

ภาคผนวกที่ 5

เอกสารการสอบเทียบเครื่องมือ

- | | |
|------------|---------------------------------------|
| เอกสาร 5-1 | เอกสารสอบเครื่องมือวิเคราะห์คุณภาพน้ำ |
| เอกสาร 5-2 | เอกสารสอบเครื่องมือตรวจวัดคุณภาพอากาศ |
| เอกสาร 5-3 | เอกสารสอบเครื่องมือตรวจวัดระดับเสียง |

ตารางสรุปรายการสอบเทียบเครื่องมือ

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|--|--|--------------------------------|
| คุณภาพน้ำผิวดิน | | |
| - Temperature | - | - Thermometer |
| - Conductivity | - | - Conductivity Meter |
| - pH | - | - pH Meter |
| - Dissolved Oxygen | - | - Electronic Balance |
| - BOD ₅ | - | - BOD Analyzer |
| - Total Suspended Solids | - | - Electronic Balance |
| - Grease & Oil | - | - Electronic Balance |
| - Total Iron | - | - ICP |
| - Lead (Pb) | - | - ICP |
| - Cadmium (Cd) | - | - ICP |
| - Total Coliform Bacteria (TCB) | - | - Incubator |
| - Fecal Coliform Bacteria (FCB) | - | - Water Bath |
| คุณภาพอากาศ | | |
| - Total Suspended Particulate (TSP) | - High Volume Air Sampler No. | - Electronic Balance |
| - Particulate Matter less than 10 micron (PM ₁₀) | - High Volume PM ₁₀ Air Sampler No. | - Electronic Balance |
| - Carbon Monoxide (CO) | - CO Analyzer No. | - CO Analyzer No. |
| - Nitrogen Dioxide (NO ₂) | - NO ₂ Analyzer No. | - NO ₂ Analyzer No. |
| ระดับเสียง | | |
| - Leq 24 hrs, L90, Ldn, Lmax | - Acoustic Calibrator No. | - |

เอกสาร 5-1

เอกสารสอบเครื่องมือวิเคราะห์คุณภาพน้ำ

Certificate of Calibration

Certificate No. : 64-400179-4

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co.,Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM 34/63

Environment : Ambient Temperature : (23 ± 2) °CRelative Humidity : (50 ± 15) %Line Voltage : (220 ± 22) VAC

Date of Received : 01 April 2021

Date of Calibration : 03 April 2021

Date of Issue : 03 April 2021

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No. | Due Date | Traceability |
|--------|------------|-------------|---|
| 400001 | TT-0016-20 | 04 Mar 2022 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-----------|-------------|---|
| 400003 | 19E134 | 06 Jun 2021 | National Institute of Metrology Thailand (NIMT) |
| 400004 | 19E134 | 06 Jun 2021 | National Institute of Metrology Thailand (NIMT) |

Certificate of Calibration

Certificate No. : 64-400179-4

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.6633 °C

| Standard Reading (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|----------------------------|-----------------------|----------------------|-------------------------|
| 4.8871 | 4 | 0.9 | 0.31 |

Remark

UUC : Unit Under Calibration

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

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

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CERTIFICATE No : 21E3592
REFERENCE No : 60760-1


PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : CONDUCTIVITY METER
MANUFACTURER : EUTECH
MODEL : CON 150
SERIAL No : 2746308
ID No : CD 04/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 02-Apr-21

APPROVED BY : 

ISSUED DATE : 02-Apr-21

RECEIVED DATE : 31-Mar-21

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



CERTIFICATE No : 21E3592

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : CONDUCTIVITY METER
MANUFACTURER : EUTECH
SERIAL NUMBER : 2746308
RECEIVED DATE : 31-Mar-21
AMBIENT TEMPERATURE : 20 °C ± 1 °C
MODEL : CON 150
ID No : CD 04/61
CALIBRATION DATE : 02-Apr-21
RELATIVE HUMIDITY : 50 % RH ± 15% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD CONDUCTIVITY BUFFER SOLUTION IN CONTROLLED TEMPERATURE BATH.
2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | LOT No | CERTIFICATE No | DUE DATE |
|-------------------------|----------|------------|----------------|-----------|
| 1) REFERENCE MATERIAL | 00652-26 | CC20562 | 4066-11793752 | 09-Dec-21 |
| 2) REFERENCE MATERIAL | 00652-30 | CC20458 | 4173-11692041 | 04-Nov-21 |
| 3) REFERENCE MATERIAL | 00652-32 | CC20466 | 4068-11695401 | 05-Nov-21 |
| 4) REFERENCE MATERIAL | 00652-34 | CC20523 | 4069-11762897 | 01-Dec-21 |
| 5) BATH | 260014 | 1247 48074 | 20T9392 | 10-Sep-21 |
| 6) STANDARD THERMOMETER | 421504 | 55000379 | 20T9616 | 10-Sep-21 |

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH ELECTROD S/N CONSEN91W

| CONDUCTIVITY BUFFER SOLUTION | UUC READING | CORRECTION | VALUE BEFORE ADJUSTMENT | UNIT | UNCERTAINTY OF MEASUREMENT (±) | COVERAGE FACTOR k |
|------------------------------------|-------------|------------|-------------------------------|-------|--------------------------------------|-------------------------|
| 99.0 | 99.4 | -0.40 | N/A | µS/cm | 3.0 | 2.0 |
| 1413.0 | 1413 | 0.00 | N/A | µS/cm | 30 | 2.0 |
| 9.992 | 9.55 | 0.44 | N/A | mS/cm | 0.21 | 2.0 |
| 99.915 | 80.3 | 19.62 | N/A | mS/cm | 2.1 | 2.0 |

