ภาคผนวก ช

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

CERTIFICATE OF CALIBRATION

Certificate No.: C0-2008004/21 **Page** 1 **of total** 4 **pages**

Customer WATER ANALYSIS CENTER CO., LTD.
30/5 Soi Viphavadee 60, Viphavadee Rangsit Road,
Kwaeng Taladbangkhen, Khet Laksi, Bangkok 10210

Equipment pH Meter
Manufacturer METTLER TOLEDO **Model** SevenCompact
Serial No. B327527211 **ID No.** WWL 0068
Description Range : 0 - 14 pH, Resolution : 0.01 pH

Environmental Conditions Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -
Calibration Location Jayhawks Laboratory (CL&GL)
Received Date 20 August 2021
Calibration Date 20 August 2021

Date of Issue 23 August 2021

Checked by **Approved by**

Act as Technical Manager — Representative of Managing Director

( ) (Krisyosl K.) ( ) (Sakda Y.) (Dr. Ekachai Puttitwong)
( ) (Patiphan K.) (✓) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Phrack Sa, Muang, Samut Prakan 10280
Tel. 0 2394 2162, 0 2757 8435, 0 2757 8496 Fax. 0 2757 8507
ANAB ACCREDITED CALIBRATION LABORATORY AC-2695

Reference Method:
- The calibration method used was CP-178 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

Type	pH Value	Lot No.	Due Date	Traceability
pH Standard Solution	4.01	081020	Feb. 1, 2022	NIMT
	7.01	020221	Dec. 25, 2021	
	10.00	091020	Jan. 19, 2022	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	753	3101007	I0-0804001/21	Apr. 7, 2022	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	I0-1006001/21	Jun. 10, 2022	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

1. Function Simulated pH Meter

Standard Applied	Nominal Value	UUC Reading		Uncertainty
(mV)	(pH)	pH	mV	(± mV)
177.48	4.00	4.01	177.4	0.060
0.00	7.00	7.00	0.0	0.060
-177.48	10.00	10.01	-177.4	0.060

UUC : Unit Under Calibration
Note : Adjust Curve to simulate pH (4,7,10)

Calibrated by Kittipong

Certificate No.: C0-2008004/21 **Page** 3 **of total** 4 **pages**

Measurement Results (Cont.):

2. Calibration of pH Electrode

pH Standard Solution	Measured Value		Uncertainty
(pH)	(pH)	(mV)	(± pH)
4.01	4.00	187.0	0.013
7.01	7.00	11.1	0.013
10.00	10.02	-161.6	0.013

Note : Adjust Curve to Buffer Solution pH (4,7,10)
Temperature stability of micro bath : 25 ± 0.2°C

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Phrack Sa, Muang, Samut Prakan 10280
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax. 0-2757-8507
ILAC-MRA ANAB ACCREDITED CALIBRATION LABORATORY AC-2695

Certificate No.: C0-2008004/21 **Page** 4 **of total** 4 **pages**

Reference Method:
- The calibration method used was CP-096 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	20E3985	Nov. 9, 2021	TPA
Platinum Resistance Thermometer	5626	4853	C0A30046	Oct. 28, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	I0-0306002/21	Jun. 3, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- TPA, Technology Promotion Association (Thailand-Japan).
- FLUKE, Fluke Comporation, U.S.A.
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results: (X) Without Adjustment
Dimension of probe : Diameter 4 mm. Sensor Type : RTD (PT100)

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	22.00	22.0	0.00	0.058
120	25.00	25.0	0.00	0.058
120	28.00	28.0	0.00	0.058

UUC : Unit Under Calibration

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
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Tel. 0 2394 2162, 0 2757 8435, 0 2757 8494 Fax. 0 2757 8507

ANAB ACCREDITED CALIBRATION LABORATORY AC-2695

CERTIFICATE OF CALIBRATION

Certificate No.: C0-2107005/21 **Page** 1 **of total** 2 **pages**

Customer WATER ANALYSIS CENTER CO., LTD.
30/5 Soi Viphavadee 60, Viphavadee Rangsit Road,
Kwaeng Taladbangkhen, Khet Laksi, Bangkok 10210

Equipment	Conductivity Meter		
Manufacturer	EUTECH	**Model**	CON 2700
Serial No.	2657889	**ID No.**	WWL 0136
Description	-		

Environmental Conditions	Ambient Temperature:	(20 ± 2) °C
	Relative Humidity:	(50 ± 10) %
	Atmospheric Pressure:	-
Calibration Location	Jayhawks Laboratory (CL&GL)	
Received Date	21 July 2021	
Calibration Date	21 July 2021	

Date of Issue 22 July 2021

Checked by **Approved by**

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

( ) (Krisyosl K.) ( ) (Sakda Y.)
( ) (Patiphan K.) (✓ (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

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Certificate No : AD2012-017-0001

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

STD Reading (mg/l)	UUC Reading Before (mg/l)	UUC Reading After (mg/l)	Error (mg/l)	Uncertainty (± mg/l)
9.046	9.07	-	0.024	0.013

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0.00 to 60.00 mg/l
Resolution 0.01 mg/l

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L2002-756,L2002-757 for Data Logger (Lutron Temperature & Humid & Baro) Serial No. B014887, Due 28-Feb-21

MIT Certificate No. L2001-629 for Hi Accuracy Thermometer Serial No. 130508834, Due 07-Jan-21

End of Certificate

929,929/1 Soi Pattanakarn 30, Pattanakarn Rd., Suanluang, Suanluang, Bangkok 10250
Head Office : Tel. 02-319-9994 ext.1 Fax.02-318-4961 E-mail : atsc@automation.co.th
Rayong Branch : 1/15 Huaypong Rd., A. Muang, Rayong 21150 Tel. 038-692-152 Fax. 038-692-345
Lamphun Branch : 122/5 M.4, T.Ban Klang, A.Muang, Lamphun 51000 Tel/Fax. 053-581-876
website : www.automation.co.th

SV 212001/2021

CERTIFICATE OF CALIBRATION

Instrument : DO Meter
Model : DO-31P
Serial No. : 780065
Manufacturer : TOA-DKK
Measuring Range : 0.00 ~ 20.00 mg/l

Machine : -
Location : -

Customer : Water Analysis Center Co.,Ltd.
1/94 Moo.5 T.Kanham, A.U-Thai
Ayutthaya 13210 Thailand

Date Of Received : 03 / 12 / 2021
Date Of Calibration : 03 / 12 / 2021

Ambient Condition : Temperature 24 °C
Humidity 47 % RH

Calibrated By :

(Ms. Phanee Yooyen)
Technician

Approved By :

(Mr. Nipon Phungsomsak)
Technical Manager

Date Of Issue : 03 / 12 / 2021

This Certificate may not be reproduced other than in full, except with the prior written approval of the head of the industrial instruments calibration center.

Calibrate Procedure

- ☐ This instrument was calibrated by comparison with standard solution (PH/ORP)
- ☐ This instrument was calibrated by comparison with scattering plate value (Turbidity)
- ☐ This instrument was calibrated by comparison with conductivity (Conductivity)
- ☑ This instrument was calibrated by comparison with Sodium sulfite anhydrous (DO)

Condition of this result of calibration

1). Reference Standard Solution

Standard	Lot No	Batch.	Cert. No.	Due Date
Sodium Sulfite Power	1.06657.0500	K52300357	-	31 Mar 2022

2). Traceability This certification is traceable to
- ☑ Merck KGaA 64271 Darmstadt
- ☐ DKK Corporation

Result Of Calibration

Standard Solution (mg/l) at 26.0°C		Before Adjust		After Adjust	
		Indicator	Error	Indicator	Error
Zero	0.00	0.10	+ 0.10	0.00	-
Span	7.99	8.21	+ 0.22	7.99	-

DO Electrode No. OE270AA(5) S/N 111F0029

Calibrated By

(Ms. Phanee Yooyen)
Technician

MCAL
MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.

547 Soi Ratchadanivat, Kwaeng Samsennok, Khet Huaykwang, Bangkok 10310
Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

TEMPERATURE
CONTROLLER ENCLOSURES

NSC-TISI-TIS 17025
CALIBRATION 0163

Certificate No.: MC 2107214

Customer	: Water Analysis Center Co., Ltd. 1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.		
Reference Job No.	: 21-1565	Received Date	: 13 July 2021
Description	: Refrigerator		
Manufacturer	: SANDENINTERCOOL	Model	: SEC-1500SBD
Serial No.	: SEC1500201A-0708-00304	ID. No.	: WWI.0038
Marking	: Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2107214) has been attached to the case.		
Method	: In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures"		
Location of Calibration	: Water Analysis Center Co., Ltd. : Laboratory.		
Environmental Conditions	: Ambient Temperature : (26.3) °C Relative Humidity : (56.4 to 59.3) %		
Date of Calibration	: 13 July 2021	Date of Issue	: 14 July 2021

Checked by : Thanagorn
Thanagorn Limchaicharoen
(Calibration Supervisor)

Approved by : Aittipong
Aittipong Kanlanawasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

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http://www.mastercalibration.com

The Reference Standard :

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2009600	MY44095818	8 August 2021
With Thermocouple Type " T " ID. No.6/1 to 6/9			

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd. And Quality Reborn Co., Ltd.

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eigh corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

Temperature 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.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minmum measured temperatures throughout observation.

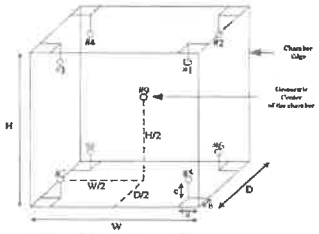

Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber veriation : 4.4 °C
Overall Line Voltage variation : 0.1 V
Chamber Size (W*H*D) : 171 cm x 157 cm x 60 cm

Checked by : Thanagorn

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http://www.mastercalibration.com

Certificate No.: MC 2107214

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
2.6	4.0	4.0	4.1	4.0	3.9	3.8	3.7	3.8	3.4	1.2

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.6	2.7	1.4	5.8

The 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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by : Thanagorn

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MASTER CALIBRATION CO.,LTD.
Master Calibration Co.,Ltd.
547 Soi Ratchadanivat, Kwaeng Samsennok, Khet Huaykwang, Bangkok 10310
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http://www.mastercalibration.com

NSC-TLSI-TIS 17025
CALIBRATION 0183

TEMPERATURE CONTROLLER ENCLOSURES

Report No. : MC 2103787

Customer	: Water Analysis Center Co., Ltd. 1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.		
Reference Job No.	: 21-0710	Received Date	: 25 March 2021
Description	: Oven		
Manufacturer	: Memmert	Model	: UF260
Serial No.	: B620.0814	ID. No.	: N/A
Marking	: Additionally for the purpose of identification by this laboratory a label marked with this report number (MC 2103787) has been attached to the case.		
Method	: In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".		
Location of Calibration	: Water Analysis Center Co., Ltd. ; Laboratory.		
Environmental Conditions	: Ambient Temperature : (31.8 to 35.3) °C Relative Humidity : (44.7 to 55.9) %		
Date of Calibration	: 25 March 2021	Date of Issue	: 26 March 2021

Checked by : Thanagorn
Thanagorn Limchaicharoen
(Calibration Supervisor)

Approved by : Aittipong
Aittipong Kanjanavasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

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

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Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989
http://www.mastercalibration.com

The Reference Standard :

Description	Report No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2016027	MY41010916	10 January 2022
With Thermocouple Type " T " ID. No.17/1 to 17/9			

This certificate is traceable to the international system of units maintained at:

- Master Carlibration Co., Ltd.

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eigh corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

Temperature 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.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minmum measured temperatures throughout observation.

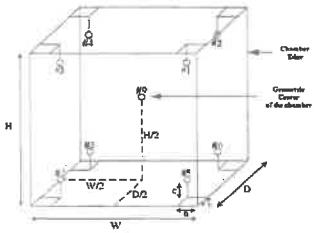

Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber veriation : 1.1 °C

Overall Line Voltage variation : 1.2 .V

Chamber Size (W*H*D) : 65 cm x 80 cm x 50 cm

Checked by : Thanagorn

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http://www.mastercalibration.com

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104.0	103.7	103.7	103.7	103.9	104.2	104.3	104.3	104.3	104.0	0.67
180.0	179.1	179.1	179.0	179.2	180.4	180.5	180.6	180.6	180.2	0.99

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.27	0.44	1.0
180.0	180.0	0.29	1.31	1.9

3. Uncertainty of Measurement

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

This report will certify of the calibrated equipment only.

End of Calibration Report

Checked by : Thanagorn

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MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.
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http://www.mastercalibration.com

Calibration Report

NSC-TISI-TIS 17025
CALIBRATION 0183

TEMPERATURE CONTROLLER ENCLOSURES

Report No. : MC 2103787

Customer	: Water Analysis Center Co., Ltd. 1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.		
Reference Job No.	: 21-0710	Received Date	: 25 March 2021
Description	: Oven		
Manufacturer	: Memmert	Model	: UF260
Serial No.	: B620.0814	ID. No.	: N/A
Marking	: Additionally for the purpose of identification by this laboratory a label marked with this report number (MC 2103787) has been attached to the case.		
Method	: In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures"		
Location of Calibration	: Water Analysis Center Co., Ltd. ; Laboratory.		
Environmental Conditions	: Ambient Temperature : (31.8 to 35.3) °C Relative Humidity : (44.7 to 55.9) %		
Date of Calibration	: 25 March 2021	Date of Issue	: 26 March 2021

Checked by : Thanagorn
Thanagorn Limchaicharoen
(Calibration Supervisor)

Approved by : Aittipong
Aittipong Kanjanawasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

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http://www.mastercalibration.com

The Reference Standard :

Description	Report No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2016027	MY41010916	10 January 2022
With Thermocouple Type " T " ID. No.17/1 to 17/9			

This certificate is traceable to the international system of units maintained at:

- Master Carlibration Co., Ltd.

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eigh corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

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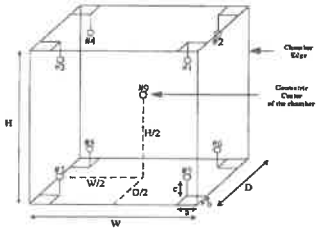

Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber veriation : 1.1 °C
Overall Line Voltage variation : 1.2 V
Chamber Size (W*H*D) : 65 cm x 80 cm x 50 cm

Checked by : Thanagorn

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Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989
http://www.mastercalibration.com

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104.0	103.7	103.7	103.7	103.9	104.2	104.3	104.3	104.3	104.0	0.67
180.0	179.1	179.1	179.0	179.2	180.4	180.5	180.6	180.6	180.2	0.99

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.27	0.44	1.0
180.0	180.0	0.29	1.31	1.9

3. Uncertainty of Measurement

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

This report will certify of the calibrated equipment only.

End of Calibration Report

Checked by : Thanagorn

[MCF-Q-077 ; Rev.5 ; Date : 15/07/2014]

Business Unit
SPC Calibration Center

SPCRT
Part of DKSH Group

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01211841
Model:	BL210S	Issued Date:	24 June 2021
Serial No. (or ID.):	15808131 (WWL 0022)	Job No.:	KSPR2107969
Manufacturer:	Sartorius	Page:	1 of 2
Condition:	In condition		

Customer: Water Analysis Center Co., Ltd.
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 27 °C ± 0.3 °C
Humidity 40 %RH ± 1.7 %RH

Calibration Place: Water Analysis Center Co., Ltd. (ห้องเครื่องชั่ง)
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Phakapol Donmin
Calibration Date: 10 June 2021
The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210017

(Mr. Phakapol Donmin)
Person in charge

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Rungrod Jenkittrakulchai)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to 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 effected 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 SPC RT Co., Ltd.

