



ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ





JIRANATEE ASSOCIATES CO.,LTD.

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

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-039-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5028A
SERIAL NUMBER : 1547
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : SGS (Thailand) Limited (Head Office)
238 TRR Tower, 19th-21st Floor, Naradhiwas Rajanagarindra Road,
Chong Nonsi, Yannawa, Bangkok 10120.

RECEIVED DATE : 23 Sep 2025
MEASUREMENT DATE : 24 Sep 2025
ISSUE DATE : 24 Sep 2025

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0016-25.

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'

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.0 °C and 50.4 %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.

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	Y	Standard Flow [Q_s] m ³ /min
1	0.702	752.272	22.79	22.18	41.514	0.969	0.983	0.663
2	1.001	752.276	23.14	22.54	28.186	2.150	1.463	0.962
3	1.118	752.254	23.32	22.84	23.157	2.749	1.654	1.081
4	1.163	752.233	23.28	22.90	21.278	3.014	1.732	1.127
5	1.412	752.178	23.32	22.91	13.073	4.622	2.145	1.383

Slope (m): **1.61333**
Intercept (b): **-0.08705**
Correlation coefficient (r): **0.99977**
Uncertainty ($k=2$): **0.015** m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	Y	Standard Flow [Q_s] m ³ /min
1	0.702	752.272	22.79	22.18	41.514	0.969	0.617	0.664
2	1.001	752.276	23.14	22.54	28.186	2.150	0.920	0.966
3	1.118	752.254	23.32	22.84	23.157	2.749	1.041	1.085
4	1.163	752.233	23.28	22.90	21.278	3.014	1.090	1.132
5	1.412	752.178	23.32	22.91	13.073	4.622	1.350	1.389

Slope (m): **1.01034**
Intercept (b): **-0.05459**
Correlation coefficient (r): **0.99977**
Uncertainty ($k=2$): **0.015** m³/min

End of Certificate of Calibration



รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd.

วันที่ : 19 มีนาคม 2568

รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T200

หมายเลขอุปกรณ์ / เครื่องมือ : 2199

TEST VALUES			
API MODEL T200		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500.0
2	STABILITY	≤ 1 PPB	0.1
3	SAMPLE FLOW	500 ± 10% cc/min	508
4	OZONE FLOW	80 ± 10% cc/min	87
5	PMT	mV	111.4
6	NORM PMT	mV	-5.4
7	A ZERO	-20 To 150 MV	12.3
8	HPVS	400 - 900 V	669
9	RX CELL TEMP	50 ± 1 °C	50.0
10	BOX TEMP	AMBIENT ± 5 °C	29.8
11	PMT TEMP	7 ± 2 °C	7.0
12	MOLY TEMP	315 ± 5 °C	314.0
13	RX CELL PRESSURE	<10 in - Hg-A	11.8
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	28.9
15	NOX SLOPE	1.0 ± 0.3	0.980
16	NOX OFFSET	-50 To 150	26.3
17	NO SLOPE	1.0 ± 0.3	0.934
18	NO OFFSET	-50 To 150	-2.7
19	NO SAMPLE READING	PPB	-1.0
20	NO2 SAMPLE READING	PPB	-6.2
21	NOX SAMPLE READING	PPB	-7.3
22	OPTIC TEST	2000 ± 1000 mV	1962.4
23	ELECTRICAL TEST	2000 ± 1000 mV	2340.1
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.28 / 12.32 / 15.88 / -15.07
25	ZERO GAS NO/NO _x	0.00/0.00 PPB	0.2 / -13.2
26	SPAN GAS NO/NO _x	400.00/400.00 PPB	412.8 / 408.6

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 3 ชิ้น, Spring 3 ชิ้น, O-ring 6 ชิ้น

-ทำการ Calibrate Multi-point

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : SGS (Thailand) Co., Ltd.

EQUIPMENT NAME : NO_x Analyzer

MANUFACTURER : Teledyne - API MODEL : T200

SERIAL NO : 2199

STANDARD GAS CONCENTRATION (PPM) : 53.16

CYLINDER NO : EB0169291

CYLINDER PRESSURE (psig) : 1550

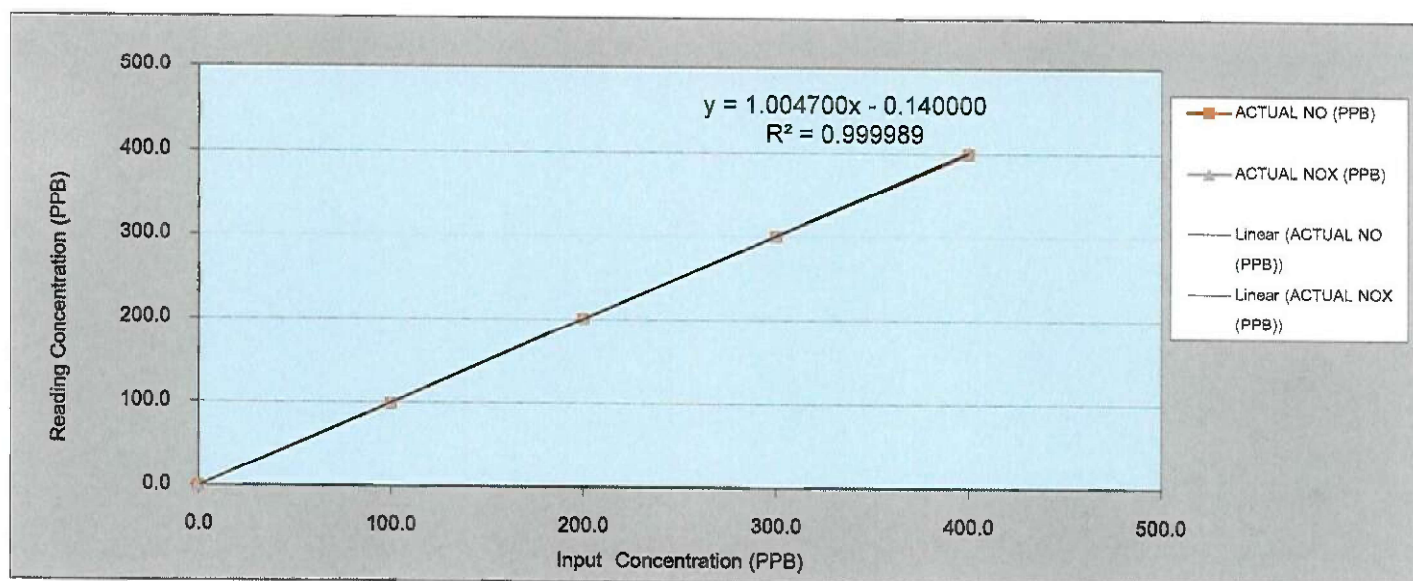
CERTIFIED DATE : Nov 08, 2023

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 08, 2031

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS						
	IDEAL (PPB)	ACTUAL NO (PPB)	ERROR NO (PPB)	% ERROR NO	ACTUAL NO _x (PPB)	ERROR NO _x (PPB)	% ERROR NO _x
ZERO	0.0	0.0	0.0	-	0.1	0.1	-
1	100.0	98.8	-1.2	-1.2	99.8	-0.2	-0.2
2	200.0	201.0	1.0	0.5	201.4	1.4	0.7
3	300.0	300.2	0.2	0.1	300.7	0.7	0.2
4	400.0	400.1	0.1	0.0	402.0	2.0	0.5
AVERAGE (%)				0.5			0.4



CALIBRATED BY : คุณธนาคม มหาอาจ

DATE : 19 มีนาคม 2568

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd.

วันที่ : 16 กรกฎาคม 2568

รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T200

หมายเลขอุปกรณ์ / เครื่องมือ : 2975

TEST VALUES			
API MODEL T200			
		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500.0
2	STABILITY	≤ 1 PPB	0.0
3	SAMPLE FLOW	500 ± 10% cc/min	501
4	OZONE FLOW	80 ± 10% cc/min	82
5	PMT	mV	58.6
6	NORM PMT	mV	29.8
7	A ZERO	-20 To 150 MV	51.2
8	HPVS	400 - 900 V	775
9	RX CELL TEMP	50 ± 1 °C	50.0
10	BOX TEMP	AMBIENT ± 5 °C	28.4
11	PMT TEMP	7 ± 2 °C	7.4
12	MOLY TEMP	315 ± 5 °C	315.0
13	RX CELL PRESSURE	<10 in - Hg-A	4.9
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	29.0
15	NOX SLOPE	1.0 ± 0.3	1.031
16	NOX OFFSET	-50 To 150	24.0
17	NO SLOPE	1.0 ± 0.3	0.936
18	NO OFFSET	-50 To 150	-1.8
19	NO SAMPLE READING	PPB	2.8
20	NO2 SAMPLE READING	PPB	9.1
21	NOX SAMPLE READING	PPB	11.9
22	OPTIC TEST	2000 ± 1000 mV	1131.2
23	ELECTRICAL TEST	2000 ± 1000 mV	1256.0
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.26 / 12.44 / 15.86 / -15.28
25	ZERO GAS NO/NO _x	0.00/0.00 PPB	0.5 / -9.4
26	SPAN GAS NO/NO _x	400.00/400.00 PPB	410.8 / 412.6

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 3 ชิ้น, Spring 3 ชิ้น, O-ring 6 ชิ้น

-ทำการ Calibrate Multi-point

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : SGS (Thailand) Co., Ltd.

EQUIPMENT NAME : NO_x Analyzer

MANUFACTURER : Teledyne - API

MODEL : T200

SERIAL NO : 2975

STANDARD GAS CONCENTRATION (PPM) : 53.16

CYLINDER NO : EB0169291

CYLINDER PRESSURE (psig) : 1550

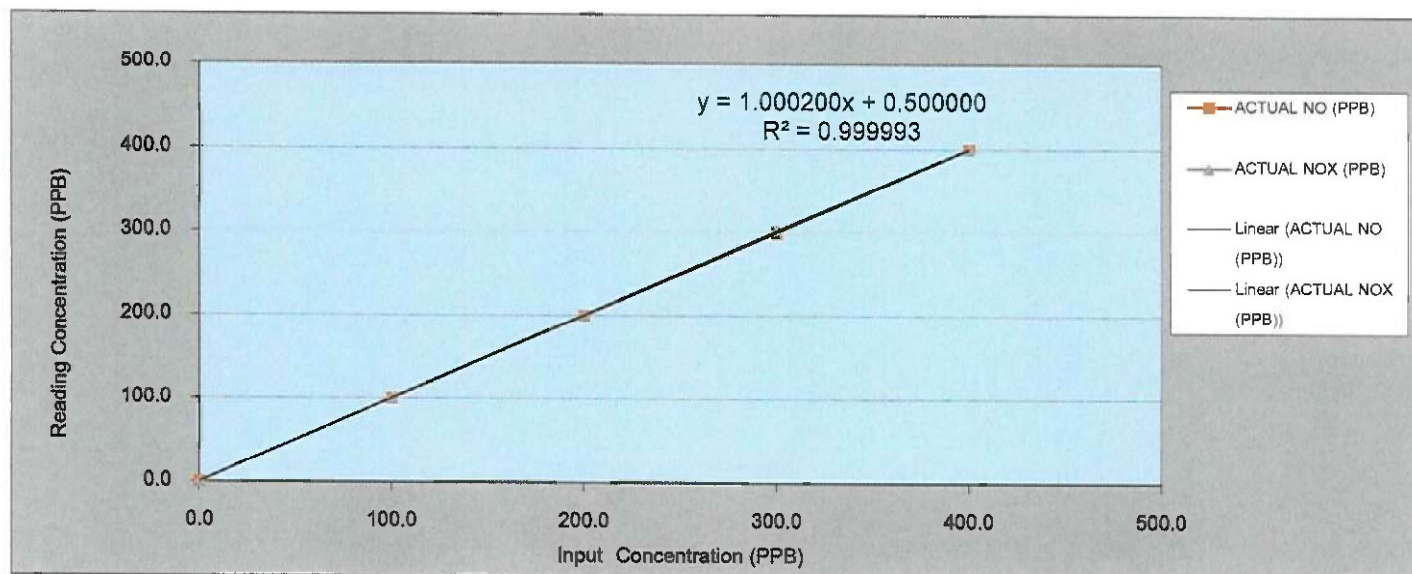
CERTIFIED DATE : Nov 08, 2023

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 08, 2031

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS						
	IDEAL (PPB)	ACTUAL NO (PPB)	ERROR NO (PPB)	% ERROR NO	ACTUAL NO _x (PPB)	ERROR NO _x (PPB)	% ERROR NO _x
ZERO	0.0	0.0	0.0	-	0.1	0.1	-
1	100.0	100.2	0.2	0.2	101.0	1.0	1.0
2	200.0	199.7	-0.3	-0.2	200.4	0.4	0.2
3	300.0	298.9	-1.1	-0.4	301.0	1.0	0.3
4	400.0	399.8	-0.2	0.0	400.2	0.2	0.0
AVERAGE (%)				0.2			0.4



CALIBRATED BY :

DATE : 16 กรกฎาคม 2568

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณณนาค มหาอาจ โทรศัพท์ : 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd.

รายชื่ออุปกรณ์ / เครื่องมือ : SO₂ Analyzer

รุ่นของอุปกรณ์ / เครื่องมือ : T100

วันที่ : 26 กุมภาพันธ์ 2568

บริษัทผู้ผลิต : Teledyne API

หมายเลขอุปกรณ์ / เครื่องมือ : 6200

TEST VALUES			
API MODEL T100			
		BEFORE	AFTER
1	RANGE 50 - 20,000 PPB	500.0	500.0
2	SO ₂ STABILITY ≤ 1 PPB	0.18	0.09
3	PRESSURE 25 - 35 in - Hg-A	29.6	29.5
4	SAMPLE FLOW 700 ± 10% cc/min	660.9	661
5	PMT mV	30.4	95.6
6	NORM PMT mV	38.7	125.5
7	UV LAMP 1000 - 4800 mV	2405.0	2429.5
8	LAMP RATIO 30 To 120 %	78.7	79.5
9	STRAY LIGHT ≤ 100 PPB	66.3	69.5
10	DARK PMT -50 ± 200 % mV	178.0	132.4
11	DARK LAMP -50 ± 200 % mV	1.7	1.4
12	SO ₂ SLOPE 1.0 ± 0.3	3.313	1.069
13	SO ₂ OFFSET < 250 mV	40.0	130.1
14	HVPS 400 - 900 V	653	645
15	RX CELL TEMP 50 ± 1 °C	50.0	50.0
16	BOX TEMP AMBIENT ± 5 °C	32.1	31.4
17	PMT TEMP 7 ± 2 °C	8.2	8.3
18	SO ₂ SAMPLE READING PPB	-1.744	0.524
19	OPTIC TEST 2000 ± 1000 mV	2385.0	2381.6
20	ELECTRICAL TEST 2000 ± 1000 mV	2775.0	2774.8
21	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.18/ 12.08 /15.65 /-15.18	5.18/ 12.08 /15.65 /-15.18
22	ZERO GAS 0.00 PPB	-1.942	0.128
23	SPAN GAS 400.00 PPB	421.792	399.086

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 1 ชิ้น, Spring 1 ชิ้น, O-ring 2 ชิ้น
- ทำการ Calibrate Multi-Point

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME :SGS (Thailand) Co., Ltd.

EQUIPMENT NAME : SO₂ Analyzer

MANUFACTURER : Teledyne - API

MODEL : T100

SERIAL NUMBER : 6200

STANDARD GAS CONCENTRATION (PPM) : 53 53.56

CYLINDER NO : EB0169291

CYLINDER PRESSURE (PSIG) : 2000

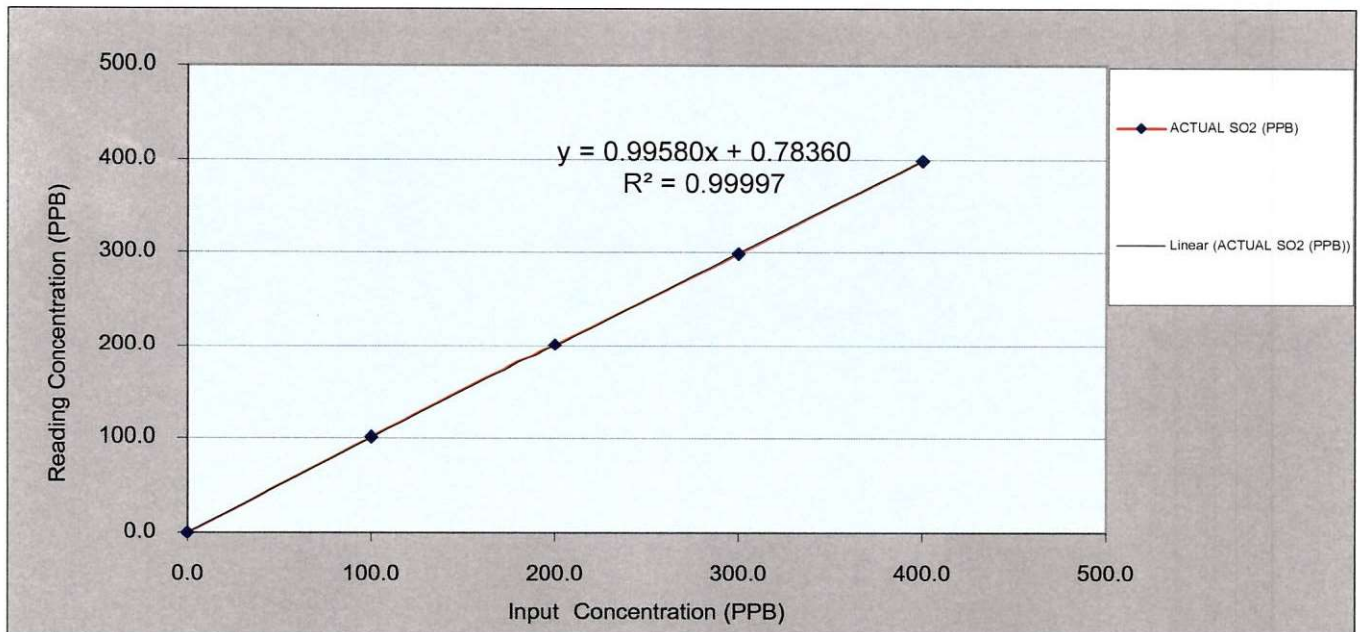
CERTIFIED DATE : Nov 08, 2023

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 08, 2031

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPB)	ACTUAL SO ₂ (PPB)	ERROR SO ₂ (PPB)	% ERROR SO ₂
ZERO	0.000	0.128	0.13	-
1	100.000	100.786	0.79	0.79
2	200.000	201.048	1.05	0.52
3	300.000	298.669	-1.33	-0.44
4	400.000	399.086	-0.91	-0.23
AVERAGE (%)				0.49



CALIBRATED BY :

DATE : 26 กุมภาพันธ์ 2568

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd.

วันที่ : 26 กุมภาพันธ์ 2568

รายชื่ออุปกรณ์ / เครื่องมือ : SO₂ Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T100

หมายเลขอุปกรณ์ / เครื่องมือ : 6201

TEST VALUES			
API MODEL T100		BEFORE	AFTER
1	RANGE 50 - 20,000 PPB	500.0	500.0
2	SO ₂ STABILITY ≤ 1 PPB	0.00	0.02
3	PRESSURE 25 - 35 in - Hg-A	26.9	26.6
4	SAMPLE FLOW 700 ± 10% cc/min	675.0	671
5	PMT mV	78.9	15.7
6	NORM PMT mV	70.2	18.7
7	UV LAMP 1000 - 4800 mV	4344.7	4321.8
8	LAMP RATIO 30 To 120 %	123.6	92.2
9	STRAY LIGHT ≤ 100 PPB	41.5	7.8
10	DARK PMT -50 ± 200 % mV	xxx	120.0
11	DARK LAMP -50 ± 200 % mV	4.5	4.3
12	SO ₂ SLOPE 1.0 ± 0.3	1.694	1.003
13	SO ₂ OFFSET < 250 mV	49.0	15.7
14	HVPS 400 - 900 V	560	529
15	RX CELL TEMP 50 ± 1 °C	50.0	50.0
16	BOX TEMP AMBIENT ± 5 °C	33.1	31.7
17	PMT TEMP 7 ± 2 °C	8.4	8.4
18	SO ₂ SAMPLE READING PPB	0.018	1.041
19	OPTIC TEST 2000 ± 1000 mV	5003.0	2116.3
20	ELECTRICAL TEST 2000 ± 1000 mV	3228.0	2660.5
21	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.10/ 12.09 /15.48 /-15.15	5.10/ 12.09 /15.48 /-15.15
22	ZERO GAS 0.00 PPB	4.750	0.406
23	SPAN GAS 400.00 PPB	460.218	400.026

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 1 ชิ้น, Spring 1 ชิ้น, O-ring 2 ชิ้น
- ทำการ Calibrate Multi-Point

ลง

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณณนาคมน 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

CUSTOMER NAME :SGS (Thailand) Co., Ltd.

EQUIPMENT NAME : SO₂ Analyzer

MANUFACTURER : Teledyne - API

MODEL : T100

SERIAL NUMBER : 6201

STANDARD GAS CONCENTRATION (PPM) : 53.79

CYLINDER NO : EB0169291

CYLINDER PRESSURE (PSIG) : 1550

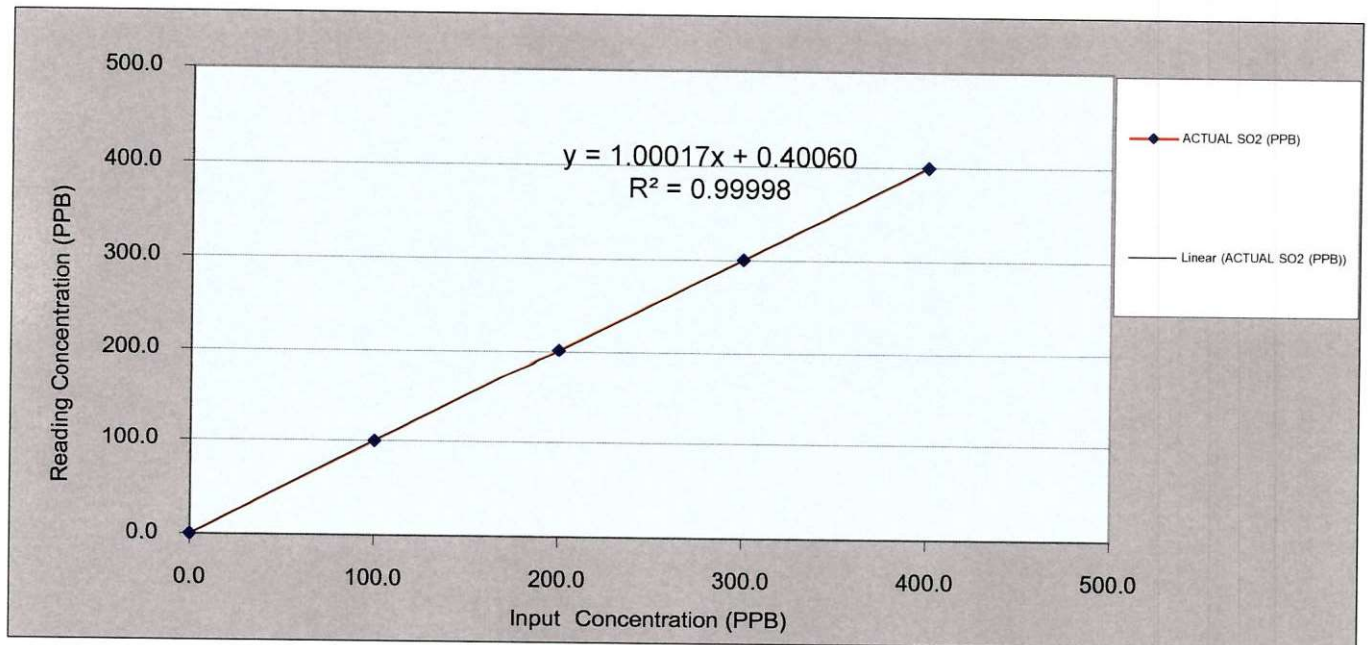
CERTIFIED DATE : Nov 08, 2023

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 08, 2031

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPB)	ACTUAL SO ₂ (PPB)	ERROR SO ₂ (PPB)	% ERROR SO ₂
ZERO	0.000	0.406	0.4	-
1	100.000	99.712	-0.3	-0.3
2	200.000	201.387	1.4	0.7
3	300.000	300.642	0.6	0.2
4	400.000	400.026	0.0	0.0
AVERAGE (%)				0.3



CALIBRATED BY :

DATE : 26 กุมภาพันธ์ 2568

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณณนาคม มหาอาจ โทรศัพท์ : 02-515-8987

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

THAI METEOROLOGICAL DEPARTMENT



4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 May, 2024

Certification No. 221/24

Page : 1 of 6

Object : Precision Weather Station

Manufacturer : Davis Instruments

Type : Vantage Pro 2 Model No. : 6152C

Mfg Code : Display AZ170619045 Transmitter BD190415075

Customer : SGS (Thailand) Limited.
100 Nanglinchee Road, Chongnonsi,
Yannawa, Bangkok 10120.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No. 9188 : testo, testo 645 Serial No. 02848057

pe PTB220 No. V1220015

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 221/24

31 May, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.00	-	-	-	7.0	0.00
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.3	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Ca