2. DISPLAY UNIT WITH TEMPERATURE

| STANDARD READING (°C) | UUC READING (°C) | CORRECTION | VALUE BEFORE ADJUSTMENT | UNCERTAINTY OF MEASUREMENT (±°C) | COVERAGE FACTOR k |
|-----------------------------|---------------------|------------|-------------------------------|--|-------------------------|
| 25.003 | 25.0 | 0.0 | N/A | 0.0085 | 2.0 |

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR SHOWN IN THE TABLE, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584CERTIFICATE No : 21E3943
REFERENCE No : 60857-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : PH 04/56
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 20-Apr-21

APPROVED BY : 

ISSUED DATE : 20-Apr-21

RECEIVED DATE : 09-Apr-21

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 21E3943

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : PH 04/56
RECEIVED DATE : 09-Apr-21
AMBIENT TEMPERATURE : 20 °C ± 1 °C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 20-Apr-21
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No / LOT No | DUE DATE |
|---------------------------|----------|------------|----------------------------|-----------|
| 1) pH STANDARD SOLUTION | 00651-36 | CC639097 | 4956-10686748 | 05-Sep-21 |
| 2) pH STANDARD SOLUTION | 00651-38 | CC646738 | 4957-10828986 | 25-Oct-21 |
| 3) pH STANDARD SOLUTION | 00651-40 | CC635214 | 4958-10640234 | 13-Aug-21 |
| 4) PROCESS CALIBRATOR | 744 | 7514008 | 20E1318 | 10-May-21 |
| 5) BATH | 260014 | 1247 48074 | 20T9392 | 10-Sep-21 |
| 6) THERMOMETER WITH PROBE | 421504 | 55000379 | 20T9616 | 10-Sep-21 |

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
 - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT**1. DISPLAY UNIT ONLY**SLOPE FACTOR $k = 2.303 RT/F = 59 \text{ mV/pH}$

| mV APPLIED | UUC READING (mV) | CORRECTION (mV) | UUC READING (pH) | UNCERTAINTY OF MEASUREMENT (± mV) | COVERAGE FACTOR k |
|---------------|---------------------|--------------------|---------------------|---|-------------------------|
| 414.11 | 414.8 | -0.69 | -0.43 | 0.14 | 2.0 |
| 354.95 | 355.6 | -0.65 | 0.62 | 0.14 | 2.0 |
| 295.80 | 296.4 | -0.60 | 1.68 | 0.14 | 2.0 |
| 236.64 | 237.2 | -0.56 | 2.73 | 0.14 | 2.0 |
| 177.48 | 177.9 | -0.42 | 3.79 | 0.14 | 2.0 |
| 118.32 | 118.8 | -0.48 | 4.84 | 0.14 | 2.0 |
| 59.16 | 59.6 | -0.44 | 5.89 | 0.14 | 2.0 |
| 0.00 | 0.4 | -0.40 | 6.95 | 0.14 | 2.0 |
| -59.16 | -58.8 | -0.36 | 7.99 | 0.14 | 2.0 |
| -118.32 | -117.9 | -0.42 | 9.03 | 0.14 | 2.0 |
| -177.48 | -177.1 | -0.38 | 10.07 | 0.14 | 2.0 |
| -236.64 | -236.3 | -0.34 | 11.08 | 0.14 | 2.0 |
| -295.80 | -295.5 | -0.30 | 12.09 | 0.14 | 2.0 |
| -354.95 | -354.7 | -0.25 | 13.10 | 0.14 | 2.0 |
| -414.11 | -413.9 | -0.21 | 14.11 | 0.14 | 2.0 |

END OF CALIBRATION REPORT PAGE 2 OF 3



QUALITY CALIBRATION CO.,LTD.

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

CERTIFICATE No : 21E3943

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 061416CM

| STANDARD pH BUFFER SOLUTION (pH) | UUC READING (pH) | CORRECTION (pH) | VALUE BEFORE ADJUSTMENT | UNCERTAINTY OF MEASUREMENT (\pm pH) | COVERAGE FACTOR k |
|--|---------------------|--------------------|-------------------------------|--|-------------------------|
| 4.007 | 4.008 | -0.001 | 4.018 | 0.012 | 2.0 |
| 6.992 | 7.001 | -0.009 | 6.888 | 0.012 | 2.0 |
| 10.016 | 10.011 | 0.005 | 10.027 | 0.014 | 2.0 |

3. PERCENT SLOPE 90%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

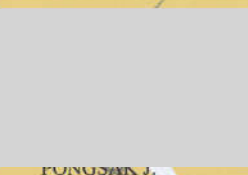


CERTIFICATE No : 21M3167
REFERENCE No : 60627-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA 09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 19-Mar-21
APPROVED BY : 
ISSUED DATE : 20-Mar-21
RECEIVED DATE : 19-Mar-21