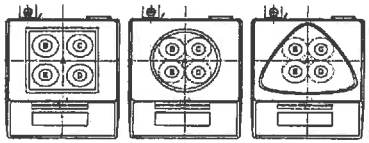
บริษัท เอสพีซี อาร์ที จำกัด
SPC RT CO., LTD.
สำนักงานใหญ่ 00003 1194 ซอยวัชรพรมราชาลิส 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
Branch 00003 1194 Soi Wachirothomsathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10: 23 Nov 2020

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 50 (g)

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

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00005

Departure of indication from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00010	2.03
2	2.00002	2.0000	0.0000	0.00010	2.03
5	4.99999	5.0000	0.0000	0.00010	2.03
10	10.00000	10.0000	0.0000	0.00011	2.02
20	19.99999	20.0000	0.0000	0.00011	2.02
50	49.99997	50.0000	0.0000	0.00012	2.01
70	69.99996	70.0000	0.0000	0.00015	2.00
100	100.00000	100.0000	0.0000	0.00017	2.00
120	119.99999	120.0001	-0.0001	0.00021	2.00
150	149.99997	150.0000	0.0000	0.00023	2.00
200	199.99990	200.0003	-0.0004	0.00029	2.00

The End of Certificate

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Branch 00003 1194 Soi Wachirthamasathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

Bara Scientific
Solution of Success

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

ilac-MRA
NSC-TISI-TIS 17025 CALIBRATION 0209

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No.	BSCC-UV-135/21
Equipment	UV/Vis Spectrophotometer
Model	UV-1800
Manufacturer	SHIMADZU
Serial No.	A11635405598CD
ID No.	WWL0082
Date of receipt	30 April 2021
Date of calibration	30 April 2021
Date of issue	10 May 2021
Customer name	Water Analysis Center Co., Ltd.
Address	1/94 Moo 5, T.Kantham, A.Uthai, Ayutthaya 13210
Temperature	(29.9-32.1) °C (On site)
Humidity	(48.7-52.6) %RH (On site)
Equipment condition	Good Operation
Calibration Location	Laboratory Room Water Analysis Center
Calibration Procedure	In-house method WI-UV-702-01 based on ASTM E275-01
Traceability	Wavelength Accuracy is traceable to certificate No. 79670 and 79671 Photometric Accuracy is traceable to certificate No. 79672 and 79673 Stray Light is traceable to certificate No. 79669 The above certificate are traceble to SI unit through Starna Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)
Calibrated by	Mr.Waruth Janphung

Approved by

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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NSC-TISI-TIS 17025 CALIBRATION 6309

Certificate of Calibration

Certificate No. BSCC-UV-135/21 Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
360.89	360.82	-0.07	0.18
418.53	418.71	0.18	0.18
445.82	446.38	0.56	0.18
453.67	453.58	-0.09	0.18
459.99	459.80	-0.19	0.18
638.00	638.10	0.10	0.18
431.22	431.38	0.16	0.18
513.39	513.57	0.18	0.18
528.90	528.82	-0.08	0.18
572.99	572.58	-0.41	0.18
585.25	585.37	0.12	0.18
684.50	684.65	0.15	0.18
741.02	741.14	0.12	0.18
879.41	879.29	-0.12	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6358	0.6310	-0.0048	0.0075

*CNR = Customer not request

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NSC-TISI-TIS 17025 CALIBRATION 6309

Certificate of Calibration

Certificate No. BSCC-UV-135/21 Number of Page(s) 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5473	0.5511	0.0038	0.0042
	0.7625	0.7655	0.0030	0.0042
	1.0484	1.0525	0.0041	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5369	0.5401	0.0032	0.0042
	0.7446	0.7464	0.0018	0.0042
	1.0235	1.0259	0.0024	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.4873	0.4906	0.0033	0.0042
	0.6868	0.6882	0.0014	0.0042
	0.9433	0.9453	0.0020	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5009	0.5027	0.0018	0.0042
	0.6952	0.6950	-0.0002	0.0042
	0.9568	0.9556	-0.0012	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5292	0.5303	0.0011	0.0042
	0.7228	0.7218	-0.0010	0.0042
	0.9993	0.9974	-0.0019	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5140	0.5151	0.0011	0.0042
	0.6902	0.6889	-0.0013	0.0042
	0.9539	0.9519	-0.0020	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelenght (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.97±0.11nm	200.40	0.9524	2.0215

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

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

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

PREVENTATIVE MAINTENANCE (PM) CHECK LIST

FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: 240 FS AA & M9182300 04

Customer : Water Analysis Center Co., Ltd

Date: 7 Apr 2021

Safety

- [x] Flame, Inspect/replace o-ring nebulizer, spray chamber and burner
- [x] Flame, Clean nebulizer, spray chamber and burner
- [x] Flame, Check liquid trap interlock, burner interlock, pressure relief bung interlock and shield interlock
- [ ] Furnace, Clean work head , electrode and shroud N/A
- [ ] Furnace, Clean PSD and PSD tray N/A
- [ ] Furnace, Check water pressure N/A
- [x] Check drain tube
- [x] Check exhaust system
- [x] Check gas pressure sensor interlock
- [x] Check and all gas hoses for SpectrAA
- [x] Clean computer control

Optics

- [x] Inspect/Replace that external optics surfaces
- [x] Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.5 nm
- [x] Check that PMT % Gain the copper at 324.8 nm,4 mA,0.5 nm slit width, Gain = 38 % (should be ≤ 64% or ≤ 380V)
- [x] Flame, Check D2 lamp is work

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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Electronics

- [x] Check power supply voltage
- [x] Check cables and connectors
- [x] Check/Clean all boards in the instrument
- [ ] Furnace, Check camera and align** N/A

**Option for Graphite Zeeman only

Mechanisms

- [x] Flame, Check the burner adjuster
- [ ] Furnace, Check PSD accessories N/A

Analytical performance

- [x] Clear the sample compartment
- [x] Flame, Check uptake rate form 7.2-10.6 mL per minute = 10.4 mL/min
- [x] Test Photometric noise, STDV = 0.0002 Abs (should be ≤ 0.00050 Abs)
- [x] Flame, Test high solids nebulizer setting use

  -Air/acet Cu 5 ppm = 0.76 Abs, and Precision (%RSD)= 0.5 % (should be > 0.55Abs and < 0.5% RSD)

  or

  -N20/Acet Cu 5 ppm = _____ Abs, and Precision (%RSD)= _____ %(should be > 0.3Abs and < 0.5% RSD)
- [ ] Furnace, Characteristic mass and sensitivity Cu 25 ppb = _____ Abs, and Precision (%RSD)= _____ % (should be ≥ 0.15 Abs and ≤ 4.0% RSD) N/A

SIGN :

Engineer : (Suriya Nachaiyon)

Customer : Kait (กฤษฎา ลิ้มศิริ)

SVD Results Report

VARIAN

Report ID: 4 **Diagnostic Start Time:** 4/7/2021 11:21:56 AM **Diagnostic End Time:** 4/7/2021 12:04:17 PM

Customer: Water Analysis Center Co., Ltd. **Service Engineer:** Suriya Nacharoen

Address: Uthai.Ayutthraya **Contact Details:** Kanitsara

Instrument Configuration

Configuration:

Serial Number:	MY18230004	**Turret Type:**	Automatic
Instrument Model:	Varian AA140/240/280	**Number Of Lamps:**	4
Flame Instrument:	True	**Mono Type:**	Automatic
Furnace Instrument:	True	**Gasbox Type:**	'Y' Gas Box
Zeeman Present:	False	**Auto Burner Adjuster:**	False
Internal Zeeman:	False	**Mains Frequency:**	50
Internal UltrAA:	False	**Firmware Version:**	2.12
Optics Type:	Double Beam	**Photomultiplier Type:**	Normal(900nm)
D2 BG Correction Fitted:	True	**PWB Version:**	181
Boot Block Version:	2.02		

EEPROM Data:

Instrument Run Hours:	16347.950	**D2 Run Hours:**	4626.033
Zero Wavelength Offset:	25.877	**D2 Serial Number:**	not set !
		D2 Install Date:	1/1/1970
Mono Correction:	-0.605	**D2 Original Intensity:**	1.000
Flame Hours:	5461.417	**D2 Last Intensity:**	400.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit: 51.00

Average Frequency: 50.00

Highest Measured Frequency: 50.00

Lower Limit: 49.00

Lowest Measured Frequency: 50.00

Result: Passed

Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

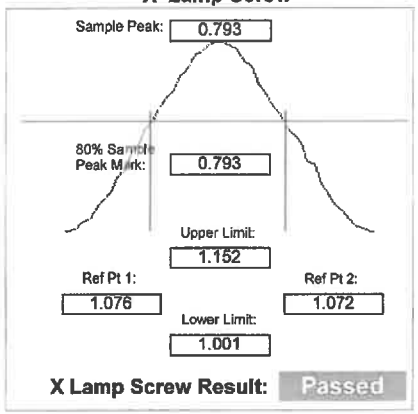
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	**12.10**	13.20	Passed
-12.00 V Rail	-13.20	**-11.90**	-10.80	Passed
5.00 V Rail	4.50	**5.00**	5.50	Passed
310.00 V Rail	279.00	**318.00**	341.00	Passed

Optics

Beam Balance:

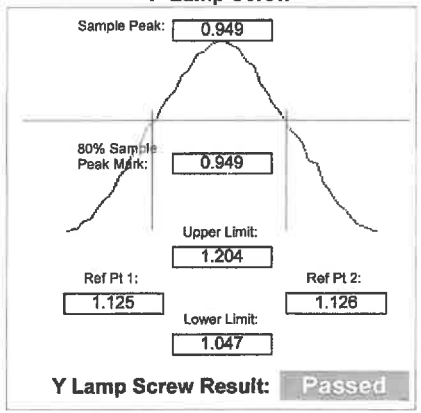
Lamp Type: Copper
Peak Selected: 324.80
Lamp Socket Used: 3
Lamp Alignment: Performed

'X' Lamp Screw



X Lamp Screw Result: Passed

'Y' Lamp Screw



Y Lamp Screw Result: Passed

Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	**0.00**	0.10	Passed
First Order	324.45	**324.62**	325.15	Passed
Second Order	649.23	**649.54**	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Lamp Current(mA): 4
Peak Used(nm): 324.750
Slit Width(nm): 0.2
Connected to Socket: 3
Slit Height: Normal

Lamp Alignment: Performed

Lower Limit(nm) 324.551 324.671 **Upper Limit(nm)**

(Approach from Zero Order)	*(Approach from end)*
Sample 1: **324.611**	Sample 2: **324.611**
Sample 3: **324.611**	Sample 4: **324.611**
Sample 5: **324.615**	Sample 6: **324.611**
Sample 7: **324.615**	Sample 8: **324.611**
Sample 9: **324.615**	Sample 10: **324.611**

Mean: 324.613
Standard Deviation: 0.002

Result: Passed

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	268	297	Passed
S1	156	166	191	Passed
S2	271	300	332	Passed
S3	474	516	579	Passed
S4	825	933	1008	Passed
S5	1435	1555	1754	Passed
S6	2498	2802	3053	Passed
S7	4347	4795	5313	Passed

Interlocks:

Burner Fitted:	Working	Flame Detect:	Working
N2O Burner Fitted:	Working	GCU Active:	Working
Flame Shield Closed:	Working	Oxidant Pressure:	Working
Gas Control Fitted:	Untested	Oxidant Changeover:	Working
Pressure Release Bung Fitted:	Working	Ignition:	Working
Liquid Trap Fitted:	Working		

Auto Lamp Recognition:

Lamp 1: 42 - Potassium (K)	**Lamp 5:** Not Supported
Lamp 2: 53 - Sodium (Na)	**Lamp 6:** Not Supported
Lamp 3: 14 - Copper (Cu)	**Lamp 7:** Not Supported
Lamp 4: 37 - Nickel (Ni)	**Lamp 8:** Not Supported

Result: Passed

GTA Temperature Monitoring:

Not Performed

Notes:

C2104SU29 PM 1/2

Signatures:

Water Analysis Center Co., Ltd	*Date*	*Suriya Nacharoen*	*Date*

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PREVENTATIVE MAINTENANCE (PM) CHECK LIST

FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: AA 240FS & AA0911M073

Customer : Water Analysis Center Co., Ltd.

Date: 04 Feb 2021

Safety

- ☑ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner
- ☑ Flame, Clean nebulizer, spray chamber and burner
- ☑ Flame, Check liquid trap interlock, burner interlock, pressure relief bung interlock and shield interlock
- ☐ Furnace, Clean work head , electrode and shroud N/A
- ☐ Furnace, Clean PSD and PSD tray N/A
- ☐ Furnace, Check water pressure N/A
- ☑ Check drain tube
- ☑ Check exhaust system
- ☑ Check gas pressure sensor interlock
- ☑ Check and all gas hoses for SpectrAA
- ☑ Clean computer control

Optics

- ☑ Inspect/Replace that external optics surfaces
- ☑ Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.8 nm
- ☑ Check that PMT % Gain the copper at 324.8 nm,4 mA,0.5 nm slit width, Gain = 56% (should be ≤ 64% or ≤ 380V)
- ☑ Flame, Check D2 lamp is work

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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Electronics

- ☑ Check power supply voltage
- ☑ Check cables and connectors
- ☑ Check/Clean all boards in the instrument
- ☐ Furnace, Check camera and align** N/A

**Option for Graphite Zeeman only

Mechanisms

- ☑ Flame, Check the burner adjuster
- ☐ Furnace, Check PSD accessories N/A

Analytical performance

- ☑ Clear the sample compartment
- ☑ Flame, Check uptake rate form 7.2-10.6 mL per minute = 9.8 mL/min
- ☑ Test Photometric noise, STDV = 0.0001 Abs (should be ≤ 0.00050 Abs)
- ☑ Flame, Test high solids nebulizer setting use

  -Air/acet Cu 5 ppm = 0.75 Abs, and Precision (%RSD)= 0.5 % (should be > 0.55Abs and < 0.5% RSD)

  or

  -N20/Acet Cu 5 ppm = _____ Abs, and Precision (%RSD)= _____ %(should be > 0.3Abs and < 0.5% RSD)
- ☐ Furnace, Characteristic mass and sensitivity Cu 25 ppb = _____ Abs, and N/A Precision (%RSD)= _____ % (should be ≥ 0.15 Abs and ≤ 4.0% RSD)

SIGN :

Engineer (Suriya Nacharoen) Customer : (นายกิตติพงศ์ สวัสดิ์ศรี)

SVD Results Report

VARIAN

Report ID: 3 **Diagnostic Start Time:** 05-Dec-20 10:38:29 AM **Diagnostic End Time:** 04-Feb-21 11:58:44 AM

Customer: Water Analysis Center Co., Ltd. **Service Engineer:** SuriyaNacharoen

Address: Prana khron si ayuthaya **Contact Details:** K_Kanitsara

Instrument Configuration

Configuration:

Serial Number:	AA0911M073	**Turret Type:**	Automatic
Instrument Model:	Varian AA140/240/280	**Number Of Lamps:**	4
Flame Instrument:	True	**Mono Type:**	Automatic
Furnace Instrument:	True	**Gasbox Type:**	'Y' Gas Box
Zeeman Present:	False	**Auto Burner Adjuster:**	False
Internal Zeeman:	False	**Mains Frequency:**	50
Internal UltrAA:	False	**Firmware Version:**	2.12
Optics Type:	Double Beam	**Photomultiplier Type:**	Normal(900nm)
D2 BG Correction Fitted:	True	**PWB Version:**	181
Boot Block Version:	2.02		

EEPROM Data:

Instrument Run Hours:	20613.650	**D2 Run Hours:**	2906.000
Zero Wavelength Offset:	-18.731	**D2 Serial Number:**	not set !
		D2 Install Date:	01-Jan-70
Mono Correction:	-0.370	**D2 Original Intensity:**	1.000
Flame Hours:	4025.000	**D2 Last Intensity:**	661.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit: 51.00

Average Frequency: 50.00

Highest Measured Frequency: 50.00

Lower Limit: 49.00

Lowest Measured Frequency: 50.00

Result: Passed

Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

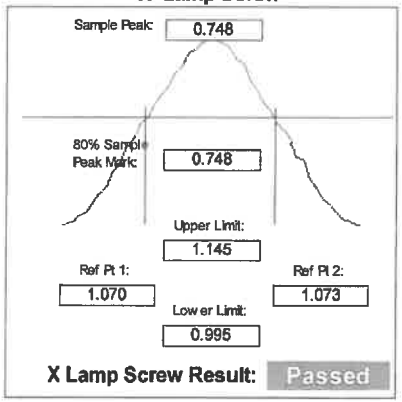
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	**12.20**	13.20	Passed
-12.00 V Rail	-13.20	**-12.00**	-10.80	Passed
5.00 V Rail	4.50	**5.10**	5.50	Passed
310.00 V Rail	279.00	**318.00**	341.00	Passed

Optics

Beam Balance:

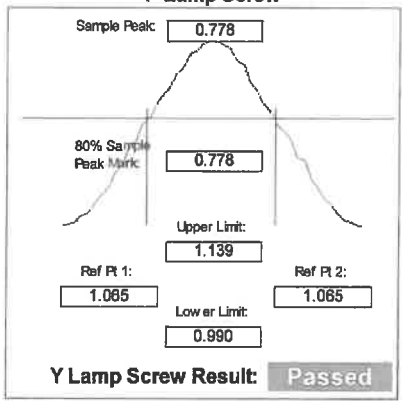
Lamp Type: Copper
Lamp Socket Used: 3
Peak Selected: 324.80
Lamp Alignment: Performed

'X' Lamp Screw



X Lamp Screw Result: Passed

'Y' Lamp Screw



Y Lamp Screw Result: Passed

Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.73	325.15	Passed
Second Order	649.23	649.56	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: Performed

Lower Limit(nm) 324.751 324.871 **Upper Limit(nm)**

(Approach from Zero Order)	*(Approach from end)*
Sample 1: 324.811	Sample 2: 324.807
Sample 3: 324.811	Sample 4: 324.811
Sample 5: 324.815	Sample 6: 324.811
Sample 7: 324.815	Sample 8: 324.811
Sample 9: 324.815	Sample 10: 324.815

Mean: 324.812 **Standard Deviation:** 0.003

Result: Passed

Mechanical

Wavelength Drive: Passed

Slit Drive: Passed

Turret Drive: Passed

Auto Burner Adjuster Drive: Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	248	297	Passed
S1	156	165	191	Passed
S2	271	294	332	Passed
S3	474	506	579	Passed
S4	825	908	1008	Passed
S5	1435	1516	1754	Passed
S6	2498	2723	3053	Passed
S7	4347	4681	5313	Passed

Interlocks:

Burner Fitted:	Working	Flame Detect:	Working
N2O Burner Fitted:	Working	GCU Active:	Working
Flame Shield Closed:	Working	Oxidant Pressure:	Working
Gas Control Fitted:	Untested	Oxidant Changeover:	Working
Pressure Release Bung Fitted:	Working	Ignition:	Working
Liquid Trap Fitted:	Working		

Auto Lamp Recognition:

Lamp 1:	50 - Selenium (Se)	Lamp 5:	Not Supported
Lamp 2:	3 - Arsenic (As)	Lamp 6:	Not Supported
Lamp 3:	14 - Copper (Cu)	Lamp 7:	Not Supported
Lamp 4:	42 - Potassium (K)	Lamp 8:	Not Supported

Result: Passed

GTA Temperature Monitoring: Not Performed

Notes:

C2102SU11 PM1/2

Signatures:

Water Analysis Center Co., Ltd.Date	SuriyaNacharoen	04 Feb 21 Date

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Tel. 0-2528-6081-2 Fax. 0-2528-6083, 0-2525-7034
www.megafil.co.th E-mail : megafil.group@gmail.com

BSC Certification Test Report

Certificate No. : M0979/21

Customer Name : LABORATORY WATER ANALYSIS CENTER COMPANY LIMITED

Customer Address : 1/94 Moo 5 T.Kanharm, A.U-Thai,
Phra Nakhon Si Ayutthaya 13210

Equipment : Biological Safety Cabinet **Class** II **Type A2**

Manufacturer : Microtech

Model : V6-T

Serial No : 0972

ID No. : WWL0084

Were in accordance with ☑ EN 12469 ☐ NSF 49 ☐ Manufacturer's specification

Test Date : 23/09/2021

Due Date : 23/09/2022 or *after HEPA filters are replaced or unit is moved*

Test by : Mr. Puwadon Keawkla

Approved by :

(Mr.Kridsada Thinhuatoei)
Authorized Signatory

Issued Date : 24/09/2021

This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

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

บริษัท ฉ - 20

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Certificate No. : M0979/21

Procedure Used :
- European Standard EN12469 : 2000 has the status of British Standard, Biotechnology Performance criteria for microbiological safety cabinets.
- NSF International Standard / American National Standard NSF / ANSI 49-2008 Biosafety Cabinet : Design, Construction, Performance and Field Certification.
- Australian Standard : AS 1807.23-2000 Determination of intensity of radiation from germicidal ultraviolet lamps.
- Manufacturer's specification.