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 0-2396-0156, 0-2399-0469

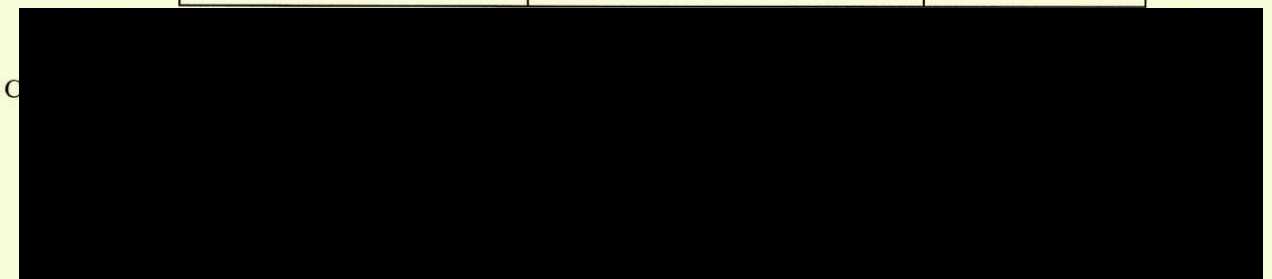
The Result of Calibration

Certification No. 221/24

31 May, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
753.68	754.6	-0.92
753.80	754.8	-1.00
753.92	754.9	-0.98
754.06	755.0	-0.94
754.69	755.6	-0.91
754.76	755.7	-0.94
755.17	756.1	-0.93
755.33	756.3	-0.97
755.45	756.4	-0.95
755.50	756.3	-0.80
754.28	755.2	-0.92
754.78	755.7	-0.92
753.98	755.0	-1.02
754.35	755.4	-1.05
754.69	755.7	-1.01
755.37	756.4	-1.03
755.70	756.7	-1.00
755.75	756.8	-1.05
755.90	756.9	-1.00
756.08	757.1	-1.02





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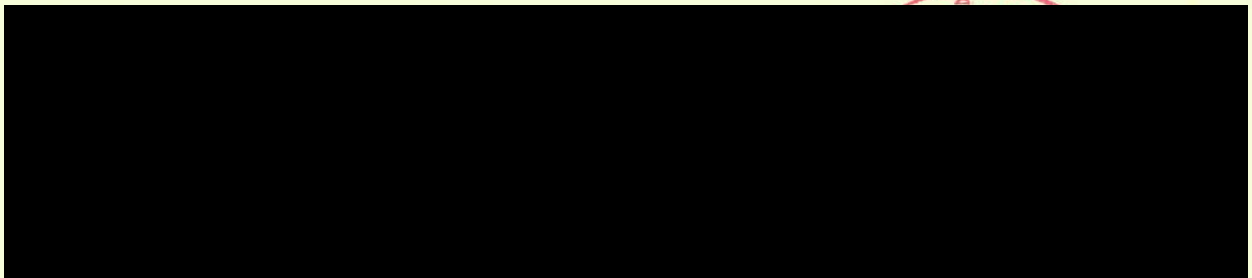
The Result of Calibration

Certification No. 221/24

31 May, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.3	-0.1
30.5	30.5	0.0
15.6	15.7	-0.1



LOGICAL D



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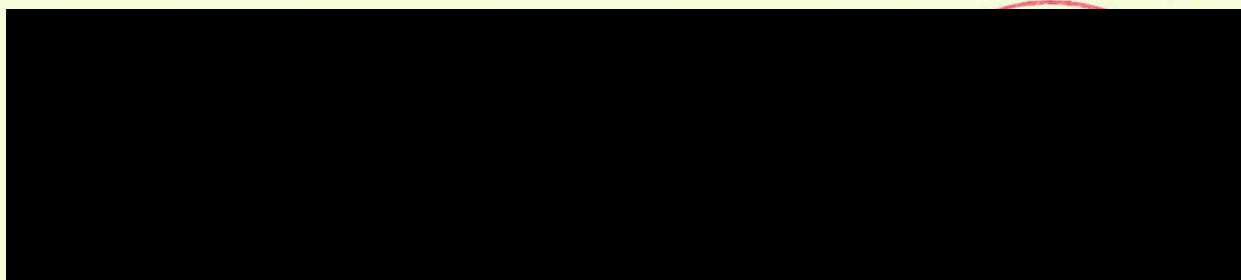
The Result of Calibration

Certification No. 221/24

31 May, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
86.32	89	-2.68
67.54	69	-1.46
46.23	47	-0.77



LOGICAL DE



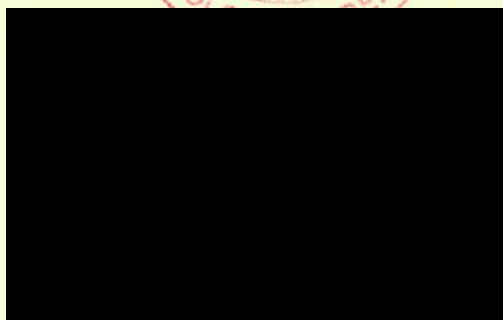
Date of Issue 31 May, 2024

Certification No. 221/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 6152C Mfg. Code. BD190415075 ทำการสอบเทียบกับแก้ววัดฝนแบบ
แก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082
และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.01 in./TIP)





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 9 September, 2024

Certification No. 313/24

Page : 1 of 6

Object : Precision Weather Station

Manufacturer : Davis Instruments

Type : Vantage Pro 2 Model No. : 6152C

Mfg Code : Display BD190415075 Transmitter BD190415075

Customer : SGS (Thailand) Limited.
100 Nanglinchee Road, Chongnonsi,
Yannawa, Bangkok 10120.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermocoupler No. 9188 : test test 645 Serial No. 02848057





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 313/24

9 September, 2024

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.9	0.10
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrat



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 0-2396-0156,0-2399-0469

The Result of Calibration

Certification No. 313/24

9 September, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
754.84	754.6	0.24
754.75	754.5	0.25
754.73	754.5	0.23
754.97	754.8	0.17
755.22	755.1	0.12
755.58	755.4	0.18
755.75	755.6	0.15
755.70	755.5	0.20
754.26	754.1	0.16
754.44	754.3	0.14
754.77	754.6	0.17
755.01	754.9	0.11
755.36	755.2	0.16
755.51	755.4	0.11
755.60	755.5	0.10
754.19	754.0	0.19
754.43	754.3	0.13
754.97	754.8	0.17
755.54	755.4	0.14
755.32	755.2	0.12

Average

0.16

Cali



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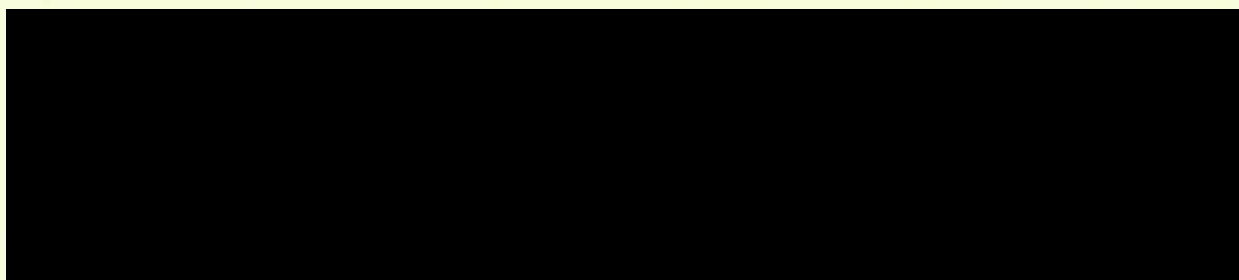
The Result of Calibration

Certification No. 313/24

9 September, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.9	-0.3
30.5	30.7	-0.2
15.4	15.5	-0.1





THAI METEOROLOGICAL DEPARTMENT

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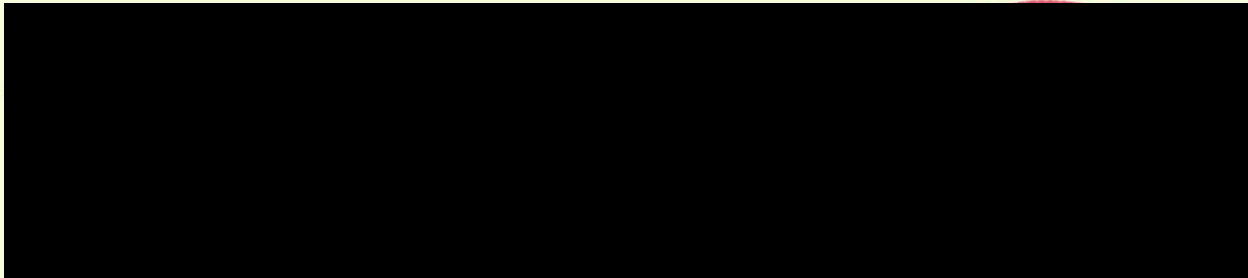
The Result of Calibration

Certification No. 313/24

9 September, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
91.35	96	-4.65
66.25	69	-2.75
45.12	46	-0.88





Date of Issue 9 September, 2024

Certification No. 313/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 6152C Mfg. Code. BD190415075 ทำการสอบเทียบกับแก้ววัดฝนแบบ
แก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082
และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.01 in./TIP)



CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: BANGKOK INDUSTRIAL
GAS CO LTD
Part Number: E04NI99E80ACP0C
Cylinder Number: LL164665
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 160-402557716-1
Cylinder Volume: 83.0 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Oct 21, 2022

Expiration Date: Oct 21, 2025

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 mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.01 PPM	G1	+/- 1.3% NIST Traceable	10/13/2022, 10/21/2022
NITRIC OXIDE	45.00 PPM	45.01 PPM	G1	+/- 1.2% NIST Traceable	10/13/2022, 10/21/2022
SULFUR DIOXIDE	45.00 PPM	45.11 PPM	G1	+/- 0.9% NIST Traceable	10/13/2022, 10/21/2022
CARBON MONOXIDE	4500 PPM	4511 PPM	G1	+/- 0.8% NIST Traceable	10/14/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	210607-21	CC708065	48.41 PPM NITRIC OXIDE/NITROGEN	+/- 1.2%	Sep 21, 2025
PRM	12395	D887660	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 22, 2022
GMIS	124206889110	CC322674	4.474 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 25, 2025
NTRM	160102-32	KAL004062	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
NTRM	08012355	KAL004734	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

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
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Sep 22, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Oct 20, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Oct 06, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Sep 29, 2022

Triad Data Available Upon Request

NOTES: PO# 5222004798

Gross Weight: 17.2 Kg

Net Weight: 2.7 Kg

Cylinder: 80A



Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+662 723 0382


MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: SGS (Thailand) Co., Ltd.
Address: 1/209,1/211 Moo 1, Ban Chang
City: Ban Chang **Contact:** Phannipha Somchit
Zip / Postal: 21130
State / Province: Rayong
Order Number: 
0 3 3 3 4 2 7 3 5 3

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: XS205DU **Asset Number:** N/A
Serial No.: B036065880 **Terminal Model:** SAT
Building: LABORATORY **Terminal Serial No.:** B036065880
Floor: 1 **Terminal Asset No.:** N/A
Room: Balance

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

Procedure

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

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

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

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

	Temperature		Humidity	
As Found	Start: 20.5 °C	End: 20.5 °C	Start: 49.0 %	End: 48.8 %

Technical Manager / Head of Calibration Center

Measurement Results

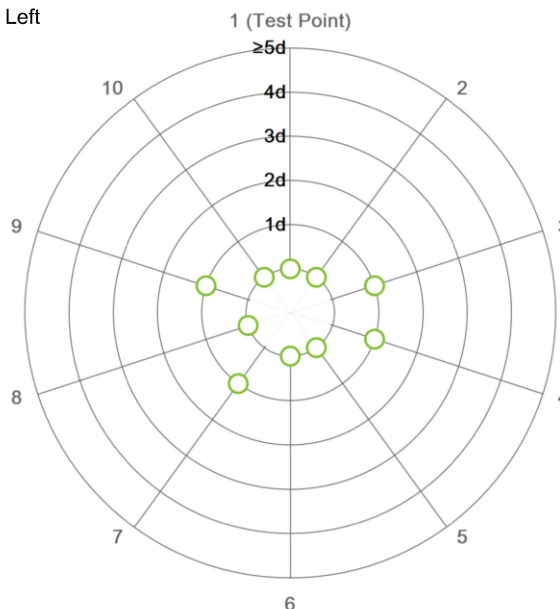
Repeatability

Test Load: 70 g

	As Found	As Left
1	69.99996 g	N/A
2	69.99996 g	N/A
3	69.99995 g	N/A
4	69.99995 g	N/A
5	69.99996 g	N/A
6	69.99996 g	N/A
7	69.99997 g	N/A
8	69.99996 g	N/A
9	69.99997 g	N/A
10	69.99996 g	N/A

Standard Deviation	0.000007 g	N/A
--------------------	------------	-----

○ As Found
◆ As Left



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

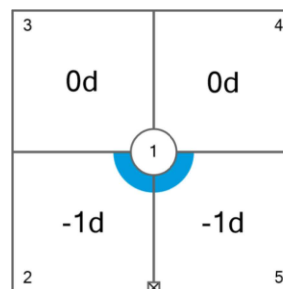
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



As Found

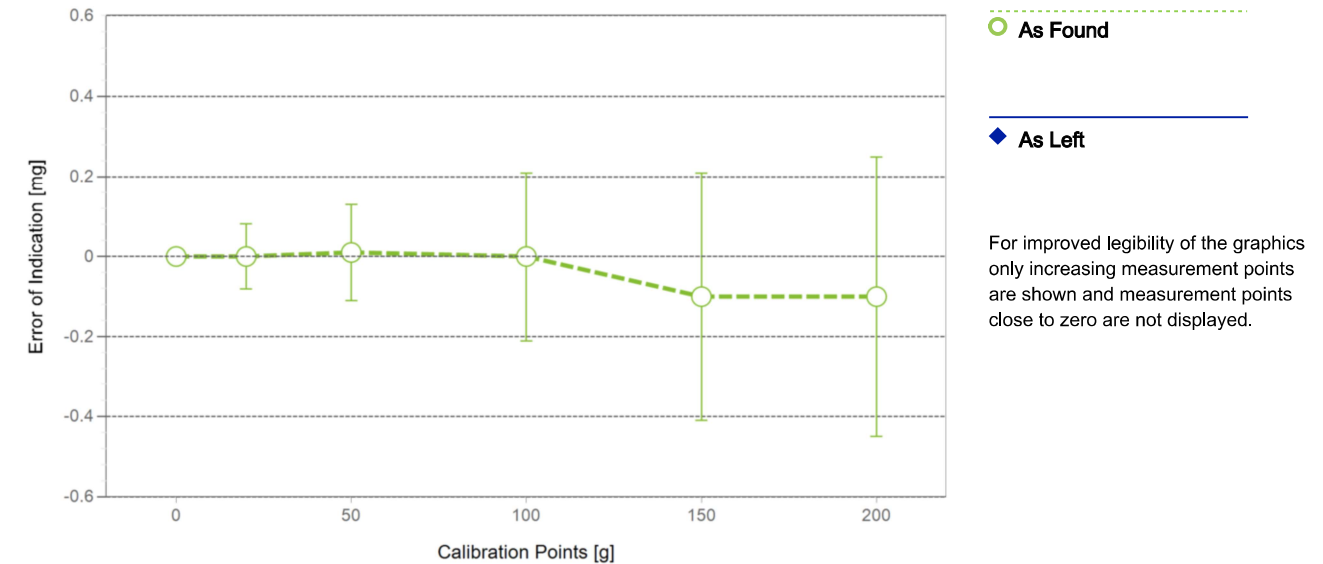
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.015 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.017 mg	2
3	0.10000 g	0.10000 g	0.00000 g	0.021 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.031 mg	2
5	5.00000 g	4.99999 g	-0.00001 g	0.047 mg	2
6	10.00000 g	9.99999 g	-0.00001 g	0.060 mg	2
7	20.00001 g	20.00001 g	0.00000 g	0.081 mg	2
8 ¹	49.99995 g	49.99996 g	0.00001 g	0.12 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.21 mg	2
10 ¹	150.0000 g	149.9999 g	-0.0001 g	0.31 mg	2
11 ¹	200.0000 g	199.9999 g	-0.0001 g	0.35 mg	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS32	Date of Issue:	07-Aug-2024
Certificate Number:	193673	Calibration Due Date:	30-Jan-2026

Weight Set 2: OIML E2

Weight Set No.:	WS32-1	Date of Issue:	06-Sep-2024
Certificate Number:	C436717337	Calibration Due Date:	26-Jan-2026

Thermo Hygrometer

Equipment No.:	IN301	Date of Issue:	25-Sep-2024
Certificate Number:	SG-H-00856/67	Calibration Due Date:	23-Sep-2025

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

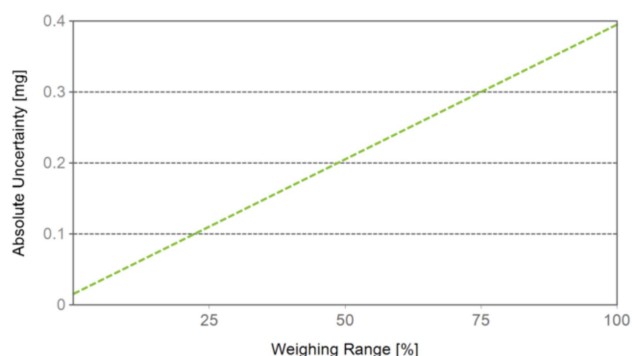
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.016 \text{ mg} + 0.00469 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00461 \text{ mg/g} \cdot R$	N/A

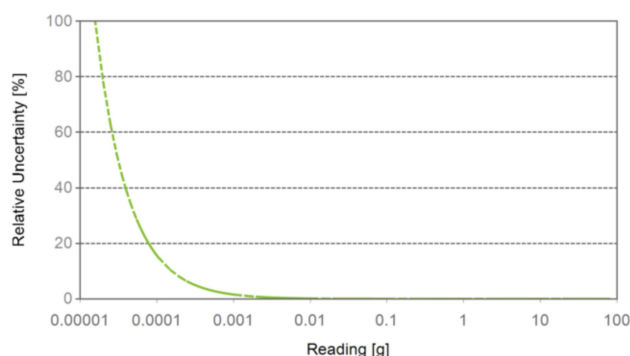
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.016 mg	0.73%	N/A	N/A
0.02200 g	0.016 mg	0.073%	N/A	N/A
0.22000 g	0.017 mg	0.0077%	N/A	N/A
2.20000 g	0.026 mg	0.0012%	N/A	N/A
220.0000 g	1.1 mg	0.00049%	N/A	N/A



As Found



As Left

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

GWP® Certificate



**As
Found**



**As
Left**



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left



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

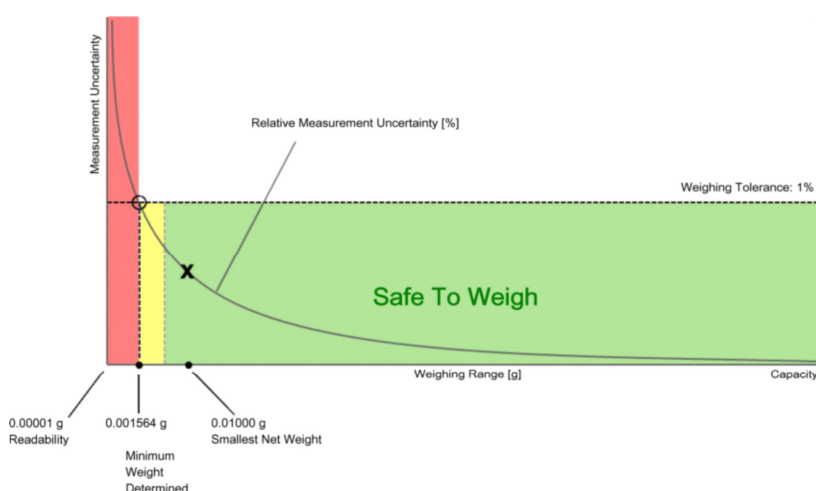
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



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

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.015708 g	0.031565 g	0.047573 g	0.080050 g	0.164036 g
0.2%	0.007836 g	0.015708 g	0.023618 g	0.039550 g	0.080050 g
0.5%	0.003130 g	0.006266 g	0.009407 g	0.015708 g	0.031565 g
1%	0.001564 g	0.003130 g	0.004697 g	0.007836 g	0.015708 g
2%	0.000782 g	0.001564 g	0.002347 g	0.003913 g	0.007836 g
5%	0.000313 g	0.000626 g	0.000938 g	0.001564 g	0.003130 g

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



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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.015708 g	0.031565 g	0.047573 g	0.080050 g	0.164036 g
0.2%	0.007836 g	0.015708 g	0.023618 g	0.039550 g	0.080050 g
0.5%	0.003130 g	0.006266 g	0.009407 g	0.015708 g	0.031565 g
1%	0.001564 g	0.003130 g	0.004697 g	0.007836 g	0.015708 g
2%	0.000782 g	0.001564 g	0.002347 g	0.003913 g	0.007836 g
5%	0.000313 g	0.000626 g	0.000938 g	0.001564 g	0.003130 g

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



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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000007 g	✗	0.000007 g	✗
0.2%	0.000010 g		✓		⚠
0.5%	0.000025 g		✓		✓
1%	0.000050 g		✓		✓
2%	0.000100 g		✓		✓
5%	0.000250 g		✓		✓

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

Eccentricity

Test Load: 100 g

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

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

Error of Indication**As Found**

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00000 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
49.99995 g	0.00001 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.00001 g	0.00000 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
49.99995 g	0.00001 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

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

**HORIBA (THAILAND) LIMITED**

46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>**MULTI-POINT GAS TEST REPORT OF NITRIC OXIDE****Equipment Information**

Manufacturer	Horiba
Model	HORIBA PG-350
Serial Number	J4D2YU7S

Calibration Date	21-Nov-24
Background	1
Coefficient	1.0044
Room Temperature	23.3 °C

Standard Gas Information

Zero Gas	
Cylinder Number	17K686056
Component	N2
Concentration	99.999 %
Expiration Date	-

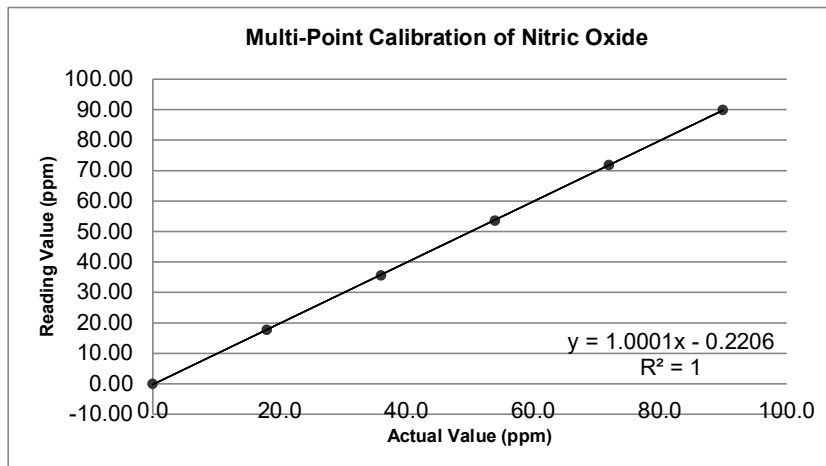
Span Gas	
Cylinder Number	ND58962
Component	NO
Concentration	89.94 ppm
Expiration Date	28-Sep-30

Measurement Range	100
% Measurement Range	89.94

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)				Difference	
		1	2	3	Average	ppm	%
0%	0.0	0.0	0.1	0.1	0.07	0.07	
20%	17.99	17.90	17.60	17.50	17.67	-0.32	1.79
40%	35.98	35.70	35.40	35.40	35.50	-0.48	1.32
60%	53.96	53.80	53.60	53.40	53.60	-0.36	0.67
80%	71.95	71.70	72.00	71.70	71.80	-0.15	0.21
100%	89.94	89.60	90.10	90.00	89.90	-0.04	0.04
						Average	0.81
						Result	PASS

Slope	1.0001	Interception	-0.2206	Correlation Coefficient	1.0000
%Slope	0.0138%	% Interception	-0.2206%	% Correlation Coefficient	-0.0019%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart

Test By	<u>Preecha.t</u>	Approve By	<u>Nakao Bzai</u>
Date	<u>2-Dec-24</u>	Date	<u>2-Dec-24</u>



HORIBA (THAILAND) LIMITED

46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>

MULTI-POINT GAS TEST REPORT OF SULFUR DIOXIDE

Equipment Information

Manufacturer Horiba
Model HORIBA PG-350
Serial Number J4D2YU7S

Calibration Date 21-Nov-24
Background 1
Coefficient 1.1182
Room Temperature 23.3 °C

Standard Gas Information

Zero Gas
Cylinder Number 17K686056
Component N2
Concentration 99.999 %
Expiration Date -