CERTIFICATE No : 21M3167

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52% RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
- REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|------------------------|-------|-----------|----------------|-----------|
| 1) STANDARD WEIGHT SET | E2 | QK-I-151 | C02210415 | 09-Feb-23 |
| 2) STANDARD WEIGHT | E2 | 15843 | C02210419 | 10-Feb-23 |
| 3) STANDARD WEIGHT | E2 | QK-I-349 | M2103235S | 26-Mar-23 |
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000045 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.0 | 0.0000 | 0.0000 | 0.000075 |
| 0.1 | 0.1000 | 0.0000 | 0.000075 |
| 0.2 | 0.2000 | 0.0000 | 0.000076 |
| 0.5 | 0.5000 | 0.0000 | 0.000076 |
| 1.0 | 1.0000 | 0.0000 | 0.000077 |
| 2.0 | 2.0000 | 0.0000 | 0.000077 |
| 5.0 | 5.0000 | 0.0000 | 0.000079 |
| 10.0 | 10.0000 | 0.0000 | 0.000082 |
| 20.0 | 20.0000 | 0.0000 | 0.000086 |
| 50.0 | 50.0000 | 0.0000 | 0.00013 |
| 100.0 | 100.0001 | -0.0001 | 0.00019 |
| 200.0 | 199.9997 | 0.0003 | 0.00032 |

5. OFF CENTER LOADING ERROR



| POINT | READING (g) |
|--------------------|-------------|
| 1 | 100.0000 |
| 2 | 100.0000 |
| 3 | 100.0001 |
| 4 | 100.0000 |
| 5 | 99.9999 |
| OFF-CENTER LOADING | 0.0001 |

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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 FAX. 0-2719-9484

Cert.No.: 21TW101
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 15B100751
ID No. : -
Received Date : 28 April 2021
Test Date : 30 April 2021
Reference : 2104-0741WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd.,
Jompol, Chatuchak, Bangkok 10900
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : 
(/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul
Issue Date : 7 May 2021

B 0259620



Cert.No.: 21TW101
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14K100246

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|-------------------------------|------------------------------|
| 8.08 | 8.09 | 0.0071 |

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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MAINTENANCE REPORT

OPTIMA 5300DV

| | | | |
|-------------------|--|---------------------------------------|---------------------|
| Customer : | S.P.S. CONSULTING SERVICE CO., LTD. | Date Tested: | January 18, 2021 |
| Address : | 7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900 | Recommendation Recertification | |
| User Name: | Phenpha Vipasthawatt | Period | 6 Months |
| Phone: | 0-2939-4370-72 | Recertification Due: | July 18, 2021 |
| Fax: | 0-2513-4221 | Date Last Certified: | July 21, 2020 |
| | | Visit Number: | 2 of 2 |
| | | PerkinElmer Phone: | 02-719-6420 ext 206 |
| | | PerkinElmer Fax: | 02-318-5597 |

| CONFIGURATION TESTED | | ACCESSORIES/COMPONENT NOT INCLUDED |
|---------------------------|---------------------------|---------------------------------------|
| MODEL | SERIAL NUMBER | |
| OPTIMA 5300DV | 077C7042401 | |
| TESTED EQUIPMENT | CALIBRATION NUMBER | EXPIRATION |
| IPV Methods | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Multielement Standard | N069-1579 | February 28, 2022 |
| Wavecal Solution | N058-2152 | January 30, 2022 |
| VIS Wavecal solution | N930-2946 | December 30, 2021 |
| Instrument Cal. STD4 | N930-0221 | June 30, 2021 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE REPORT

OPTIMA 5300DV

| | | | |
|----------------------|-------------|--------------------|------------------|
| SERIAL NUMBER | 077C7042401 | DATE TESTED | January 18, 2021 |
|----------------------|-------------|--------------------|------------------|

- 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
- OPTICAL CHECKS**
 - A. Inspect and clean all optical components. ☐ OK
 - B. As required, check and replace all purgefilters. ☐ OK
 - C. Recheck optical alignment. ☐ OK
- COOLING SYSTEM CHECKS**
 - A. Perform preventive maintenance on chiller. ☐ OK
 - B. Flush out the chiller every six months. ☐ OK
- PERFORMANCE CHECKS**
 - A. Torch View Alignment. ☐ OK
 - B. Wavelength Calibration. ☐ OK



MAINTENANCE REPORT OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 DATE TESTED : January 18, 2021

| PARAMETER | SPECIFICATION | | FINAL VALUE |
|----------------------------------|---------------|-------------|-------------|
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00592 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00771 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00792 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01605 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02172 |
| Precision | As 193.656 nm | % RSD < 1.0 | 0.55 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.58 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.46 % |
| | La 379.478 nm | % RSD < 1.0 | 0.36 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.6 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.74 % |
| Detection Limits : Axial | Tl 190.800 nm | 3(sd) | 1.92 ppb |
| | As 193.696 nm | 3(sd) | 3.64 ppb |
| | Pb 220.353 nm | 3(sd) | 1.20 ppb |
| Detection Limits : Radial | As 193.696 nm | 3(sd) | 34.30 ppb |
| | Zn 213.856 nm | 3(sd) | 1.66 ppb |
| | Mn 257.610 nm | 3(sd) | 1.87 ppb |
| | La 379.478 nm | 3(sd) | 0.82 ppb |
| | Ba 455.403 nm | 3(sd) | 0.14 ppb |
| | Ba 493.408 nm | 3(sd) | 0.15 ppb |
| BEC : Axial (IB X 5000)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 28.94 ppb |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 27.84 ppb |



MAINTENANCE REPORT OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 18, 2021

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.