1. Downflow velocity test.

Measurement Information

No. of Rows	No. of Readings	Grid Spacing Front-Back	Grid Spacing Side-Side	Probe height Above sash
2	8	1/4,3/4	1/8,3/8	100 mm.

Measurement Data.

0.34	0.37	0.36	0.35
0.32	0.33	0.32	0.34

Average velocity 0.34 m/s (67 FPM.) **Velocity range** 0.25-0.50 m/s (49-98 FPM.)

Uniformity(EN: +/-20%avg. 0.27 - 0.41 m/s (54 - 80 FPM.)

Supply filter dimension 24 x 72 **(inch x inch)** **Supply filter area** 10.69 **SQ.FT**

Downflow volume (Q) 716 **CFM.**

Result Summary ☑ **Pass** ☐ **Fail**

Equipment used : Thermo Anemometer **Model** 425 **S/N :** 03004786 **Calibration date :** 23/02/2021

Certificate No. : M0979/21

2. Inflow velocity test.

Select method. : ☐ DIM ☑ Exhaust velocity. ☐ MFG's Specifications

0.57	0.59	0.56	0.61	0.63
0.58	0.6	0.56	0.59	0.58
0.61	0.57	0.56	0.54	0.56
0.59	0.56	0.62	0.59	0.62
0.59	0.57	0.63	0.59	0.58

Average Inflow velocity 0.50 **m/s (98 FPM.) Velocity range** ≥0.40 **m/s (** ≥79 **FPM.)**

Inflow dimension 8 x 72 **(inch x inch) Inflow area** 4.00 **SQ.FT**

Inflow volume(Q) 392 **CFM**

Result Summary ☑ **Pass** ☐ **Fail**

Adjustments Required ☐ **Fan Speed** ☐ **Damper**

Equipment used : Thermo Anemometer **Model** 425 **S/N :** 03004786 **Calibration date** 23/02/2021

3. HEPA filter leak test.

Measurement Data

HEPA Filter	PAO Upstream Conc.(calculated)		Specification	Measured leak penetration
Supply HEPA Filter	18	µg/l.	<0.003%	<0.003%
Exhaust HEPA Filter	18	µg/l.	<0.003%	<0.003%

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Certificate No. : M0979/21

Leak location

Supply HEPA Filter
Back

Exhaust HEPA Filter
Back

Result Summary ☑ **Pass** ☐ **Fail**

Equipment used : Aerosol Photometer **Model** TDA-2H **S/N :** 21683 **Calibration date** 24/02/2021

Equipment used : Smoke Generator **Model** TDA-6C **S/N :** 21623

4. Airflow smoke patterns test

Measurement Information

1. Downflow Pattern test : Smoke shall be passed from one end of the cabinet to the other, along the centerline of the work surface, at a height of 4 inch (10 cm) above the top of the access opening
2. View screen retention test : Smoke shall be passed from one end of the cabinet to the other, 1.0 in (2.5 cm) behind the view screen, at a height 6.0 inch (15 cm) above the top of the access opening.
3. Work opening edge retention test : Smoke shall be passed along the entire perimeter of the work opening Particular attention should be paid to corners and vertical edges.
4. Sash/window seal test : Smoke shall be passed up the inside of the window 2 in (5 cm) from the sides and along the top of the work area.

ภาคผนวก ข - 21

Certificate No. : M0979/21

Result Summary

Downflow Pattern test	☑ **Accept**	☐ **Non-Conforming**
View screen retention test	☑ **Accept**	☐ **Non-Conforming**
Work opening edge retention test	☑ **Accept**	☐ **Non-Conforming**
Sash/window seal test	☑ **Accept**	☐ **Non-Conforming**

5. Site installation

Sash Alarm.	☐ **Pass**	☐ **Fail**	☑ **N/A**
Interlock System.	☐ **Pass**	☐ **Fail**	☑ **N/A**
Exhaust System Performance	☐ **Pass**	☐ **Fail**	☑ **N/A**

Remark / Recommendation

ระบบ Site installation ไม่มีการตรวจสอบ เนื่องจากตู้ไม่มีฟังก์ชั่นนี้

6. Illumination Test (Lighting) : Option

Lighting should be adequate for safe working within the cabinet. Illumination measured at the work surface.

Lux

632	1000	997	630
947	1456	1449	921

Remark :

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Certificate No. : M0979/21

7. Ultraviolet Lamp Test (UV) : Option

Ultraviolet radiation where UV Lamp are fitted, the intensity of radiation at a wavelength of 254 nm. Shall be not less than 400 mW/m2 when measures at work floor surface.

mW/m^2

740	1580	1570	750
480	1040	1020	480

Remark :

-oOo-

63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No: WS-01022022
Page 1 of 2 pages

Measurement Item	: Cup anemometer with data logger.
Manufacturer	: Data logger: Novalynx : Cup anemometer: Novalynx
Model/Type	: Data logger: 200-WS-25LB : Cup anemometer: WS-02F
Serial Number	: Data logger: A5040 : Cup anemometer: K6-040
ID No	: Data logger: - : Cup anemometer: -
Customer	Water Analysis Center Co.,Ltd 94/1 Moo 5, T.kanham, A.U-thai, Ayutthaya 13210

Test Conditions			
	Wind tunnel cross test section area	900	cm^2
	: Anemometer frontal area	100	cm^2
	: Diameter of mounting pipe		mm
	: Blockage ratio of test object	0.111	[-]

Test Conditions			
	: Air temperature	25.3	±0.8 °C
	: Air pressure	1011.1	±0.4 hPa
	: Relative air humidity	55.5	±3.5 %RH

Calibration Procedure

Calibration was carried out base on;
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability

This calibration documents the traceable to national standard. Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : FEB 18, 2022.
Issued Date : FEB 21, 2022.

Calibrated by
☒ Mr. Sorawit Thachatad
☐ Miss Orathai Wiratchaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory: .....
Mr. Pariya Boonchanan
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Result of calibration: ☑ Without adjustment ☐ With adjustment
Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.
The results of calibration and associated measurement uncertainties are reported in the table below.

V_{STD} Reading m/s	V_{UUC}* Reading m/s	Error (m/s)	Uncertainty (%)
2.097	2.0	-0.1	2.4
4.136	4.1	0.0	1.7
6.04	6.0	0.0	1.1
8.03	8.1	0.1	0.71
10.00	10.0	0.0	1.1
11.97	12.1	0.1	0.91
13.97	13.9	-0.1	0.53
16.04	16.1	0.1	0.60
14.97	15.1	0.1	1.2
12.97	13.0	0.0	0.87
11.01	11.0	0.0	1.5
8.99	9.0	0.0	1.4
6.98	7.0	0.0	0.85
5.171	5.2	0.0	0.97
3.033	3.0	0.0	2.3
1.034	0.9	-0.1	4.5

UUC*: Unit Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352146	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 06, 2021	MW-0036-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 - 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	SSSOM	MP330D	-	-	0 – 50 Hz

End of certificate of calibration

JIRANATE ASSOCIATES CO., LTD.

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CERTIFICATE OF CALIBRATION

Certificate No.: WD-01022022
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger

Manufacturer : Data logger: Novalynx.
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25LB
: Wind direction sensor: WS-02P

Serial Number : Data logger: A5040
Wind direction sensor: K6-040

ID No : Data logger: -
: Wind direction sensor:

Customer : Water Analysis Center Co.,Ltd
: 94/1 Moo 5, T.Kanham, A.U-thai, Ayutthaya 13210

Environmental Condition:
The measurement was carried out in an ambient temperature of (23±3) °C, and relative humidity of (40±10) %.

Measurement Method:
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:
The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21080014, Certificate No.: RWS64/0025.

Measurement Date : FEB 18, 2022.
Issued Date : FEB 21, 2022.

Performed by
☑ Mr. Sorawit Thachatad
☐ Miss Orapin Wiwatchai

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory:
Mr. Pariya Boonchareon
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-01022022
Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☑ With adjustment.
Calibration in the range of 0 – 360 ° at a calibration interval of 45°.
The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	135	0	3.0
5		180	180	182	2	3.0
6		225	225	227	2	3.0
7		270	270	273	3	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	135	0	3.0
13		180	180	182	2	3.0
14		225	225	227	2	3.0
15		270	270	273	3	3.0
16		315	315	319	4	3.0

UUC*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

End of Certificate of Calibration

JIRANATE ASSOCIATES CO., LTD.

TISCH Environmental

RECALIBRATION DUE DATE:
February 24, 2022

Certificate of Calibration

Calibration Certification Information

Cal. Date:	February 24, 2021	Rootsmeter S/N: 438320	Ta: 295	°K
Operator:	Jim Tisch		Pa: 745.24	mm Hg
Calibration Model #:	TE-5028A	Calibrator S/N: 3271		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.2730	4.2	1.50
2	3	4	1	0.9830	7.0	2.50
3	5	6	1	0.8990	8.4	3.00
4	7	8	1	0.8340	9.7	3.50
5	9	10	1	0.6300	16.7	6.00

Data Tabulation.

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H\left(Ta/Pa\right)}$ (y-axis)
0.9850	0.7737	1.2189	0.9944	0.7811	0.7706
0.9812	0.9982	1.5736	0.9906	1.0077	0.9948
0.9794	1.0894	1.7238	0.9887	1.0998	1.0897
0.9777	1.1722	1.8620	0.9870	1.1834	1.1771
0.9683	1.5371	2.4379	0.9776	1.5517	1.5411
QSTD	m=	1.59945	QA	m=	1.00155
	b=	-0.01874		b=	-0.01185
	r=	0.99997		r=	0.99997

Calculations

Vstd=	ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va=	ΔVol((Pa-ΔP)/Pa)
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime

For subsequent flow rate calculations:

$$Qstd = 1/m\left(\left(\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}\right)-b\right) \qquad Qa = 1/m\left(\left(\sqrt{\Delta H\left(Ta/Pa\right)}\right)-b\right)$$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg

Key

- ΔH: calibrator manometer reading (in H2O)
- ΔP: rootsmeter manometer reading (mm Hg)
- Ta: actual absolute temperature (°K)
- Pa: actual barometric pressure (mm Hg)
- b: intercept
- m: slope

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30.

n Environmental, Inc.
South Miami Avenue
ge of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
FAX: (513)467-9009

SPC Calibration Center

SPRT Part of DKSH Group

ilac-MRA NSC-TISI-TIS 17025 Calibration 0007

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01213617
Model:	AX205	Issued Date:	10 December 2021
Serial No. (or ID.):	1121501689 (WWL 0154)	Job No.:	KSPR2116268
Manufacturer:	Mettler Toledo	Page:	1 of 2
Condition:	In condition		

Customer: Water Analysis Center Co., Ltd.
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 25 °C ± 0.5 °C
Humidity 65 %RH ± 1.8 %RH

Calibration Place: Water Analysis Center Co., Ltd. (ห้องเครื่องชั่ง)
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Adinan Ninviboon
Calibration Date: 09 December 2021
The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210715, C02211055

(Mr. Adinan Ninviboon)
Person in charge

SPRT บริษัท เอสพีซี อาร์ที จำกัด SPC RT Co., Ltd.

(Mr. Thalerngkeat Poungngam)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to 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 effected 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 SPC RT Co., Ltd.

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Branch 00003 1194 Soi Wachirathamasathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2183 4333 Ext. 3303-3308 Fax: 0 2183 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

SPC Calibration Center

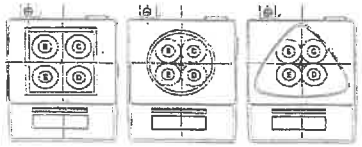
SPCRT
Part of DKSH Group

Certificate No.: C01213617 Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 5 (g)

Reference Points (g)				
A	B	C	D	E
-	0.00000	0.00000	0.00000	0.00000

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

Nominal test value (g)	Standard Deviation
1	0.000007
10	0.000009

Departure of indication from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
0.001	0.001001	0.00100	0.00000	0.000014	2.10
0.005	0.005002	0.00500	0.00000	0.000014	2.10
0.01	0.010002	0.01000	0.00000	0.000014	2.08
0.05	0.049999	0.05000	0.00000	0.000015	2.07
0.1	0.100003	0.10000	0.00000	0.000016	2.06
0.5	0.499994	0.49998	0.00001	0.000018	2.03
1	0.999988	0.99999	0.00000	0.000020	2.02
2	1.999986	1.99999	0.00000	0.000023	2.01
5	4.999983	4.99998	0.00000	0.000028	2.00
10	10.000005	9.99998	0.00002	0.000035	2.00

The End of Certificate

บริษัท เอสพีซี สารรัส จำกัด
SPC RT CO., LTD.
สาขาที่ 00003 1194 ซอยวัชรธรรมสาธิต 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
Branch 00003 1194 Soi Wachirathamsatit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3306 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

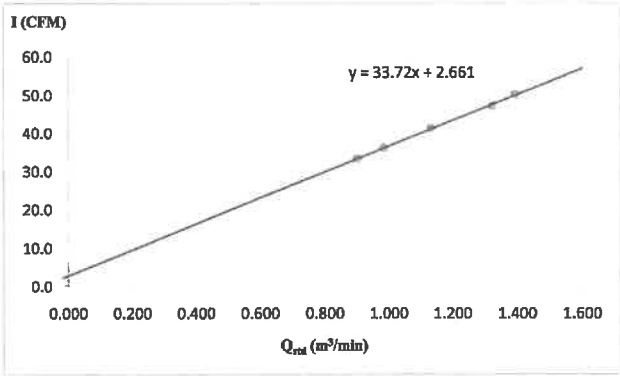
SPCC-FM-C01-10: 23 Nov 2020

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.กานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	วัดโคกมะยม		
Date of measurement :	8/4/2022		
Worksheet No. :	C-270220-WWL0093	**Calibration Orifice**	
High Volume ID :	WWL0093	Calibrator ID :	WWL0103
High Volume Model :	TE-5170 (TSP)	Calibrator Model :	TE-5028A
High Volume S/N :	2729	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	4.90	1.397	50.0	49.80	Slope : 33.59
2	4.40	1.325	47.0	46.81	Intercept : 2.6512
3	3.20	1.134	41.0	40.83	Correlation Coefficient : 0.9995
4	2.40	0.985	36.0	35.85	
5	2.00	0.902	33.0	32.87	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

FO.LAB 6.4-1/25

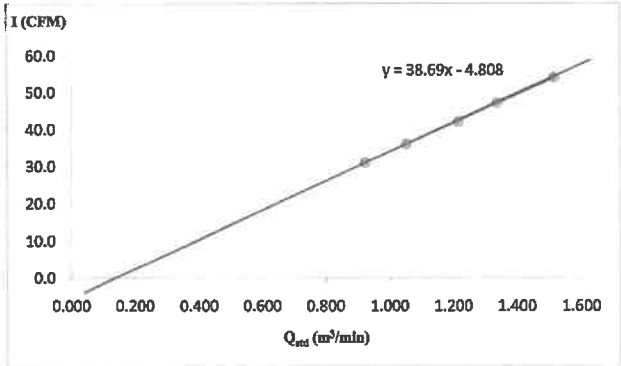
แก้ไขครั้งที่: 0 วันที่บังคับใช้ : 1 ม.ค.2562 หน้า : 1 จาก 1

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	วัดคานหาม		
Date of measurement :	8/4/2022		
Worksheet No. :	C-270220-WWL0094	**Calibration Orifice**	
High Volume ID :	WWL0094	Calibrator ID :	WWL0103
High Volume Model :	TE-5170 (TSP)	Calibrator Model :	TE-5028A
High Volume S/N :	2736	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	5.80	1.517	54.0	53.77	Slope : 38.53
2	4.50	1.339	47.0	46.80	Intercept : -4.7881
3	3.70	1.217	42.0	41.82	Correlation Coefficient : 0.9998
4	2.75	1.053	36.0	35.85	
5	2.10	0.923	31.0	30.87	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

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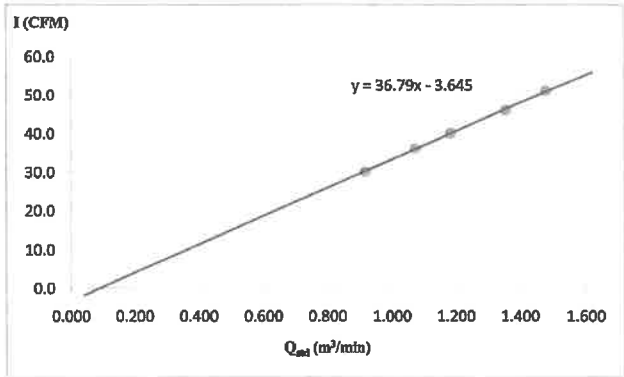
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	บ้านคานหาม		
Date of measurement :	8/4/2022		
Worksheet No. :	C-270220-WWL0095	**Calibration Orifice**	
High Volume ID :	WWL0095	Calibrator ID :	WWL0103
High Volume Model :	TE-5170 (TSP)	Calibrator Model :	TE-5028A
High Volume S/N :	2727	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	5.60	1.480	51.0	50.424	Slope : 36.37
2	4.70	1.359	46.0	45.480	Intercept : 1.5785
3	3.55	1.184	40.0	39.548	Correlation Coefficient : 0.9997
4	2.90	1.073	36.0	35.593	
5	2.10	0.917	30.0	29.661	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