Span Gas
Cylinder Number ND58962
Component SO2
Concentration 89.58 ppm
Expiration Date 28-Sep-30

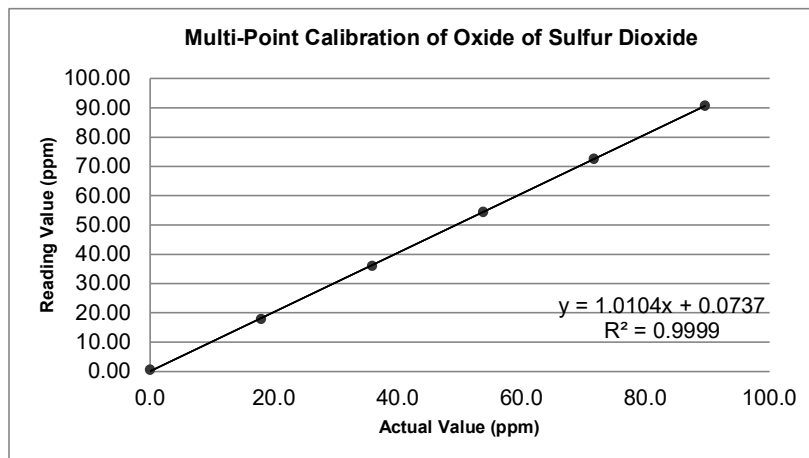
Measurement Range 200
% Measurement Range 44.79

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)				Difference	
		1	2	3	Average	ppm	%
0%	0.0	0.5	0.5	0.5	0.50	0.50	
20%	17.92	17.80	17.70	18.00	17.83	-0.08	0.46
40%	35.83	35.80	36.10	36.10	36.00	0.17	0.47
60%	53.75	54.32	54.50	54.30	54.37	0.63	1.16
80%	71.66	72.10	73.20	72.40	72.57	0.90	1.26
100%	89.58	90.30	91.00	90.80	90.70	1.12	1.25
						Average	0.92
						Result	PASS

Slope	1.0104	Interception	0.0737	Correlation Coefficient	1.0000
%Slope	1.0387%	% Interception	0.0368%	% Correlation Coefficient	-0.0035%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Date



HORIBA (THAILAND) LIMITED

46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>

MULTI-POINT GAS TEST REPORT OF CARBON MONOXIDE

Equipment Information

Manufacturer	Horiba	Calibration Date	21-Nov-24
Model	HORIBA PG-350	Background	0
Serial Number	J4D2YU7S	Coefficient	1.2848
		Room Temperature	23.3 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	17K686056	Cylinder Number	ND58962
Component	N2	Component	CO
Concentration	99.999 %	Concentration	89.58 ppm
Expiration Date	-	Expiration Date	28-Sep-30

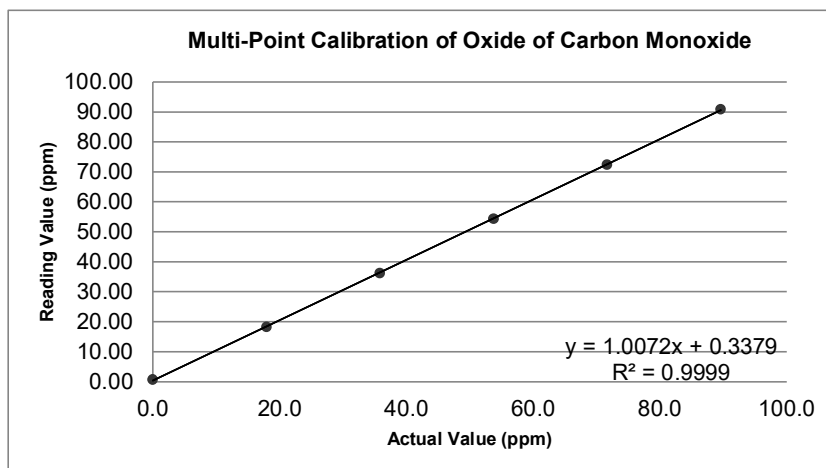
Measurement Range	200
% Measurement Range	44.79

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)				Difference	
		1	2	3	Average	ppm	%
0%	0.0	0.6	0.9	0.6	0.70	0.70	
20%	17.92	18.20	18.20	18.20	18.20	0.28	1.59
40%	35.83	35.80	36.40	36.40	36.20	0.37	1.03
60%	53.75	54.80	54.20	54.10	54.37	0.62	1.15
80%	71.66	72.10	72.21	72.70	72.34	0.67	0.94
100%	89.58	90.30	91.50	90.90	90.90	1.32	1.47
						Average	1.24
						Result	PASS

Slope	1.0072	Interception	0.3379	Correlation Coefficient	1.0000
%Slope	0.7203%	% Interception	0.1690%	% Correlation Coefficient	-0.0033%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Date

**HORIBA (THAILAND) LIMITED**

46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>**MULTI-POINT GAS TEST REPORT OF CARBON DIOXIDE****Equipment Information**

Manufacturer	Horiba
Model	HORIBA PG-350
Serial Number	J4D2YU7S

Calibration Date	21-Nov-24
Background	0
Coefficient	1.0022
Room Temperature	23.3 °C

Standard Gas Information

Zero Gas	
Cylinder Number	17K686056
Component	N2
Concentration	99.999 %
Expiration Date	-

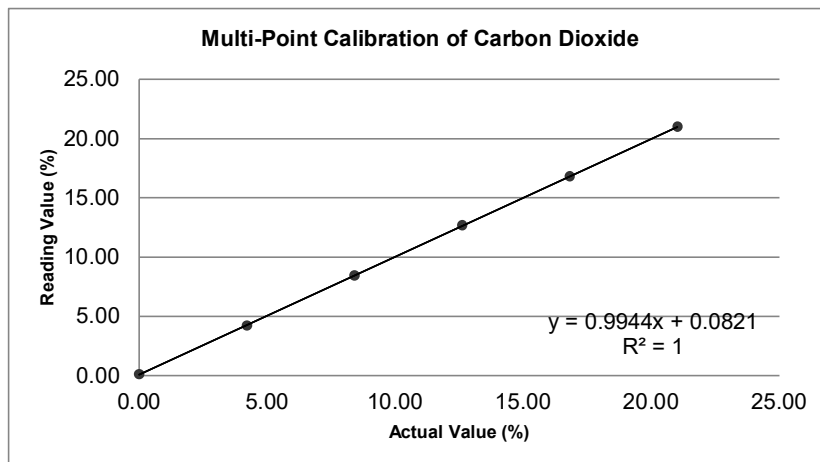
Span Gas	
Cylinder Number	ND11246
Component	CO2
Concentration	21.02 %
Expiration Date	8-Aug-30

Measurement Range	30
% Measurement Range	70.07

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (%)				Difference	
		1	2	3	Average	%	%
0%	0.00	0.00	0.15	0.18	0.11	0.11	
20%	4.20	4.18	4.23	4.25	4.22	0.02	0.38
40%	8.41	8.43	8.46	8.41	8.43	0.03	0.30
60%	12.61	12.72	12.62	12.64	12.66	0.05	0.38
80%	16.82	16.78	16.79	16.79	16.79	-0.03	0.17
100%	21.02	20.94	20.98	21.04	20.99	-0.03	0.16
						Average	0.28
						Result	PASS

Slope	0.9944	Interception	0.0821	Correlation Coefficient	1.0000
%Slope	-0.5641%	% Interception	0.2735%	% Correlation Coefficient	-0.0007%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart

Test By

Date



HORIBA (THAILAND) LIMITED

46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>

MULTI-POINT GAS TEST REPORT OF OXYGEN

Equipment Information

Manufacturer	Horiba
Model	HORIBA PG-350
Serial Number	J4D2YU7S

Calibration Date	21-Nov-24
Background	17
Coefficient	1.0146
Room Temperature	23.3 °C

Standard Gas Information

Zero Gas	
Cylinder Number	17K686056
Component	N2
Concentration	99.999 %
Expiration Date	-

Span Gas	
Cylinder Number	ND60790
Component	O2
Concentration	20.87 %
Expiration Date	20-Jan-30

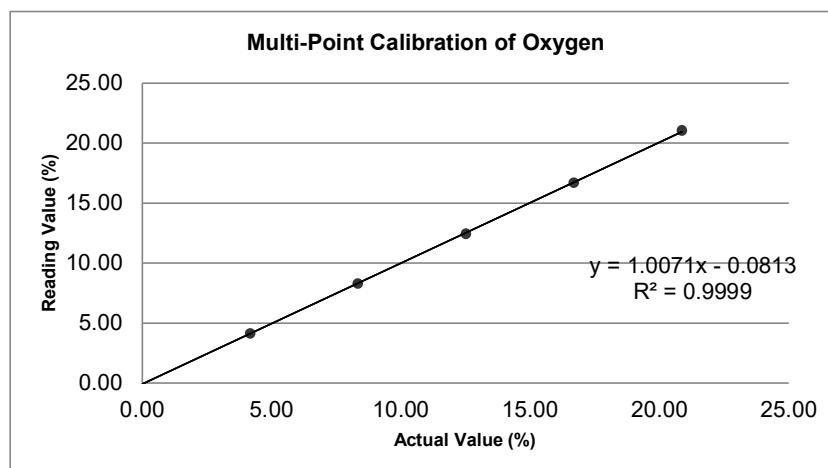
Measurement Range	25
% Measurement Range	83.48

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (%)				Difference	
		1	2	3	Average	%	%
0%	0.00	0.01	0.00	-0.05	-0.01	-0.01	
20%	4.17	4.10	4.12	4.18	4.13	-0.04	0.97
40%	8.35	8.34	8.23	8.25	8.27	-0.07	0.89
60%	12.52	12.42	12.44	12.45	12.44	-0.09	0.68
80%	16.70	16.63	16.73	16.72	16.69	0.00	0.02
100%	20.87	21.03	21.01	21.09	21.04	0.17	0.83
						Average	0.68
						Result	PASS

Slope	1.0071	Interception	-0.0813	Correlation Coefficient	1.0000
%Slope	0.7096%	% Interception	-0.3251%	% Correlation Coefficient	-0.0047%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Date

**HORIBA (THAILAND) LIMITED**46/8 Rungrojthanakul Bld., 1st, 2nd Fl., Ratchadapisek Rd., Huai Khwang, Huai Khwang, Bangkok 10310 THAILAND

Telephone: +66 (0) 2861 5995, +66 (0) 2734-4434 Facsimile: +66 (0) 2861 5200

Website : <http://www.horiba.com>**LOWER DETECTABLE LIMIT TESTING REPORT****Equipment Information**

Manufacturer Horiba
Model HORIBA PG-350
Serial Number J4D2YU7S

Calibration Date 21-Nov-24
Room Temperature 23.3 °C

Standard Gas Information

Zero Gas
Cylinder Number 17K686056

Component N2
Concentration 99.999 %

Parameters	Measurement Range	Unit	Background	Coefficient
NO	100	ppm	1	0.9934
SO ₂	200	ppm	0	1.0684
CO	200	ppm	0	1.1705
CO ₂	30	%	0	1.004
O ₂	25	%	16	1.0078

TESTING REPORT RESULTS

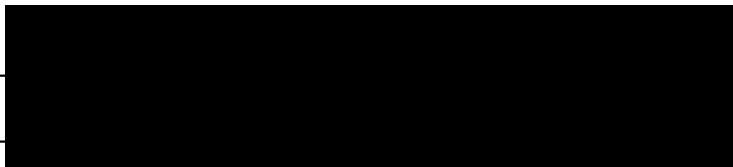
Parameters	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	STDEV.
NO	0.10	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.052
SO ₂	0.40	0.20	0.20	0.20	0.90	0.50	0.90	0.80	0.50	0.50	0.277
CO	0.00	0.00	0.00	0.00	0.20	0.30	-0.20	0.10	-0.20	0.00	0.155
CO ₂	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.000
O ₂	-0.28	-0.28	-0.28	-0.28	-0.27	-0.29	-0.29	-0.29	-0.29	-0.29	0.007

Conclusion

NO Lower detectable limit (LDL) value is 0.052 ppm
SO₂ Lower detectable limit (LDL) value is 0.277 ppm
CO Lower detectable limit (LDL) value is 0.155 ppm
CO₂ Lower detectable limit (LDL) value is 0.000 % Vol.
O₂ Lower detectable limit (LDL) value is 0.007 % Vol.

Test By

Date





Certificate of Conformity

BANGKOK INDUSTRIAL GAS CO.,LTD.

1 Park Silom Tower, 24th Floor, Convent Road

Silom, Bangrak, Bangkok 10500 Thailand

Tel : (662) 481-6789 Fax : (662) 481-6790

Customer Name : SGS (Thailand) Limited				Delivery Date : 10 Oct 2024			
Product : 1100060				Analyzed Date :			
Product Name : CY N2 UHP 7M3 47S CGA580				Best if used by : -			
Cylinder Type : 47 LITERS STEEL				Delivery order : 3300205200			
Cylinder Valve : CGA 580				Inspection lot : 040000044205			
Filling Pressure : 2000 PSIG @ 27°C				Gas content : 7 M3			
COMPONENT	UNIT	LOWER LIMIT	UPPER LIMIT	NOMINAL VALUE	ACTUAL VALUE	ANALYTICAL ACCURACY	TEST METHOD

Purity	%	99.9990					
Oxygen	ppm(V)		<3.0000				
Moisture	ppm(V)		<3.0000				
Carbon Monoxide	ppm(V)		<1.0000				
Carbon Dioxide	ppm(V)		<1.0000				
Total Hydrocarbon as CH4	ppm(V)		<1.0000				

Batch : 071024N201,081024N201

Sampling Cylinder :

Cylinder Serial Number : D9143005,M5280017,12D048146

Remark :

This certificate is issued electronically and is valid without a signature.

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: BANGKOK INDUSTRIAL
GAS CO LTD
Part Number: E02NI88E200000C
Cylinder Number: 5139908Y
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: O2,BALN

Reference Number: 160-402891090-1
Cylinder Volume: 216.6 CF
Cylinder Pressure: 2014 PSIG
Valve Outlet: 590
Certification Date: Nov 27, 2023

Expiration Date: Nov 27, 2031

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 mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	12.00 %	12.05 %	G1	+/- 0.4% NIST Traceable	11/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010205	K001516	23.2 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Nov 08, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 59.3Kg
Net Weight: 7.2 Kg
PO# 5223006228



CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: BANGKOK INDUSTRIAL
GAS CO LTD
Part Number: E02NI79E20004DC
Cylinder Number: 4621366Y
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: O2,BALN

Reference Number: 160-402891088-1
Cylinder Volume: 218.0 CF
Cylinder Pressure: 2014 PSIG
Valve Outlet: 590
Certification Date: Nov 27, 2023

Expiration Date: Nov 27, 2031

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 mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

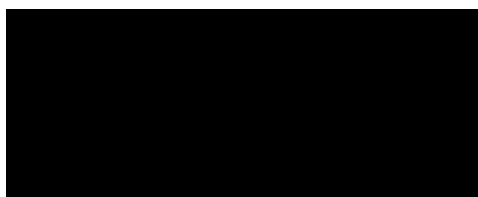
ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	21.00 %	20.85 %	G1	+/- 0.5% NIST Traceable	11/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010205	K001516	23.2 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Nov 08, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 59.0 Kg
Net Weight: 7.4 Kg
PO# 5223006228



Certificate of Calibration

Customer

Name : SGS (Thailand) Limited. **Certificate No** : 25-ACT-174
Address : 238 TRR Tower, 19th-21st Floor, Naradhiwas Rajanagarindra **Request No** : Req-2025-2564
Road, Chong Nonsi, Yannawa, Bangkok 10120

Unit Under Calibration Details

Measurement item : Acoustic Calibrator **Class** : 1
Manufacturer : Cirrus **Range** : 94 dB / 1000 Hz
Model : CR:515 **Instrument Status** : Used
Serial Number : 88350
ID : ENAC 19010

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 20 November 2025
Calibration Date : 26 November 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

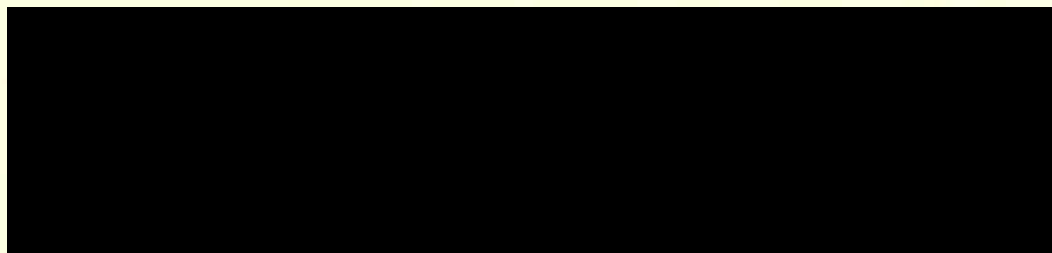
Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	20 June 2026
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By :





Certificate No : 25-ACT-174

Request No : Req-2025-2564

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.95	-0.05	-	-	0.13

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value (%)	Measured (Hz)	Deviated value (%)	
94 dB / 1000 Hz	1000.00	0.000	-	-	0.010

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	1.60	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration



Certificate of Calibration

Customer

Name : SGS (Thailand) Limited. **Certificate No** : 25-ACT-111
Address : 238 TRR Tower, 19th-21st Floor, Naradhiwas Rajanagarindra Road, **Request No** : Req-2025-1541
Chong Nonsi, Yannawa, Bangkok 10120

Unit Under Calibration Details

Measurement item : Acoustic Calibrator **Class** : 1
Manufacturer : Cirrus **Range** : 94 dB / 1000 Hz
Model : CR:515 **Instrument Status** : Used
Serial Number : 88373
ID : ENSL 19176

Calibration Environment and Details

Temperature : (23 \pm 2 °C)
Humidity : (50 \pm 20 %RH)
Barometric Pressure : (1013 \pm 10.0 hPa)
Received Date : 7 July 2025
Calibration Date : 15 July 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

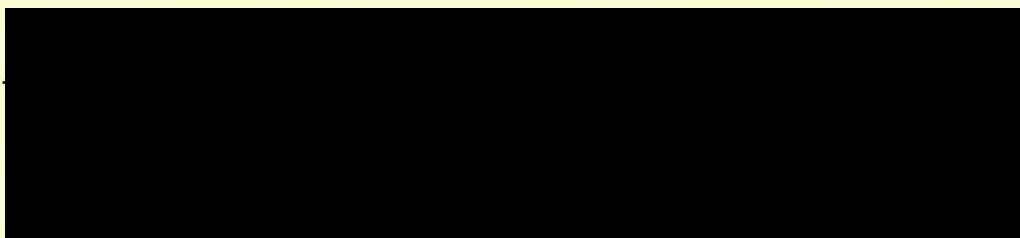
Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	20 June 2026
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By :





Certificate No : 25-ACT-111

Request No : Req-2025-1541

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.98	-0.02	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.0	0.00	-	-	0.01

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	2.10	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

Certificate of Calibration

Date of Issue	:	19 August 2024
Certificate No.	:	241990/ME
Customer Company	:	SGS (Thailand) Limited 1/209, 1/211 Moo 1, T.Ban Chang, A.Ban Chang, Rayong 21130
Instrument Manufacturer	:	Metrohm
Instrument Type	:	Titration
Model	:	848
Instrument Serial Number	:	1848001021332
Calibration Place	:	Laboratory, SGS (Thailand) Limited 1/209, 1/211 Moo 1, T.Ban Chang, A.Ban Chang, Rayong 21130
Environment Status	:	Temperature : $26.75^{\circ}\text{C} \pm 1.15^{\circ}\text{C}$ Humidity : $46.85\% \pm 2.55\%$
Date of Receipt	:	16 August 2024
Date of Calibration	:	16 August 2024
Job Number	:	CAL240633/ME
Condition of Calibration Item	:	Used Item
Result of Calibration	:	<input checked="" type="checkbox"/> Without Adjustment <input type="checkbox"/> Adjustment
Calibrated By	:	
Approved By	:	

The uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the issuing Laboratory Metrohm Siam Ltd.

Calibration Report

Certificate No: 241990/ME

1. Reference Standards

Item	Description/Model	Serial No.	Manufacturing	Certificate No.	Due Date
1	Multifunction Calibrator MC3	30328704	Beamex	CAL0252-24P0014	25 Jan 2025
2	Digital Dial Gauge	12159004	Sylvac	MC2311074	14 Sep 2024
3	Temperature and Humidity Logger	62329129	Ebro	L202311303-0002	23 Nov 2024

2. The measurement standards are traceable to International system of units (SI) by mean of an unbroken chain of calibration via accredited calibration laboratory, National or International metrology institute.

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

4. The results of test were found accurate as shown on date and place of test only.

5. Procedure Used :

On-Site method WI-08 by substitute measurement with digital multimeter (DC Voltage) (Direct)

On-Site method WI-08 based on BS 3145 : 1978 (pH)

On-Site method WI-08 based on CEI IEC 60751 : 2008 (Temperature)

Method WI-14 by direct measurement with digital indicator (Dimension)

6. The calibration results apply accuracy of display unit titrator only. User shall be validation of the titrator included electrode test , Volume and specific titration method, user certified primary standard for the validation of titrator.

Calibration Report

Certificate No: 241990/ME

1. Input I (DC Voltage)

Range (mV)	¹ STD Setting (mV)	² Tolerance (mV)	³ UUC Reading (mV)	Uncertainty (± mV)
2 V	0.00	-2.0 to 2.0	-0.1	0.239
	300.00	298.0 to 302.0	299.8	0.306
	600.00	598.0 to 602.0	599.7	0.375
	900.00	898.0 to 902.0	899.7	0.443
	1200.00	1198.0 to 1202.0	1199.7	0.52
	-1200.00	-1202.0 to -1198.0	-1199.7	0.52

2. Input I (pH)*

¹ STD Setting (mV)	Nominal Value (pH)	² Tolerance (pH)	³ UUC Reading (pH)	Uncertainty (± pH)
414.12	0	-0.034 to 0.034	0.004	0.0019
354.96	1	0.966 to 1.034	1.004	0.0019
295.80	2	1.966 to 2.034	2.003	0.0019
236.64	3	2.966 to 3.034	3.002	0.0019
177.48	4	3.966 to 4.034	4.002	0.0019
118.32	5	4.966 to 5.034	5.002	0.0019
59.16	6	5.966 to 6.034	6.001	0.0019
0.00	7	6.966 to 7.034	7.001	0.0019
-59.16	8	7.966 to 8.034	8.000	0.0019
-118.32	9	8.966 to 9.034	9.000	0.0019
-177.48	10	9.966 to 10.034	10.000	0.0019
-236.64	11	10.966 to 11.034	11.000	0.0019
-295.80	12	11.966 to 12.034	11.999	0.0019
-354.96	13	12.966 to 13.034	12.999	0.0019
-414.12	14	13.966 to 14.034	13.998	0.0019

Reference Temperature : 25° C

Calibration Report

Certificate No: 241990/ME

3. Temperature

3.1 Input I PT-1000 (385)

¹ STD Setting (Ω)	Nominal Value ($^{\circ}\text{C}$)	² Tolerance ($^{\circ}\text{C}$)	³ UUC Reading ($^{\circ}\text{C}$)	Uncertainty ($\pm ^{\circ}\text{C}$)
1000.0	0	-1.0 to 1.0	0.1	0.16
1077.9	20	19.0 to 21.0	20.1	0.18
1097.3	25	24.0 to 26.0	25.1	0.18
1116.7	30	29.0 to 31.0	30.1	0.18
1194.0	50	49.0 to 51.0	50.1	0.19
1385.1	100	99.0 to 101.0	100.2	0.22

4. Dimension

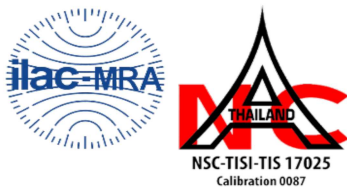
4.1 Spindle Stroke

³ UUC Setting (ml)	Nominal Value (mm)	² Tolerance (mm)	¹ STD Reading (mm)	Uncertainty (\pm mm)
1.3	10.400	10.330 to 10.470	10.432	0.011
5.6	44.800	44.730 to 44.870	44.845	0.012
10.0	80.000	79.930 to 80.070	80.002	0.013

Remark:

- ¹STD = Standard Equipment.
- ²Tolerance according to manufacturer specification and service manual.
- ³UUC = Unit Under Calibration.
- The result as per (*) marked are not TISI Accreditation Scope.

End of data



Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01243462
Model:	CPA225D	Issued Date:	13 November 2024
Serial No. (or ID.):	28812504 (B2014002)	Job No.:	WO-00047988
Manufacturer:	Sartorius	Page:	1 of 5
Condition:	In condition		

Customer: SGS (THAILAND) CO., LTD.
1/209, 1/211 Moo 1, Tambol Banchang,
Amphur Banchang, Rayong 21130 Thailand

Environment Condition: Temperature 21 °C ± 0.9 °C
Humidity 72 %RH ± 1.6 %RH

Calibration Place: SGS (THAILAND) CO., LTD. (Balance Lab)
1/209, 1/211 Moo 1, Tambol Banchang,
Amphur Banchang, Rayong 21130 Thailand

Calibration By:

Calibration Date: 07 November 2024

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02240400

international or national standard or other recognized national standard laboratories.

