Signature*



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

MTC No. EEL. BP. 13/0267

## CALIBRATION CERTIFICATE

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

**Address** : 683 Moo 11, Sukhapibarn 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-42A  
**Serial No.** : 00322757  
**Microphone** : UC-52 No.196481  
**Preamplifier** : NH-24 No.15489

### Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
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. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 5 Feb. 2024

**Date of Calibration** : 6 Mar. 2024

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

FM.BL.MTC.002 Rev.1

**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 : [surnalee@tistr.or.th](mailto:surnalee@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 : [surnalee@tistr.or.th](mailto:surnalee@tistr.or.th)

FM.BL.MTC.002 Rev.1

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

**Date of Calibration** : 6 Mar. 2024

2 / 9

COPY

COPY

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.92	114.0	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
15.6	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	12.1	0.10	N/A
C-Weight	17.6	0.10	N/A
Flat	23.3	0.10	N/A

Date of Calibration : 6 Mar. 2024

The results relate only to the items tested/calibrated or value assigned. Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

FM.BLMTC.002 Rev.1

COPY 3/9

### 3. Acoustical signal test of frequency weightings

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

### 4. Electrical signal test of frequency weightings

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

Date of Calibration : 6 Mar. 2024

The results relate only to the items tested/calibrated or value assigned. Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

FM.BLMTC.002 Rev.1

COPY 4/9



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

### 5. Long-term stability

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

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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



Date of Calibration : 6 Mar. 2024

The results relate only to the items tested/calibrated or value assigned. Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

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

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 : tistr@tistr.or.th

FM.BL.MTC.002 Rev.1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 13/0267

### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3



Date of Calibration : 6 Mar. 2024

The results relate only to the items tested/calibrated or value assigned. Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

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

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 : tistr@tistr.or.th

FM.BL.MTC.002 Rev.1

### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

### 8. Level linearity including the level range control

At reference sound level on the reference level range

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

Date of Calibration : 6 Mar. 2024

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

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
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

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.

### 8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
	0.25	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 6 Mar. 2024

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

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

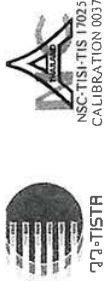
Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

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

Office  
196 Phahonyothin Road, Chatuchak Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592

FM.BL.MTC.002 Rev.

COPY



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. BEL. BP. 13/0267

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	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 value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.6	136.6	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated

Approved by :



Director  
Electrical and Electronics Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 6 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267020500503005

End of Certificate

9 / 9

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM(BL)MTC.002 Rev.1

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 : nrmh@nist.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 : 106 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



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL BP. 11/0267

## CALIBRATION CERTIFICATE

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

Address : 683 Moo 11, Sukhapibarn 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-42A  
Serial No. : 00322744  
Microphone : UC-52 No.196467  
Preamplifier : NH-24 No.15476

### Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
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. Pisonophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 5 Feb. 2024

Date of Calibration : 5 Mar. 2024

The results relate only to the items tested/calibrated or value assigned  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office : 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, 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 : 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.BLMTC.002 Rev./



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL BP. 11/0267

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 : 5 Mar. 2024

2 / 9

The results relate only to the items tested/calibrated or value assigned  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office : 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, 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 : 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.BLMTC.002 Rev./



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 11/0267

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value(dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.92	113.8	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.2 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.9	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	12.4	0.10	N/A
C-Weight	17.9	0.10	N/A
Flat	23.1	0.10	N/A

Date of Calibration : 5 Mar. 2024

The results relate only to the items tested/calibrated or value assigned.  
Advising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.1

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 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2323 9165



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 11/0267

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.1	0.3	0.4	1.5	0.45	0.6
1 000	0.0	0.0	-0.1	1.0	0.45	0.6
8 000	-0.2	-0.2	-0.2	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

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

Date of Calibration : 5 Mar. 2024

The results relate only to the items tested/calibrated or value assigned.  
Advising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.1

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 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2323 9165



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 11/0267

### 5. Long-term stability

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

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

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

#### 6.2 Time weightings at 1 kHz

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

Date of Calibration : 5 Mar. 2024

5/9



The results relate only to the items tested/calibrated or value assigned  
Advising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.