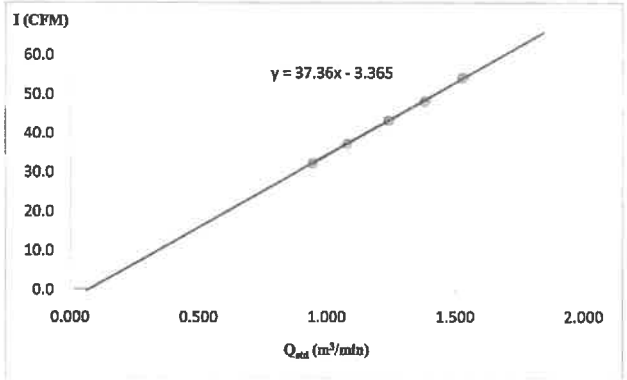
Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	สำนักงานโครงการ		
Date of measurement :	8/4/2022		
Worksheet No. :	C-270220-WWL0096	**Calibration Orifice**	
High Volume ID :	WWL0096	Calibrator ID :	WWL0103
High Volume Model :	TE-5170 (TSP)	Calibrator Model :	TE-5028A
High Volume S/N :	2730	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	5.90	1.530	54.0	53.77	Slope : 37.21
2	4.80	1.382	48.0	47.80	Intercept : -3.3516
3	3.85	1.241	43.0	42.82	Correlation Coefficient : 0.9998
4	2.90	1.080	37.0	36.84	
5	2.20	0.945	32.0	31.87	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

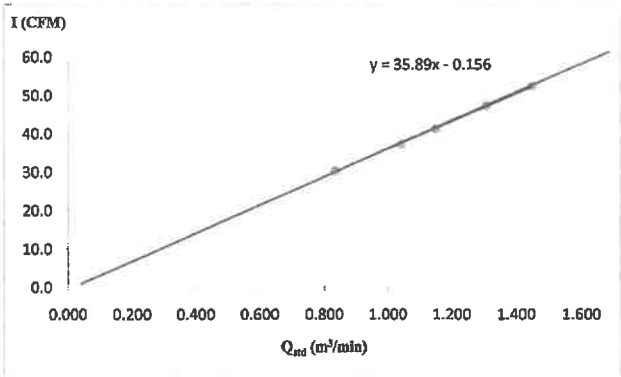
Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	วัดโตนดเตี้ย		
Date of measurement :	8/4/2022		
Worksheet No. :	C-270220-WWL0097	**Calibration Orifice**	
High Volume ID :	WWL0097	Calibrator ID :	WWL0103
High Volume Model :	TE-5170 (TSP)	Calibrator Model :	TE-5028A
High Volume S/N :	2726	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	5.30	1.451	52.0	51.78	Slope : 35.74
2	4.30	1.310	47.0	46.80	Intercept : -0.1557
3	3.30	1.151	41.0	40.83	Correlation Coefficient : 0.9997
4	2.70	1.043	37.0	36.84	
5	1.70	0.834	30.0	29.87	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

บริษัท สไมล์ [illegible] จำกัด
Smile Laboratory Co., Ltd

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท ศูนย์วิเคราะห์น้ำ จำกัด	Date	22 April 2022
Project Site	บ้านหนองไม้ดู่ (วัดน้ำใส)	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intecept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

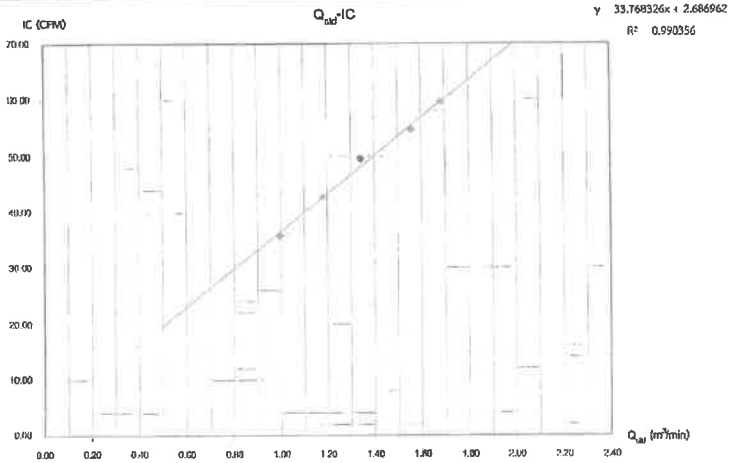
Sampler Number		Motor Serial Number		Recorder Serial Number	596

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Q_{std} = (1/m)[(A-b)] (m^3/min)	(I) Sample Flow Rate Indication	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1			4.30	2.05646	0.99603	36.0	35.70	303.0	760.0
2		2.9	6.10	2.44936	1.18279	43.0	42.64	303.0	760.0
3			7.90	2.78741	1.34348		49.59		760.0
4	5.4		10.70	3.24398	1.56051	55.0	54.54		760.0
5		6.2	12.50	3.50624	1.68518	60.0	59.50	303.0	
							Average	303.0	760.0

Linear Regression : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.995166

Andersen Instruments, Inc.



Calibrated By

Mr.Chatmongkhon Sariphaeng

บริษัท สไมล์ [illegible] จำกัด
Smile Laboratory Co., Ltd.

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท ศูนย์วิเคราะห์น้ำ [illegible]	Date	22 April 2022
Project Site	บ้านหนองไม้ดู่	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intecept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

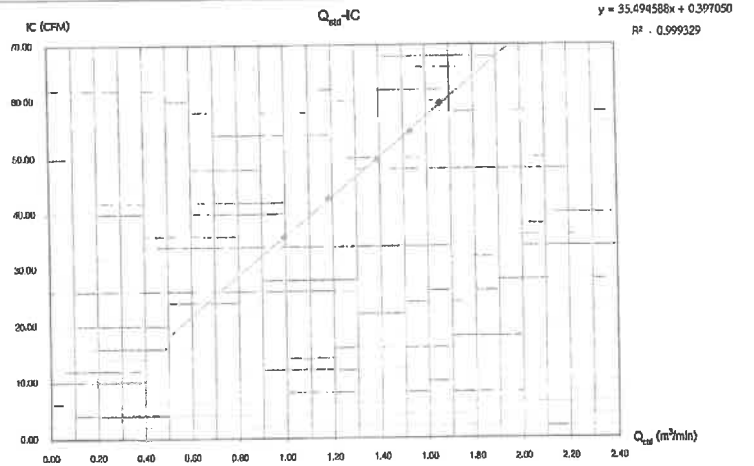
Sampler Number	TSP 1	Motor Serial Number	1393 471	Recorder Serial Number	596

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Q_{std} = (1/m)[(A-b)] (m^3/min)	(I) Sample Flow Rate Indication	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1			4.30	2.05646	0.99603	[illegible]	35.70		760.0
2		3.0	6.10	2.44936	1.18279	43.0	42.64	303.0	760.0
3		4.7	8.50	2.89132	1.39288	50.0	49.59		760.0
4		5.1	10.30	3.18277	1.53142	55.0	54.54	303.0	760.0
5	6.1	6.0	12.10	3.44969	1.65829	60.0	59.50	303.0	760.0
							Average	303.0	760.0

Linear Regression : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.999664

Andersen Instruments, Inc.



Calibrated By

Mr.Chatmongkhon Sariphaeng

SMILE
Laboratory Co., Ltd.

บริษัท สไมล์ [illegible]

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท ยูนอเวิลด์เทค จำกัด	Date	22 April 2022
Project Site	วัดหนองน้ำใส	Person	Mr.Tannakorn Tawisakultrat

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intercept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

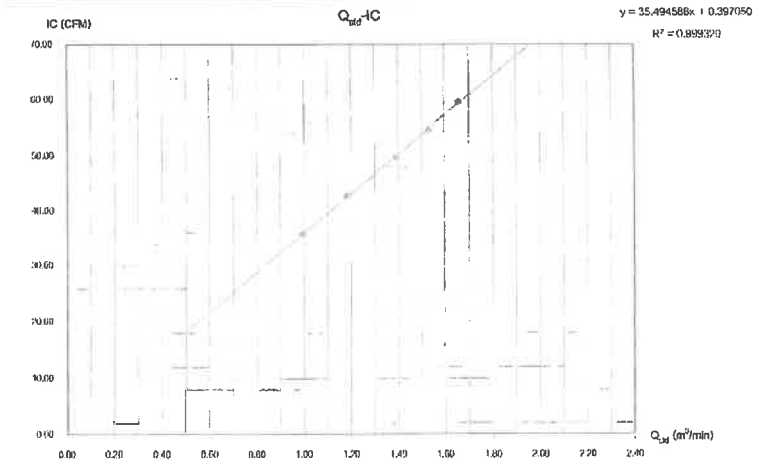
Sampler Number	TSP No.05	Motor Serial Number	[illegible]	Recorder Serial Number	

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Q_{std} = (1/m)[(A-b)] (m^3/min)	(I) Sample Flow Rate Indication (ft^3/min)	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$ (ft^3/min)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1		[illegible]	4.30	2.05648	0.99603		35.70		760.0
2	3.1	3.0	6.10	2.44930	1.18279	[illegible]	42.64	303.0	760.0
3			8.50	2.80132	1.39288	[illegible]	49.59		[illegible]
4			10.30	3.18277	1.53142	[illegible]	54.54	303.0	[illegible]
5	[illegible]	[illegible]	12.10	3.44989	1.65829	[illegible]	59.50		
							Average	303.0	760.0

Linear Regression : y= mX + b

Slope (m)	[illegible]
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.999931

Andersen Instruments, Inc.



Calibrated By

Mr.Chatmongkhon Saripheng

บริษัท สไมล์ [illegible]

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท [illegible] จำกัด	Date	22 April 2022
Project Site	[illegible]	Person	Mr.Chatmongkhon Saripheng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intercept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

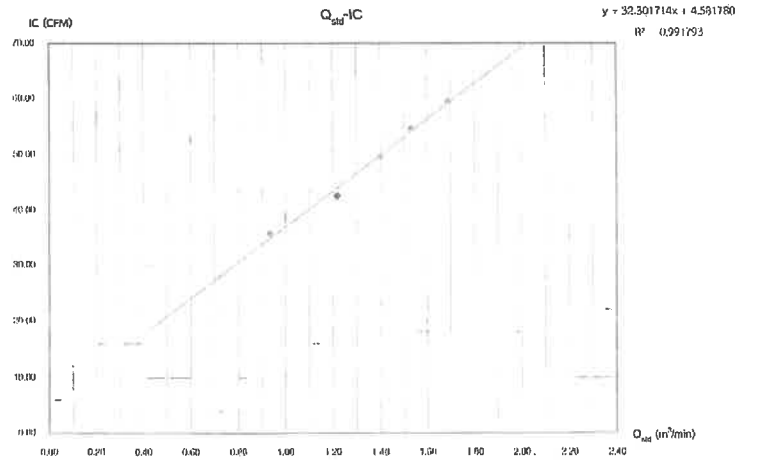
Sampler Number	TSP [illegible]	Motor Serial Number		Recorder Serial Number	[illegible]

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Q_{std} = (1/m)[(A-b)] (m^3/min)	(I) Sample Flow Rate Indication	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1	1.9	1.9	3.80	1.93321	0.93744	[illegible]	35.70	[illegible]	760.0
2	4.3	4.2	8.50	2.52039	1.22036		42.64		760.0
3			8.60	2.90828	1.40094		49.59		760.0
4	5.2		10.30	3.18277	1.53142		54.54		760.0
5	6.1	6.2	12.60	3.52024	1.69183	[illegible]	59.50		760.0
							Average	303.0	760.0

Linear Regression : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.995088

Andersen Instruments, Inc.



Calibrated By

Mr.Chatmongkhon Saripheng

SMILE
Laboratory Co., Ltd.

บริษัท สไมล์ แล็บบอ[illegible]
Smile Laboratory Co., Ltd.

[illegible] 02 277-0265 02 4 4

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location		Date	22 April 2022
Project Site	[illegible]	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intecept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

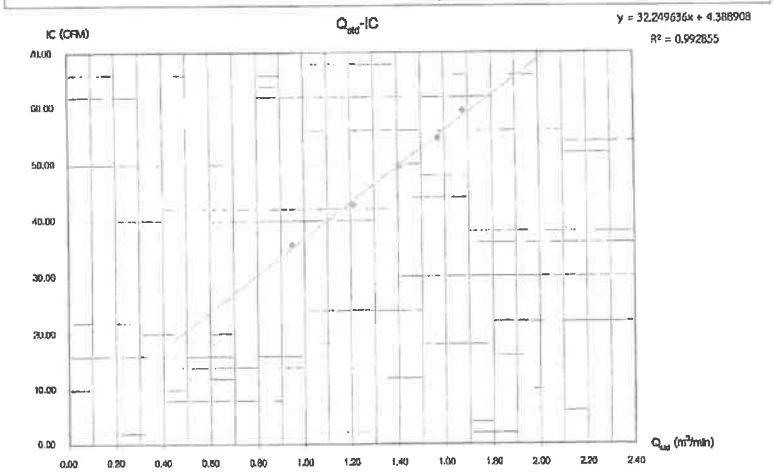
Sampler Number	[illegible]	Motor Serial Number	[illegible]	Recorder Serial Number	[illegible]

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Q_{std} = (1/m)[(A-b)] (m^3/min)	(I) Sample Flow Rate Indication	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1	2.0	1.9	3.90	1.95848	0.94945	36.0	35.70	303.0	760.0
2	3.3		6.40	2.50086	1.21107	43.0	42.64	303.0	760.0
3			8.70	2.92514	1.40895		49.59		
4	5.5	5.4	10.90	3.27416	1.57486	55.0	54.54		760.0
5	6.3	6.1	12.40	3.49219	1.67850	60.0	59.50		
							Average	303.0	760.0

Linear Regresstion : y= mX + b

Slope (m)	[illegible]
Intercept (b)	[illegible]
R-Square (R^2)	
Correlation Coefficient (r)	0.996421

Andersen Instruments, Inc.



SMILE
Laboratory Co., Ltd.

Calibrated By

Mr.Chatmongkhon Sariphaeng

ภาคผนวก ข - 31

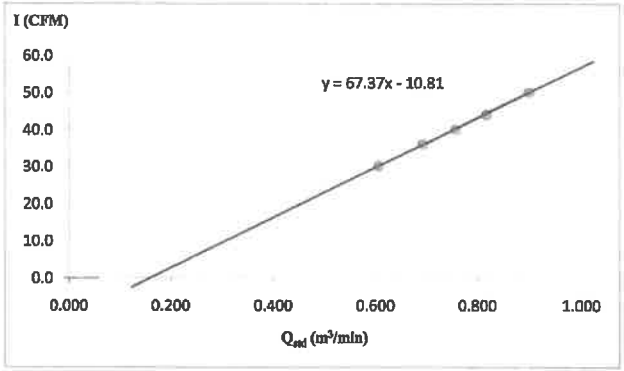
บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayuthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site : สวนอุตสาหกรรมโรจนะอยุธยา
Location : วัดโคกมะยม
Date of measurement : 8/4/2022
Worksheet No. : C-280220-WWL0098
High Volume ID : WWL0098
High Volume Model : TE-6070 (PM-10)
High Volume S/N : 2734
Ambient Condition
Temperature (°C) : 27
Barometric Pressure (mmHg) : 757

Calibration Orifice
Calibrator ID : WWL0103
Calibrator Model : TE-5028A
Calibrator S/N : 3271
Calibrate Date : 11/02/22
Quality Standard Slope : 1.60965
Quality Standard Intercept : -0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	5.00	0.900	50.0	31.41	Slope : 42.33
2	4.10	0.817	44.0	27.64	Intercept : -6.7959
3	3.50	0.757	40.0	25.13	Correlation Coefficient : 0.9996
4	2.90	0.692	36.0	22.62	SSP : 65.3115
5	2.20	0.606	30.0	18.85	



Calibrated by : (Mr.RATTAPOL BAJKAI)
Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM)
Technical Management

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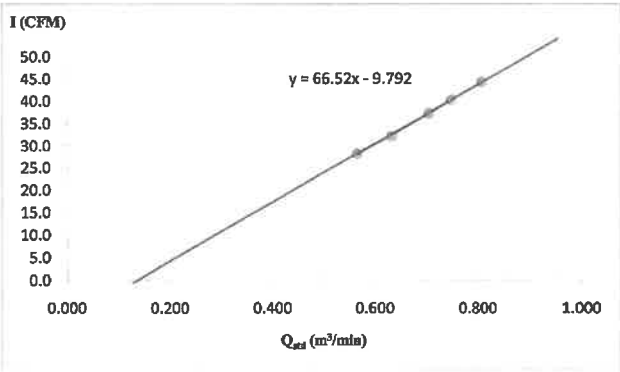
High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	วัดคานหาม		
Date of measurement :	8/4/2022		
Worksheet No. :	C-280220-WWL0099	**Calibration Orifice**	
High Volume ID :	WWL0099	Calibrator ID :	WWL0103
High Volume Model :	TE-6070 (PM-10)	Calibrator Model :	TE-5028A
High Volume S/N :	2732	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	4.00	0.808	44.0	27.67	Slope : 41.83
2	3.40	0.747	40.0	25.15	Intercept : -6.1579
3	3.00	0.704	37.0	23.27	Correlation Coefficient : 0.9997
4	2.40	0.632	32.0	20.12	SSP : 65.3825
5	1.90	0.565	28.0	17.61	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

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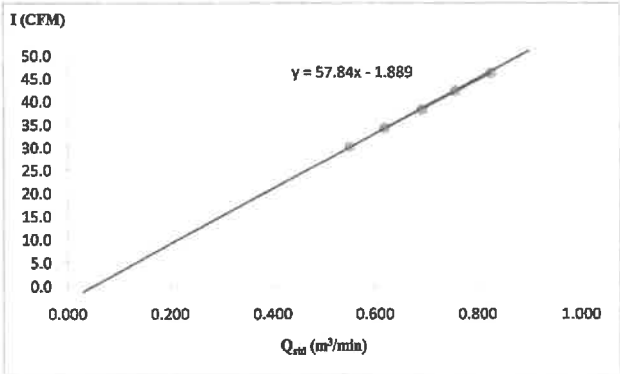
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	บ้านคานหาม		
Date of measurement :	8/4/2022		
Worksheet No. :	C-280220-WWL0100	**Calibration Orifice**	
High Volume ID :	WWL0100	Calibrator ID :	WWL0103
High Volume Model :	TE-6070 (PM-10)	Calibrator Model :	TE-5028A
High Volume S/N :	2735	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	4.20	0.828	46.0	28.93	Slope : 36.37
2	3.50	0.758	42.0	26.41	Intercept : -1.1884
3	2.90	0.692	38.0	23.90	Correlation Coefficient : 0.9999
4	2.30	0.619	34.0	21.38	SSP : 63.47
5	1.80	0.551	30.0	18.87	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