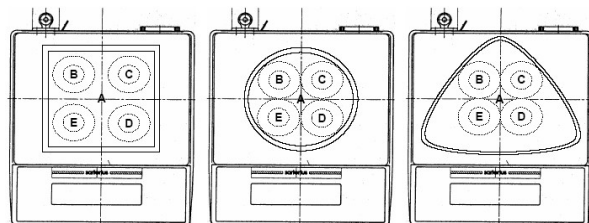
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 110 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0000	-0.0001	-0.0003	0.0000

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
5	0.000005
50	0.000005

Error of indication from nominal or conventional mass value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
0.01	0.010001	0.01001	0.00001	0.000011	2.03
0.05	0.049998	0.05001	0.00001	0.000012	2.02
0.1	0.100003	0.10002	0.00002	0.000013	2.01
0.5	0.500003	0.50000	0.00000	0.000016	2.01
1	1.000014	1.00001	0.00000	0.000018	2.00
5	5.000016	5.00003	0.00001	0.000027	2.00
10	10.000013	10.00005	0.00004	0.000034	2.00
20	20.000011	20.00006	0.00005	0.000048	2.00
50	50.000028	50.00008	0.00005	0.000080	2.00
70	70.000039	70.00012	0.00008	0.00013	2.00
90	90.000048	90.00013	0.00008	0.00016	2.00

Before Adjustment (Cont.)

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

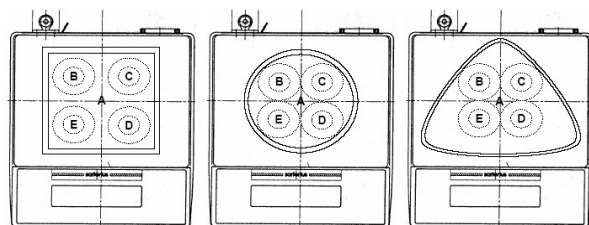
Nominal test value (g)	Standard Deviation
110	0.00005
200	0.00005

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
105	104.99998	105.0002	0.0002	0.00019	2.00
110	109.99997	110.0002	0.0002	0.00019	2.00
120	119.99997	120.0003	0.0003	0.00021	2.00
130	129.99998	130.0003	0.0003	0.00023	2.00
140	139.99998	140.0003	0.0003	0.00024	2.00
150	149.99999	150.0004	0.0004	0.00023	2.00
160	160.00000	160.0004	0.0004	0.00027	2.00
170	170.00000	170.0002	0.0002	0.00027	2.00
180	180.00001	180.0002	0.0002	0.00030	2.00
190	190.00001	190.0002	0.0002	0.00031	2.00
200	199.99996	200.0003	0.0003	0.00029	2.00

After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 110 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0000	-0.0001	-0.0003	0.0000

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
5	0.000005
50	0.000005

Error of indication from nominal or conventional mass value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
0.01	0.010001	0.01000	0.00000	0.000011	2.03
0.05	0.049998	0.05000	0.00000	0.000012	2.02
0.1	0.100003	0.09998	-0.00002	0.000013	2.01
0.5	0.500003	0.49998	-0.00002	0.000016	2.01
1	1.000014	1.00001	0.00000	0.000018	2.00
5	5.000016	5.00001	-0.00001	0.000027	2.00
10	10.000013	10.00000	-0.00001	0.000034	2.00
20	20.000011	20.00001	0.00000	0.000048	2.00
50	50.000028	50.00002	-0.00001	0.000080	2.00
70	70.000039	70.00003	-0.00001	0.00013	2.00
90	90.000048	90.00003	-0.00002	0.00016	2.00

After Adjustment (Cont.)

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
110	0.00005
200	0.00004

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
105	104.99998	105.0000	0.0000	0.00019	2.00
110	109.99997	110.0000	0.0000	0.00019	2.00
120	119.99997	120.0000	0.0000	0.00021	2.00
130	129.99998	130.0000	0.0000	0.00023	2.00
140	139.99998	140.0000	0.0000	0.00024	2.00
150	149.99999	150.0000	0.0000	0.00023	2.00
160	160.00000	160.0000	0.0000	0.00027	2.00
170	170.00000	170.0000	0.0000	0.00027	2.00
180	180.00001	180.0000	0.0000	0.00030	2.00
190	190.00001	190.0000	0.0000	0.00031	2.00
200	199.99996	200.0000	0.0000	0.00029	2.00

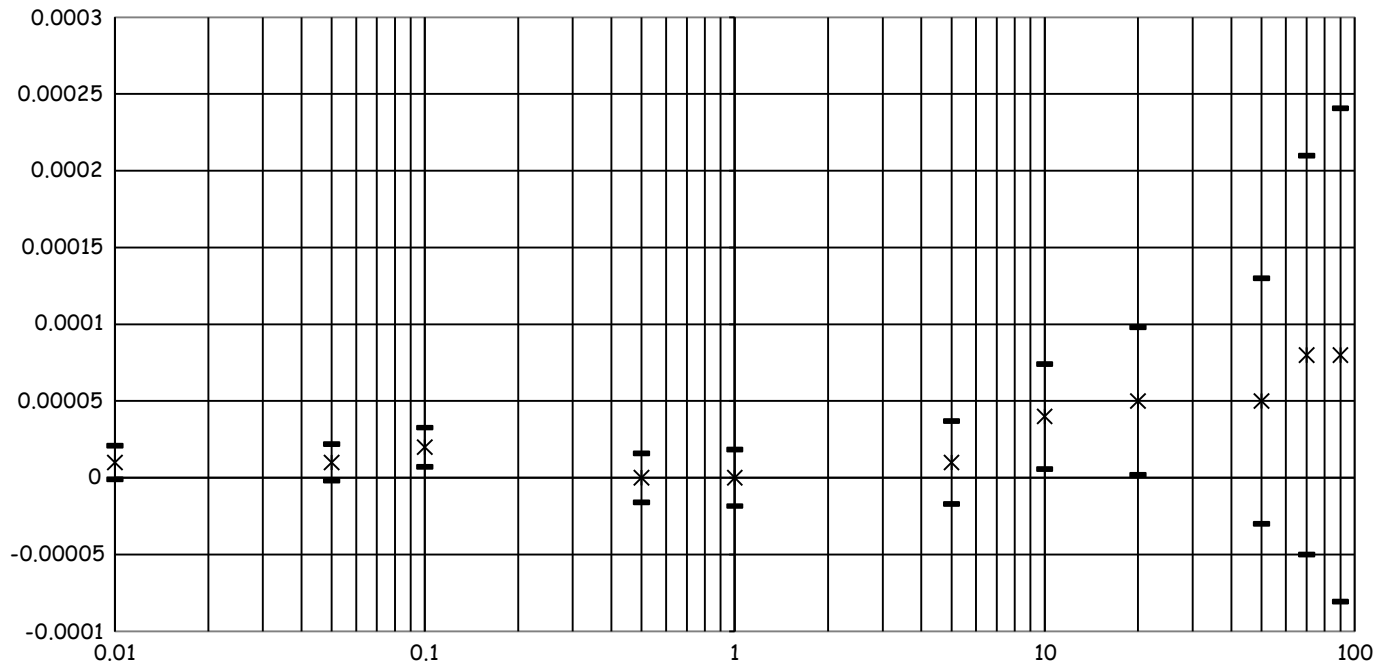
The End of Certificate

Before Adjustment

Job No. WO-00047988

Readability: 0.00001g

Error of indication



Display of balance

× Error of indication

— Uncert (+)

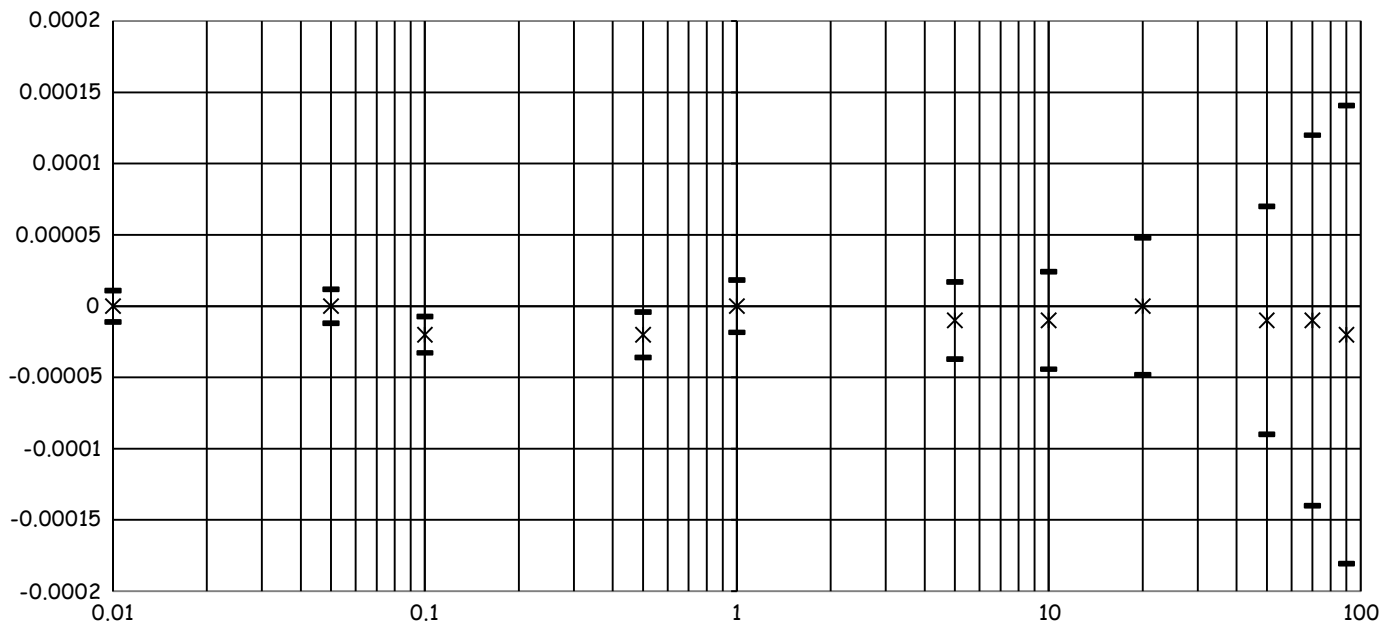
— Uncert (-)

After Adjust

Job No. WO-00047988

Readability: 0.00001g

Error of indication



Display of balance

× Error of indication

— Uncert (+)

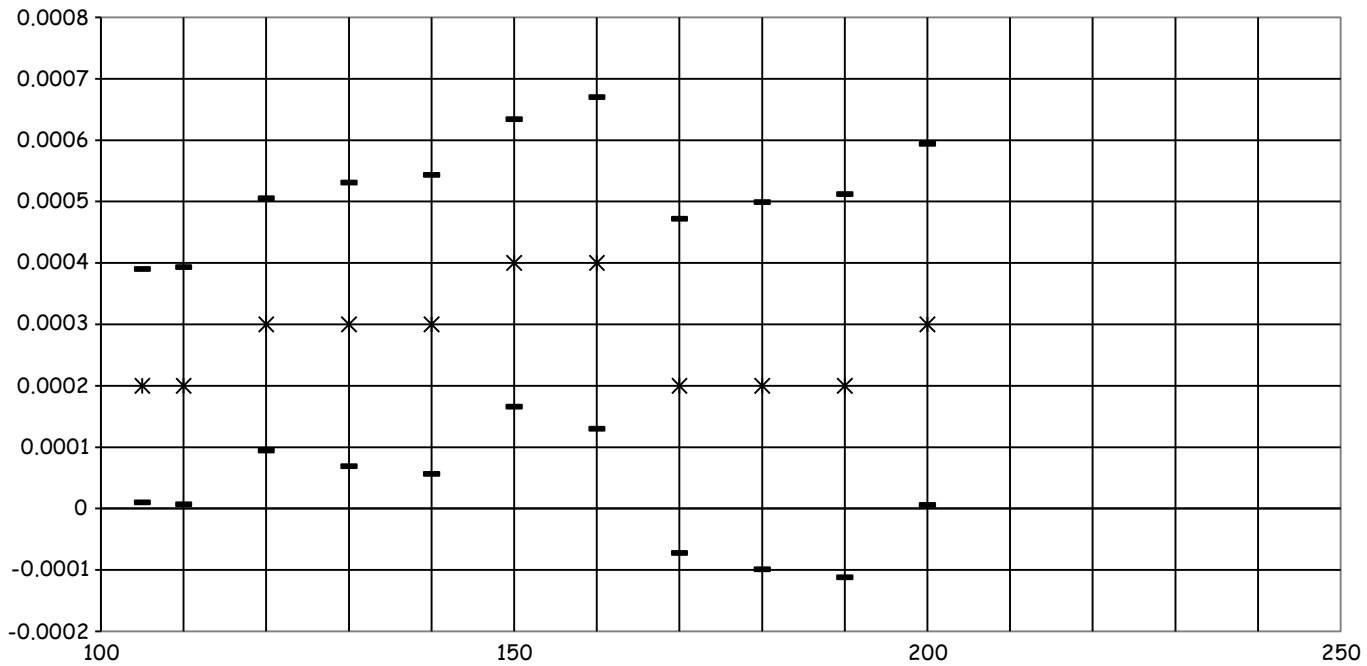
— Uncert (-)

Before Adjustment

Job No. WO-00047988

Readability: 0.0001g

Error of indication



Display of balance

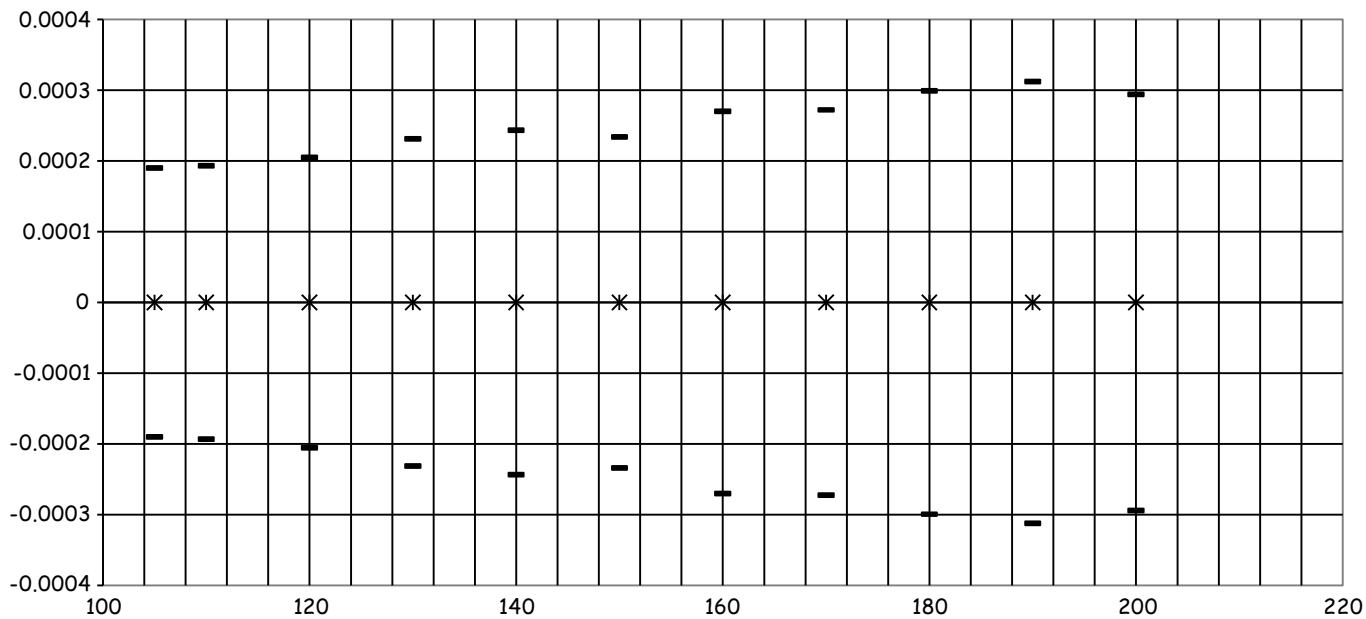
*Error of indication

—Uncert (+)

—Uncert (-)

—

Error of indication



Display of balance

*Error of indication

—Uncert (+)

—Uncert (-)

ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00047988

ชนิดเครื่องมือ: Balance

รุ่น: CPA225D

หมายเลขเครื่อง: 28812504

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
07 Nov 2024			07 Nov 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระจกกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input type="checkbox"/>	<input checked="" type="checkbox"/>	เสื่อมสภาพ
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตอบสนองของปุ่มกด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input type="checkbox"/>	<input checked="" type="checkbox"/>	**
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

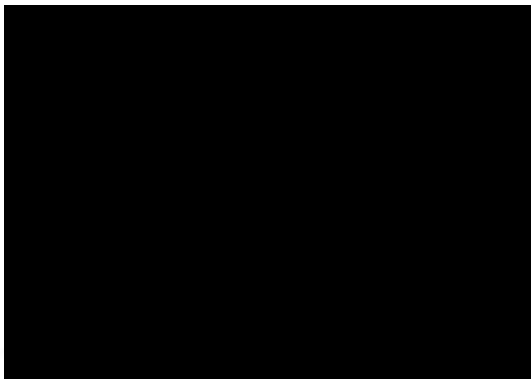
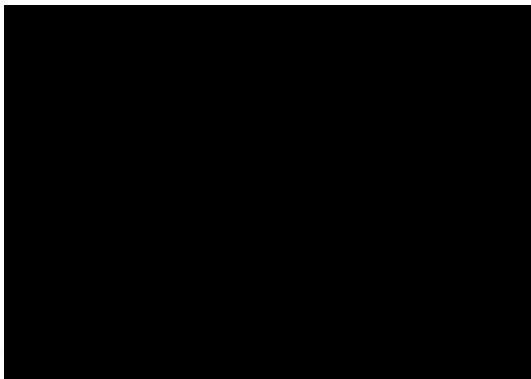
หมายเหตุเพิ่มเติม/ข้อแนะนำ :

** การแสดงผลของ Display หลังวางน้ำหนัก : มีค่าน้ำหนักติดไปถึงตำแหน่งที่ 3
แล้วค่าน้ำหนักก็จะค่อยๆลดลง ไปค่าที่ใกล้เคียงกับค่าตม้มน้ำหนักที่ใช้วาง Test

Metrohm Siam Ltd.

979/111-115 S.M. Tower 33rd Floor,
Phahonyothin Rd., Phayathai,
Phyathai, Bangkok 10400 THAILAND
Phone (+66)0 2298 0864
Fax (+66)0 2298 0865
E-mail: service@metrohm.co.th
www.metrohm.co.th

Certificate of Calibration

Date of Issue	:	29 August 2024
Certificate No.	:	241991/ME
Customer Company	:	SGS (Thailand) Limited 1/209, 1/211 Moo 1, T.Ban Chang, A.Ban Chang, Rayong 21130
Instrument Manufacturer	:	Metrohm
Instrument Type	:	Piston burettes of volumetric apparatus for automatic titrator
Model	:	20 ml for Exchange Units
Instrument Serial Number	:	257435
Calibration Place	:	Calibration Lab, Metrohm Siam Ltd. 979/111-115 S.M.Tower 33 Floor, Phahonyothin Road, Phyathai, Phyathai, Bangkok 10400
Environment Status	:	Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Humidity : $60\% \pm 10\%$ Barometric Pressure : $995\text{ mBar} \pm 10\text{ mBar}$
Date of Receipt	:	19 August 2024
Date of Calibration	:	21 August 2024
Job Number	:	CAL240633/ME
Condition of Calibration Item	:	Used Item
Result of Calibration	:	<input checked="" type="checkbox"/> Without Adjustment <input type="checkbox"/> Adjustment
Calibrated By	:	
Approved By	:	

The uncertainties are for a confidence probability of approximately 95%

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Calibration Report

Certificate No: 241991/ME

1. Reference Standards

Item	Description/Model	Serial No.	Manufacturing	Certificate No.	Due Date
1	Electronic Balance MSE1203S-100-DU	32506673	Sartorius	C01242378	18 Jan 2025
2	Digital Thermometer with Sensor CKT 100	378192	Anton Paar	23T2865	14 Sep 2024
3	Humidity/Baro/Temp. Data Recorder	B012860	Lutron	L202406116-0002	12 Jun 2025
4	Humidity/Baro/Temp. Data Recorder	B012860	Lutron	L202406116-0003	20 Jun 2025
5	Titration 904	1904001021140	Metrohm	240162/ME	10 Jan 2025

2. The measurement standards are traceable to International system of units (SI) by mean of an unbroken chain of calibration via accredited calibration laboratory, National or International metrology institute.

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

4. The results of test were found accurate as shown on date and place of test only.

5. Procedure Used :

In-house method WI-03 base on ISO-8655:2002 (E)

Calibration Report

Certificate No: 241991/ME

1. Piston burettes of volumetric apparatus for automatic titrator 20 ml

Nominal Volume (ml)	Mean Volume (ml)	Systematic Error (μ l)	Random Error (μ l)	Uncertainty (\pm μ l)
2.0	2.0014	1.37	0.67	4.0
10.0	10.0019	1.94	0.52	4.1
20.0	20.0000	-0.03	0.63	4.7

Reference Temperature : 20 °C

2. Permitted limits according to ISO 8655-3:2002 (E)

Table 1 - Maximum permissible errors for motor-driven piston burettes

Cylinder Volume	Maximum Systematic Error	Maximum Random Error
20 ml	$\pm 40 \mu$ l	$\pm 14 \mu$ l

End of data

Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Equipment No.	D2016008
Serial No.	00827-A	Model	DB 200/3
Reference Standard Instrument	XXXXXXXXXX	Cert. Reference std. No.	25/1248
Temperature Verify	150 ± 2 °C	Due Date Ref. std.	24/03/2025
Calibration Date	10/04/2025	Next Cal. Date	10/04/2026

Left											
Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.6	-0.18	148.4	1	148.6	-0.18	148.4	1	148.4	-0.18	148.2
2	148.4	-0.18	148.2	2	148.7	-0.18	148.5	2	148.6	-0.18	148.4
3	148.6	-0.18	148.4	3	148.6	-0.18	148.4	3	148.5	-0.18	148.3
Mean			148.35	Mean			148.45	Mean			148.32
SD			0.115	SD			0.058	SD			0.100
%RSD			0.078	%RSD			0.039	%RSD			0.067

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.3	-0.18	148.1	1	148.4	-0.18	148.2	1	148.4	-0.18	148.2
2	148.4	-0.18	148.2	2	148.6	-0.18	148.4	2	148.4	-0.18	148.2
3	148.3	-0.18	148.1	3	148.5	-0.18	148.3	3	148.3	-0.18	148.1
Mean			148.15	Mean			148.32	Mean			148.19
SD			0.058	SD			0.100	SD			0.058
%RSD			0.039	%RSD			0.067	%RSD			0.039

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.4	-0.18	148.2	1	148.6	-0.18	148.4	1	148.5	-0.18	148.3
2	148.6	-0.18	148.4	2	148.4	-0.18	148.2	2	148.6	-0.18	148.4
3	148.4	-0.18	148.2	3	148.6	-0.18	148.4	3	148.6	-0.18	148.4
Mean			148.29	Mean			148.35	Mean			148.39
SD			0.115	SD			0.115	SD			0.058
%RSD			0.078	%RSD			0.078	%RSD			0.039

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.4	-0.18	148.2	1	148.5	-0.18	148.3	1	148.5	-0.18	148.3
2	148.3	-0.18	148.1	2	148.4	-0.18	148.2	2	148.4	-0.18	148.2
3	148.5	-0.18	148.3	3	148.5	-0.18	148.3	3	148.5	-0.18	148.3
Mean			148.22	Mean			148.29	Mean			148.29
SD			0.100	SD			0.058	SD			0.058
%RSD			0.067	%RSD			0.039	%RSD			0.039

Verified By

XXXXXXXXXX

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Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Equipment No.	D2016008
Serial No.	00827-A	Model	DB 200/3
Reference Standard Instrument		Cert. Reference std. No.	25/1248
Temperature Verify	150 ± 2 °C	Due Date Ref. std.	24/03/2025
Calibration Date	10/04/2025	Next Cal. Date	10/04/2026

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.2	-0.18	150.0	1	150.6	-0.18	150.4	1	150.2	-0.18	150.0
2	150.4	-0.18	150.2	2	150.7	-0.18	150.5	2	150.7	-0.18	150.5
3	150.6	-0.18	150.4	3	150.8	-0.18	150.6	3	150.3	-0.18	150.1
Mean			150.22	Mean			150.52	Mean			150.22
SD			0.200	SD			0.100	SD			0.265
%RSD			0.133	%RSD			0.066	%RSD			0.176

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	149.6	-0.18	149.4	1	149.5	-0.18	149.3	1	149.6	-0.18	149.4
2	149.5	-0.18	149.3	2	149.5	-0.18	149.3	2	149.5	-0.18	149.3
3	149.5	-0.18	149.3	3	149.2	-0.18	149.0	3	149.4	-0.18	149.2
Mean			149.35	Mean			149.22	Mean			149.32
SD			0.058	SD			0.173	SD			0.100
%RSD			0.039	%RSD			0.116	%RSD			0.067