Authorized Representative

Service Engineer



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : SS2010-015-0003

Date Issued : 02-Oct-20

Customer & Calibrated Place : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 01-Oct-20

Date Calibrated : 01-Oct-20

Calibrated by : Mr. Chaiya Engchoun

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by :

Certificate No. : SS2010-015-0003

Environment : Ambient Temperature : Start record 25.2 °C, Stop record 25.3 °C
Relative Humidity : Start record 56.4 %RH, Stop record 56.6 %RH

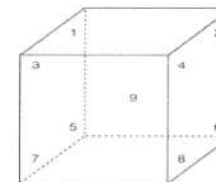
| Calibration Temperature (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Stability ¹ (°C) | Measured Uniformity ² (°C) | Overall Variation ³ (°C) |
|------------------------------|--------------------------|-----------------------------|--------------------------------------|---------------------------------------|-------------------------------------|
| 35.0 | 35.0 | 35.0 | 0.03 | 0.25 | 0.32 |
| 41.5 | 41.5 | 41.5 | 0.03 | 0.19 | 0.20 |

Without adjustment

| Calibration Temperature (°C) | STD No. 1 (°C) | STD No. 2 (°C) | STD No. 3 (°C) | STD No. 4 (°C) | STD No. 5 (°C) | STD No. 6 (°C) | STD No. 7 (°C) | STD No. 8 (°C) | STD No. 9 (°C) | Uncertainty ⁴ (°C) |
|------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------------------------|
| 35.0 | 35.10 | 35.02 | 35.02 | 34.88 | 34.89 | 34.89 | 34.85 | 34.83 | 35.04 | 0.18 |
| 41.5 | 41.51 | 41.49 | 41.48 | 41.33 | 41.47 | 41.38 | 41.38 | 41.37 | 41.50 | 0.18 |

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. -



Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2005-051-0001 for Digital Thermometer with Probe (Agilent) Module 1 (93) Serial No. MY41008700, Due 03-Feb-21

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 21T3175

REFERENCE No : 60627-7

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
MODEL : WPE45
SERIAL No : L715.0400
ID No : WB 06/58
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.**CALIBRATION DATE** : 19-Mar-21**APPROVED BY** : _____**ISSUED DATE** : _____**RECEIVED DATE** : 19-Mar-21THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

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CERTIFICATE No : 21T3175

PAGE : 2 OF 2

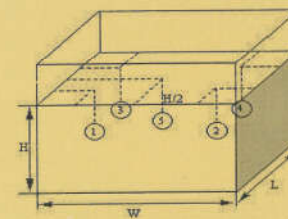
Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB 06/58
RECEIVED DATE : 19-Mar-21
AMBIENT TEMPERATURE : 25 °C ± 1 °C
MODEL : WPE45
SERIAL NUMBER : L715.0400
CALIBRATION DATE : 19-Mar-21
RELATIVE HUMIDITY : 55 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|---|-------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH RTD | 2635A | 7286308 | 20T6464 | 06-Jul-21 |
| 3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY. | | | | |
| 4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION. | | | | |
| 5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:- - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD. | | | | |

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENTPROBE INSTALLATION
POSITION IN THE BATH**GENERAL INFORMATION**

Overall Variation of Ambient Temperature around the Bath (°C) : 0.3

Overall Variation of Line Voltage (V) : 0

Instrument Condition : Normal

Bath Inner Size (W*L*H) : 60*40*24 cm

BATH PERFORMANCE

| Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| 44.5 | 44.5 | 0.03 | 0.00 | 0.06 |

TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations | | | | Ref. 5 | Uncertainty (± °C) |
|----------------------|----------------------|---|-------|-------|-------|--------|--------------------|
| | | #1 | #2 | #3 | #4 | | |
| 44.5 | 44.5 | 44.52 | 44.53 | 44.52 | 44.53 | 44.52 | 0.14 |

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

เอกสาร 5-2

เอกสารสอบเครื่องมือตรวจวัดคุณภาพอากาศ



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscon.com, www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data