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WATER ANALYSIS CENTER COMPANY LIMITED
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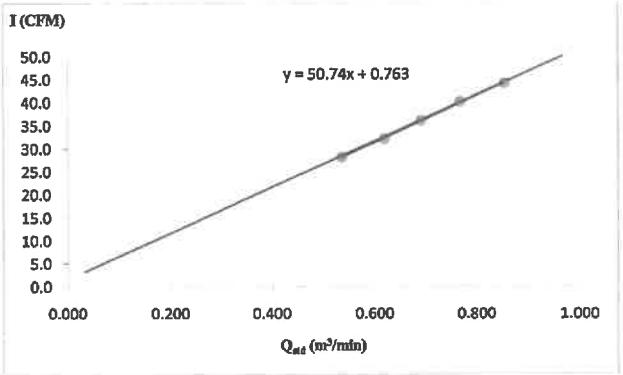
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	สำนักงานโครงการ		
Date of measurement :	8/4/2022		
Worksheet No. :	C-280220-WWL0101	**Calibration Orifice**	
High Volume ID :	WWL0101	Calibrator ID :	WWL0103
High Volume Model :	TE-6070 (PM-10)	Calibrator Model :	TE-5028A
High Volume S/N :	2733	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	4.50	0.856	44.0	27.67	Slope : 31.91
2	3.60	0.768	40.0	25.15	Intercept : 0.4804
3	2.90	0.692	36.0	22.64	Correlation Coefficient : 0.9995
4	2.30	0.619	32.0	20.12	SSP : 58.11
5	1.70	0.536	28.0	17.61	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.กานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
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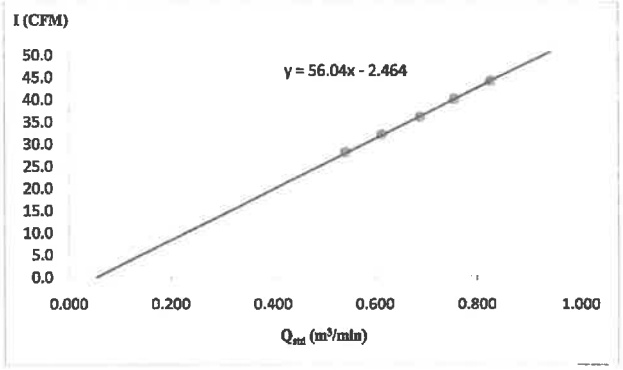
High Volume Air Sampler Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะอยุธยา		
Location :	วัดโตนดเตี้ย		
Date of measurement :	8/4/2022		
Worksheet No. :	C-280220-WWL0102	**Calibration Orifice**	
High Volume ID :	WWL0102	Calibrator ID :	WWL0103
High Volume Model :	TE-6070 (PM-10)	Calibrator Model :	TE-5028A
High Volume S/N :	2731	Calibrator S/N :	3271
Ambient Condition		Calibrate Date :	11/02/22
Temperature (°C) :	27	Quality Standard Slope :	1.60965
Barometric Pressure (mmHg) :	757	Quality Standard Intercept :	-0.04335

Test No.	delta H_2O (inch)	Q_{std} (m^3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	4.10	0.828	44.0	28.03	Slope : 35.71
2	3.40	0.757	40.0	25.48	Intercept : -1.5704
3	2.80	0.689	36.0	22.94	Correlation Coefficient : 0.9999
4	2.20	0.614	32.0	20.39	SSP : 60.87
5	1.70	0.543	28.0	17.84	



Calibrated by : (Mr.RATTAPOL BAIKAI) Chemist

Approved by : (Mr.RUNGSASIKORN KOSUM) Technical Management

บริษัท เทมรี่ จำกัด

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location		Date	22 April 2022
Project Site	ชำแหละหมูเล็ก (ชั้นบนใหม่)	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intercept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

Sampler Number	[illegible]	Motor Serial Number		Recorder Serial Number	[illegible]

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) $Q_{std} = (1/m)[(A-b)]$ (m^3/min)	(I) Sampler Flow Rate Indication	(Y) IC = $I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1	1.6	1.5	3.10	1.74036	0.84577	[illegible]	31.63		
2	3.0	2.9	5.90	2.40096	1.15978	42.0	41.52	305.0	
3			8.30	2.80772	1.37215	[illegible]	51.40	305.0	760.0
4		5.5	11.20	3.30801	1.59095	58.0	57.33	305.0	760.0
5	6.6		13.00	3.56390	1.71260	62.0	61.28	305.0	760.0
							Average	305.0	760.0

Linear Regresstion : y= mX + b

Slope (m)	
Intercept (b)	2.174014
R-Square (R^2)	
Correlation Coefficient (r)	0.997006

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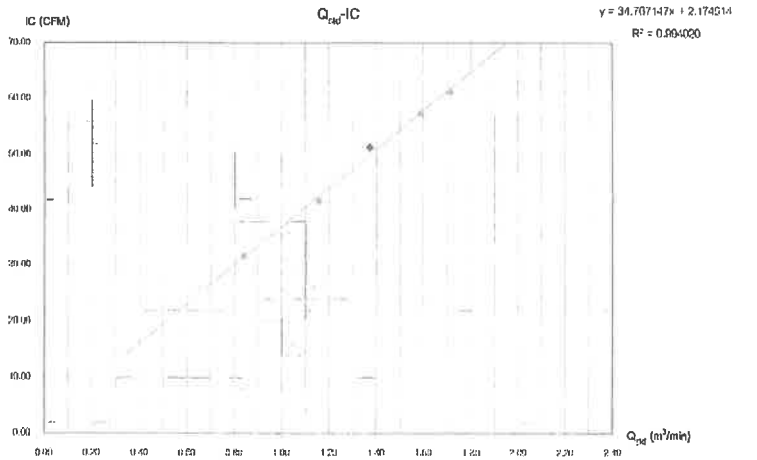


Calibrated By

Mr.Chatmongkhon Sariphaeng

SMILE
Laboratory Co., Ltd.

สไมล์ แล็บบอร์ [illegible]
Smile Laboratory Co., L[illegible]

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	[illegible]	Date	22 April 2022
Project Site	ชำแหละหมูเล็ก	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intercept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

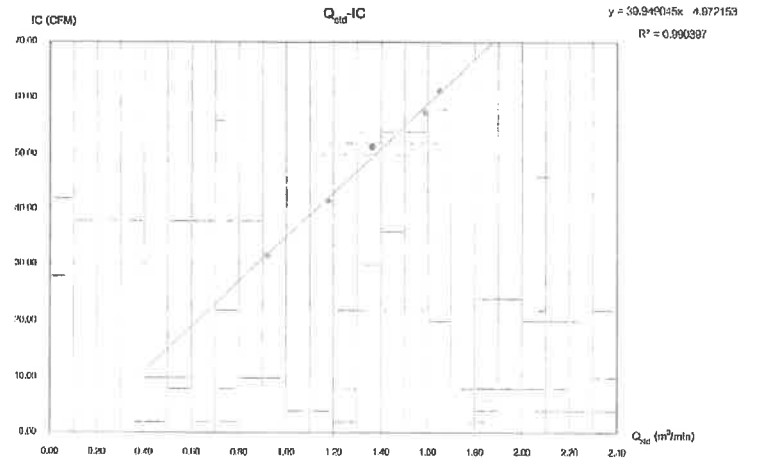
Sampler Number	12310 No.02	Motor Serial Number	1203-0[illegible]5	Recorder Serial Number	613

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) $Q_{std} = (1/m)[(A-b)]$ (m^3/min)	(I) Sampler Flow Rate Indication	(Y) IC = $I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1		1.8	3.70	1.90134	0.92229	42.0	31.63	305.0	760.0
2	4.1	3.0	6.10	2.44131	1.17896	42.0	41.52	305.0	760.0
3		4.0	8.20	2.83051	1.36397	52.0	51.40	305.0	760.0
4			11.20	3.30801	1.59095	58.0	57.33	305.0	760.0
5	6.1	6.0	12.10	3.43836	1.65291	62.0	61.28	[illegible]	[illegible]
							Average	305.0	760.0

Linear Regresstion : y= mX + b

Slope (m)	
Intercept (b)	4.972153
R-Square (R^2)	
Correlation Coefficient (r)	0.995187

Andersen Instruments, Inc.



Calibrated By

Mr.Chatmongkhon Sariphaeng

SMILE
Laboratory Co., Ltd.

บริษัท สไมล์ แอนด์ แทเรี่
Ltd.

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location	บริษัท ซูมเบ้ยง ซะนี่ ; จำกัด	Date	22 April 2022
Project Site	วัดหนองน้ำส้ม	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intecept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

Sampler Number	PM10 No.05	Motor Serial Numbe		Recorder Serial Numbe	606

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) $Q_{std} = (1/m)[(A-b)]$ (m^3/min)	(I) Sample flow rate indication	(Y) IC = $I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)
1	1.9	1.8	3.70	1.90134	0.92229	40.0	31.63		760.0
2	3.1	3.0	6.10	2.44131	1.17896	42.0	41.52	305.0	760.0
3	4.2	4.0	8.20	2.83051	1.36397	52.0	51.40	305.0	
4	5.7	[illegible]	11.20	3.30801	1.59095	58.0	57.33	305.0	760.0
5	6.1	6.0	12.10	3.43836	1.65291	62.0	61.28	305.0	760.0
							Average	305.0	760.0

Linear Regresstion : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.995187

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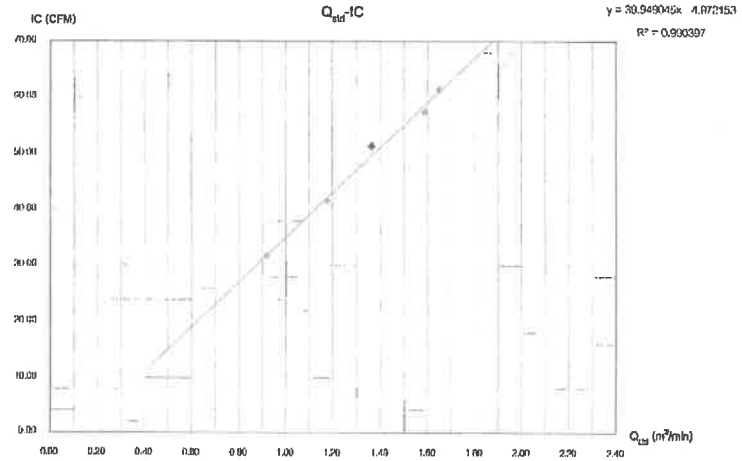

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Calibrated By

Mr.Chatmongkhon Sariphaeng

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Laboratory Co., Ltd.

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location		Date	22 April 2022
Project Site	ตกท บ้านที่ง	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intecept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

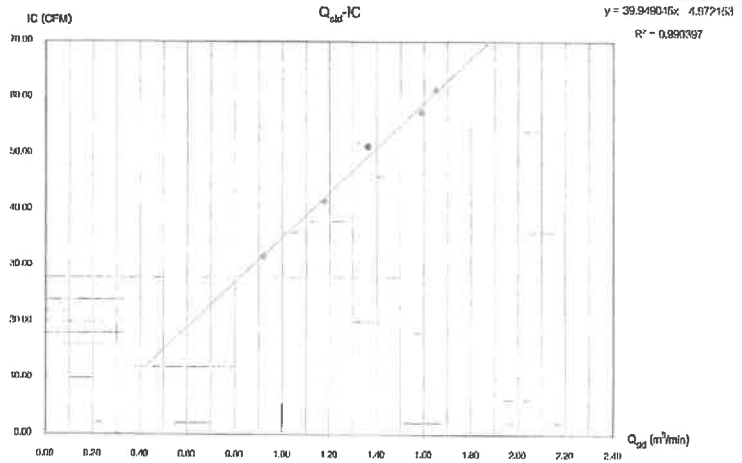
Sampler Number	PM10	Motor Serial Numbe	1205 453	Recorder Serial Number	610

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) $Q_{std} = (1/m)[(A-b)]$ (m^3/min)	(I) Sample flow rate indication	(Y) IC = $I[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temparature (°K = °C+273)	Barometric Pressure (mmHg)
1	1.9	1.8	3.70	1.90134	0.92229		31.63		760.0
2		3.0	6.10	2.44131	1.17896	42.0	41.52	305.0	760.0
3		4.0	8.20	2.83051	1.36397		51.40		760.0
4	5.7		11.20	3.30801	1.59095	58.0	57.33		760.0
5	6.1	6.0	12.10	3.43836	1.65291	62.0	61.28	305.0	760.0
							Average	305.0	760.0

Linear Regresstion : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.995187

Andersen Instruments, Inc.



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Laboratory Co., Ltd.

Calibrated By

Mr.Chatmongkhon Sariphaeng

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PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Site Information

Sampler Location		Date	22 April 2022
Project Site	บ้านดอนมิ่งเมือง	Person	Mr.Chatmongkhon Sariphaeng

Calibration Orifice

Transfer Standard Type	Orifice	Q_{std} Slope (m)	2.10372
Calibrator Model	TE-5025A	Q_{std} Intercept (b)	-0.03890
Calibrator Serial Number	3092		

Calibration Information

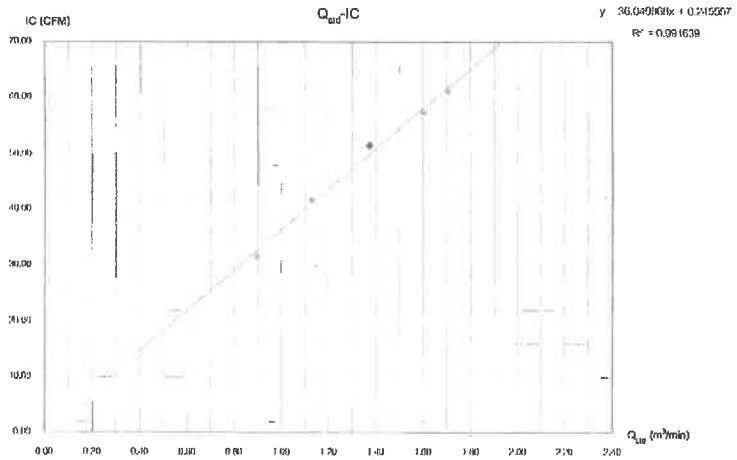
Sampler Number	14310	Motor Serial Number	-	Recorder Serial Number	

Test No.	Pressure Drop Across Orifice (ΔH_2O) (inH_2O) Positive	Negative	ΔH_2O	(A) $[\Delta H_2O(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	(X) $Q_{std} = (1/m)[(A-b)]$ (m^3/min)	(I) Sampler Flow Rate Indication	(Y) IC = $[(P_a/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)
1	1.8	1.7	3.50	1.84924	0.89752	[illegible]	31.63		760.0
2	2.9	2.7	5.60	2.33912	1.13039	420	41.52		760.0
3	4.2	4.1	8.30	2.84772	1.37215		51.40		760.0
4	5.8		11.40	3.33742	1.60493	510	57.33		760.0
5	6.5	6.4	12.90	3.55020	1.70607	620	61.28	305.0	760.0
							Average	305.0	760.0

Linear Regression : y= mX + b

Slope (m)	
Intercept (b)	
R-Square (R^2)	
Correlation Coefficient (r)	0.995811

Andersen Instruments, Inc.



SMILE Laboratory Co., Ltd.

Calibrated By

Mr.Chatmongkhon Sariphaeng

ENVIR SERVICE
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

ENVIR SERVICE
42 Raminthra 14 yeak 9, Tha Raeng, Bangkhen, Bangkok 10230
Tel : 02-9435814-5 Fax : 02-9438201 Tax id : 0105555170865

REPORT QA. GAS-CALIBRATOR

CALIBRATE DATE: 18 Dec 21

GAS CALIBRATOR

MANUFACTURER : Environics MODEL : 6100 S/N: 7462

FLOW CALIBRATOR : DryCal® DC-Lite MODEL : DCL-H S/N: 107934

MODEL : DCLT 5K S/N : 2105

MANUFACTURER : Bios International Corporation

REPORT QA. GAS-CALIBRATOR

AIR FLOW (CCM)	SETTING	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	AVG
	REF	997.00	2002.00	3005.00	3994.00	5000.00	5995.00	6990.00	7994.00	9004.00	9871.00	
	%ERROR	-0.300	0.100	0.167	-0.150	0.000	-0.083	-0.143	-0.075	0.044	-1.290	-0.17

GAS FLOW (CCM)	SETTING	10	20	30	40	50	60	70	80	90	100	AVG
	REF	10.18	20.19	30.27	40.16	50.34	60.33	70.54	80.69	90.28	100.7	
	%ERROR	1.800	0.950	0.900	0.400	0.680	0.550	0.771	0.862	0.311	0.700	0.79

Standard Reference

Reference Photometer Zero Air Brand : API Analyzer Model 701 S/N 349

Calibration Test Results

Expected Ozone (PPM)	REF Photometer Reading before adjust	REF Photometer Reading after adjust	% Error	Status
0.000	0.131	0.000	0.000	pass
0.100	0.164	0.102	2.000	pass
0.200	0.211	0.202	1.000	pass
0.300	0.242	0.298	-0.667	pass
0.400	0.377	0.397	-0.750	pass

TEMPERATURE : 26.5 DEG.C

PRESSURE : 752 mmHg

TESTED BY :

Mr. Pasagon Samol

ENVIR SERVICE
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

ENVIR SERVICE
42 Raminthra 14 yeak 9, Tha Raeng, Bangkhen, Bangkok 10230
Tel : 02-9435814-5 Fax : 02-9438201 Tax id : 0105555170865
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

Standard Reference

Reference Photometer Zero Air

Brand : API Analyzer Model 701 S/N 349

Calibration Test Results

Expected Ozone (PPM)	REF Photometer Reading before adjust	REF Photometer Reading after adjust	% Error	Status
0.000	0.020	0.000	0.000	pass
0.100	0.088	0.100	0.000	pass
0.200	0.176	0.199	-0.500	pass
0.300	0.286	0.298	-0.667	pass
0.400	0.388	0.396	-1.000	pass

TEMPERATURE : 26.5 DEG.C

PRESSURE : 752 mmHg

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

TESTED BY :