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.2	-0.18	150.0	1	150.2	-0.18	150.0	1	150.2	-0.18	150.0
2	150.3	-0.18	150.1	2	150.4	-0.18	150.2	2	150.4	-0.18	150.2
3	150.4	-0.18	150.2	3	150.6	-0.18	150.4	3	150.4	-0.18	150.2
Mean			150.12	Mean			150.22	Mean			150.15
SD			0.100	SD			0.200	SD			0.115
%RSD			0.067	%RSD			0.133	%RSD			0.077

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.1	-0.18	149.9	1	150.8	-0.18	150.6	1	150.9	-0.18	150.7
2	150.6	-0.18	150.4	2	150.2	-0.18	150.0	2	151.0	-0.18	150.8
3	151.5	-0.18	151.3	3	150.6	-0.18	150.4	3	150.9	-0.18	150.7
Mean			150.55	Mean			150.35	Mean			150.75
SD			0.709	SD			0.306	SD			0.058
%RSD			0.471	%RSD			0.203	%RSD			0.038

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Verification COD Reactor

Equipment Name Dri-Block Heater-Digital
 Serial No. 00827-A
 Reference Standard Instrument XXXXXXXXXX
 Temperature Verify 150 ± 2 °C
 Calibration Date 10/04/2025

Equipment No. D2016008
 Model DB 200/3
 Cert. Reference std. No. 25/1248
 Due Date Ref. std. 24/03/2025
 Next Cal. Date 10/04/2026

Right

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.2	-0.18	148.0	1	148.2	-0.18	148.0	1	148.2	-0.18	148.0
2	148.3	-0.18	148.1	2	148.3	-0.18	148.1	2	148.3	-0.18	148.1
3	148.2	-0.18	148.0	3	148.2	-0.18	148.0	3	148.2	-0.18	148.0
	Mean		148.05		Mean		148.05		Mean		148.05
	SD		0.058		SD		0.058		SD		0.058
	%RSD		0.039		%RSD		0.039		%RSD		0.039

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.5	-0.18	148.3	1	148.6	-0.18	148.4	1	148.3	-0.18	148.1
2	148.4	-0.18	148.2	2	148.9	-0.18	148.7	2	148.5	-0.18	148.3
3	148.2	-0.18	148.0	3	148.2	-0.18	148.0	3	148.2	-0.18	148.0
	Mean		148.19		Mean		148.39		Mean		148.15
	SD		0.153		SD		0.351		SD		0.153
	%RSD		0.103		%RSD		0.237		%RSD		0.103

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.4	-0.18	148.2	1	148.3	-0.18	148.1	1	148.2	-0.18	148.0
2	148.3	-0.18	148.1	2	148.5	-0.18	148.3	2	148.4	-0.18	148.2
3	148.2	-0.18	148.0	3	148.2	-0.18	148.0	3	148.2	-0.18	148.0
	Mean		148.12		Mean		148.15		Mean		148.09
	SD		0.100		SD		0.153		SD		0.115
	%RSD		0.068		%RSD		0.103		%RSD		0.078

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	148.3	-0.18	148.1	1	148.4	-0.18	148.2	1	148.2	-0.18	148.0
2	148.3	-0.18	148.1	2	148.3	-0.18	148.1	2	148.4	-0.18	148.2
3	148.2	-0.18	148.0	3	148.2	-0.18	148.0	3	148.2	-0.18	148.0
	Mean		148.09		Mean		148.12		Mean		148.09
	SD		0.058		SD		0.100		SD		0.115
	%RSD		0.039		%RSD		0.068		%RSD		0.078

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Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Equipment No.	D2016008
Serial No.	00827-A	Model	DB 200/3
Reference Standard Instrument		Cert. Reference std. No.	25/1248
Temperature Verify	150 ± 2 °C	Due Date Ref. std.	24/03/2025
Calibration Date	10/04/2025	Next Cal. Date	10/04/2026

สรุปผลการ Verify COD Reactor

Set Temp. ที่ 159.5 องศาเซลเซียส ทำให้ Temp. อยู่ในช่วง 148 - 152 องศาเซลเซียส

Verified By

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24LM134

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000

Serial No. : 17E101765

ID No. : D2017006

Submitted by : SGS (Thailand) Limited
1/209, 1/211 Moo 1 T.Ban Chang,
A.Ban Chang,
Rayong 21130

Location : TPA On Site Calibration Laboratory

Received Order : 22 August 2024

Calibrated Date : 23 August 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by :

Approved by :

Issue Date :

26 August 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2408-0766WSC-2

Cert. No.: 24LM134

Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	3240076	24I317	TPA	21 Mar 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, ID No.: D2017006

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.00	80	19.996	19.93	-0.066	0.15	2.00

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 of approximately 95 %.

-o0o-

การ Verify เครื่อง DO Meter โดยเปรียบเทียบระหว่างวิธีการไตเตรต กับ การวัดด้วยเครื่อง DO Meter

รายการทดสอบ : หาค่าความเข้มข้น GAGU 198 ± 30.5 mg/L

Portion	Membrane	Azide
1	201.5	202.5
2	203.5	199.0
3	202.0	199.0
4	200.5	206.5
5	203.5	199.0
6	203.5	199.0
7	202.5	202.5
8	200.0	199.0
9	201.0	206.5
10	202.0	199.0
Mean	202.00	201.20
SD	1.26930	3.13759

F-Test Two-Sample for Variances

	Membrane	Azide
Mean	202	201.2
Variance	1.611111111	9.844444444
Observations	10	10
df	9	9
F	0.163656885	
P(F<=f) one-tail	0.006350471	
F Critical one-tail	0.314574906	

t-Test: Two-Sample Assuming Unequal Variances

	Membrane	Azide
Mean	202	201.2
Variance	1.611111111	9.844444444
Observations	10	10
Hypothesized Mear	0	
df	12	
t Stat	0.747449592	
P(T<=t) one-tail	0.234593177	
t Critical one-tail	1.782287556	
P(T<=t) two-tail	0.469186354	
t Critical two-tail	2.17881283	

Summary

ข้อมูลทั้งสองชุดที่ได้จากการทำการทดสอบ t- test จากสองเครื่องมือไม่มีความแตกต่างกัน $T\text{-stat} < T(\text{critical})$
สรุปว่าข้อมูล 2 ข้อมูลไม่แตกต่างกัน

Analyst by : 

Date : 16/09/2024

Check by : 

Date : 17/09/24

Determination of BOD

Date of test	11/09/2024	DO Meter No.	D2017006
Sample Name	Water	Incubator No.	I2022007
Sample No.	QC	Analyzed by	TB

Sample Identification	V (mL)	pH	Temp.	D1 (mg/L)	D2 (mg/L)	Depletion (mg/L)	Dilution	(S)Vs (mg/L)	BOD ₅ (mg/L)	Report (mg/L)
Dilution water blank	1000	7.11	20.50	8.70	8.50	0.20	-		0.20	0.19
	1000			8.69	8.50	0.19	-		0.19	
QC	20	7.10	20.49	8.66	3.66	5.00	50	0.97	201.5	202
Seed control	50	7.13	20.55	8.56	3.60	4.96	-	Average =		4.97
	50			8.58	3.60	4.98	-			
1	20		20.40	8.69	3.69	5.00	50	0.97	201.5	201.5
2	20		20.40	8.68	3.64	5.04	50	0.97	203.5	203.5
3	20		20.45	8.69	3.68	5.01	50	0.97	202	202.0
4	20		20.46	8.65	3.67	4.98	50	0.97	200.5	200.5
5	20		20.51	8.69	3.65	5.04	50	0.97	203.5	203.5
6	20	7.10	20.50	8.68	3.64	5.04	50	0.97	203.5	203.5
7	20		20.41	8.67	3.65	5.02	50	0.97	202.5	202.5
8	20		20.51	8.66	3.69	4.97	50	0.97	200	200.0
9	20		20.47	8.65	3.66	4.99	50	0.97	201	201.0
10	20		20.48	8.65	3.64	5.01	50	0.97	202	202.0
Initial pH	-	*ใส่เมื่อมีการปรับ pH สารตัวอย่างเท่านั้น								
		*0.6<(S)Vs<1.0								

*spike seed 3 mL ต่อ Diluted sample 1 L เมื่อใช้ V = 500 mL

*เมื่อทั้ง 3 dilution มีค่า depletion < 2 ให้ทำการคำนวณโดยใช้ dilution ที่ V สูงสุดมาคำนวณโดยถือว่า depletion = 2

$$\text{BOD (mg/L)} = ((\text{DO1} - \text{DO2}) - (\text{S})\text{Vs}) \times \text{Dilution}$$

$$\text{D1} = \text{ค่า O2 ที่ละลายน้ำวันแรก (mg/L)}$$

$$\text{D2} = \text{ค่า O2 ที่ละลายน้ำวันที่ 5 หลังการบ่มในตู้ควบคุมอุณหภูมิ 20 ± 1 °C (mg/L)}$$

$$\text{S} = \frac{\text{Average DO Depletion ที่เกิดจาก Seed control (mg/L)}}{\text{ปริมาตรของ Seed ที่ใช้ใน Seed control (mL)}}$$

$$\text{Vs} = \text{ปริมาตรของ Seed ที่ใช้ใน Sample (mL)} = \frac{1000 - \text{V (mL)}}{100}$$

Checked by XXXXXXXXXX Date 17/09/24

Biochemical Oxygen Demand (BOD) in Water
(Azide Modification)

Date : 11 / 09 / 2024

Product : QC (Out 16/09/2024) Analyzed by : XXXXXXXXXX

Sample No.	mL. 0.025 Na ₂ S ₂ O ₃ ที่ใช้ไตรเตรต D ₁	mL. 0.025 Na ₂ S ₂ O ₃ ที่ใช้ไตรเตรต D ₂	Factor	D1 (mg/L)	D2 (mg/L)
1	5.80	2.45	1.5	8.70	3.68
2	5.80	2.50	1.5	8.70	3.75
3	5.80	2.50	1.5	8.70	3.75
4	5.85	2.45	1.5	8.78	3.68
5	5.80	2.50	1.5	8.70	3.75
6	5.80	2.50	1.5	8.70	3.75
7	5.80	2.45	1.5	8.70	3.68
8	5.80	2.50	1.5	8.70	3.75
9	5.85	2.45	1.5	8.78	3.68
10	5.80	2.50	1.5	8.70	3.75

Calculation: D₁ = mL. 0.025 Na₂S₂O₃ ที่ใช้ไตรเตรต D₁ x Factor

D₂ = mL. 0.025 Na₂S₂O₃ ที่ใช้ไตรเตรต D₂ x Factor

Checked by : XXXXXXXXXX

Date : 17/09/24

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Membrane						
Sample No.	DO0	DO5	Depletion	Seed	dilution	mg/L BOD
1	8.69	3.69	5.00	0.97	50	201.5
2	8.68	3.64	5.04	0.97	50	203.5
3	8.69	3.68	5.01	0.97	50	202.0
4	8.65	3.67	4.98	0.97	50	200.5
5	8.69	3.65	5.04	0.97	50	203.5
6	8.68	3.64	5.04	0.97	50	203.5
7	8.67	3.65	5.02	0.97	50	202.5
8	8.66	3.69	4.97	0.97	50	200.0
9	8.65	3.66	4.99	0.97	50	201.0
10	8.65	3.64	5.01	0.97	50	202.0
AVERAGE	8.67	3.66	5.01	0.97	50	202.0

Azide						
Sample No.	DO0	DO5	Depletion	Seed	dilution	mg/L BOD
1	8.70	3.68	5.02	0.97	50	202.5
2	8.70	3.75	4.95	0.97	50	199.0
3	8.70	3.75	4.95	0.97	50	199.0
4	8.78	3.68	5.10	0.97	50	206.5
5	8.70	3.75	4.95	0.97	50	199.0
6	8.70	3.75	4.95	0.97	50	199.0
7	8.70	3.68	5.02	0.97	50	202.5
8	8.70	3.75	4.95	0.97	50	199.0
9	8.78	3.68	5.10	0.97	50	206.5
10	8.70	3.75	4.95	0.97	50	199.0
AVERAGE	8.72	3.72	4.99	0.97	50	201.2



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025 Cert No. 25/1241
Order No. 25030172

Customer SGS (Thailand) Limited.
1/209, 1/211 Moo 1, T. Ban Chang, A. Ban Chang Rayong 21130 Thailand.

Place of Calibration Sample Area

Description Incubator

Model i250DS

Serial No. i250402-0810-0319

ID.No. I2010004

Date of Receipt Mar 24, 2025

Date of Calibration Mar 24, 2025

Environment

Temperature	(Min)	24.2	°C	(Max)	27.7	°C
Relative Humidity	(Min)	40.8	%rh	(Max)	46.5	%rh

Calibration Method

WI-17: The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard Equipment	Serial No.	Certificate No.	Due Date
1) Data Acquisition Switch Unit with Sensor	MY49010059	QR24-0874	24 Apr 2025

This certificate is traceable to SI unit.



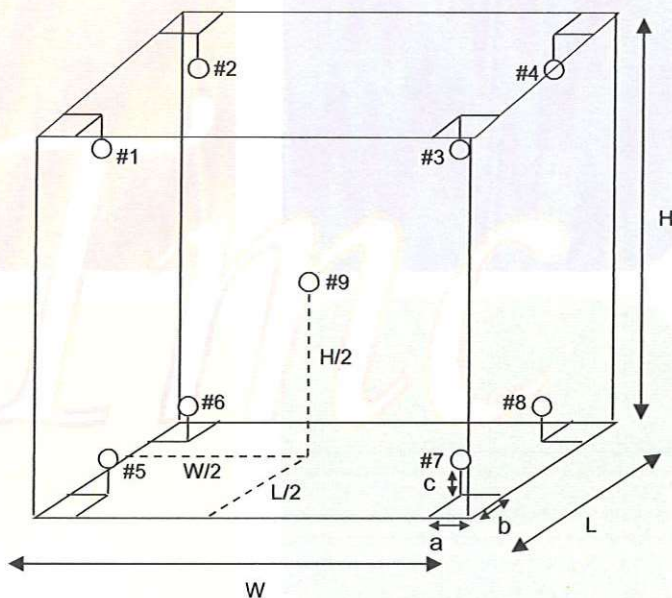
CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1241

Order No. 25030172

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension (W x L x H) is 50 x 50 x 105 cm
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1241

Order No. 25030172

Results (without adjustment)

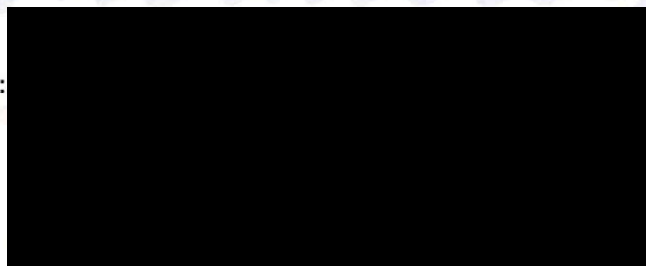
Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability ±(°C)	Uniformity (°C)	Uncertainty ±(°C)
20.0	20.0	20.0	Position 1	20.236	0.362	0.508	0.60
			Position 2	20.055			
			Position 3	19.967			
			Position 4	19.712			
			Position 5	19.849			
			Position 6	19.974			
			Position 7	19.660			
			Position 8	19.835			
			Position 9	19.781			

The stability and uniformity were taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in this report.

This reported expanded uncertainty was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

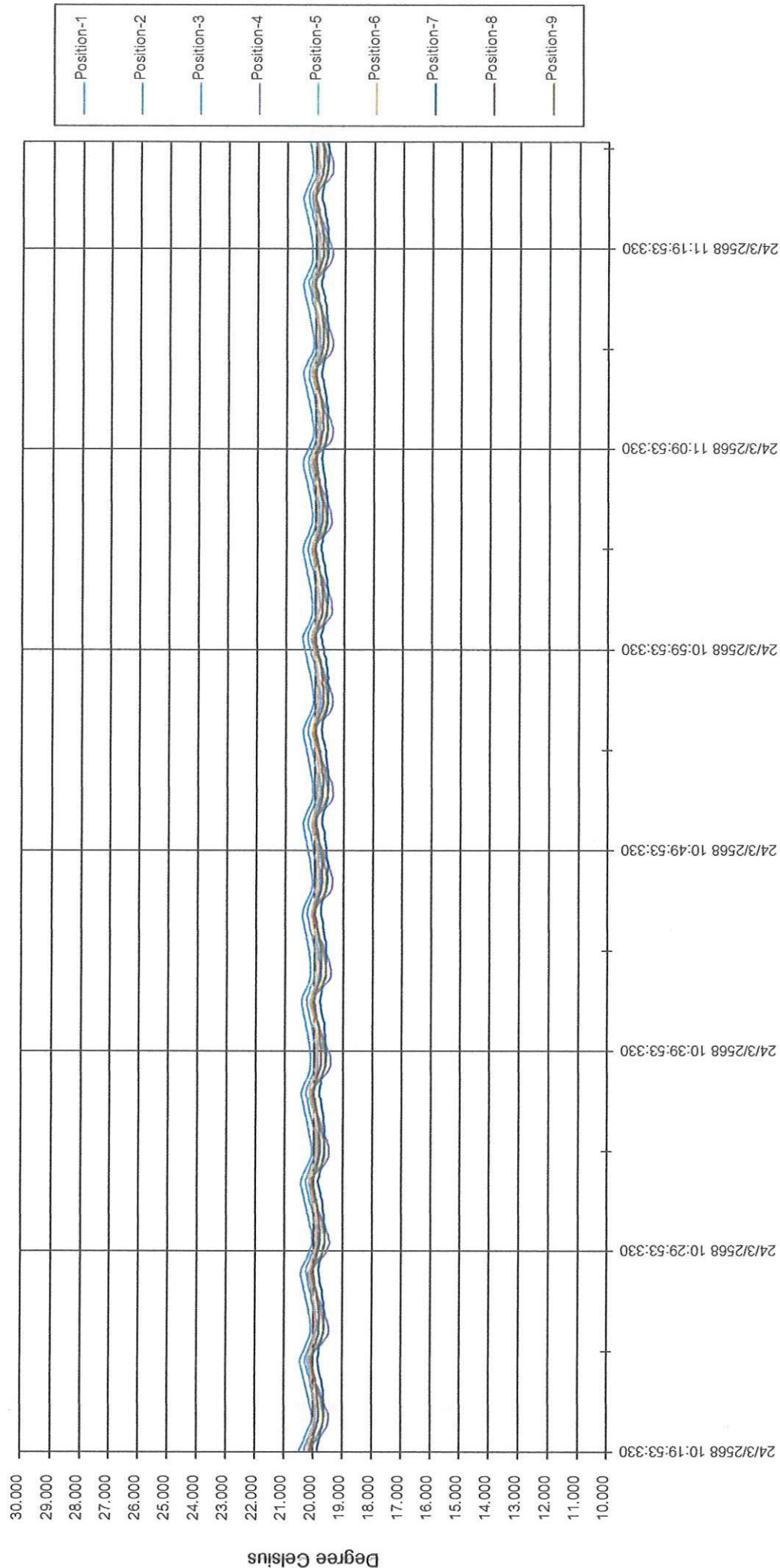
APPROVED SIGNATORY :



Cert.No. 25/1241

Incubator

Model: I250DS S/N: I250402-0810-0319 ID.No. I2010004



Times

PlasmaQuant® MS (Elite) ICP-MS



1 Customer and service data

Customer data

Company	SGS
Department	Environmental Laboratory 1
Name	
Address (Street, Number, ZIP code, City)	Sukhumvit 2 Rd, Ban Chang, Ban Chang District, Rayong 21150
Telephone	
E-Mail	
Customer no.	
Order no.	

Device data

Device Type	PQMS Elite
Serial number	10-5000-030-26-AR109

Data of the authorized person for the Maintenance

Name, Company		
Date of the Maintenance	25 June 2025	
	yes	no
Maintenance with following Operational Qualification OQ (requires a separate OQ protocol)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

2 Maintenance Checklist

Tick each checkbox as the steps are completed.

Parts required

<input checked="" type="checkbox"/>	10-5000-220-20	Kit preventative maintenance ICP-MS
<input checked="" type="checkbox"/>	13-410-540	Cooling Water Additives
Choose one of the following oil types as it is important for rotary pump type:		
<input type="checkbox"/>	418-88089-0	Vacuum Pump Oil (Esther Oil LVO 200) N/A
<input checked="" type="checkbox"/>	418-10-406-251	Vacuum Pump Oil (PFPE Oil LVO 420)

Initial performance tests

<input checked="" type="checkbox"/>	Print out Details, Plasma Align (Time Scan mode), Res & Trim, Mass Call, Detector Setup, Mass Scan (after new scan with tuning solution), Vacuum (Gate Valve opened and closed), iCRC, Ion Optics and Stepper pages from the instrument setup
<input checked="" type="checkbox"/>	Verify performance (sensitivity/oxides/double charges) of system before starting maintenance

Vacuum system

<input checked="" type="checkbox"/>	Drain and replace oil in rotary pump. Inspected
<input checked="" type="checkbox"/>	Clean exterior of pump.
<input checked="" type="checkbox"/>	Test vacuum interlock by attempting to start vacuum with Turbo pump #1 dismounted. Verify that appropriate error message is displayed.

Mass spectrometer system

<input checked="" type="checkbox"/>	Check/adjust gate valve.
<input checked="" type="checkbox"/>	Clean sampler/skimmer cones/replace O-rings.
<input checked="" type="checkbox"/>	Check quadrupole resolution and check Quad Controller resonance. Resonance peak voltage is 2.75 v.
<input checked="" type="checkbox"/>	Clean entrance lens and entrance plate Detector voltage is: 3210 v.

Sample introduction system

<input checked="" type="checkbox"/>	Inspect torch.
<input checked="" type="checkbox"/>	Inspect/replace torch gas tubing.
<input checked="" type="checkbox"/>	Inspect/clean/adjust RF coil.
<input checked="" type="checkbox"/>	Inspect igniter/replace ignitor cable.
<input checked="" type="checkbox"/>	Clean sampler/skimmer cones/replace O-rings.
<input checked="" type="checkbox"/>	Clean extraction lenses #1 and #2.
<input checked="" type="checkbox"/>	Remove nebulizer from spray chamber. Turn on the peristaltic pump (15 rpm) and nebulizer gas flow (1.0 L/min) and aspirate de-ionized water. Check that the aerosol produced by the nebulizer is normal and uniform.
<input checked="" type="checkbox"/>	Check spray chamber and replace all O-rings and water tubing.
<input checked="" type="checkbox"/>	Inspect sample introduction system electrical connections.

Water cooling system

<input checked="" type="checkbox"/>	Drain water reservoir.
<input checked="" type="checkbox"/>	Clean air intake filters & heat exchange fins as needed.
<input checked="" type="checkbox"/>	Inspect all water hoses for cracks/leaks.
<input checked="" type="checkbox"/>	Disassemble inline water filter & clean cartridge.
<input checked="" type="checkbox"/>	Fill water reservoir with additives and check the water conductivity according to instruction. Conductivity = 100 uS/cm.
<input checked="" type="checkbox"/>	Inspect mains cable and plug.
<input checked="" type="checkbox"/>	Turn on and re-check water level.
<input checked="" type="checkbox"/>	Check pressure (440±40 kPa) and temperature set point (20 °C); adjust if necessary.
<input checked="" type="checkbox"/>	Verify operation of the water solenoid.

Basic instrument

<input checked="" type="checkbox"/>	Inspect condition of argon supply hose.
<input checked="" type="checkbox"/>	Inspect mains power cable and plug.
<input checked="" type="checkbox"/>	Check operation of exhaust system and inspect airflow sensor; if necessary clean according to instruction.
<input checked="" type="checkbox"/>	Inspect USB and serial cables/connections.
<input checked="" type="checkbox"/>	Clean all external covers and fans.
<input checked="" type="checkbox"/>	Check argon inlet pressure if it is at recommended pressure of 700 kPa (100 psi) (allowed range is 600 to 830 kPa, 90 to 120 psi) Actual setting is 102 kPa/psi.
<input checked="" type="checkbox"/>	Check iCRC for leakage and blockage according to service info. Check gas pressures: He ~150 kPa (22 psi), H ₂ ~100 kPa (16 psi)

Interlock Tests

- ☒ Turn off argon supply and ignite plasma. Verify if low argon error message is displayed.
- ☒ Ignite plasma and press emergency stop button. Verify that plasma goes out and appropriate error message is displayed.
- ☒ Ignite plasma and unlatch plasma compartment/main RF door. Verify that plasma goes out and appropriate error message is displayed.
- ☒ Ignite plasma and turn off argon supply. Check if plasma is turned off and appropriate low argon flow message is displayed.
- ☒ Turn off water cooler and light plasma. Verify if appropriate error message is displayed.

Accessories

- ☒ Verify initialization and operation of auto sampler. Check belts and wheels etc.
- ☒ Check all other accessories.