Calibration Data

| Recorder No. | Blower No. | Date | Actual Flowrate (l/min) | R ² |
|--------------|------------|------------|-------------------------|----------------|
| B35 | B35 | 02/05/2022 | $y = 1.345x - 12.323$ | 0.999 |
| B36 | B36 | 03/05/2022 | $y = 1.154x - 4.565$ | 0.999 |
| B37 | B37 | 04/05/2022 | $y = 1.139x - 2.122$ | 0.996 |
| B38 | B38 | 06/05/2022 | $y = 1.126x - 2.401$ | 0.999 |
| B39 | B39 | 02/05/2022 | $y = 1.188x - 5.455$ | 0.998 |
| B40 | B40 | 06/05/2022 | $y = 1.156x - 3.823$ | 0.995 |
| B41 | B41 | 06/05/2022 | $y = 1.187x - 6.052$ | 0.997 |
| B42 | B42 | 04/05/2022 | $y = 1.063x + 0.537$ | 0.998 |
| B43 | B43 | 04/05/2022 | $y = 1.258x - 9.645$ | 0.998 |
| B44 | B44 | 03/05/2022 | $y = 1.252x - 9.964$ | 0.999 |
| R01 | R01 | 02/05/2022 | $y = 1.220x - 6.992$ | 0.999 |
| R02 | R02 | 10/05/2022 | $y = 1.121x - 3.616$ | 0.997 |
| R03 | R03 | 02/05/2022 | $y = 1.161x - 5.046$ | 0.999 |
| R04 | R04 | 06/05/2022 | $y = 1.115x - 1.773$ | 0.999 |
| R05 | R05 | 06/05/2022 | $y = 1.217x - 7.663$ | 0.998 |
| R06 | R06 | 04/05/2022 | $y = 1.245x - 8.155$ | 0.996 |
| R07 | R07 | 06/05/2022 | $y = 1.042x + 1.155$ | 0.995 |
| R08 | R08 | 04/05/2022 | $y = 1.220x - 6.674$ | 0.998 |
| R09 | R09 | 04/05/2022 | $y = 1.192x - 5.710$ | 0.997 |
| R10 | R10 | 10/05/2022 | $y = 1.209x - 6.199$ | 0.999 |
| R11 | R11 | 02/05/2022 | $y = 1.101x - 2.414$ | 0.999 |
| R12 | R12 | 10/05/2022 | $y = 1.209x - 6.618$ | 0.995 |
| R13 | R13 | 10/05/2022 | $y = 1.158x - 3.923$ | 0.999 |
| R14 | R14 | 06/05/2022 | $y = 1.128x - 2.065$ | 0.999 |
| R15 | R15 | 04/05/2022 | $y = 1.014x + 2.496$ | 0.998 |
| R16 | R16 | 04/05/2022 | $y = 1.159x - 5.442$ | 0.997 |
| R17 | R17 | 10/05/2022 | $y = 1.203x - 5.717$ | 0.999 |
| R18 | R18 | 02/05/2022 | $y = 1.325x - 12.252$ | 0.997 |
| R19 | R19 | 03/05/2022 | $y = 1.246x - 7.147$ | 0.998 |
| R20 | R20 | 04/05/2022 | $y = 1.230x - 7.354$ | 0.999 |



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Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscon.com, www.spscon.com

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume PM-10 Data

Calibration Data

| Recorder No. | Blower No. | Date | Actual Flowrate (l/min) | R ² |
|--------------|------------|------------|-------------------------|----------------|
| B01 | B01 | 02/05/2022 | $y = 1.171x - 0.211$ | 0.997 |
| B02 | B02 | 02/05/2022 | $y = 0.960x + 5.104$ | 0.998 |
| B03 | B03 | 04/05/2022 | $y = 1.214x - 5.211$ | 0.996 |
| B04 | B04 | 02/05/2022 | $y = 1.310x - 9.479$ | 0.999 |
| B05 | B05 | 03/05/2022 | $y = 1.202x - 5.734$ | 0.999 |
| B06 | B06 | 04/05/2022 | $y = 1.241x - 7.631$ | 0.998 |
| B07 | B07 | 04/05/2022 | $y = 1.186x - 4.480$ | 0.999 |
| B08 | B08 | 03/05/2022 | $y = 1.322x - 8.634$ | 0.999 |
| B09 | B09 | 04/05/2022 | $y = 1.219x - 5.756$ | 0.998 |
| B10 | B10 | 03/05/2022 | $y = 1.234x - 7.417$ | 1.000 |
| B11 | B11 | 02/05/2022 | $y = 1.260x - 7.479$ | 0.999 |
| B12 | B12 | 02/05/2022 | $y = 1.225x - 5.900$ | 0.998 |
| B13 | B13 | 04/05/2022 | $y = 1.326x - 10.711$ | 0.999 |
| B14 | B14 | 07/05/2022 | $y = 1.197x - 3.534$ | 0.999 |
| B15 | B15 | 04/05/2022 | $y = 1.096x - 0.244$ | 0.998 |
| B16 | B16 | 04/05/2022 | $y = 1.209x - 1.612$ | 1.000 |
| B17 | B17 | 03/05/2022 | $y = 1.198x - 3.075$ | 0.999 |
| B18 | B18 | 07/05/2022 | $y = 1.159x - 2.421$ | 0.999 |
| B19 | B19 | 03/05/2022 | $y = 1.053x + 1.562$ | 0.999 |
| B20 | B20 | 03/05/2022 | $y = 1.206x - 6.147$ | 1.000 |
| B21 | B21 | 04/05/2022 | $y = 1.156x - 0.999$ | 0.998 |
| B22 | B22 | 04/05/2022 | $y = 1.293x - 8.368$ | 0.998 |
| B23 | B23 | 07/05/2022 | $y = 1.149x - 2.644$ | 1.000 |
| B24 | B24 | 02/05/2022 | $y = 1.250x - 7.392$ | 1.000 |
| B25 | B25 | 03/05/2022 | $y = 1.131x - 2.476$ | 0.999 |
| B26 | B26 | 07/05/2022 | $y = 1.154x + 1.978$ | 1.000 |
| B27 | B27 | 02/05/2022 | $y = 1.278x - 8.984$ | 0.998 |
| B28 | B28 | 04/05/2022 | $y = 1.093x - 0.217$ | 0.999 |
| B29 | B29 | 04/05/2022 | $y = 1.280x - 9.168$ | 0.999 |
| B30 | B30 | 03/05/2022 | $y = 1.290x - 8.822$ | 0.997 |
| B31 | B31 | 03/05/2022 | $y = 1.116x - 0.814$ | 0.997 |