Mr. Pasagon Samol

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.ลำตาหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kamham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Nitrogen Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดโคกมะยม
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0114
Ambient NOx Analyzer ID :	WWL 0114
Manufacturer	HORIBA
Ambient NOx Analyzer Model :	APNA-370
Ambient NOx Analyzer S/N :	P1EJ99E5

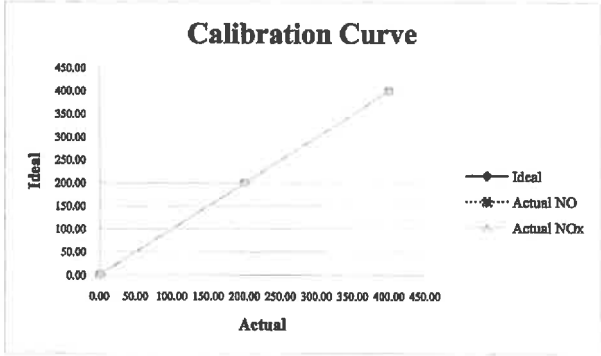
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	20 June 2020

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	50.90
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NO_x	Error NO_x	%Error NO_x
ZERO	0.00	0.20	0.20	-	0.20	0.20	-
SPAN 200 ppb	200.00	200.10	0.10	0.05	200.20	0.20	0.10
SPAN 400 ppb	400.00	400.10	0.10	0.03	400.20	0.20	0.05
AVERAGE (%)				0.04			0.07



Calibrated by (Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by (Mr. RUNGSASIKORN KOSUM)
Technical Management

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Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Nitrogen Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดคานหาม
Date of measurement :	02 April 2022
Worksheet No. :	C-220422-WWL 0115
Ambient NOx Analyzer ID :	WWL 0115
Manufacturer	HORIBA
Ambient NOx Analyzer Model :	APNA-370
Ambient NOx Analyzer S/N :	705KA9JJ

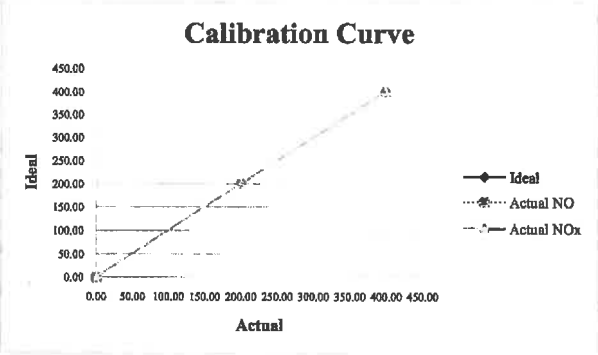
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	20 June 2020

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	50.90
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NO_x	Error NO_x	%Error NO_x
ZERO	0.00	0.20	0.20	-	0.20	0.20	-
SPAN 200 ppb	200.00	200.10	0.10	0.05	200.20	0.20	0.10
SPAN 400 ppb	400.00	400.10	0.10	0.03	400.20	0.20	0.05
AVERAGE (%)				0.04			0.07



Calibrated by Sutiwat
(Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by
(Mr. RUNGSASIKORN KOSUM)
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Nitrogen Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	บ้านคานหาม
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0116
Ambient NOx Analyzer ID :	WWL 0116
Manufacturer	HORIBA
Ambient NOx Analyzer Model :	APNA-370
Ambient NOx Analyzer S/N :	9BRKGTUK

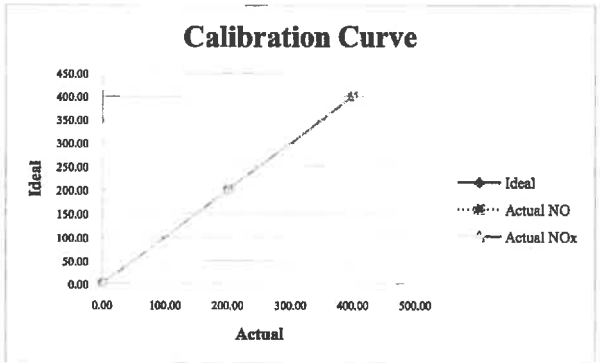
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	50.90
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NO_x	Error NO_x	%Error NO_x
ZERO	0.00	0.20	0.20	-	0.20	0.20	-
SPAN 200 ppb	200.00	200.20	0.20	0.10	200.30	0.30	0.15
SPAN 400 ppb	400.00	400.30	0.30	0.08	400.20	0.20	0.05
AVERAGE (%)				0.09			0.10



Calibrated by Sutiwat
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Chemist

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Nitrogen Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	สำนักงานโครงการ
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0117
Ambient NOx Analyzer ID :	WWL 0117
Manufacturer	HORIBA
Ambient NOx Analyzer Model :	APNA-370
Ambient NOx Analyzer S/N :	VKLYC3K0

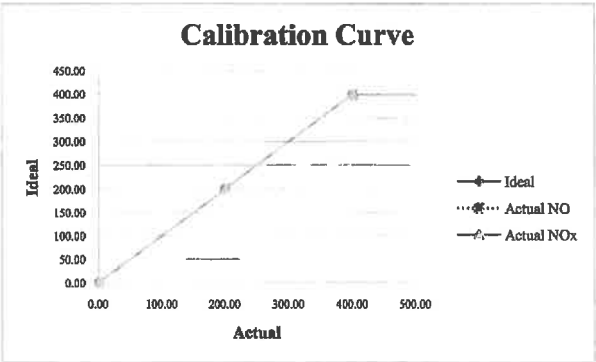
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	50.90
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NO_x	Error NO_x	%Error NO_x
ZERO	0.00	0.20	0.20	-	0.20	0.20	-
SPAN 200 ppb	200.00	200.10	0.10	0.05	200.30	0.30	0.15
SPAN 400 ppb	400.00	400.20	0.20	0.05	400.20	0.20	0.05
AVERAGE (%)				0.05			0.10



Calibrated by _____
(Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by _____
(Mr. RUNGSASIKORN KOSUM)
Technical Management

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Nitrogen Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดโคนตเดี่ย
Date of measurement :	22 April 2022
Worksheet No. :	C-121121-WWL 0113
Ambient NOx Analyzer ID :	WWL 0113
Manufacturer	HORIBA
Ambient NOx Analyzer Model :	APSA-370
Ambient NOx Analyzer S/N :	WDMY8HT8

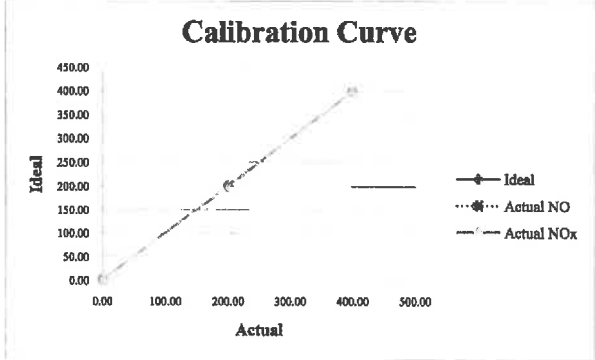
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	50.90
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NO_x	Error NO_x	%Error NO_x
ZERO	0.00	0.20	0.20	-	0.20	0.20	-
SPAN 200 ppb	200.00	200.20	0.20	0.10	200.30	0.30	0.15
SPAN 400 ppb	400.00	400.10	0.10	0.03	400.20	0.20	0.05
AVERAGE (%)				0.06			0.10



Calibrated by _____
(Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by _____
(Mr. RUNGSASIKORN KOSUM)
Technical Management

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 **Location :** บ้านหนองไม้ซุง (A6)

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer **Model:** 42C	**Manufacturer** Thermo Environmental **S/N:** 42C-65112-346

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

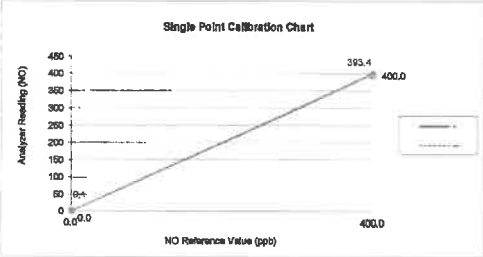
Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NOx	0.1	0.0	0.1	395.7	400.0	-1.1

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
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บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 **Location :** บ้านดอนใหญ่ (A7)

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer **Model:** 42C	**Manufacturer** Thermo Environmental **S/N:** 42C-77282-365

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

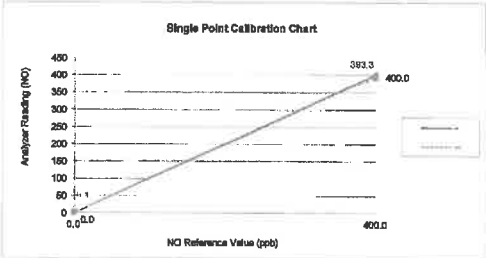
Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NOx	0.1	0.0	0.1	396.1	400.0	-1.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
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บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : วัดหนองน้ำกุ่ม (A8)

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-0329002531

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

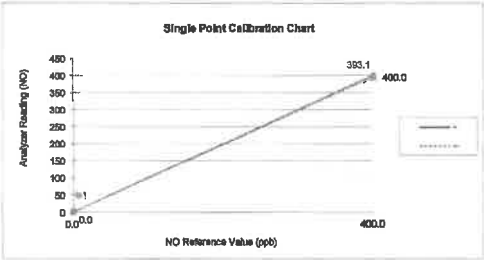
Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.1	400.0	-1.7
NOx	0.1	0.0	0.1	395.8	400.0	-1.1

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol

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บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : บ้านทึ่ม (A9)

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-0413406288

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

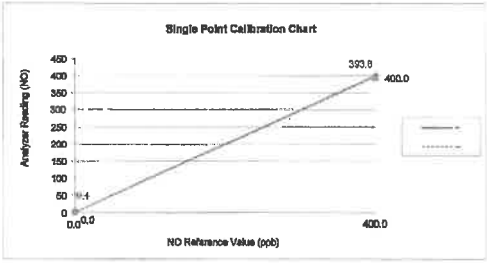
Environment: Temperature 25.5 °C Humidity: 61 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.6	400.0	-1.6
NOx	0.1	0.0	0.1	396.4	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : บ้านชายสิงห์ (A10)

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: APNA-360	Manufacturer Horiba Environmental S/N: 8517870112

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

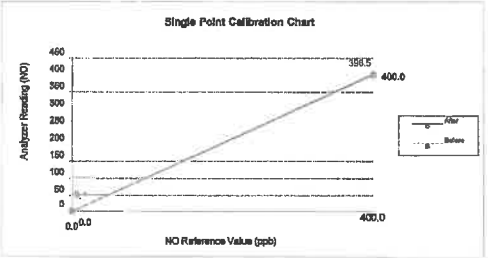
Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	398.6	400.0	-0.9
NOx	0.1	0.0	0.1	400.0	400.0	0.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samoi

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด
WATER ANALYSIS CENTER COMPANY LIMITED
1/94 หมู่ 5 ต.กานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210
1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Sulfur Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดโคกมะยม
Date of measurement :	22 April 2022
Worksheet No. :	C-220422WWL 0113
Ambient SOx Analyzer ID :	WWL 0113
Manufacturer	HORIBA
Ambient SOx Analyzer Model :	APSA-370
Ambient SOx Analyzer S/N :	WDMY8HT8

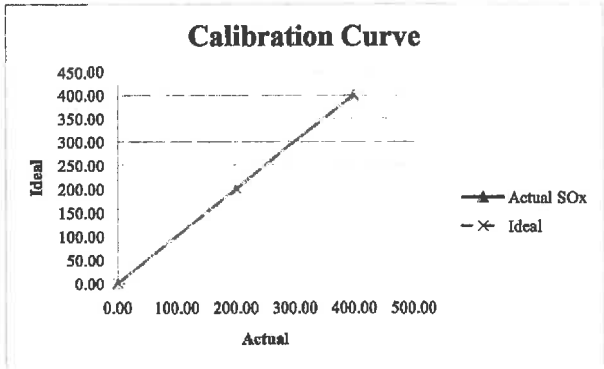
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	20 June 2020

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	49.68
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS			
	Ideal	Actual SOx	Error Sox	%Error Sox
ZERO	0.00	0.00	0.00	-
SPAN 200 ppb	200.00	200.10	0.10	0.05
SPAN 400 ppb	400.00	400.10	0.10	0.03
AVERAGE (%)				0.04



Calibrated by (Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by (Mr. RUNGSASIKORN KOSUM)
Technical Management

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1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Sulfur Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดคานหาม
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0110
Ambient SOx Analyzer ID :	WWL 0110
Manufacturer	HORIBA
Ambient SOx Analyzer Model :	APSA-370
Ambient SOx Analyzer S/N :	Y8SW7T00

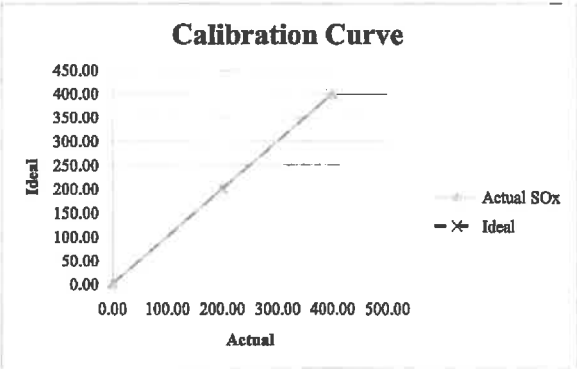
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	49.68
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS			
	Ideal	Actual SOx	Error Sox	%Error Sox
ZERO	0.00	0.00	0.00	-
SPAN 200 ppb	200.00	200.20	0.20	0.10
SPAN 400 ppb	400.00	400.20	0.20	0.05
AVERAGE (%)				0.07



Calibrated by Sutiwat
(Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by
(Mr. RUNGSASIKORN KOSUM)
Technical Management

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Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Sulfur Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	บ้านคานหาม
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0111
Ambient SOx Analyzer ID :	WWL 0111
Manufacturer	HORIBA
Ambient SOx Analyzer Model :	APSA-370
Ambient SOx Analyzer S/N :	PGRKTBDX

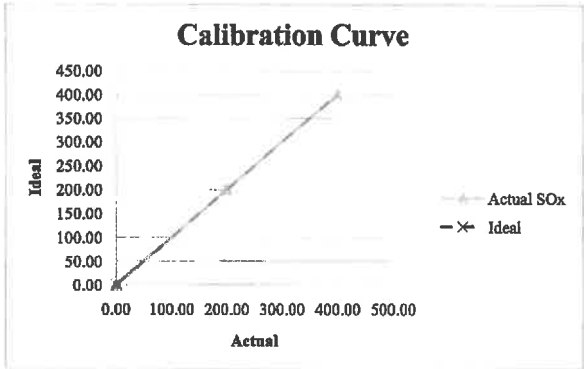
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	49.68
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS			
	Ideal	Actual SOx	Error Sox	%Error Sox
ZERO	0.00	0.00	0.00	-
SPAN 200 ppb	200.00	200.20	0.20	0.10
SPAN 400 ppb	400.00	400.20	0.20	0.05
AVERAGE (%)				0.07



Calibrated by Sutiwat
(Mr. SUTIWAT JAITHEERAPAPKUL)
Chemist

Approved by
(Mr. RUNGSASIKORN KOSUM)
Technical Management

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1/94 Moo 5, T.Kanham, A.U-Thai, Ayutthaya 13210, Thailand
Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Sulfur Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	สำนักงานโครงการ
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0112
Ambient SOx Analyzer ID :	WWL 0112
Manufacturer	HORIBA
Ambient SOx Analyzer Model :	APSA-370
Ambient SOx Analyzer S/N :	8R18JBBF

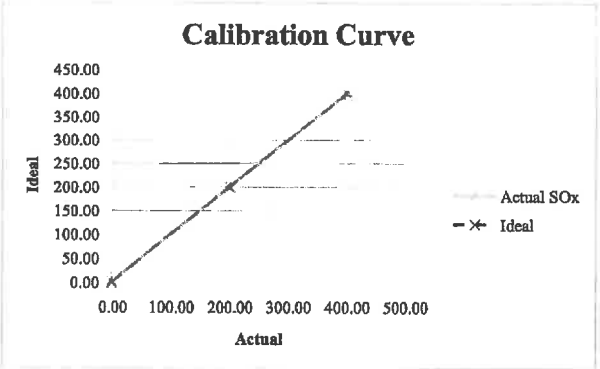
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	28 February 2019

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	49.68
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS			
	Ideal	Actual SOx	Error Sox	%Error Sox
ZERO	0.00	0.00	0.00	-
SPAN 200 ppb	200.00	200.10	0.10	0.05
SPAN 400 ppb	400.00	400.10	0.10	0.03
AVERAGE (%)				0.04



Calibrated by _____ (Mr. SUTIWAT JAITHEERAPAPKUL) Chemist

Approved by _____ (Mr. RUNGSASIKORN KOSUM) Technical Management

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Tel: 0-35226-383, 0-35800-593 Fax: 0-35800-594

Sulfur Dioxide Analyzer Calibration Worksheet

Project Site :	สวนอุตสาหกรรมโรจนะ อยุธยา
Location :	วัดโดนตเดีย
Date of measurement :	22 April 2022
Worksheet No. :	C-220422-WWL 0118
Ambient SOx Analyzer ID :	WWL 0118
Manufacturer	HORIBA
Ambient SOx Analyzer Model :	APNA-370
Ambient SOx Analyzer S/N :	W2VNUX08

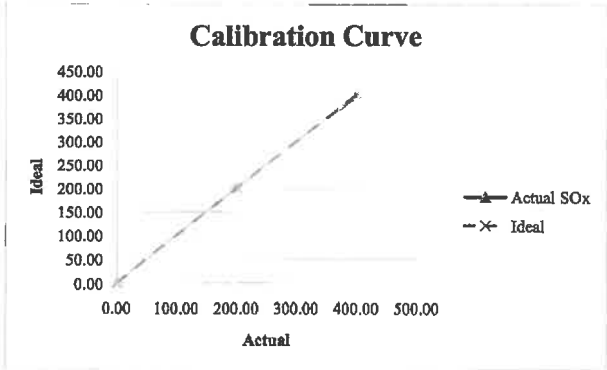
Multi Gas Calibrator

Calibrator ID :	WWL0128
Calibrator Model :	Series 6100
Calibrator S/N :	S/N 7462
Calibrate Date :	20 June 2020