Performance tests

- ☒ Update entries in Details page of Instrument Setup window as required.
- ☒ Print out every section of the Instrument Setup (service mode) and put it into the logbook.
- ☒ Tune up instrument and run performance test. Perform any corrective action necessary if results do not meet specifications. Add performance test results to logbook.

Instrument condition

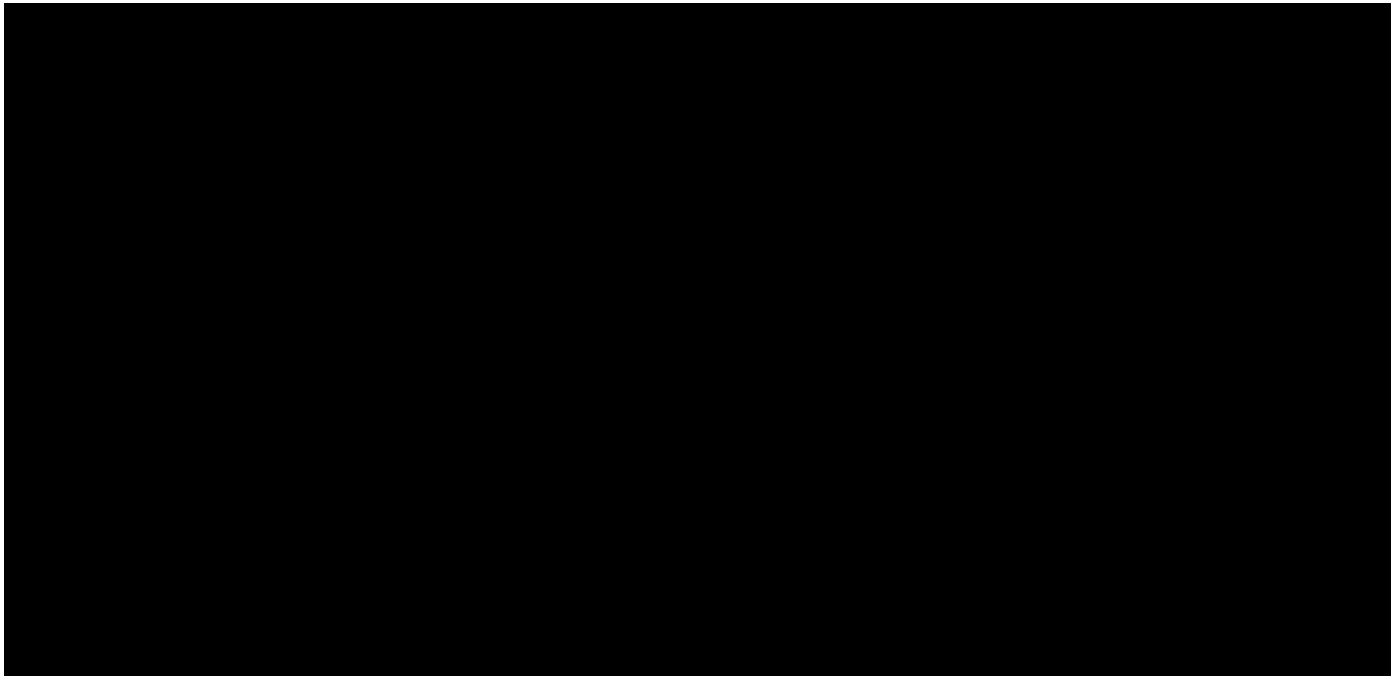
- ☒ Assess and comment on condition of ICP-MS system
- ☒ Discuss condition, preventative maintenance results and instrument performance with the customer.
- ☒ Sign and date this checklist after obtaining customer's signature.

Instrument and environmental conditions

- | | | |
|--|-------------------------------|-------------------------------|
| <input checked="" type="checkbox"/> Good | <input type="checkbox"/> Fair | <input type="checkbox"/> Poor |
|--|-------------------------------|-------------------------------|

Comments and recommendations:

-



Service Report

Customer's address :		Customer's Ref. No.		DISTRIBUTOR	
SGS Rayong					
Sukhumvit 2 Rd, Ban Chang, Ban Chang District, Rayong 21150					
Sirirat.Saelim@sgs.com					
E-mail :		Phone :	Fax :		
Job No. 2506286PB	User :	Service Engineer :		Date : 24-26/06/2025	Page : 1/1
Instrument model :	Serial No. 10-5000-030-26-AR109			Software Version No. 4.3.3	
<input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep.(SP) <input type="checkbox"/> Visit(VI)					
Fault / Claim :					<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Error Code
PM1/2025					
Clean cooling system , replaces DI water, adjust conductivity to 101 uS/cm, Clean water filter					
Action taken : Clean extraction lenses #1 and #2.					
Clean sample introduction system, torch,spray chamber,nebulizer, replace quick lock and clamp.					
Clean water manifold, water valve assembly					
Check spray chamber and replace all O-rings and water tubing.					
Clean sampler/skimmer cones/replace O-rings.					
Inspect/clean/adjust RF coil/ igniter/replace ignitor cable.					
Clean all external covers and fans. Interlock Tests all passed.					
Replace Activated Alumina (vacuum oil trap)					
Tune up instrument ,res and trim, mass calibration and run performance test with 1 ppb tuning standard.					
Instrument working properly.					
Action Pending / Recommendation : ส่งของรายการอะไหล่ AutoSample					
418-10-405-336 Sample Probe (demountable) complete 1 ea. ติดตั้งให้ ลค แล้ว					
418-13-410-541 Set pump tubing autosampler (grey/grey) 1 set					
10-405-102 Z-Axis drive belt 1 ea.					
10-405-316 Nipple, polypropylene, 2,5mm nipple 2,5 mm					
fixed wash reservoir *จำนวน 2 ชิ้น*					
<input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration					
Item No.	Name			Quantity	Unit Price
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
Herewith the undersigned confirm the time devoted, the work performed, the perfect function of the device, and the receipt/delivery of the specified spare parts. *Traveled hours and kilometers can only be entered after the return of the service engineer.				Work completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Details

Instrument Details

Last Read: 2025-06-25 09:44:34
Undo
Send to Instrument

Runtimes (Hrs : Mins)

Plasma: 3,767 : 3
Turbo Pump 1 & 2: 56,627 : 56,627
Rotary Pump: 56,636 :

Component Serial Numbers & Installation Dates

Instrument:	10-5000-030-26-AR109	10/25/2017
Control Board:	0806170600010	10/25/2017
RF Generator:	10-5300S-AR239	10/25/2017
RF DC Supply:	31127	6/25/2025
Turbo Pump 1:	16872279	10/25/2017
Turbo Pump 2:	16872278	10/25/2017
Rotary Pump 1:	960365	2/26/2018
Gauge 2:		2/26/2018
Detector:	254534	10/25/2017
Ion Optics Board:	00091C	10/25/2017
Quad Controller:	60017090764	10/25/2017
Mass Flow Controller Neb:	2550	10/25/2017
Mass Flow Controller Sheath:	2523	10/25/2017
iCRC Skimmer Cone MFC:	2016	10/25/2017
<input checked="" type="checkbox"/> Nitrox Installed	1128	10/25/2017

Instrument Version Info

Instrument ID & Type: PQMS Elite, 6

Firmware Build Date: Sep 7 2020 10:11:53

Firmware Version: 5.69

Control Board Version: 06

FPGA Chip Version: 200

CPLD Chip Version: 16

Optics Board Version: 7

Type and Key Status: Not AMR

Accessories

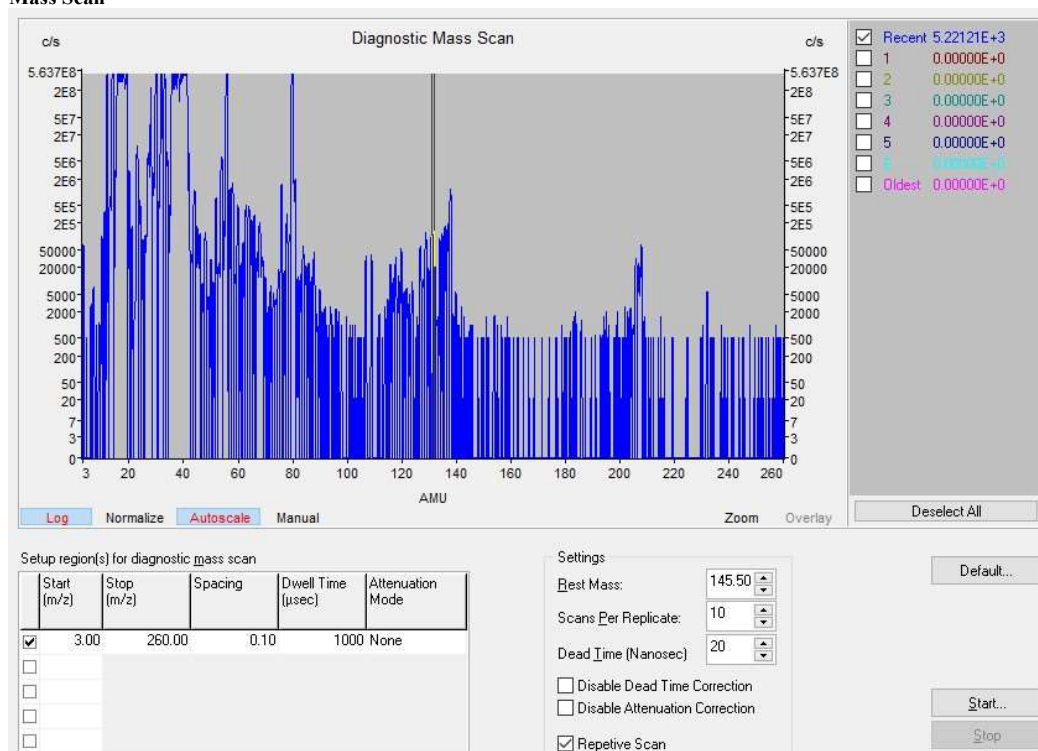
☐ Vacuum Exhaust Monitoring Installed

☒ Skimmer Installed

☐ Vacuum Gauge 2 Installed

☒ Sheath Gas MFC installed

Mass Scan



Report Date 2025-06-25 15:12:44 GMT+07:00

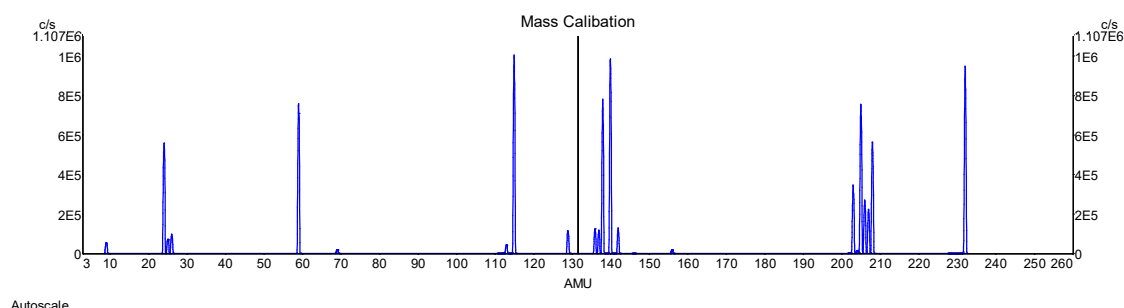
Title PM1_2025 Jun 25

Mass Calibration

Last calibration: 2025-06-25 14:43:26

[Worksheet: C:\ProgramData\Analytik Jena\ASpect MS\Supplied Worksheets\System Setup 25 Jun 2025.msws]

Isotope	Exact Mass	Current Mass	Theory - Curr	Resolution	Height (c/s)	Status
Be9	9.012	9.009	0.003	0.77	56237.33	Pass
Mg25	24.986	24.984	0.002	0.75	73121.00	Pass
Co59	58.933	58.944	-0.011	0.70	785394.69	Pass
In115	114.904	114.904	0.000	0.70	1051608.38	Pass
Ce140	139.905	139.911	-0.006	0.70	1001149.00	Pass
Pb206	205.975	205.954	0.021	0.77	278202.00	Pass
Th232	232.038	232.040	-0.002	0.75	969168.00	Pass



Autoscale

	Squared Term Scale Factor	Offset
RF	-20.113E-6	25.648E-3

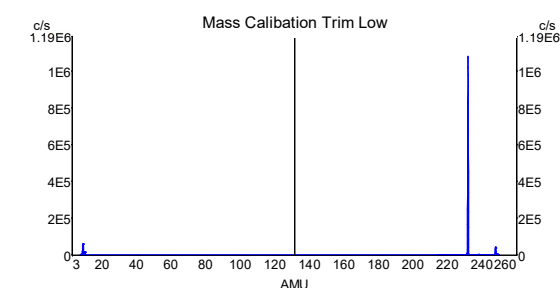
Resolution and Trim

Last modified: 2025-06-25 14:43:26

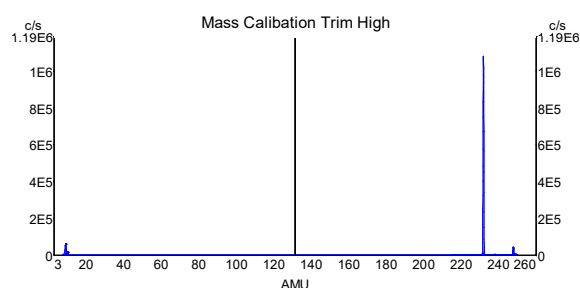
[Worksheet: C:\ProgramData\Analytik Jena\ASpect MS\Supplied Worksheets\System Setup 25 Jun 2025.msws]

	Offset	Scale Factor
RF	-132.436	226.239
DC	-192.046	252.539

	Isotope	Observed AMU	Width
LOW Mass	Be9	8.996	0.80
HIGH Mass	Th232	232.039	0.78



Autoscale

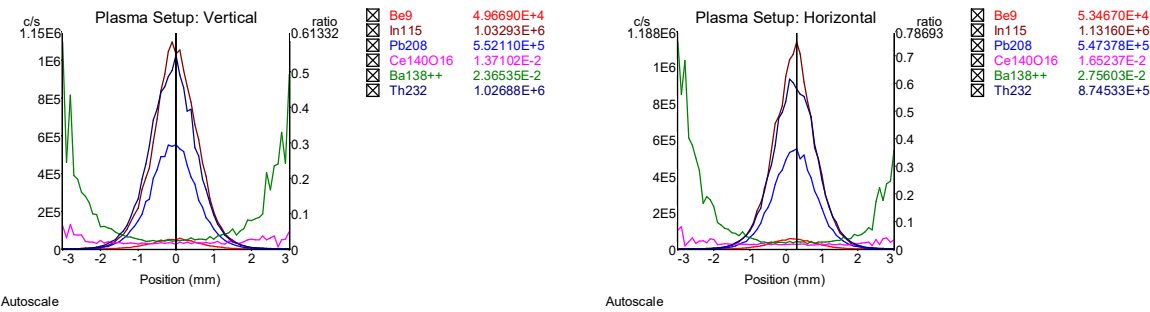


Autoscale

Plasma Setup

Last modified: 2025-06-25 14:48:19
[Worksheet: C:\ProgramData\Analytik Jena\ASpect MS\Supplied Worksheets\System Setup 25 Jun 2025.msws]

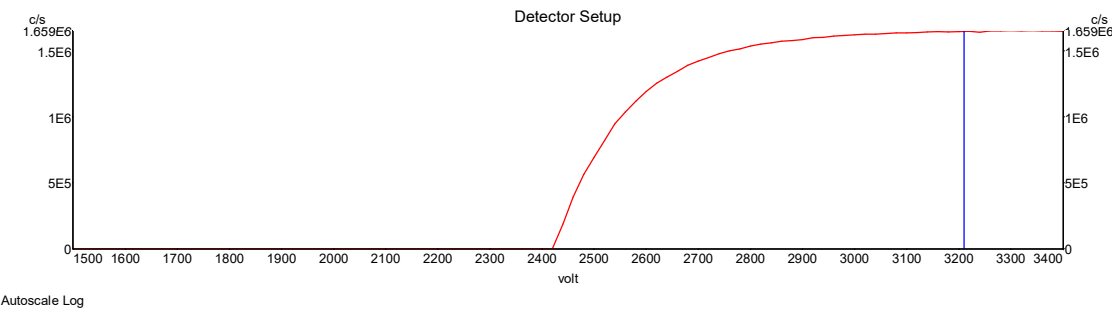
Horizontal (x) alignment: 0.30 mm, Vertical (y) alignment: 0.00 mm



Detector Setup

Last modified: 2025-06-25 14:06:44
[Worksheet: C:\ProgramData\Analytik Jena\ASpect MS\Supplied Worksheets\System Setup 25 Jun 2025.msws]

Detector Voltage: 3210 volt, Scan Range From: 1500 - 3400 volt



Report Date 2025-06-25 15:11:24 GMT+07:00

Worksheet System Test 25 Jun 2025.msws

Analyst

Worksheet Summary

Worksheet: System Test 25 Jun 2025.msws
Created: 2020-06-03 07:36:54
Analyst:
Computer: APPLICATIONICP
Last Saved: 2025-06-25 15:10:23 GMT+07:00
Software Ver.: 4.3 r19995
Firmware Ver.: 5.69
Samples: 1
Comment:

Chemistry

Matrix:
Acids Used:
Keywords:
CRM:

Measurement Parameters

Analysis Modes Analysis Type: Quantitative, Acquisition Mode: Steady State, Scan Mode: Peak Hopping
Spacing: Coarse, Points/Peak: 1, Scans/Replicate: 50, Replicates/Sample: 10

Plasma Plasma flow: 9.00 L/min Auxiliary flow: 1.35 L/min Sheath Gas Flow: 0.00 L/min Nebulizer flow: 0.99 L/min
Sampling depth: 6.00 mm
Power: 1.20 kW Pump rate: 18 rpm Stabilization delay: 30 sec Nitrox Flow: 0.00 mL/min

**Ion Optics
(Volt)**

Skimmer Bias: 0.00
First Extraction Lens: -53.00 Second Extraction Lens: -493.00 Third Extraction Lens: -499.00
Left Mirror Lens: 61.00 Right Mirror Lens: 51.00 Bottom Mirror Lens: 54.00
Corner Lens: -446.00 Entrance Lens: 6.00
Fringe Bias: -3.00 Entrance Plate: -70.00
Detector Focus: True Pole Bias: 0.00

iCRC Skimmer Cone: Off iCRC Skimmer Gas Flow: 0 mL/min

Nitrox 0 mL/min

Sampling Aerosol generation: Nebulizer, Source: Manual
Fast pump during sample delay/rinse: On, Enable device control: Off
Spray Chamber Cooling: On Spray Chamber Temp: 3.00 °C
Sample uptake delay: 30 sec, Smart Rinse: No, Switch Delay: OFF
Scan time: 1407 msec, Replicate time: 70.35 sec

Analytes (6)

Be9, Co59, In115, Ce140, Pb208, Th232

SemiQuant Analytes (0)**Internal Standards (0)**

No. of isotope ratio standards: 0

Isotope Ratios (2)

CeO/Ce(Ce140O16/Ce140), Ba++/Ba(Ba138++/Ba138)

Default exclusions (7)

Ar40, Ar40Ar40, N14, N14H1, O16, O16H1, Ar40H1

User-specified exclusions (0)**Scan Segments (11)**

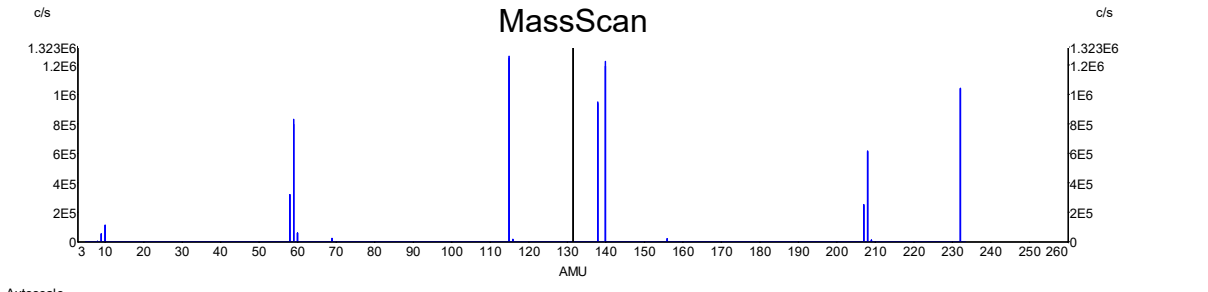
Start (m/z)	Stop (m/z)	Dwell (µsec)	Attenuation	mode	Norm-Med	Med-High
5	5	60000		None		
8	10	60000		None		
58	60	60000		None		
69	69	60000		None		
114	116	60000		None		
138	140	60000		None		
156	156	60000		None		
207	209	60000		None		
220	220	60000		None		
228	228	60000		None		

Start (m/z) 231 Stop (m/z) 233 Dwell (µsec) 60000 Attenuation mode None Norm-Med Med-High

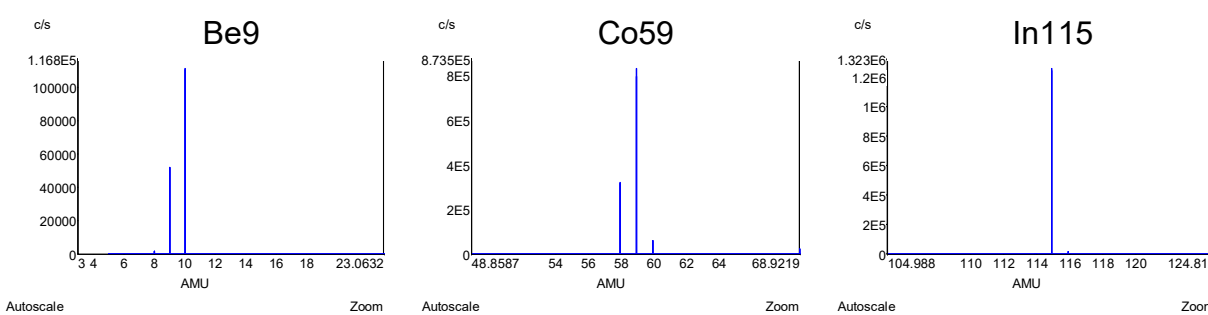
1 ppb Tuning solution [1 ppb Tuning solution]
Tube: 2, Replicates: 10, Auto Dilutions factor: -, Cal Set 1, Time measured: 2025-06-25 15:10:23
Actual weight: 1.0000 g, Actual volume: 1.00 mL, Dilution Factor: 1.00
Position Horizontal: 0.30 mm Position Vertical: 0.00 mm Detector Voltage: 3210.00 volt

Analyte	Soln Conc	Unit	QC	Mean c/s	%RSD	SD	Replicates (c/s)				
Be9	1.0000	ppb	-	51301.60	0.72	371.8	51707	51842	51366	51270	
							51436	51450	50842	51171	
							51346	50586			
Co59	1.0000	ppb	-	820025.1	1.18	9673.2	831885	796500	824672	817928	
							819266	823205	823859	824786	
							825083	813067			
In115	1.0000	ppb	-	1249330	0.64	8001.3	1259767	1243571	1237494	1251080	
							1243334	1257160	1248353	1260675	
							1250458	1241409			
Ce140	1.0000	ppb	-	1209218	0.77	9256.5	1225517	1192488	1208656	1211723	
							1211688	1215015	1213598	1211060	
							1197430	1205004			
Pb208	1.0000	ppb	-	616915.1	0.96	5936.7	610351	615035	610190	609081	
							620719	616461	615905	625686	
							623426	622297			
Th232	1.0000	ppb	-	1042654	0.70	7316.2	1040777	1041780	1045469	1042580	
							1044542	1037439	1044444	1060087	
							1033062	1036358			

Isotope Ratio	Ratio	%RSD	SD	Replicates (ratio)							
Ce140O16/Ce140	0.017	1.95	0.000	0.017	0.017	0.016	0.016	0.016	0.017	0.017	0.017
				0.016	0.017						
Ba138+/Ba138	0.023	1.09	0.000	0.023	0.023	0.024	0.023	0.023	0.023	0.023	0.023
				0.023	0.023						