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/Laboratory  
Sri 1.C. 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



NSC-TIS-TIS 17025  
CALIBRATION 0037

NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 11/0267

### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.1	0.1	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
129	129.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.1	0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3

Date of Calibration : 5 Mar. 2024

6/9



The results relate only to the items tested/calibrated or value assigned  
Advising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.

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/Laboratory  
Sri 1.C. 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

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	26.0	0.0	1.1	0.30	0.3
25	25.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

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

Date of Calibration : 5 Mar. 2024

8/9

The results relate only to the items tested/calibrated or value assigned  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
	0.25	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 5 Mar. 2024

8/9

The results relate only to the items tested/calibrated or value assigned  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. BEL. BP. 11/0267

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Complete cycle	125.4	125.2	-0.2	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 value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Positive one-half cycle	Negative one-half cycle				
136.5	136.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by

Approved by :



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267020500503003

End of Certificate

9 / 9

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

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

FM.BLMTC.002 Rev.

**Head Office**  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2377 9000  
Fax. (66) 0 2377 9009  
E-mail : nunnasamster.nr.th.Wskstn@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  
F-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 : sunalee@tistr.or.th



Acoustic Laboratory (Thailand) Co., Ltd.  
6/57 Soi Phom Sin 42, Sai Mai, Sai Mai, Bangkok 10220  
Tel: (+66) 02-1296780 Email: info@altbkk.com



## Certificate of Calibration

Certificate No.: S2402-0651-01

### Customer:

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

### Date of calibration:

2024-03-04

### Date of issue:

2024-03-26

### Instrument Calibrated:

Sound Level Meter

### Manufacturer:

Rion

### Model:

NL-42A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)

### Serial no:

00322755 (Meter), 21960 (Microphone), 22336 (Preamplifier)

### Calibration and verification performed:

Acoustical levels are stated relative to 20µPa. Other dB levels are relative values.  
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.  
The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

### Preconditioning:

The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

### Instruments and Program:

A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

### Equipment standards used:

- Sound measuring equipment calibration unit 483B S/N31083
- Digital multimeter Keysight S/N HP34401A
- Ultra-low distortion function generator Stanford SRS DS360 S/N123625
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NN2520568

### Traceability

The measured values are traceable to following the ISO/IEC 17025 laboratories:

Sound Pressure Level: EEL, Thailand

Reference Pressure, Humidity and Temperature: TPA, Thailand

Voltage: TPA, Thailand

Frequency: TPA, Thailand

**COPY**

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.



Certificate No.: S2402-0651-01

### Environmental conditions:

Reference conditions:

Measurement conditions:

Pressure:

101.325 kPa

100.87 ± 0.10 kPa

Temperature:

23.0 °C

23.5 ± 1.0 °C

Relative humidity:

50 %RH

57.0 ± 2.0 %RH

### 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)		Deviated value (dB)	Acceptance limit (dB)
	Before adjust	After adjust		
93.9	93.9	93.9	0.0	±1.0

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator Type NC-75 S/N: 34234715

### 2. Self-generated noise

Frequency weightings		Measured value (dB)
A-Weighting		10.8
C-Weighting		15.3
Z-Weighting		20.7

### 3. Electrical signal test of frequency weighting at 91 dB

Frequency (Hz)	Deviation from various frequency weighting response curve			
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)	Acceptance limit (dB)
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	-0.1	-0.2	±2.0
4000	-0.3	-0.3	-0.3	±3.0
8000	0.1	0.1	0.0	±5.0

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

**COPY**

Registration number 0105564086235  
6/57 Poemsin Soi 42, Sai Mai, 10220 Bangkok Thailand  
Tel (+66) 02-1296780 Email: info@altbkk.com  
www.altbkk.com

## 4. Frequency and time weighting at 1 kHz

## 4.1 Frequency weighting at 1 kHz

Frequency weightings	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
A	94.0	0.0	$\pm 0.3$
C	94.0	0.0	$\pm 0.3$
Z	94.0	0.0	$\pm 0.3$