Cylinder Std. Gas

Std. Gas Concentration (PPM) :	49.68
Cylinder Pressure (psi)	2000
Certified Date :	07 December 2017
Expired Date :	07 December 2021
Serial No. :	CC241587

Point	CALIBRATION RESULTS			
	Ideal	Actual SOx	Error Sox	%Error Sox
ZERO	0.00	0.10	0.10	-
SPAN 200 ppb	200.00	200.10	0.10	0.05
SPAN 400 ppb	400.00	400.10	0.10	0.03
AVERAGE (%)				0.04



Calibrated by _____ (Mr. SUTIWAT JAITHEERAPAPKUL) Chemist

Approved by _____ (Mr. RUNGSASIKORN KOSUM) Technical Management

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
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บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Ramintra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : บ้านหนองไม้ซุง (A6)

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: 319

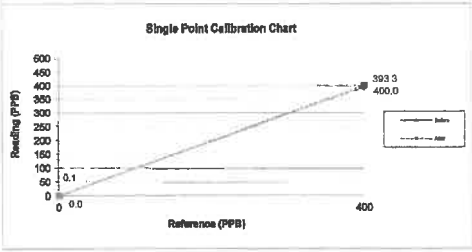
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.3	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :
Mr.PASAGORN SAMOL

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Ramintra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : บ้านดอนใหญ่ (A7)

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: 378

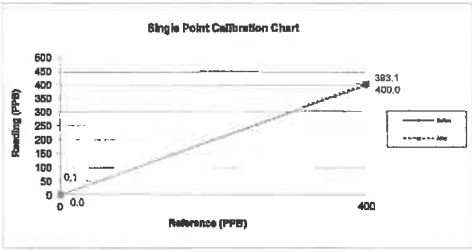
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :
Mr.PASAGORN SAMOL

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO.,LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : วัดหนองน้ำขุ่น (A8)

Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer API
Model: 100A	S/N: 405

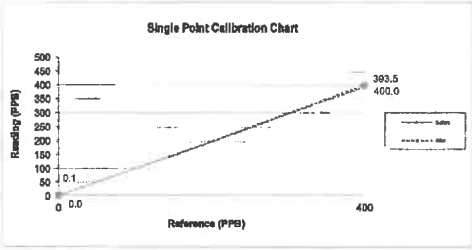
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Genearator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

Environment: Temperature 25.6 °C Humidity: 61 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.5	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :
Mr.PASAGORN SAMOL

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
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บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO.,LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 Location : บ้านที่บ (A9)

Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer API
Model: 100A	S/N: 1192

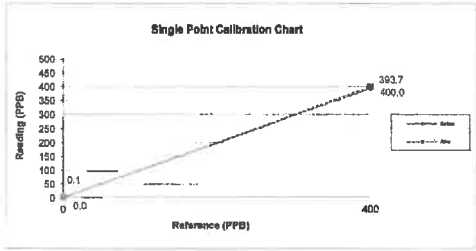
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Genearator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C Humidity: 61 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.7	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :
Mr.PASAGORN SAMOL

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ENVIR SERVICE CO.,LTD. 42 Ramindra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 22 April 2022 **Location :** บ้านราชพึงษ์ (A10)

Instruments Information

Analyzer Type: SO2 Analyzer **Model:** 100A	**Manufacturer** API Environmental **S/N:** 1818

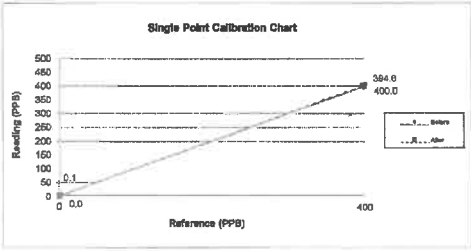
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Desibi Model 5008 **S/N:** 705 **ZERO AIR Generator** API MODEL 701 **S/N:** 1924	**NO Conc** 55.47 PPM **SO2 Conc** 55.11 PPM **CO Conc** 4,635 PPM **Cylinder number** EB0129027 **Expire Date:** 29 Oct. 2027

Environment: Temperature 25.5 °C **Humidity:** 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	394.6	-1.3
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :
Mr.PASAGORN SAMOL

วว.TISTR
NSC-TISI-TIS 17025 CALIBRATION 0037
THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. .21-64/0570 MTC No. EEL. BP. 86/0564

CALIBRATION CERTIFICATE

Submitted by : WATER ANALYSIS CENTER CO.,LTD

Address 1/94 MOO 5, T.KANHAM, A.U-THAI, AYUTTHAYA 13120.

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 : BSWATECH

Model : CA111

Serial No. 520272

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 21 May 2021

Date of Calibration : 31 May 2021

1 3

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Request No. 21-64/0570 MTC No. EEL. BP 86/0564

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	Sound Pressure Level: Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	93.80	-0.20	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Frequency: Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1001.0	1.0	± 1.5	±1.0%

3. Total distortion

Standard Microphone Type	Total distortion: Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1.99	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 31 May 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0570 MTC No. EEL. BP 86/0564

Nominal Output of Unit Under Test = 114 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	Sound Pressure Level: Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	113.88	-0.12	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Frequency: Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1000.9	0.9	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Total Distortion: Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	0.75	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 31 May 2021

Date of Issue : 4 Jun. 2021

Ref [illegible]

End of Certificate

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W	FO.LAB 6.4-1 /28	แก้ไขครั้งที่ : 0	วันที่บังคับใช้ : 1 ม.ค. 2562	หน้า : 1 ของ 1

แบบบันทึกการทวนสอบเครื่อง Sound Level Meter

เครื่อง CA111 Sound Calibrator S/N 520272 รหัสเครื่องมือ SR004 เกณฑ์การยอมรับ 93.80 ± 0.3, 113.88 ± 0.3

วันที่สอบเทียบ 31/05/64 วันที่สอบเทียบครั้งต่อไป 30/05/65

เครื่อง Digital Thermohygro Meter S/N 105091609 รหัสเครื่องมือ WWL 0055

วันที่สอบเทียบ 02/12/64 วันที่สอบเทียบครั้งต่อไป 01/12/65

เครื่อง Sound Level Meter S/N 200051 รหัสเครื่องมือ WWL 0206

วันที่สอบเทียบ 17-28/09/63 วันที่สอบเทียบครั้งต่อไป 16/09/65

การทวนสอบก่อนออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 24/04/65

การทวนสอบหลังจากออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 30/04/65

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.8
2	93.8	113.8
3	93.8	113.8
4	93.8	113.8
5	93.8	113.8
6	93.8	113.8
7	93.8	113.8
8	93.8	113.8
9	93.8	113.8
10	93.8	113.8
$\overline{X}$	93.80	113.80
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

ผู้บันทึก

ผู้ตรวจสอบ

ผู้บันทึก

ผู้ตรวจสอบ

NSC-TISI-TIS 17025 CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No. EEL. BP. 44/0963**

CALIBRATION CERTIFICATE

Submitted by : Water Analysis Center Co.,Ltd.

Address : 1/94 Moo 5,T.Kanham,A.U-Thai,Ayutthaya 13210.

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

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6226

Serial No. : 200051 Code:WWL0206

Microphone : Type 7052 No.75988

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712;
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871;
3. Decade Attenuator Ando AL-205 S/N 00464602;
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668;
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037;
6. Digital Multimeter Fluke 8520A S/N 4985007;
7. Pistonphone Rion NC-72 S/N 00402446;
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484;

Date of Receipt : 15 Sep. 2020

Date of Calibration : 17-28 Sep. 2020

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

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.91	113.4	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
24.8	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	15.6	0.10
C-Weighting	26.5	0.10
Flat	31.8	0.10

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty	Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	(±dB)	Class 2 (±dB)
125	-0.2	0.0	-0.1	0.40	2.0
1 000	0.6	0.6	0.7	0.40	1.4
4 000	0.1	0.2	0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty	Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	(±dB)	Class 2 (±dB)
63	0.2	0.1	-0.1	0.20	2.5
125	0.1	0.1	0.1	0.20	2.0
250	0.2	0.1	0.1	0.20	1.9
500	0.1	0.1	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	-0.1	0.20	2.6
4 000	-0.3	-0.2	-0.1	0.20	3.6
8 000	-0.3	-0.1	-0.1	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	91.9	-2.1	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.1	0.1	0.30	1.4
31	31.2	0.2	0.30	1.4
30	30.2	0.2	0.30	1.4

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No.** EEL. BP. 44/0963

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limit Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limit Class 2 (dB)
Fast	200	115.9	-0.1	0.20	±1.3
	2	98.3	-0.7	0.20	+1.3; -2.8
	0.25	89.8	-0.2	0.20	+1.8; -5.3
Slow	200	109.3	-0.3	0.20	±1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
SEL	200	110.1	0.1	0.20	±1.3
	2	90.1	0.1	0.20	+1.3; -2.8
	0.25	81.1	0.1	0.20	+1.8; -5.3

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No.** EEL. BP. 44/0963

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerence limits Class 2 (±dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value	Uncertainty	Tolerance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	Class 2 (±dB)
131.1	131.1	0.0	0.30	1.8

Calibrated by :

Kontrit Laohasiri

(Mr. Komkrit Laohasiri)

Approved by :

(Nisawadee Wongkhalee)
Director

Electrical and Electronics Standards Laboratory
Industrial Metrology and Testing Service Center

Date of Calibration : 17-28 Sep. 2020

Date of Issue : 29 Sep. 2020

Ref : 20112630915036040 01

End of Certificate

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W	FO.LAB 6.4-1 /28	แก้ไขครั้งที่ : 0	วันที่บังคับใช้ : 1 ม.ค. 2562	หน้า : 1 ของ 1

แบบบันทึกการทวนสอบเครื่อง Sound Level Meter

เครื่อง CA111 Sound Calibrator S/N 520272 รหัสเครื่องมือ SR004 เกณฑ์การยอมรับ 93.80 ± 0.3, 113.88 ± 0.3

วันที่สอบเทียบ 31/05/64 วันที่สอบเทียบครั้งต่อไป 30/05/65

เครื่อง Digital Thermohygro Meter S/N 105091609 รหัสเครื่องมือ WWL 0055

วันที่สอบเทียบ 02/12/64 วันที่สอบเทียบครั้งต่อไป 01/12/65

เครื่อง Sound Level Meter S/N 200052 รหัสเครื่องมือ WWL 0207

วันที่สอบเทียบ 13-16/12/64 วันที่สอบเทียบครั้งต่อไป 12/12/66

การทวนสอบก่อนออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 24/04/65

การทวนสอบหลังจากออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 30/04/65

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

ผู้บันทึก

ผู้ตรวจสอบ

ผู้บันทึก

ผู้ตรวจสอบ

CALIBRATION CERTIFICATE

Submitted by : Water Analysis Center Co.,Ltd.

Address : 1/94 Moo 5,T.Kanham,A.U-Thai,Ayutthaya 13210.

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

Instrument Calibrated :

Description : Integrating Sound Level Meter
Manufacturer : ACO
Model : 6226
Serial No. : 200052 Code:WWL0207
Microphone : Type 7052 No.75989
Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712;
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871;
3. Decade Attenuator Ando AL-205 S/N 00464602;
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668;
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037;
6. Digital Multimeter Fluke 8520A S/N 4985007;
7. Pistonphone Rion NC-72 S/N 00402446;
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484;

Date of Receipt : 15 Sep. 2020

Date of Calibration : 17-28 Sep. 2020

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No. EEL. BP. 45/0963**

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

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 17-28 Sep. 2020

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สำเนาถูกต้อง - 54

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.90	113.4	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
27.5	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	15.9	0.10
C-Weighting	25.6	0.10
Flat	29.3	0.10

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Request No. 21-63/0837 **MTC No. EEL. BP. 45/0963**

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.5	0.3	0.3	0.40	2.0
1 000	-0.2	-0.1	-0.1	0.40	1.4
4 000	-0.4	0.6	-0.2	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	0.1	0.0	0.20	2.5
125	0.1	0.1	0.1	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.0	0.20	2.6
4 000	-0.3	-0.2	-0.1	0.20	3.6
8 000	-0.2	-0.1	-0.2	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	92.1	-1.9	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	121.9	-0.1	0.30	1.4
121	120.9	-0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No.** EEL. BP. 45/0963

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	0.30	1.4
33	33.1	0.1	0.30	1.4
32	32.1	0.1	0.30	1.4
31	31.2	0.2	0.30	1.4
30	30.3	0.3	0.30	1.4

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7. Level linearlity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limit Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limit Class 2 (dB)
Fast	200	115.7	-0.3	0.20	±1.3
	2	98.7	-0.3	0.20	+1.3; -2.8
	0.25	89.0	-1.0	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	±1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
SEL	200	110.1	0.1	0.20	±1.3
	2	90.2	0.2	0.20	+1.3; -2.8
	0.25	81.1	0.1	0.20	+1.8; -5.3

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Request No. 21-63/0837 **MTC No.** EEL. BP. 45/0963

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerence limits Class 2 (±dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
133.0	133.0	0.0	0.30	1.8

Calibrated by :

Komkrit Laohasiri

(Mr. Komkrit Laohasiri)

Approved by :

(Ms. Wanee Wichaidit)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Center

Date of Calibration : 17-28 Sep. 2020

Date of Issue : 29 Sep. 2020

Ref : 2011263091503604002

End of Certificate

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ภาคผนวก ข - 57

W	FO.LAB 6.4-1 /28	แก้ไขครั้งที่ : 0	วันที่บังคับใช้ : 1 ม.ค. 2562	หน้า : 1 ของ 1

แบบบันทึกการทวนสอบเครื่อง Sound Level Meter

เครื่อง CA111 Sound Calibrator S/N 520272 รหัสเครื่องมือ SR004 เกณฑ์การยอมรับ 93.80 ± 0.3, 113.88 ± 0.3

วันที่สอบเทียบ 31/05/64 วันที่สอบเทียบครั้งต่อไป 30/05/65

เครื่อง Digital Thermohygro Meter S/N 105091609 รหัสเครื่องมือ WWL 0055

วันที่สอบเทียบ 02/12/64 วันที่สอบเทียบครั้งต่อไป 01/12/65

เครื่อง Sound Level Meter S/N 200053 รหัสเครื่องมือ WWL 0207

วันที่สอบเทียบ 17-28/09/63 วันที่สอบเทียบครั้งต่อไป 16/09/65

การทวนสอบก่อนออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 24/04/65

การทวนสอบหลังจากออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 30/04/65

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.9	113.9
2	93.9	113.9
3	93.9	113.9
4	93.9	113.9
5	93.9	113.9
6	93.9	113.9
7	93.9	113.9
8	93.9	113.9
9	93.9	113.9
10	93.9	113.9
$\overline{X}$	93.90	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.9	113.8
2	93.9	113.8
3	93.9	113.8
4	93.9	113.8
5	93.9	113.8
6	93.9	113.8
7	93.9	113.8
8	93.9	113.8
9	93.9	113.8
10	93.9	113.8
$\overline{X}$	93.90	113.80
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

ผู้บันทึก ..... ผู้บันทึก .....

ผู้ตรวจสอบ ..... ผู้ตรวจสอบ .....

วว.TISTR

NSC-TISI-TIS 17025 CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No. EEL. BP. 46/0963**

CALIBRATION CERTIFICATE

Submitted by : Water Analysis Center Co.,Ltd.

Address : 1/94 Moo 5,T.Kanham,A.U-Thai,Ayutthaya 13210.

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

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

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6226

Serial No. : 200053 Code:WWL0208

Microphone : Type 7052 No.75990

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712;
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871;
3. Decade Attenuator Ando AL-205 S/N 00464602;
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668;
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037;
6. Digital Multimeter Fluke 8520A S/N 4985007;
7. Pistonphone Rion NC-72 S/N 00402446;
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484;

Date of Receipt : 15 Sep. 2020

Date of Calibration : 17-28 Sep. 2020

The results relate only to the items tested or calibrated.
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FM.BL.MTC.002 Rev.3

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E-mail : sumalee@tistr.or.th

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

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No. EEL. BP. 46/0963**

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.90	133.3	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
21.1	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	22.2	0.10
C-Weighting	32.5	0.10
Flat	37.2	0.10

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty	Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	(±dB)	Class 2 (±dB)
125	0.2	0.1	-0.1	0.40	2.0
1 000	0.0	-0.1	0.1	0.40	1.4
4 000	0.2	0.4	0.4	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty	Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	(±dB)	Class 2 (±dB)
63	-0.1	-0.4	-0.4	0.20	2.5
125	0.1	0.0	0.0	0.20	2.0
250	0.2	0.1	0.0	0.20	1.9
500	0.2	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.1	0.20	2.6
4 000	-0.3	-0.2	0.0	0.20	3.6
8 000	-0.3	-0.2	-0.2	0.20	5.6

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	92.1	-1.9	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	121.9	-0.1	0.30	1.4
121	120.9	-0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	118.9	-0.1	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.8	-0.2	0.30	1.4

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อาคารหมายเลข 9 - 60

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.3	0.3	0.30	1.4
33	33.4	0.4	0.30	1.4
32	32.5	0.5	0.30	1.4
31	31.7	0.7	0.30	1.4
30	30.9	0.9	0.30	1.4

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0837 **MTC No.** EEL. BP. 46/0963

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	74.8	-0.2	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (dB)
Fast	200	115.5	-0.5	0.20	±1.3
	2	98.2	-0.8	0.20	+1.3; -2.8
	0.25	89.6	-0.4	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	±1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
SEL	200	110.1	0.1	0.20	±1.3
	2	90.1	0.1	0.20	+1.3; -2.8
	0.25	81.2	0.2	0.20	+1.8; -5.3

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Request No. 21-63/0837 **MTC No. EEL. BP. 46/0963**

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerence limits Class 2 (±dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	123.9	-0.5	0.20	1.4
Negative half cycle	124.4	124.0	-0.4	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value	Uncertainty	Tolerance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	Class 2 (±dB)
130.8	130.8	0.0	0.30	1.8

Calibrated by :

Kornkrit Laohasiri

(Mr. Komkrit Laohasiri)

Approved by :

(Mr. [illegible])
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Center

Date of Calibration : 17-28 Sep. 2020

Date of Issue : 29 Sep. 2020

Ref : 2011263091503604003

End of Certificate

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FM.BL.MTC.002 Rev.3

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W	FO.LAB 6.4-1 /28	แก้ไขครั้งที่ : 0	วันที่บังคับใช้ : 1 ม.ค. 2562	หน้า : 1 ของ 1

แบบบันทึกการทวนสอบเครื่อง Sound Level Meter

เครื่อง CA111 Sound Calibrator S/N 520272 รหัสเครื่องมือ SR004 เกณฑ์การยอมรับ 93.80 ± 0.3, 113.88 ± 0.3

วันที่สอบเทียบ 31/05/64 วันที่สอบเทียบครั้งต่อไป 30/05/65

เครื่อง Digital Thermohygro Meter S/N 105091609 รหัสเครื่องมือ WWL 0055

วันที่สอบเทียบ 02/12/64 วันที่สอบเทียบครั้งต่อไป 01/12/65

เครื่อง Sound Level Meter S/N 00396803 รหัสเครื่องมือ WWL 0160

วันที่สอบเทียบ 13-16/12/64 วันที่สอบเทียบครั้งต่อไป 12/12/66

การทวนสอบก่อนออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 24/04/65

การทวนสอบหลังจากออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 30/04/65

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

ผู้บันทึก

ผู้ตรวจสอบ

ผู้บันทึก

ผู้ตรวจสอบ

CALIBRATION CERTIFICATE

Submitted by : WATER ANALYSIS CENTER CO., LTD.