Autoscale



Autoscale

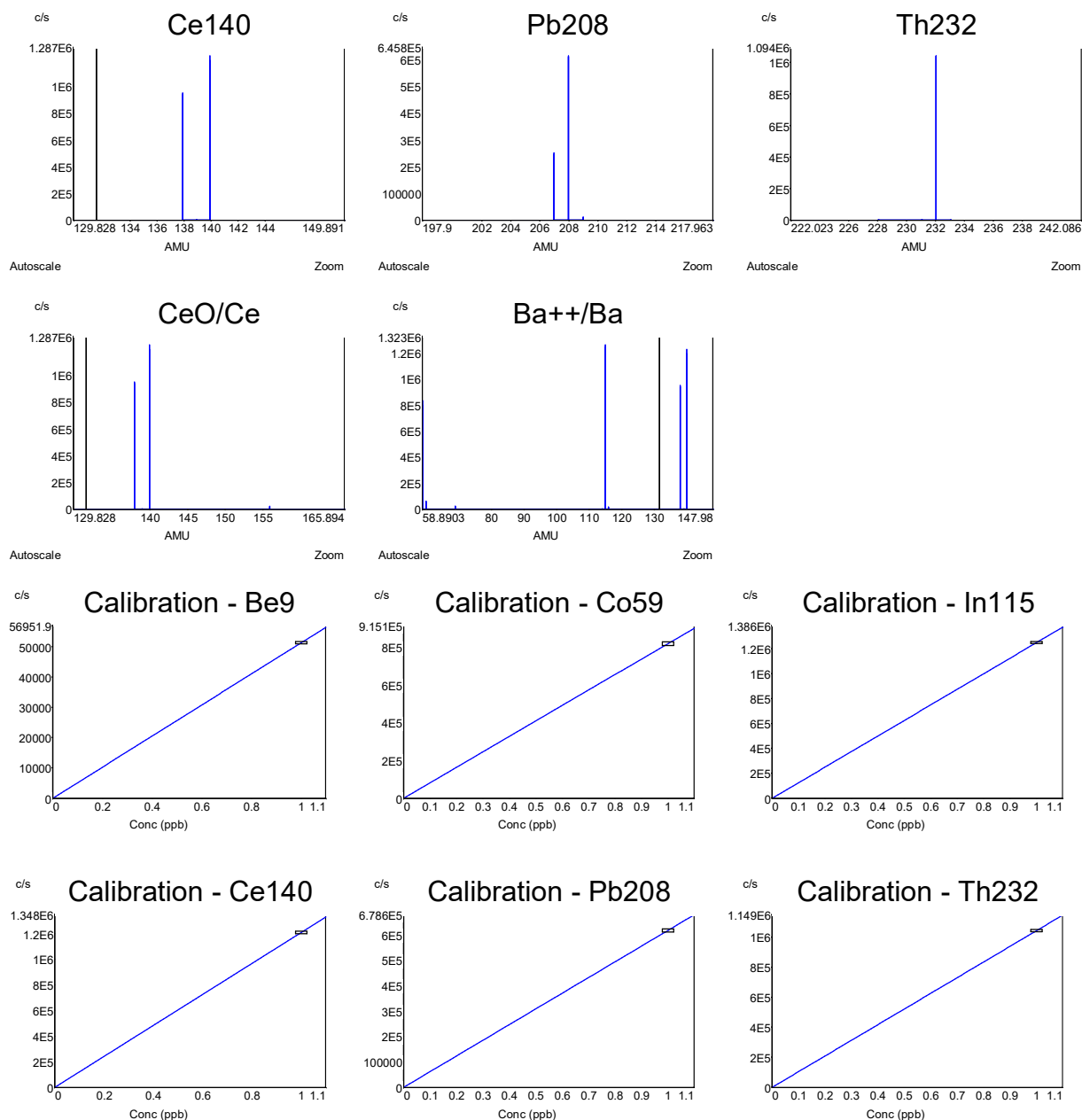
Zoom

Autoscale

Zoom

Autoscale

Zoom



Instrument - Master service access password entered [***]Details

FileViewActionsPageHelp

Report

Stop

Vacuum

Plasma

Inst

Pump

Help

SummaryDetailsIgnitionPlasma AlignResolution and TrimMass CalDetector SetupDetector AttenuationMass ScanPlasmaVacuumiCRCIon OpticsStepper

Instrument Details

Last Read : 2025-06-24 12:22:03

Undo

Send to Instrument

Runtimes (Hrs : Mins)

Plasma:3.766 : 5Turbo Pump 1 & 2:56.604 : 56.604Rotary Pump :56.613 :

Component Serial Numbers & Installation Dates

Instrument:	10-5000-030-26-AR109	10/25/2017
Control Board:	0806170600010	10/25/2017
RF Generator:	10-5300S-AR239	10/25/2017
RF DC Supply:	31127	6/24/2025
Turbo Pump 1:	16872279	10/25/2017
Turbo Pump 2:	16872278	10/25/2017
Rotary Pump 1:	960365	2/26/2018
Gauge 2:		2/26/2018
Detector:	254534	10/25/2017
Ion Optics Board:	00091C	10/25/2017
Quad Controller:	60017090764	10/25/2017
Mass Flow Controller Neb:	2550	10/25/2017
Mass Flow Controller Sheath:	2523	10/25/2017
iCRC Skimmer Cone MFC:	2016	10/25/2017
<input checked="" type="checkbox"/> Nitrox Installed	1128	10/25/2017

Instrument Version Info

Instrument ID & Type: PQMS Elite, 6

Firmware Build Date: Sep 7 2020 10:11:53

Firmware Version: 5.69

Control Board Version: 06

FPGA Chip Version: 200

CPLD Chip Version: 16

Optics Board Version: 0

Type and Key Status: Not AMR

Accessories

☐ Vacuum Exhaust Monitoring Installed

☒ Skimmer Installed

☐ Vacuum Gauge 2 Installed

☐ Sheath Gas MFC installed

IdleIdle0



Certificate of Calibration

AQUION RFIC : Anion (ID#1054)

This certificate is to verify that instrument below are calibrated

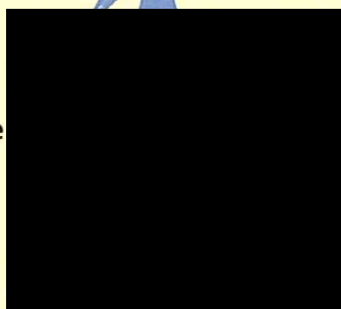


AQUION RFIC S/N: 220380025

AS-DV S/N: 2203880170

for

SGS (THAILAND) Limited



Operator Signature

Date : May 15, 2025



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025 **Cert No.** 25/1242
Order No. 25030172

Customer SGS (Thailand) Limited.
1/209, 1/211 Moo 1, T. Ban Chang, A. Ban Chang Rayong 21130 Thailand.

Place of Calibration Sample Area

Description BOD Incubator
Model ICP450
Serial No. F721.0023
ID.No. I2022007
Date of Receipt Mar 24, 2025
Date of Calibration Mar 24, 2025

Environment

Temperature	(Min)	24.2	°C	(Max)	27.7	°C
Relative Humidity	(Min)	40.8	%rh	(Max)	46.5	%rh

Calibration Method

WI-17: The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard Equipment	Serial No.	Certificate No.	Due Date
1) Data Acquisition Switch Unit with Sensor	MY49010059	QR24-0874	24 Apr 2025

This certificate is traceable to SI unit.



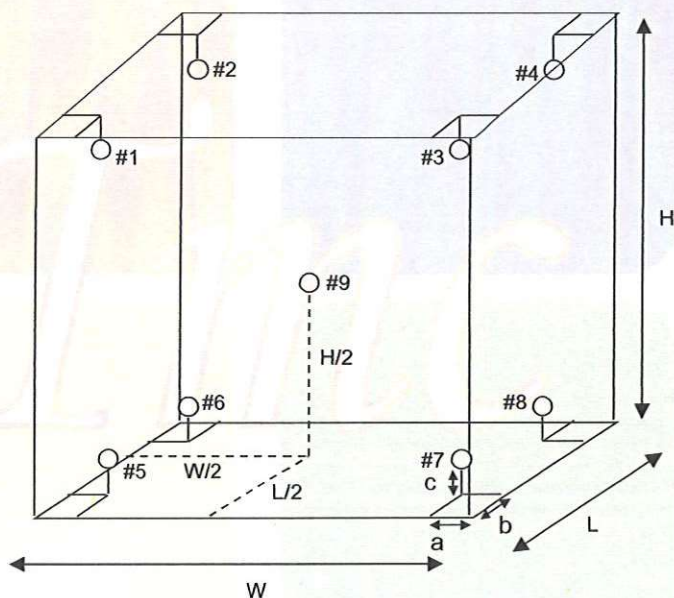
CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1242

Order No. 25030172

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension (W x L x H) is 104 x 60 x 72 cm
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1242

Order No. 25030172

Results (without adjustment)

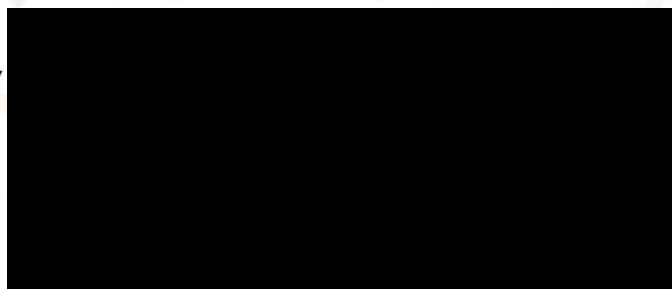
Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
20.0	20.0	20.0	Position 1	20.064	0.397	0.428	0.57
			Position 2	20.085			
			Position 3	20.235			
			Position 4	20.231			
			Position 5	20.077			
			Position 6	20.083			
			Position 7	19.899			
			Position 8	19.990			
			Position 9	20.168			

The stability and uniformity were taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in this report.

This reported expanded uncertainty was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

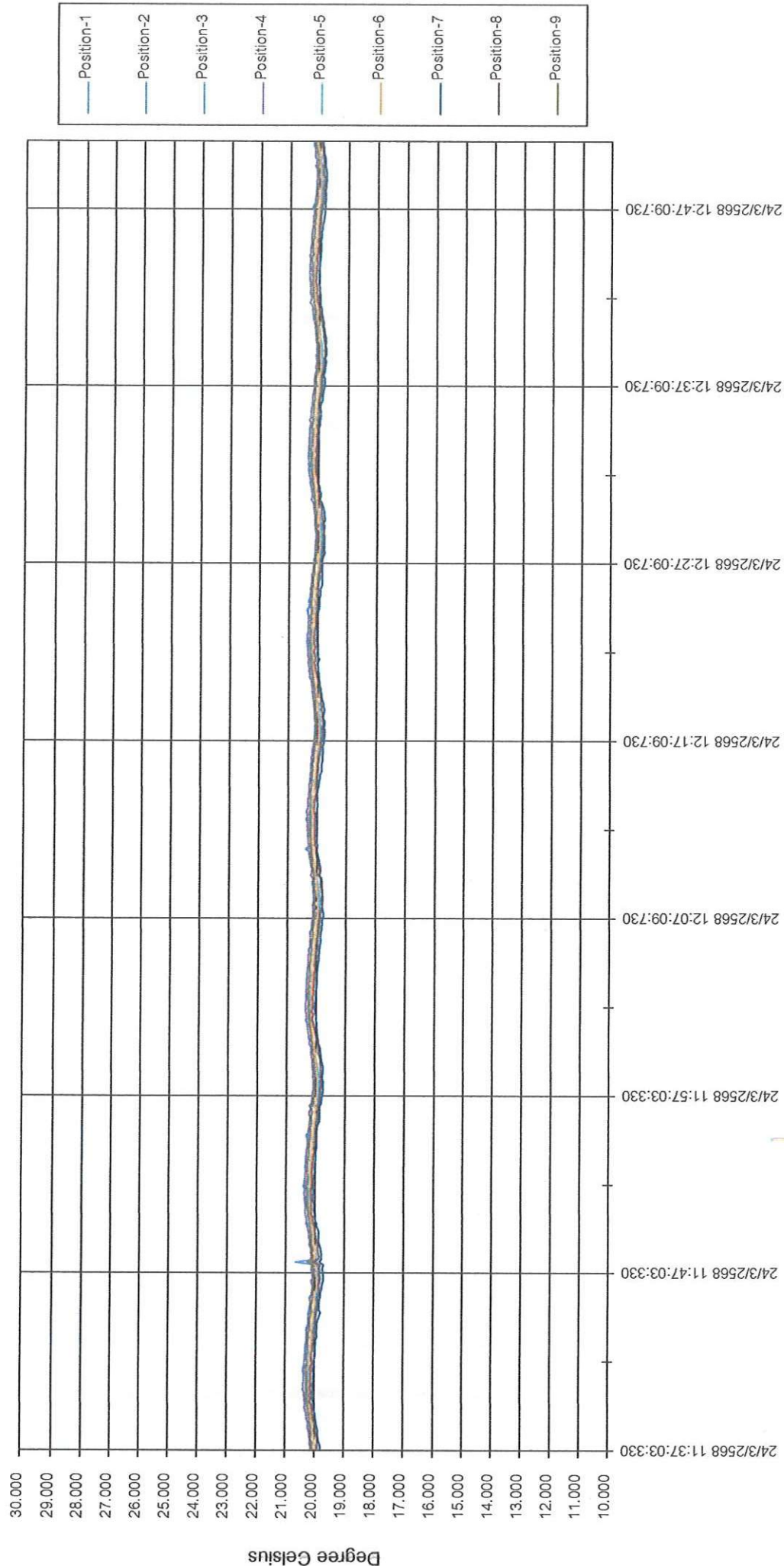
APPROVED SIGNATORY



Cert.No. 25/1242

BOD Incubator

Model. ICP450 S/N. F721.0023 ID.No. I2022007



Times

SGS (Thailand) Limited

Automatic Mercury Analyzer

Model : RA-4500

Preventive Maintenance Report

SERIAL No. RA-4500 : 14780131

Soft version : Ver 2.0.4

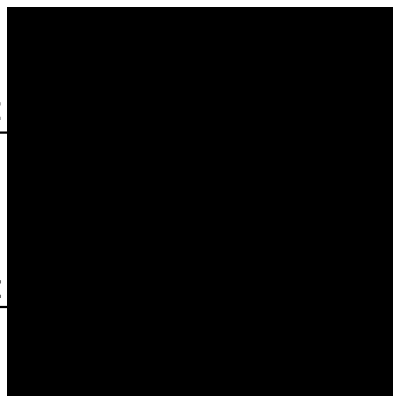
ROM version : Ver 2.0.0

DATE : 6 FEBRUARY 2025

DUE DATE : 6 FEBRUARY 2026

INSPECTED BY :

APPROVED BY :



บริษัท เคเนติก โซลูชั่น จำกัด
KINETIC SOLUTIONS CO.,LTD.



Kinetic Solutions Company Limited.

2, Soi Lat Krabang 1, Lat Krabang Subdistrict,

Lat Krabang District, Bangkok 10520

Tel. (+66) 062-789-5221

Inspection

ITEMS		SPECIFICATIONS	RESULT	JUDGE
1. Quantity	-	Accessories are completed.	GOOD	OK
2. Appearance	2.1 Overall Appearance	No visible damage.	GOOD	OK
	2.2 Parts / Cables	Correctly placed and connected.	GOOD	
3. Indication	Nameplate / Label	Plate and Label are indicated.	GOOD	OK
4. Self check				
4.1 GLP Counter	Mercury Lamp	5000 hours	2419 hr	OK
	Membrane Filter	2000 hours or 1 year after replace	< 2 hr	OK
	Main Pump Tube	750 hours or 1 year after replace	< 2 hr	OK
	Absorbed Hg	1500 mg	< 1 mg	OK
	P1 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P2 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P3 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P4 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P5 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P6 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	P7 Tube	2000 hours or 1 year after replace	< 1 hr	OK
	Heater	2000 hours	25 hr	OK
4.2 Check/Test	Flow rate Adjustment	Flow rate 0.14 - 0.20 L/min	0.18 L/min	OK
	Signals Detector	V.SIG is 3.5 - 4.5 V.	4.06 V.	OK
		V.REF is 3.5 - 4.5 V.	4.06 V.	OK
	Cooling Fan	Check the operation of cooling fan	PASS	OK
	Color Sensor	signals (R,G,B) at least one nonzero	PASS	OK
	Radiation Thermometer	a positive valve form thermometer	PASS	OK
	Heater	heater temp rises 4 °C within 5 min.	PASS	OK
5. Heater	Temperature	At 95°C ± 2°C with 30 min.	94.8°C	OK
6. Calibration Curve	no pretreatment	0-10 ng : Max.Dev. ≤ 5.0%	2.50%	OK
7. Repeatability	100 ug/L, 50ul, 5ng (n=5)	Average: 100ug/L ± 10 µg/L	101.38 µg/L	OK
		C.V. ≤ 5.0%	2.37%	OK
8. Blank	no pretreatment	Less than 0.001 (PEAK)	0.0005492 PEAK	OK

Apparatus

NAME	Date Certified	Expiration
Mercury ICP Standard (1000 µg/mL) AccuStandard, Inc. Lot 223035027	March 10, 2023	March 10, 2028

Inspection details

Remark

1. Cleaning Mercury Analyzer RA-4500

- Body case, Reagent Tube, Cell Detector, Table of Sample , Measurement Probe, Rinse Tube

2. Replace One Year Consumable Parts Set for RA-4500

3. Checking Mercury Analyzer RA-4500

- | | |
|----------------------|----------------------------------|
| - Mercury Lamp | - Outlet Activated Carbon Filter |
| - Membrane Filter | - Flow Sensor |
| - Main Pump Tube | - Valves |
| - Motor Pump | - Heater |
| - Motor Reagent pump | - Cooling Fan |
| - Motor of Arm | - Instrument Performance |
| - Motor of Table | |
| - Motor of Lift | |

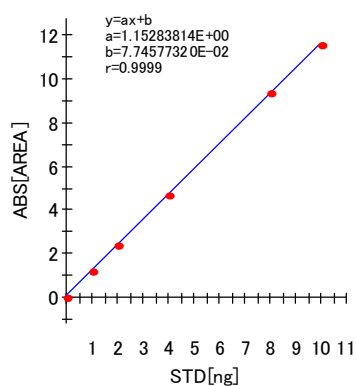
4. Inspection Calibration curve and Reproducibility of Mercury Analyzer RA-4500

**เนื่องจาก color sensor เสื่อมสภาพ จึงทำการทดสอบ พบว่า color sensor ยังคงทำงานและมีแสง แต่ในขั้นตอน Self Check นั้น
ค่าสัญญาณต่ำกว่าเกณฑ์ จึงทำการทดสอบ การทำงาน test check color พบว่ายังสามารถเช็คสีได้**

เบื้องต้นแนะนำให้สำรองอะไหล่

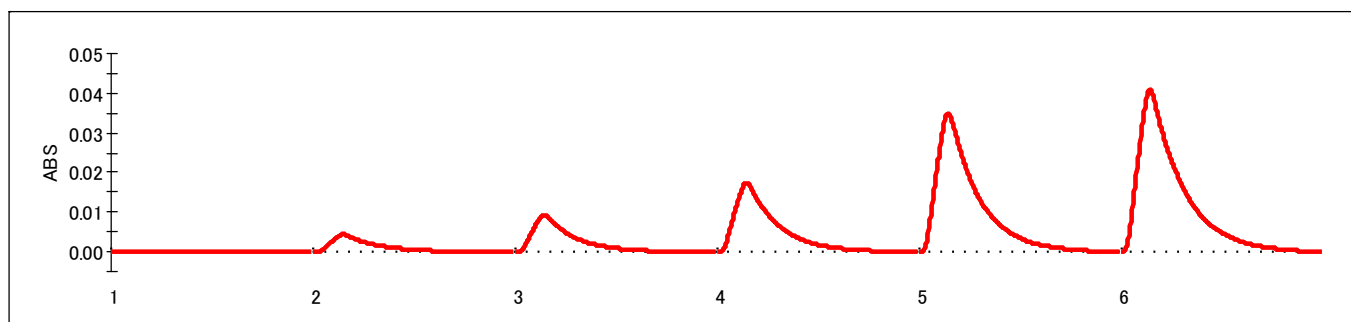
Title : Preventive Maintenance RA-4500 SN:14780131
 Date : 05-Feb-25
 Name : Kinetic solutions
 Memo : Calibration Curve 0 - 10 ng

Calib



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	0.000	0.000	5.000	5.000	0.000	0.0040	-0.0637	-	
2	100.000	0.010	5.000	5.000	1.000	1.2303	1.0000	0.0	
3	100.000	0.020	5.000	5.000	2.000	2.4410	2.0502	2.5	
4	100.000	0.040	5.000	5.000	4.000	4.7239	4.0304	0.8	
5	100.000	0.080	5.000	5.000	8.000	9.3307	8.0265	0.3	
6	100.000	0.100	5.000	5.000	10.000	11.5558	9.9566	0.4	

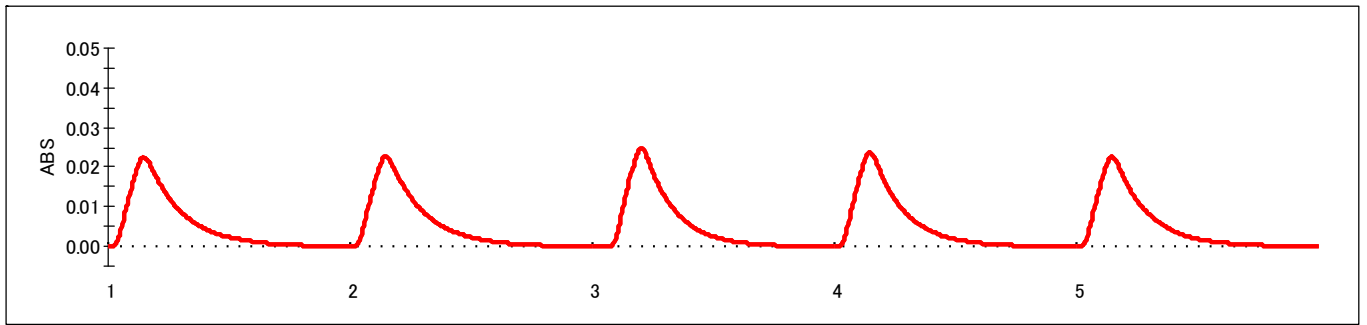


SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.0432	5.1748	103.496	
2	100ppb	0.050	5.000	5.000	6.0736	5.2012	104.024	
3	100ppb	0.050	5.000	5.000	5.8983	5.0491	100.982	
4	100ppb	0.050	5.000	5.000	5.8536	5.0104	100.208	
5	100ppb	0.050	5.000	5.000	5.7373	4.9095	98.190	

Statistics

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	5	101.3800	2.407087	2.37



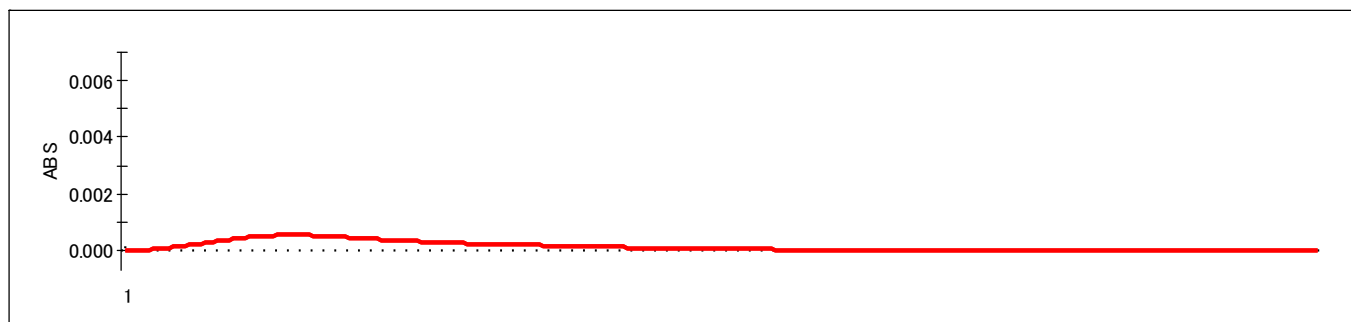
Self Check

Heat check:PASS!! (29.0degC[05:00] -> 33.1degC[02:52])
 Sensor check:FAIL!! (0- 1= -1)
 Leak check:PASS!! (0.18L/min)
 Sig/Ref check:PASS!! (Sig:4.06V, Ref:4.06V)
 Drift check:PASS!! (-0.0000047 - -0.0000135 = 0.0000088)

Title : Preventive Maintenance RA-4500 SN:14780131
Date : 05-Feb-25
Name : Kinetic solutions
Memo : Blank

SMP

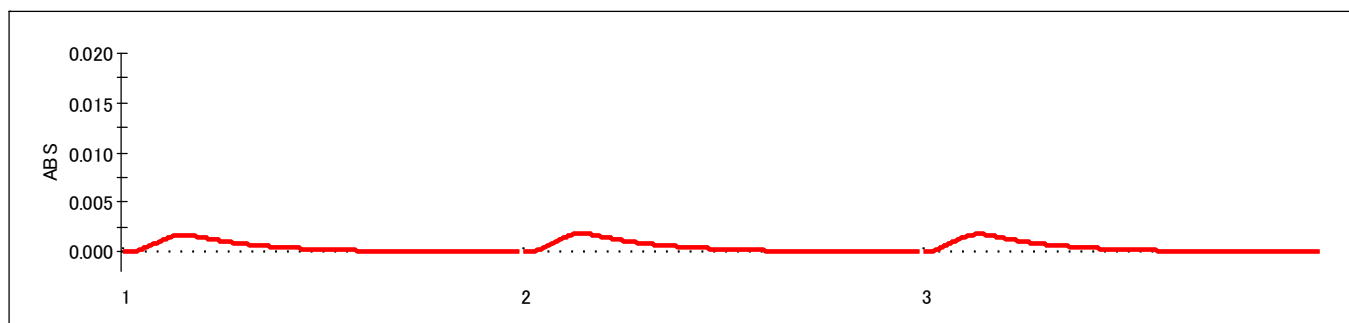
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	PEAK [ON]	MEAS [ng]	CONC [ug/L]	Note
1	blank				0.0005492	0.0065		



Title : Preventive Maintenance RA-4500 SN:14780131
 Date : 05-Feb-25
 Name : Kinetic solutions
 Memo : Test Check Color Sensor

SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	PEAK [ON]	MEAS [ng]	CONC [ug/L]	Note
1	test check color				0.0017089	0.2856		
2	test check color				0.0018641	0.3230		
3	test check color				0.0017824	0.3033		





CERTIFICATE OF ANALYSIS

AccuTrace™ Reference Standard

Catalog No: ICP-34N-1

Description: Mercury ICP Standard

Element: Mercury (Hg)

SRM: 3133

Lot: 223035027

Matrix: 10% Nitric acid

Hazards: Refer to SDS for complete safety information

Date Certified: Mar 10, 2023

Expiration: Mar 10, 2028

Density: 1.052 g/mL

Sample Size: 100 mL

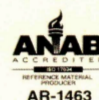
Components: 1

Storage Condition: Ambient (>5 °C)

Certified Reference Material



Signal Word: Danger



AR-1463

Certified Concentration: 1000 µg/mL

Trace Elements in µg/mL

Ag	nd<0.02	Ce	nd<0.2	Gd	nd<0.02	Lu	nd<0.02	Pb	nd<0.2	Sc	nd<0.02	Ti	nd<0.02
Al	nd<0.02	Co	nd<0.02	Ge	nd<0.2	Mg	nd<0.02	Pd	nd<0.2	Se	nd<0.2	Tl	nd<0.2
As	nd<0.2	Cr	nd<0.02	Hf	nd<0.02	Mn	nd<0.02	Pr	nd<0.2	Si	N/A	Tm	nd<0.02
Au	nd<0.02	Cs	N/A	Hg	*	Mo	nd<0.02	Pt	nd<0.2	Sm	nd<0.2	U	nd<0.2
B	nd<0.2	Cu	nd<0.02	Ho	nd<0.02	Na	nd<0.02	Rb	N/A	Sn	nd<0.02	V	nd<0.02
Ba	nd<0.02	Dy	nd<0.02	In	nd<0.2	Nb	nd<0.2	Re	nd<0.2	Sr	nd<0.02	W	nd<0.2
Be	nd<0.02	Er	nd<0.02	Ir	nd<0.2	Nd	nd<0.02	Rh	nd<0.2	Ta	nd<0.2	Y	nd<0.02
Bi	nd<0.2	Eu	nd<0.02	K	nd<0.2	Ni	nd<0.02	Ru	nd<0.02	Tb	nd<0.02	Yb	nd<0.02
Ca	nd<0.02	Fe	nd<0.02	La	nd<0.02	Os	N/A	S	N/A	Te	nd<0.2	Zn	nd<0.02
Cd	nd<0.02	Ga	nd<0.02	Li	nd<0.02	P	N/A	Sb	nd<0.2	Th	nd<0.02	Zr	nd<0.02

This Certified Reference Material was verified in accordance with ISO/IEC 17025 (AT-1339) and ISO 17034 (AR-1463)

This solution was assayed gravimetrically, using a balance calibrated against weight sets, ID #88270, traceable to NIST

A product with a suffix (-1A, -2B, etc. or -01, -02, etc.) on its lot number has had its expiration date extended and is identical to the same lot number without the suffix.