CERTIFICATE No : 22M2570
REFERENCE No : 64386-4

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XSR 105DU
SERIAL No : B926859981
ID No : BA 10/62
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : TETNITHI W.
CALIBRATION DATE : 11-Mar-22

APPROVED BY :

ISSUED DATE : 11-Mar-22

RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22M2570

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XSR 105DU
MANUFACTURER : METTLER TOLEDO S/N : B926859981
ID No : BA 10/62 RECEIVED DATE : 11-Mar-22
AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22
AMBIENT TEMPERATURE : 22°C \pm 1°C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|------------------------|-------|-----------|----------------|-----------|
| 1) STANDARD WEIGHT SET | E2 | QK-1-151 | C02210415 | 09-Feb-23 |

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

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

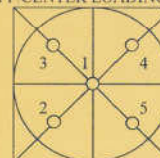
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 20 g WAS 0.000014 g
4. REPEATABILITY OF READING AT 100 g WAS 0.000042 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.00000 | 0.00000 | 0.000051 |
| 0.02 | 0.01999 | 0.00001 | 0.000051 |
| 0.10 | 0.10000 | 0.00000 | 0.000052 |
| 0.20 | 0.20001 | -0.00001 | 0.000050 |
| 0.50 | 0.50002 | -0.00002 | 0.000051 |
| 1.00 | 1.00002 | -0.00002 | 0.000052 |
| 2.00 | 2.00002 | -0.00002 | 0.000052 |
| 5.00 | 5.00003 | -0.00003 | 0.000054 |
| 10.00 | 10.00007 | -0.00007 | 0.000058 |
| 20.00 | 20.00007 | -0.00007 | 0.000067 |
| 50.00 | 50.00000 | 0.00000 | 0.00011 |
| 100.00 | 100.00001 | -0.00001 | 0.00019 |
| 120.00 | 120.00001 | -0.00001 | 0.00022 |

6. OFF CENTER LOADING ERROR



| POINT | READING (g) | |
|--------------------|-------------|---------|
| 1 | 10.00003 | 50.0000 |
| 2 | 10.00003 | 50.0000 |
| 3 | 10.00004 | 50.0000 |
| 4 | 10.00003 | 49.9999 |
| 5 | 10.00003 | 50.0000 |
| OFF-CENTER LOADING | 0.00001 | 0.0001 |

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

| CALIBRATION REPORT | | | | | |
|---------------------------------------|-----------------------------------|-------------------|---------------------------------|--------------------------------|-------------|
| NON-DISPERSIVE INFRARED CO ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 300E |
| NO. | CO-B04 | SERIAL NO. | 3089 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 20 September 2021 | | Serial No. | : 421 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Carbon Monoxide (CO) | | Cylinder No. | : D196045 | |
| Certified Date | : 16 April 2022 | Expired Date | : 15 April 2024 | Cylinder Conc. | : 4,570 PPM |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPM | | | Final Reading (After Adj.),PPM | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | |
| Zero | 0 | 0.10 | - | 0 | |
| CO Span | 40.00 | 40.08 | 0.200 | 40.00 | |
| API Model 300E CO Analyzer Check list | | | | | |
| Parameter | Observed Value | Units | Nominal Range | | |
| RANGE | 50 | PPM | 0-1000 ppm | | |
| STABILITY | 0.10 | PPM | < 1 ppm with zero air | | |
| CO MEASURE | 4014.5 | mV | 2500-4800 mV | | |
| CO REFERENCE | 3948.7 | mV | 2500-4800 mV | | |
| MEASURE/REFERENCE RATIO | 1.179 | - | 1.1-1.3 w/zero air | | |
| SAMPLE PRESSURE | 28.6 | In-Hg-A | -2" < ambient absolute pressure | | |
| SAMPLE FLOW | 804 | cc/min | 800 ± 10% | | |
| SAMPLE TEMPERATURE | 48.2 | °C | 48 ± 4 | | |
| BENCH TEMPERATURE | 48.1 | °C | 48 ± 2 | | |
| WHEEL TEMPERATURE | 68.3 | °C | 68 ± 2 | | |
| BOX TEMPERATURE | 30.7 | °C | Ambient temp + 7 ± 10. | | |
| PHOTO-DRIVE | 3029.4 | mV | 250 mV to 4750 mV | | |
| SLOPE | 1.017 | - | 1.0 ± 0.3 | | |
| OFFSET | 0.2 | - | 0 ± 0.3 | | |



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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

| CALIBRATION REPORT | | | | | |
|-------------------------------------|-----------------------------------|-------------------|-----------------|--------------------------------|-------------|
| NON-DISPERSIVE INFRARED CO ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | Thermo | MODEL : | 48C |
| NO. | CO-B07 | SERIAL NO. | 0335203746 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 20 September 2021 | | Serial No. | : 421 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Carbon Monoxide (CO) | | Cylinder No. | : D196045 | |
| Certified Date | : 16 April 2022 | Expired Date | : 15 April 2024 | Cylinder Conc. | : 4,570 PPM |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPM | | | Final Reading (After Adj.),PPM | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | |
| Zero | 0 | -0.10 | - | 0 | |
| CO Span | 40.00 | 40.04 | 0.100 | 40.00 | |
| INSTRUMENT STATUS | | | | | |
| CHAMBER TEMP | 47.2 | °C | FLOW | 1.5 LPM | |
| PRESSURE | 730.7 | mm Hg | MOTOR SPEED | 100.00% | |