## 4.2 Time weighting at 1 kHz

Time weightings	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Fast	94.0	0.0	$\pm 0.3$
Slow	94.0	0.0	$\pm 0.3$
L/Aeq	94.0	0.0	$\pm 0.3$

## 5. Long term stability

Time interval (mm:ss)	Start level (dB)	Stop level (dB)	Deviated value (dB)	Acceptance limit (dB)
28:58	94.0	94.0	0.0	$\pm 0.3$

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

COPY

## 6. Level linearity on the reference level range

## 6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
84.0	84.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
92.6	92.6	0.0	$\pm 1.1$
93.6	93.6	0.0	$\pm 1.1$
94.6	94.6	0.0	$\pm 1.1$
95.6	95.6	0.0	$\pm 1.1$
96.6	96.6	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.1	0.1	$\pm 1.1$
40.0	39.9	-0.1	$\pm 1.1$
39.0	38.9	-0.1	$\pm 1.1$
38.0	38.0	0.0	$\pm 1.1$
37.0	37.0	0.0	$\pm 1.1$
36.0	36.0	0.0	$\pm 1.1$

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

COPY

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
40.0	40.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
38.0	38.0	0.0	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

**COPY**

6.3 Measured at 8 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.9	130.9	0.0	±1.1
131.9	131.9	0.0	±1.1
132.9	132.8	-0.1	±1.1
133.9	133.9	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	78.9	-0.1	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	63.9	-0.1	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
40.0	39.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
38.0	37.9	-0.1	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

**COPY**

7. Tone burst response

Time weightings	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Fast	200	133.0	0.0	±1.0
	2	116.0	0.0	+1.0,-2.5
Slow	0.25	107.0	0.0	+1.5,-5.0
	200	126.6	0.0	±1.0
SEL	2	107.0	0.0	+1.0,-5.0
	200	127.0	0.0	±1.0
	2	107.0	0.0	+1.0,-2.5
	0.25	97.9	-0.1	+1.5,-5.0

8. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Complete cycle	128.4	127.4	-1.0	±3.0
Positive half cycle	130.4	130.1	-0.3	±2.0
Negative half cycle	130.4	130.1	-0.3	±2.0

9. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit (dB)
Positive one half cycle	Negative one half cycle	0.2	±1.5
139.1	138.9		

10. High level stability

Initial level (dB)	Final level (dB)	Deviated value (dB)	Acceptance limit (dB)
135.0	135.0	0.0	±0.3

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

Uncertainty of measurement

Parameters	Uncertainty
1. Indication at the calibration check frequency	0.12 dB
2. Self-generated noise	
- Frequency Weighting A	0.090 dB
- Frequency Weighting C	0.13 dB
- Frequency Weighting Z	0.090 dB
3. Electrical signal test of frequency weighting	0.13 dB
4. Frequency and time weightings at 1 kHz	0.13 dB
5. Long term stability test	0.10 dB
6. Level linearity on the reference level range	0.14 dB
7. Tone burst response	0.14 dB
8. Peak C sound level	0.13 dB
9. Overload indication	0.13 dB
10. High level stability test	0.10 dB

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%

Remark : The acoustical signal test of frequency weighting at 125Hz, 1kHz, and 8kHz is not included, along with correction values for environmental conditions in a free-field or diffuse field, and the effect of reflection and diffraction on the measurement microphone and the sound level meter.

Replacement Calibration Certificate for calibration certificate number S

Calibrated By

Approved By:

(Mr. Pitupong Saraphin)

Date of calibration : 2024-03-04  
2024-03-26  
Date of issue : 2024-03-26

----- End of Certificate of Calibration -----

COPY

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206868

Certificate Number:

206868

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.13 kPa

Temperature: 22.0 °C

Humidity: 37.0 %

After

Pressure: 100.15 kPa

Temperature: 21.9 °C

Humidity: 35.4 %

Cirrus Research plc

Acoustic House

Bridlington Road

Hummanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory

N Smith

Electronically signed:

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR:110A

Serial number:

CB1497

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 8 Rd., Nongkham,  
Sriacha, Chonburi 20230

Test summary

Date of calibration:

19 January 2024

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.