This product contains mercury and MUST be disposed of in accordance with all federal, state and local regulations.

The gravimetric uncertainty for this product is ±0.24%. The CRM uncertainty is ±2.4%.

In order to verify the concentration(s), the final solution was checked by plasma emission spectroscopy (ICP) against material traceable to the above listed NIST SRM(s).

We use the highest purity raw materials available to minimize impurity levels in the final solution. Typically 99.999%+ pure starting materials are used as well as high purity acids and ASTM Type I 18 megohm deionized water.

All trace level elemental impurities were determined via plasma emission spectroscopy on the concentrate.

All weights are traceable through NIST, Test No. 684/291344-18 & 684/292805-19

All glassware used in preparation is Class A.

All bottles are acid leached and triple rinsed with deionized water prior to use.

Shake bottle prior to use and do not pipette directly out of the bottle. Use only cleaned Class A volumetric glassware. Keep bottle tightly capped.

1. Quality Standards:

ISO 17034:2016 – General Requirements for the Competence of Reference Material Producers

ISO/IEC 17025:2017 – General Requirements for the Competence of Testing And Calibration Laboratories

ISO 9001:2015 – Quality Management System – Requirements
Eagle Registrations

- 2. Intended Use:** The product covered by this certificate is designed for calibration or for use in quality control procedures for the specified chemical compounds listed on the reverse side. This product can be used for quantification and/or identification. This product can also be used as a reference material to validate analytical procedures, subject to the conditions under Section 7.
- 3. Manufacturing:** All balances are calibrated daily using an in-house procedure with weights that are compared annually to master weights and traceable to NIST. The balances are also calibrated annually by an ISO/IEC 17025 accredited calibration laboratory. Please refer to the NIST test number listed on the front of this certificate. Class A glassware is used in the manufacture and quality control of all standards. Good Laboratory Practices have been used throughout the preparation of this Standard.
- 4. Homogeneity:** This product is sufficiently homogeneous and any sample size would be within the uncertainty budget.
- 5. Stability:** The manufacturer guarantees the stability of this solution through the expiration date stated on the label, when handled and stored according to the conditions stated on the label
- 6. Uncertainty:** The uncertainty values as stated on the face of this certificate have been determined using the EURACHEM/CITAC Guide. We report a combined expanded uncertainty equal to the positive square root of the total variance of the uncertainty of the components using the following formula: $u_a = \sqrt{(u(V))^2 + (u(m))^2 + (u(IV))^2 + (u(RO))^2}$ This formula represents uncertainty components from the mass, volume, short-term stability, long-term stability and homogeneity factors associated with the production of this product. The expanded uncertainty, assumes a normal distribution and a coverage factor of $k=2$ is chosen using approximately a 95% confidence level.
- 7. Legal Notice and Limit of Liability:** This product is for routine laboratory analysis and research purposes only. The company's liability will be limited to replacement of product or refund of purchase price. Notice of claims must be made within thirty (30) days from date of delivery.



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025 Cert No. 25/1244
Order No. 25030172

Customer SGS (Thailand) Limited.
1/209, 1/211 Moo 1, T. Ban Chang, A. Ban Chang Rayong 21130 Thailand.

Place of Calibration Hot Lab

Description Oven

Model UF110

Serial No. B415.2321

ID.No. O2016001

Date of Receipt Mar 24, 2025

Date of Calibration Mar 24, 2025

Environment

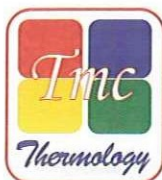
Temperature	(Min)	28.4	°C	(Max)	29.6	°C
Relative Humidity	(Min)	37.3	%rh	(Max)	44.9	%rh

Calibration Method

WI-17: The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard Equipment	Serial No.	Certificate No.	Due Date
1) Data Acquisition Switch Unit with Sensor	MY59003190	QR24-1215	07 Jun 2025

This certificate is traceable to SI unit.



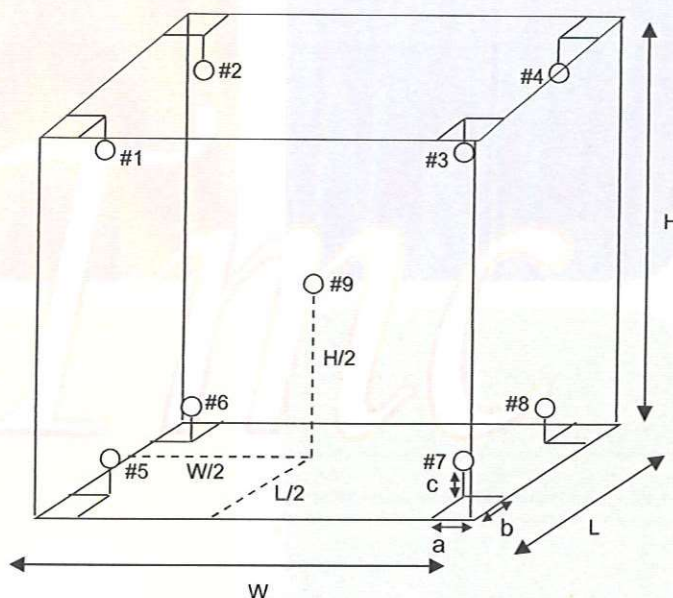
CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1244

Order No. 25030172

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension (W x L x H) is 56 x 40 x 48 cm
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1244

Order No. 25030172

Results (without adjustment)

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
85.0	85.0	85.0	Position 1	85.045	0.063	0.503	0.32
			Position 2	84.847			
			Position 3	84.948			
			Position 4	84.794			
			Position 5	84.724			
			Position 6	84.705			
			Position 7	85.245			
			Position 8	84.718			
			Position 9	84.774			

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
104.0	104.0	104.0	Position 1	104.087	0.095	0.834	0.36
			Position 2	103.784			
			Position 3	103.928			
			Position 4	103.730			
			Position 5	103.613			
			Position 6	103.593			
			Position 7	104.450			
			Position 8	103.556			
			Position 9	103.663			



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

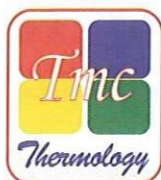
Cert No. 25/1244

Order No. 25030172

Results (without adjustment)

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
150.0	150.0	150.0	Position 1	150.287	0.077	1.593	0.48
			Position 2	149.735			
			Position 3	149.970			
			Position 4	149.645			
			Position 5	149.458			
			Position 6	149.399			
			Position 7	151.056			
			Position 8	149.325			
			Position 9	149.524			

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
180.0	180.0	180.0	Position 1	180.530	0.123	1.983	0.57
			Position 2	179.776			
			Position 3	180.075			
			Position 4	179.657			
			Position 5	179.443			
			Position 6	179.338			
			Position 7	181.362			
			Position 8	179.217			
			Position 9	179.496			



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

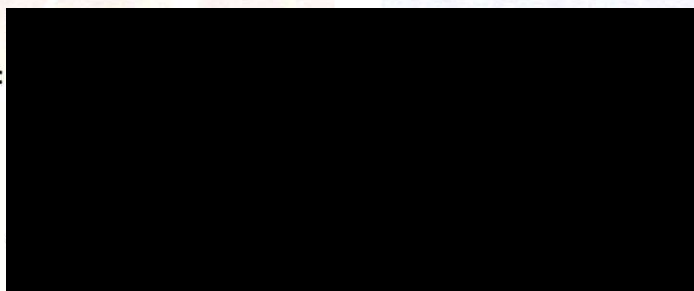
Cert No. 25/1244
Order No. 25030172

The stability and uniformity were taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in this report.

This reported expanded uncertainty was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

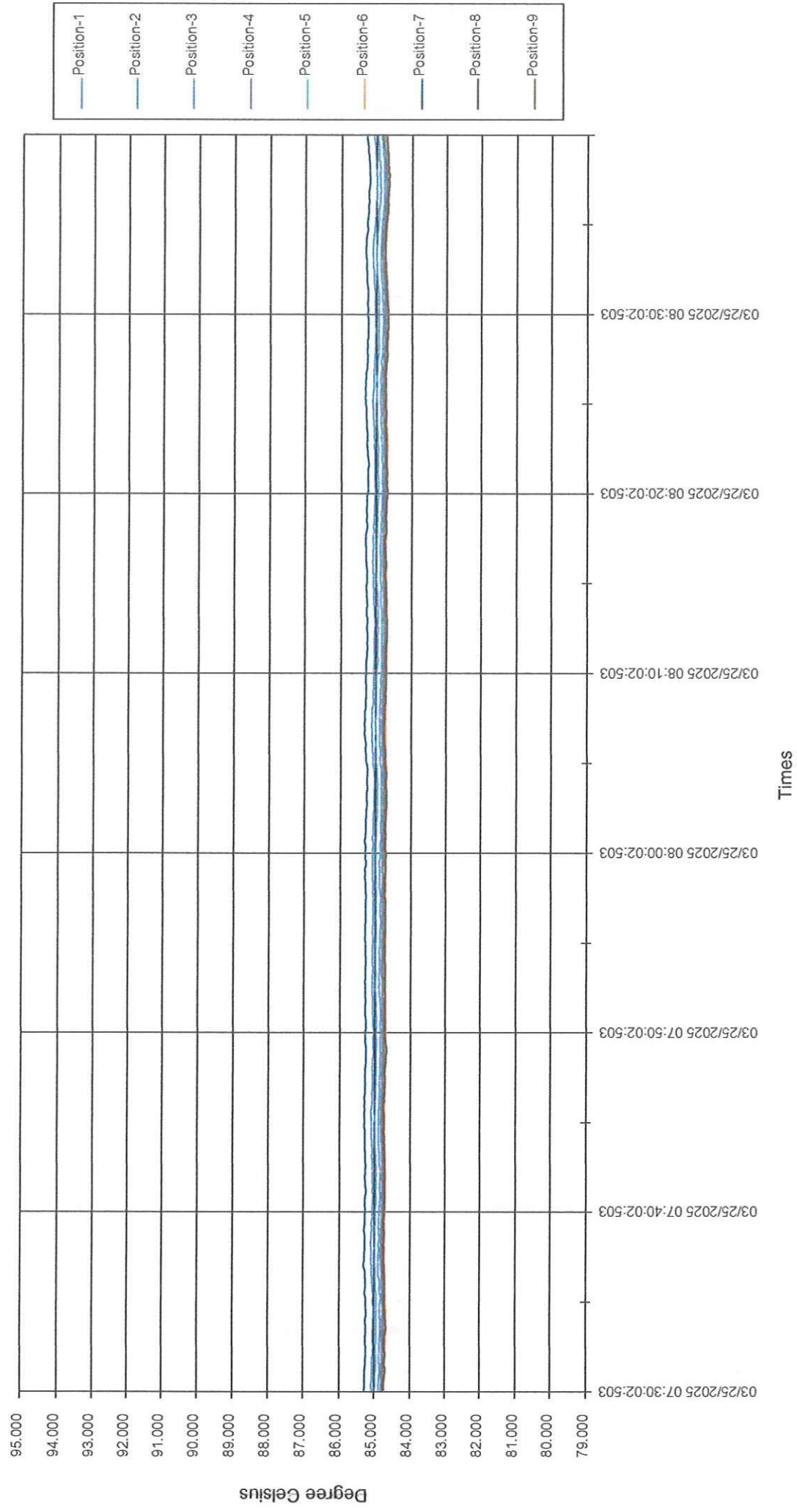
APPROVED SIGNATORY :



Thermology

Cert.No. 25/1244

Model. UF110 S/N. B415.2321 ID.No. Q2016001





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 24CH1159

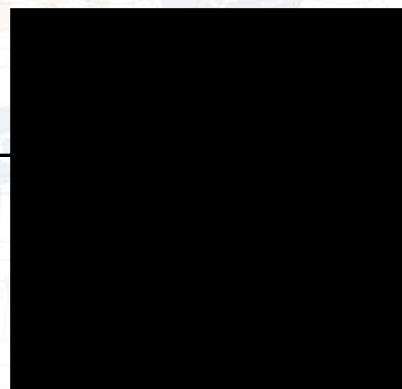
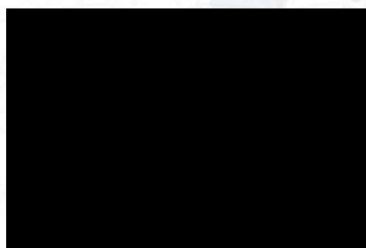
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven Easy S20
Serial No. : 1231235141
ID No. : P2010024
Condition As-Received: Used Item
Received Date : 17 September 2024
Calibration Date : 18 September 2024
Reference : 2409-0647WSC-2
Submitted by : SGS (Thailand) Limited
1/209, 1/211 Moo 1, Ban Chang,
Ban Chang, Rayong 21130

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 24CH1159

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1)Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2)Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,

Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00

:The measurement results are traceable to SI through CPA chem Ltd.,

ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 1.678	CPA chem	940101	02 Nov 2025
pH 4.006	Hach Lenge GmbH	C03146	23 Feb 2026
pH 7.000	Hach Lenge GmbH	C03020	23 Feb 2026
pH 10.013	Hach Lenge GmbH	C03141	09 Feb 2026

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 1231235141	1.680	314.73	315.0	1.680	0.058	2.00
	4.000	177.48	177.7	4.000	0.058	2.00
	7.000	0.00	0.3	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00



Cert.No.: 24CH1159

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: 8446396	1.678	1.709	310.8	0.0044	2.00
	4.006	4.007	176.4	0.0053	2.00
	7.000	7.001	1.2	0.0084	2.00
	10.013	10.013	-175.4	0.0077	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Pro

- Serial No. : 8446396

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	24.999	24.9	-0.099	0.13	2.00

Remark - 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 of approximately 95 %.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 25CH584

Page.: 1 of 3

Equipment : pH / Conductivity Meter
Manufacturer : Mettler Toledo
Model : S213
Serial No. : B902060027
ID No. : P2019019
Condition As-Received: Used Item
Received Date : 20 May 2025
Calibration Date : 21 May 2025
Reference : 2505-0596WSC-1
Submitted by : SGS (Thailand) Limited
1/209, 1/211 Moo 1, T.Ban Chang,
A.Ban Chang, Rayong 21130

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Approved by :

23 May 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 25CH584

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 1.678	CPA chem	940101	02 Nov 2025
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (1.7,4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B902060027	1.680	314.73	314.6	1.681	0.058	2.00
	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.4	10.000	0.058	2.00



Cert.No.: 25CH584

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing four buffers standard curve by using buffer nominal pH (1.7,4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: 8512743	1.678	1.681	305.5	0.0044	2.00
	4.007	4.008	171.3	0.0044	2.00
	7.000	7.000	-1.5	0.0084	2.00
	10.010	10.011	-172.5	0.0065	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Pro-ISM
- Serial No. : 8512743

Dimension of probe

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	24.999	25.0	0.001	0.13	2.00

Remark - 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 of approximately 95 %.

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MAINTENANCE AND TEST CERTIFICATE MODEL

Avio220 Max

Customer : <u>SGS(Thailand)Limited</u> <u>Rayong Branch</u> Address : <u>1/209 , 1/211 Moo 1,</u> <u>T. Banchang, A. Banchang</u> <u>Rayong 21130</u> User Name XXXXXXXXXX Phone: <u>+66(0)38685260-64</u> Email: <u>saijai.ruangsawat@sgs.com</u>	Date Tested: <u>January 27, 2025</u> Recommendation Recertification Period <u>6</u> Months Recertification Due: <u>July 28, 2025</u> Date Last Certified: <u>July 8, 2024</u> Visit Number: <u>20F2 W</u> PerkinElmer Phone: <u>02-719-6420 ext 206</u> PerkinElmer Fax: <u>02-318-5597</u>
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CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
<u>AVIO200 MAX</u>	<u>M79S2304111</u>	<u>Syngristix V5</u>
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2025</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

**MAINTENANCE AND TEST CERTIFICATE MODEL****Avio220 Max****SERIAL NUMBER** M79S2304111**DATE TESTED** January 27, 2025**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

Avio220 Max

SERIAL NUMBER <u>M79S2304111</u>		DATE TESTED	<u>January 27, 2025</u>	
PARAMETER	SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV				
As 193.696 nm	≤ 0.009	nm	<u>0.00784</u>	nm
Ni 231.604 nm	≤ 0.011	nm	<u>0.00926</u>	nm
Ni 341.476 nm	≤ 0.015	nm	<u>0.01377</u>	nm
Spectral Resolution : VIS				
Ba 455.403 nm	≤ 0.020	nm	<u>0.01607</u>	nm
Precision				
Zn 206.200 nm	% RSD	≤ 1.0 %	<u>0.57</u>	%
Mg 280.271 nm	% RSD	≤ 1.0 %	<u>0.28</u>	%
Mg 285.213 nm	% RSD	≤ 1.0 %	<u>0.43</u>	%
Ba 455.403 nm	% RSD	≤ 1.0 %	<u>0.47</u>	%
Detection Limits : Axial				
Tl 190.801 nm	3(sd)		<u>1.52</u>	ppb
As 193.696 nm	3(sd)		<u>1.40</u>	ppb
Se 196.026 nm	3(sd)		<u>1.53</u>	ppb
Pb 220.353 nm	3(sd)		<u>1.72</u>	ppb
Detection Limits : Radial				
As 193.696 nm	3(sd)		<u>1.69</u>	ppb
Zn 213.857 nm	3(sd)		<u>0.41</u>	ppb
Mn 257.610 nm	3(sd)		<u>0.1</u>	ppb
La 379.478 nm	3(sd)		<u>0.61</u>	ppb
Ba 455.403 nm	3(sd)		<u>0.13</u>	ppb
Ba 493.408 nm	3(sd)		<u>0.1</u>	ppb
BEC : Axial (IB X 1000)/(IS-IB)				
Mn 257.610 nm	≤ 30 ppb		<u>9.59</u>	ppb
BEC : Radial (IB X 1000)/(IS-IB)				
Mn 257.610 nm	≤ 30 ppb		<u>22.38</u>	ppb



MAINTENANCE AND TEST CERTIFICATE MODEL
Avio220 Max

SERIAL NUMBER M79S2304111

DATE TESTED January 27, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets

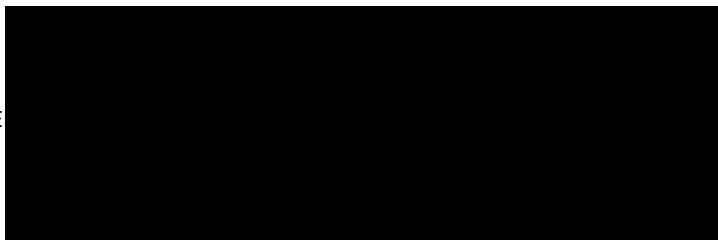


does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.

Customer Service E





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 24CHO498

Page.: 1 of 3

Equipment : Spectrophotometer
Manufacturer : Hach
Model : DR5000
Serial No. : 1215327
ID No. : S2020021
Condition As-Received: Used Item
Received Date : 19 September 2024
Calibration Date : 20 September 2024
Reference : 2409-0660OC-3
Submitted by : SGS (Thailand) Limited
1/209, 1/211 Moo 1, Ban Chang,
Ban Chang, Rayong 21130
Calibration Place : Hot Room
Ambient Temperature : (23.9 to 24.2) °C (On-Site)
Relative Humidity : (65.7 to 66.9) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01

Calibrated by :

Approved by :

4 October 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert. No. : 24CHO498

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	44487	122584	31 May 2026
2. Wavelength Standard set	36730	118120	15 Jan 2026
3. Wavelength Standard set	36730	118121	15 Jan 2026

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained through :

- Starna Scientific Ltd.

4. Spectral BandWidth : 2 nm
Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
418.61	418	0.59	2.00
446.10	446	0.59	2.00
536.66	537	0.59	2.00
637.98	638	0.59	2.00
879.27	879	0.59	2.00



Cert. No. : 24CHO498

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5598	0.563	0.0028	2.00
	0.7037	0.707	0.0028	2.00
	1.0013	1.006	0.0030	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5234	0.526	0.0028	2.00
	0.7007	0.704	0.0028	2.00
	0.9992	1.004	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5648	0.568	0.0029	2.00
	0.7654	0.767	0.0031	2.00
	1.0961	1.103	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- 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 of approximately 95 %.

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CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025 Cert No. 25/1248
Order No. 25030172

Customer SGS (THAILAND) Limited
1/209,1/211 Moo1, T.Ban Chang, A.Ban Chan, Rayong 21130 Thailand.

Place of Calibration Storage Sample

Description Digital Thermometer with Thermocouple
Digital Thermometer Model. CHY803 S/N. 100165
Thermocouple Model. Type K S/N. 11040160/1

Sheath Material : Stainless Diameter : 3.0 mm
Length : 50 mm Immersion : 150 mm

ID.No. T2011034

Date of Receipt Mar 24, 2025

Date of Calibration Mar 24, 2025

Environment

Temperature (Min) 32.1 °C (Max) 34.2 °C
Relative Humidity (Min) 65.7 %rh (Max) 77.7 %rh

Calibration Method

WI-05 : The Unit Under Calibration was calibrated against reference standard thermometer in temperature source.
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard Equipment	Serial No.	Certificate No.	Due Date
1) Platinum Resistance Thermometer (PRT)	N42P303521	QR25-0208	23 Jan 2026

This certificate is traceable to SI unit.



CALIBRATION CERTIFICATE

Date of Issue Mar 26, 2025

Cert No. 25/1248

Order No. 25030172

Results (without adjustment)

CH : T1

Reference Thermometer (°C)	UUC Reading (°C)	Error (°C)	Uncertainty ± (°C)
0.00	0.0	0.00	0.32
3.00	3.0	0.00	0.32
20.00	19.9	-0.10	0.32
85.00	84.9	-0.10	0.32
104.01	104.1	0.09	0.32
150.02	150.2	0.18	0.32
180.00	180.1	0.10	0.60

The above results are valid exclusively for calibration samples as mentioned in this report.

This reported expanded uncertainty was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

APPROVED SIGNATORY