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| CALIBRATION REPORT | | | | | |
|-------------------------------------|-----------------------------------|-------------------|--------------|--------------------------------|-----|
| NON-DISPERSIVE INFRARED CO ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | Thermo | MODEL : | 48C |
| NO. | CO-B08 | SERIAL NO. | 0508011067 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 20 September 2021 | | Serial No. | : 421 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Carbon Monoxide (CO) | | Cylinder No. | : D196045 | |
| Certified Date | : 16 April 2022 | | Expired Date | : 15 April 2024 | |
| Cylinder Conc. | : 4,570 PPM | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.5 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPM | | | Final Reading (After Adj.),PPM | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | |
| Zero | 0 | 0.10 | - | 0 | |
| CO Span | 40.00 | 40.06 | 0.150 | 40.00 | |
| INSTRUMENT STATUS | | | | | |
| CHAMBER TEMP | 47.4 | °C | FLOW | 1.5 | LPM |
| PRESSURE | 730.7 | mm Hg | MOTOR SPEED | 100.00 | % |



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| CALIBRATION REPORT | | | | | |
|-------------------------------------|-----------------------------------|-------------------|--------------|--------------------------------|-----|
| NON-DISPERSIVE INFRARED CO ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | Thermo | MODEL : | 48C |
| NO. | CO-B09 | SERIAL NO. | 65433-348 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 20 September 2021 | | Serial No. | : 421 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Carbon Monoxide (CO) | | Cylinder No. | : D196045 | |
| Certified Date | : 16 April 2022 | | Expired Date | : 15 April 2024 | |
| Cylinder Conc. | : 4,570 PPM | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPM | | | Final Reading (After Adj.),PPM | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | |
| Zero | 0 | 0.10 | - | 0 | |
| CO Span | 40.00 | 39.94 | -0.150 | 40.00 | |
| INSTRUMENT STATUS | | | | | |
| CHAMBER TEMP | 47.5 | °C | FLOW | 1.5 | LPM |
| PRESSURE | 730.4 | mm Hg | MOTOR SPEED | 100.00 | % |



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| CALIBRATION REPORT | | | | | |
|-------------------------------------|-----------------------------------|-------------------|--------------|--------------------------------|-----|
| NON-DISPERSIVE INFRARED CO ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | Thermo | MODEL : | 48C |
| NO. | CO-B11 | SERIAL NO. | 0401304262 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 20 September 2021 | | Serial No. | : 421 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Carbon Monoxide (CO) | | Cylinder No. | : D196045 | |
| Certified Date | : 16 April 2022 | | Expired Date | : 15 April 2024 | |
| Cylinder Conc. | : 4,570 PPM | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.5 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPM | | | Final Reading (After Adj.),PPM | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | |
| Zero | 0 | -0.10 | - | 0 | |
| CO Span | 40.00 | 39.93 | -0.175 | 40.00 | |
| INSTRUMENT STATUS | | | | | |
| CHAMBER TEMP | 47.5 °C | | FLOW | 1.5 LPM | |
| PRESSURE | 730.8 mm Hg | | MOTOR SPEED | 100.00% | |



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| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-B05 | SERIAL NO. | 2284 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2021 | | Serial No. | : 911 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Nitric Oxide (NO) | | Cylinder No. | : A00681SK | |
| Certified Date | : 24 August 2020 | | Expired Date | : 24 August 2022 | |
| Cylinder Conc. | : 51.0 ppm | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.5 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | 0.10 | - | 0 | - |
| NO Span | 400 | 399.8 | -0.050 | 400.0 | 1.005 |
| NO _x Span | 400 | 400.2 | 0.050 | 400.0 | 1.009 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 505 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.4 | mV | -20 - 150 | | |
| AZERO | 94.2 | mV | -20 - 150 | | |
| HVPS | 670 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.1 | °C | 50 ± 1 | | |
| BOX TEMP | 29.2 | °C | 8 - 48 | | |
| PMT TEMP | 7.4 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.9 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.3 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.5 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.005 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.009 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.2 | mV | -20 to +150 | | |
| NO _x Offset | 0.9 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |



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| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-B07 | SERIAL NO. | 4338 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2021 | | Serial No. | : 911 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Nitric Oxide (NO) | | Cylinder No. | : A00681SK | |
| Certified Date | : 24 August 2020 | | Expired Date | : 24 August 2022 | |
| Cylinder Conc. | : 51.0 ppm | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | 0.11 | - | 0 | - |
| NO Span | 400 | 399.9 | -0.025 | 400.0 | 1.005 |
| NO _x Span | 400 | 400.1 | 0.025 | 400.0 | 1.008 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 506 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.2 | mV | -20 - 150 | | |
| AZERO | 94.1 | mV | -20 - 150 | | |
| HVPS | 670 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.2 | °C | 50 ± 1 | | |
| BOX TEMP | 29.3 | °C | 8 - 48 | | |
| PMT TEMP | 7.1 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.9 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.4 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.7 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.005 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.008 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.1 | mV | -20 to +150 | | |
| NO _x Offset | 0.7 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |



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| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-B10 | SERIAL NO. | 4465 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2021 | | Serial No. | : 911 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Nitric Oxide (NO) | | Cylinder No. | : A00681SK | |
| Certified Date | : 24 August 2020 | | Expired Date | : 24 August 2022 | |
| Cylinder Conc. | : 51.0 ppm | | | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.5 | °C |
| % RH | 49 | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| NO Span | 400 | 399.7 | -0.075 | 400.0 | 1.004 |
| NO _x Span | 400 | 400.1 | 0.025 | 400.0 | 1.007 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 509 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.2 | mV | -20 - 150 | | |
| AZERO | 94.0 | mV | -20 - 150 | | |
| HVPS | 675 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.4 | °C | 50 ± 1 | | |
| BOX TEMP | 29.1 | °C | 8 - 48 | | |
| PMT TEMP | 7.5 | °C | 7 ± 2 | | |
| MOLY TEMP | 315.2 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.5 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.7 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.004 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.007 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.1 | mV | -20 to +150 | | |
| NO _x Offset | 0.7 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |



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| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|------------|
| CHEMILUMINESCENT NO / NO _x / NO _x ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 200A |
| NO. | NOX-B12 | SERIAL NO. | 2675 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2021 | | Serial No. | : 911 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Nitric Oxide (NO) | | Cylinder No. | : A00681SK | |
| Certified Date | : 24 August 2020 | Expired Date | : 24 August 2022 | Cylinder Conc. | : 51.0 ppm |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH 49 | | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| NO Span | 400 | 400.1 | 0.025 | 400.0 | 1.006 |
| NO _x Span | 400 | 400.3 | 0.075 | 400.0 | 1.010 |
| API Model 200A NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 509 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 79 | cc/min | 80 ± 15 | | |
| PMT | 103.3 | mV | -20 - 150 | | |
| AZERO | 94.0 | mV | -20 - 150 | | |
| HVPS | 669 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.4 | °C | 50 ± 1 | | |
| BOX TEMP | 29.5 | °C | 8 - 48 | | |
| PMT TEMP | 7.3 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.7 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.3 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.5 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.006 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.010 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.4 | mV | -20 to +150 | | |
| NO _x Offset | 0.9 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |



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| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|------------|
| CHEMILUMINESCENT NO / NO _x / NO _x ANALYZER | | | | | |
| DATE : | 30 May 2022 | BRAND : | API | MODEL : | 200A |
| NO. | NOX-B17 | SERIAL NO. | 1977 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2021 | | Serial No. | : 911 | |
| Reference Standard Gas | | | | | |
| Standard Gas | : Nitric Oxide (NO) | | Cylinder No. | : A00681SK | |
| Certified Date | : 24 August 2020 | Expired Date | : 24 August 2022 | Cylinder Conc. | : 51.0 ppm |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| % RH 49 | | | | | |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| NO Span | 400 | 399.5 | -0.125 | 400.0 | 1.004 |
| NO _x Span | 400 | 399.8 | -0.050 | 400.0 | 1.007 |
| API Model 200A NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 512 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 79 | cc/min | 80 ± 15 | | |
| PMT | 103.0 | mV | -20 - 150 | | |
| AZERO | 93.9 | mV | -20 - 150 | | |
| HVPS | 673 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.5 | °C | 50 ± 1 | | |
| BOX TEMP | 29.2 | °C | 8 - 48 | | |
| PMT TEMP | 7.4 | °C | 7 ± 2 | | |
| MOLY TEMP | 315.2 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.2 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.4 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.004 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.007 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.0 | mV | -20 to +150 | | |
| NO _x Offset | 0.6 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

เอกสาร 5-3

เอกสารสอบเครื่องมือตรวจวัดระดับเสียง



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Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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

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

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|------------------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 93.93 | -0.07 | ± 0.10 | ± 0.40 dB |

2. Frequency

| Standard Microphone Type | Measured Frequency (Hz) | Deviated value (Hz) | Uncertainty (Hz) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|-------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 999.9 | -0.1 | ± 1.5 | ± 1.0% |

3. Total Distortion

| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|-------------------------------|-----------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 1.44 | ± 0.50 | ± 3.0% |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :



(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

2 / 2

Date of Calibra

Date of Issue

End of Certificate

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

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FM.BLMTC.002 Rev.4

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Noise B_310/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|----------------|------------------|---------------|
| Brand | ACO | Number | AC 03/56 |
| Model | 2127 | Serial No. | 130006 |
| Calibration Range | 94 dB, 1000 Hz | Last Calibration | 28 April 2022 |
| | | Due Date | 28 April 2023 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|-------|-------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| ACO-B14 | ACO | 6236 | 00172034 | 30 May 2022 | 94.0 | 94.0 |
| ACO-B24 | ACO | 6236 | 00182005 | 30 May 2022 | 93.9 | 94.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.93 ± 0.10 dB | |

Noise B_318/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|----------------|------------------|---------------|
| Brand | ACO | Number | AC 03/56 |
| Model | 2127 | Serial No. | 130006 |
| Calibration Range | 94 dB, 1000 Hz | Last Calibration | 28 April 2022 |
| | | Due Date | 28 April 2023 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|-------|-------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| ACO-B05 | ACO | 6236 | 00142002 | 30 May 2022 | 94.0 | 94.0 |
| ACO-B31 | ACO | 6236 | 00182013 | 30 May 2022 | 93.9 | 94.0 |
| NL 21-B19 | RION | NL-21 | 00554237 | 30 May 2022 | 94.0 | 94.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.93 ± 0.10 dB | |