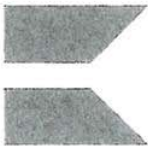
Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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. The certificate may only be used to evidence the accuracy of the items calibrated. The results are valid only for 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%.

COPY

COPY



Cirrus Research plc

Acoustic House

Bridlington Road

Hunmanby


North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory  
N.Smith

Electronically signed:  


Dosimeter : IEC 61252-1993+A

**Instrument information**

Manufacturer: Cirrus Research plc      Notes: Eastern Thai Consulting 1992 Co., Ltd.  
Model: CR:110A      683 Moo.11, Sukaphibai 8 Rd., Nongkham,  
Serial number: CB1498      Sriracha, Chonburi 20230  
Firmware version: 5.4

**Test summary**

Date of calibration: 19 January 2024

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	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

**Notes**

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%.

**Environmental conditions**

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

<b>Before</b>	Pressure: 100.96 kPa	Temperature: 21.6 °C	Humidity: 33.2 %
<b>After</b>	Pressure: 100.97 kPa	Temperature: 21.5 °C	Humidity: 33.4 %

**Test results summary**

Test	Result
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies
Absolute Acoustic Sensitivity	Complies

COPY

COPY

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206866

CERTIFICATE OF CALIBRATION

Certificate Number:  
206866

Page 2 of 2



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

Page 1 of 2

Approved signatory  
N.Smith  
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:  
Cirrus Research plc

Model:  
CR 110A

Serial number:  
CB1500

Firmware version:  
5.4

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

Test summary

Date of calibration:  
19 January 2024

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	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE.952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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 expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor K=2, providing a coverage probability of approximately 95%.

Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 34.1 %

After

Pressure: 100.95 kPa

Temperature: 21.6 °C

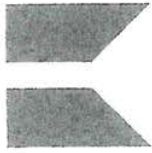
Humidity: 34.7 %

Test results summary

Test	Result
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies
Absolute Acoustic Sensitivity	Complies

COPY

COPY



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

Page 1 of 2
Approved signatory N.Smith
Electronically signed:



Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc  
Model: CR-110A  
Serial number: CB1365  
Firmware version: 5.4

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

Test summary

Date of calibration: 19 January 2024

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	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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 in whole or in part, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items described. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Environmental conditions

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

Before Pressure: 99.92 kPa Temperature: 21.7 °C Humidity: 33.2 %  
After Pressure: 99.96 kPa Temperature: 21.8 °C Humidity: 34.2 %

Test results summary

Test	Result
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies
Absolute Acoustic Sensitivity	Complies

COPY

COPY

# CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206871



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

## Dosimeter : IEC 61252-1993+A1:2000

### Instrument information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: CB0643  
Firmware version: 5.4

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

### Test summary

Date of calibration: 19 January 2024

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	SIGLENT	SDG1032X	SDG1XDDQ8R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

### Notes

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%.

# CERTIFICATE OF CALIBRATION

### Environmental conditions

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

Before Pressure: 100.93 kPa Temperature: 21.6 °C Humidity: 36.1 %  
After Pressure: 100.92 kPa Temperature: 21.5 °C Humidity: 35.5 %

### Test results summary

Test	Result
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies
Absolute Acoustic Sensitivity	Complies

COPY

COPY

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206881

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

Page 1 of 2

Approved signatory  
N.Smith

CERTIFICATE OF CALIBRATION

Certificate Number:  
206877

Page 2 of 2

Environmental conditions

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

Before	Pressure: 100.90 kPa	Temperature: 21.3 °C	Humidity: 31.5 %
After	Pressure: 100.91 kPa	Temperature: 21.5 °C	Humidity: 32.6 %

Test results summary

Test	Result
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies
Absolute Acoustic Sensitivity	Complies

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:  
Cirrus Research plc

Model:  
CR:110A

Serial number:  
CB1499

Firmware version:  
5.4

Notes:

Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 8 Rd., Nongkham,  
Srracha, Chonburi 20230

Test summary

Date of calibration: 19 January 2024  
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	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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 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%.

COPY

COPY