Address : 1/94 MOO 5, T.KANHAM, A.U-THAI, AYUTTHAYA 13210.

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

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 00396803 (WWL 0160)
Microphone : Type UC-52 No.180449
Preamplifier : Type NH-24 No.87814

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 26 Nov. 2021

Date of Calibration : 13-16 Dec.2021

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0137 **MTC No.** EEL. BP 105/1164

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

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 13-16 Dec.2021

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สำเนาถูกต้อง - 63

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.91	114.1	113.9	0.0	0.30	1.4

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.5	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	12.6	0.10
C-Weighting	17.8	0.10
Flat	23.2	0.10

Date of Calibration : 13-16 Dec.2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	-0.2	-0.1	-0.1	0.40	2.0
1 000	-0.1	-0.1	-0.1	0.40	1.4
4 000	-0.8	-0.7	-0.7	0.40	3.6

4. Electrical signal test of frequency weightings

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

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weightings at 1 kHz

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

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
137	137.0	0.0	0.30	1.4
136	136.1	0.1	0.30	1.4
135	135.0	0.0	0.30	1.4
134	134.1	0.1	0.30	1.4
133	133.1	0.1	0.30	1.4
132	132.0	0.0	0.30	1.4
131	131.0	0.0	0.30	1.4

Date of Calibration : 13-16 Dec.2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0137 **MTC No.** EEL. BP. 105/1164

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
130	130.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.0	0.0	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	28.0	0.0	0.30	1.4

Date of Calibration : 13-16 Dec.2021

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
27	27.0	0.0	0.30	1.4
26	25.9	-0.1	0.30	1.4
25	25.0	0.0	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (±dB)
20-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (dB)
Fast	200	126.0	0.0	0.20	±1.3
	2	109.0	0.0	0.20	+1.3; -2.8
	0.25	99.9	-0.1	0.20	+1.8; -5.3
Slow	200	119.5	-0.1	0.20	±1.3
	2	99.9	-0.1	0.20	+1.3; -5.3
SEL	200	120.0	0.0	0.20	±1.3
	2	100.0	0.0	0.20	+1.3; -2.8
	0.25	90.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 13-16 Dec.2021

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Request No. 21-65/0137 **MTC No.** EEL. BP. 105/1164

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerence limits Class 2 (±dB)
Complete cycle	125.4	125.4	0.0	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value	Uncertainty	Tolerance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	Class 2 (±dB)
136.6	136.6	0.0	0.30	1.8

Calibrated by :

(Mr. Panya Phasingsri)

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Thavale Kleaypa)

Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-16 Dec.2021

Date of Issue : 17 Dec. 2021

Ref : 20112641126049390 02

End of Certificate

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W	FO.LAB 6.4-1 /28	แก้ไขครั้งที่ : 0	วันที่บังคับใช้ : 1 ม.ค. 2562	หน้า : 1 ของ 1

แบบบันทึกการทวนสอบเครื่อง Sound Level Meter

เครื่อง CA111 Sound Calibrator S/N 520272 รหัสเครื่องมือ SR004 เกณฑ์การยอมรับ 93.80 ± 0.3, 113.88 ± 0.3

วันที่สอบเทียบ 31/05/64 วันที่สอบเทียบครั้งต่อไป 30/05/65

เครื่อง Digital Thermohygro Meter S/N 105091609 รหัสเครื่องมือ WWL 0055

วันที่สอบเทียบ 02/12/64 วันที่สอบเทียบครั้งต่อไป 01/12/65

เครื่อง Sound Level Meter S/N 00396923 รหัสเครื่องมือ WWL 0161

วันที่สอบเทียบ 13-16/12/64 วันที่สอบเทียบครั้งต่อไป 12/12/66

การทวนสอบก่อนออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 24/04/65

การทวนสอบหลังจากออกหน้างาน

อุณหภูมิ (°C) 24 เกณฑ์การยอมรับ 23.0±2.0

ความชื้นสัมพัทธ์ (%) 46 เกณฑ์การยอมรับ 50.0±15.0

วันที่ทวนสอบ 30/04/65

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

Item	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 94.0dB)	ระดับเสียงที่วัดได้ (dB) (ความดังที่ 114.0dB)
1	93.8	113.9
2	93.8	113.9
3	93.8	113.9
4	93.8	113.9
5	93.8	113.9
6	93.8	113.9
7	93.8	113.9
8	93.8	113.9
9	93.8	113.9
10	93.8	113.9
$\overline{X}$	93.80	113.90
SD	0.00	0.00
%RSD (≤ 10)	0.00	0.00
ผลการทวนสอบ	ผ่าน	ผ่าน

ผู้บันทึก

ผู้ตรวจสอบ

ผู้บันทึก

ผู้ตรวจสอบ

วว.TISTR

NSC-TISI-TIS 17025 CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0137 **MTC No.** EEL. BP. 104/1164

CALIBRATION CERTIFICATE

Submitted by : WATER ANALYSIS CENTER CO., LTD.

Address : 1/94 MOO 5, T.KANHAM, A.U-THAI, AYUTTHAYA 13210.

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

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42

Serial No. : 00396923 (WWL 0161)

Microphone : Type UC-52 No.180583

Preamplifier : Type NH-24 No.87936

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 26 Nov. 2021

Date of Calibration : 13-16 Dec.2021

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FM.BL.MTC.002 Rev.4

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10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

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This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.91	114.2	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.4	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	12.5	0.10
C-Weighting	17.7	0.10
Flat	23.4	0.10

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty	Tolerance Limits
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	(±dB)	Class 2 (±dB)
125	-0.1	0.0	0.0	0.40	2.0
1 000	-0.3	-0.3	-0.3	0.40	1.4
4 000	-0.6	-0.6	-0.6	0.40	3.6

4. Electrical signal test of frequency weightings

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

Date of Calibration : 13-16 Dec.2021

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weightings at 1 kHz

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

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
137	137.0	0.0	0.30	1.4
136	136.0	0.0	0.30	1.4
135	135.0	0.0	0.30	1.4
134	134.0	0.0	0.30	1.4
133	133.0	0.0	0.30	1.4
132	132.0	0.0	0.30	1.4
131	131.0	0.0	0.30	1.4

Date of Calibration : 13-16 Dec.2021

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
130	130.0	0.0	0.30	1.4
129	129.0	0.0	0.30	1.4
124	124.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.0	0.0	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.0	0.0	0.30	1.4
29	28.9	-0.1	0.30	1.4
28	27.9	-0.1	0.30	1.4

Date of Calibration : 13-16 Dec.2021

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FM.BL.MTC.002 Rev.4

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วว.TISTR NSC-TISI-TIS 17025 CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0137 **MTC No.** EEL. BP. 104/1164

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
27	26.9	-0.1	0.30	1.4
26	25.9	-0.1	0.30	1.4
25	24.9	-0.1	0.30	1.4

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (±dB)
20-130	125	125.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerence Limits Class 2 (dB)
Fast	200	126.0	0.0	0.20	±1.3
	2	108.9	-0.1	0.20	+1.3; -2.8
	0.25	99.9	-0.1	0.20	+1.8; -5.3
Slow	200	119.5	-0.1	0.20	±1.3
	2	99.9	-0.1	0.20	+1.3; -5.3
SEL	200	120.0	0.0	0.20	±1.3
	2	100.0	0.0	0.20	+1.3; -2.8
	0.25	90.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 13-16 Dec.2021

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FM.BL.MTC.002 Rev.4

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0137

MTC No. EEL. BP. 104/1164

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerence limits Class 2 (±dB)
Complete cycle	125.4	125.4	0.0	0.20	2.4
Positive half cycle	124.4	124.1	-0.3	0.20	1.4
Negative half cycle	124.4	124.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value	Uncertainty	Tolerance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	Class 2 (±dB)
136.7	136.7	0.0	0.30	1.8

Calibrated by :

(Mr. Panya Phasingsri)

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prawate Kluaypa)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-16 Dec.2021

Date of Issue : 17 Dec. 2021

Ref : 2011264112604939001

End of Certificate

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FM.BL.MTC.002 Rev.4

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Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: CN10630014
Organization Name: S.P.S.Consulting Service Co.,Ltd.
Organization Location: 7 Soi Paholyothin 24 Bangok 10900

Date: September 8, 2021 11:48:04 AM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.51, GCMS.02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 6890

Setpoint Status: **Pass**

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 6890
Front SSL

Setpoint Status: **Pass**
Pressure: 25.0 psi

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

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 6890
Front SSL

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi

Accuracy: 0.1 psi
Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Accuracy

Name: 6890
Back SSL

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.0	psi

Accuracy: 0.0 psi
Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 6890
Front FID

Setpoint Status: Pass

Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.8 mL/min

Accuracy: 0.8 mL/min
Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 401.6 mL/min

Accuracy: 1.6 mL/min
Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 25.7 mL/min

Accuracy: 0.7 mL/min
Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 6890

Setpoint Status: Pass

Zone: Oven
Setpoint/Actual
Temperature: 230.0 230.5 °C

Accuracy: 0.5 °C
Agilent Recommended: >= -1.0 % setpoint in K (-5.0 °C)
<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status:	**Pass**					
Zone:	Oven					
	Setpoint/Actual					
Temperature:	100.0	100.1	°C			
Accuracy:		0.1	°C			
Agilent Recommended:	>=	-1.0	% setpoint in K	(-3.7	°C	)
	<=	1.0	% setpoint in K	(3.7	°C	)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:	6890			
Setpoint Status:	**Pass**			
	Setpoint/Average			
Temperature:	100.0	100.1	°C	
Stability:		0.0	°C	
Agilent Recommended:	<=	0.5		

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7683B			
Setpoint Status:	**Completed**			
Injection Volume on Column:	1.0	uL		

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1	Front	SSL	/ Front	FID

Name:	6890					
Setpoint Status:	**Pass**					
Base Signal:	20.2	pA				
			ASTM Noise			Drift
			counts			counts/Hr
			321.58			195.20
Agilent Recommended:		<=	768.00		<=	19200.00
Status:	Pass			Pass		

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1	Front	SSL	/ Front	FID			
Name:	7683B						
Setpoint Status:	**Pass**						
Injection Volume on Column:	1.0	uL					
Area RSD:		0.41	%	Retention Time RSD:		0.13	%
Agilent Recommended:	<=	3.00			<=	1.00	

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	6890			
Setpoint Status:	**Pass**			
Signal to Noise:		1019653		
Agilent Recommended:	>=	300000		

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			

Setpoint Status: Pass

Amu:	1050	m/z	Drift After Five Minutes:			RFPA Voltage:	
			10	mV		498	mV
Agilent Recommended:			>= -100	and	<= 100	<= 1100	

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 609

Agilent Recommended: >= 160

Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 286

Agilent Recommended: >= 160

This test's 0 comment(s) and 2 deviation(s) are available in the Attachments section.

Overall Signal to Noise EI Test Status

Pass

ATTACHMENT 8 - 74

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN10630014
Manufacturer	Agilent Technologies
Name	6890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No

Tested Combination2

Injection Technique	Manual Injection
Inlet	Back
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683B
Model Number	G2913A
Serial Number	CN64136101
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 2

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	6890
Model Number	G1530N
Serial Number	CN10630014
Firmware Revision	N.02.01
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	6890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	6890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External
Detector 2	
Manufacturer	Agilent Technologies
Name	6890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen
Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
Serial Number	US61633454
Firmware Revision	5.02.04
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Electronic Signature

Purpose

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Details

Full Name of Signer:	Adirek Rattanawijit
Logged On User Name:	adirek.rattanawijit@non.agilent.com
Signature Creation Date:	September 8, 2021
Reason for Signature:	Executed protocol and published this original version of document

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ANNEXURE 9 - 76

User Name: adirek.raitanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:06 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 2:28:20 PM	Audit	SessionCreated	Session	None
September 7, 2021 2:28:20 PM	Start	Configuration	Session	None
September 7, 2021 2:28:20 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
September 7, 2021 3:12:19 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
September 7, 2021 3:12:25 PM	End	Configuration	Session	None
September 7, 2021 3:12:30 PM	Start	Qualification	Session	OQ
September 7, 2021 3:12:30 PM	Start	Execution	System Inspection and Basic Safety and Operation - 6890: - Qualitative Test - No setpoints associated	None

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User Name: adirek.raitanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:06 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:12:48 PM	End	Execution	System Inspection and Basic Safety and Operation - 6890: - Qualitative Test - No setpoints associated	Run Count : 1
September 7, 2021 3:13:47 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
September 7, 2021 3:40:18 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
September 7, 2021 3:40:29 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
September 7, 2021 3:40:39 PM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
September 7, 2021 3:40:41 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
September 7, 2021 3:40:45 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
September 7, 2021 3:40:49 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
September 7, 2021 3:40:53 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1

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ENGINEER 8 - 77

User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:40:55 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
September 7, 2021 3:41:11 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 7, 2021 3:41:12 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
September 7, 2021 3:41:14 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
September 7, 2021 3:41:34 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 7, 2021 3:41:36 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
September 7, 2021 3:41:38 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
September 7, 2021 3:41:50 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 7, 2021 3:41:52 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
September 7, 2021 3:41:54 PM	Start	Execution	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:42:09 PM	Audit	Data	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
September 7, 2021 3:42:11 PM	End	Execution	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
September 7, 2021 3:42:13 PM	Start	Execution	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
September 7, 2021 3:42:34 PM	Audit	Data	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
September 7, 2021 3:42:36 PM	End	Execution	GC Oven Temperature Accuracy - 6890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
September 7, 2021 3:42:38 PM	Start	Execution	GC Oven Temperature Stability - 6890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
September 7, 2021 3:43:24 PM	Audit	Data	GC Oven Temperature Stability - 6890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
September 7, 2021 3:43:27 PM	End	Execution	GC Oven Temperature Stability - 6890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
September 7, 2021 3:43:33 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:06 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:46:05 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : K:\SPS\OQPV2021\SCOUTING01.D\FID1A.CH
September 7, 2021 3:46:38 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
September 7, 2021 3:46:41 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
September 7, 2021 3:47:00 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : K:\SPS\OQPV2021\SIGNSDRF01.D\FID1A.CH
September 7, 2021 3:47:51 PM	End	Qualification	Session	OQ
September 7, 2021 3:47:51 PM	Start	Configuration	Session	None
September 7, 2021 3:48:45 PM	End	Configuration	Session	None
September 7, 2021 3:48:45 PM	Start	Qualification	Session	OQ
September 7, 2021 3:48:45 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
September 7, 2021 3:49:02 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:06 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:49:06 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC02.D\FID1A.CH
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC03.D\FID1A.CH
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC04.D\FID1A.CH
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC05.D\FID1A.CH
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC06.D\FID1A.CH
September 7, 2021 3:49:22 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : K:\SPS\OQPV2021\INJPREC07.D\FID1A.CH
September 7, 2021 3:49:47 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1

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ATTACHMENT 6 - 79

User Name: adirek.rattanawijit
Hostname: DESKTOP-86M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQQCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 3:49:51 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
September 7, 2021 3:50:05 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : K:\SPS\OQPV2021\SIGTONS01.D\FID1A.CH
September 7, 2021 3:50:22 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
September 7, 2021 3:50:32 PM	Start	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	None
September 7, 2021 3:50:54 PM	End	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	Run Count : 1
September 7, 2021 3:50:58 PM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
September 7, 2021 3:55:05 PM	End	Qualification	Session	OQ
September 7, 2021 3:55:05 PM	Start	Configuration	Session	None
September 7, 2021 3:57:26 PM	End	Configuration	Session	None
September 7, 2021 3:57:26 PM	Start	Qualification	Session	OQ
September 7, 2021 3:57:26 PM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
September 7, 2021 3:59:40 PM	End	Execution	RFPA - 5975C SQ: - Source: EI - Inert	Run Count : 1
September 7, 2021 3:59:54 PM	Start	Execution	Tune EI - 5975C SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None

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User Name: adirek.rattanawijit
Hostname: DESKTOP-86M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQQCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 4:00:10 PM	Start	Execution	Tune EI - 5975C SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
September 7, 2021 4:00:20 PM	End	Execution	Tune EI - 5975C SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
September 7, 2021 4:00:22 PM	Start	Execution	Tune EI - 5975C SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
September 7, 2021 4:00:33 PM	End	Execution	Tune EI - 5975C SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
September 7, 2021 4:00:36 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
September 7, 2021 4:01:05 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SNF1_01.D\DATA.MS
September 7, 2021 4:03:33 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SN_F1_002.D\DATA.MS
September 7, 2021 4:03:44 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	None
September 7, 2021 4:03:49 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SNF2_01.D\DATA.MS

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQQCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 4:06:56 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Run Count : 1
September 7, 2021 4:06:02 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
September 7, 2021 4:06:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SNF1_01.D\DATA.MS
September 7, 2021 4:13:01 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SNF1_01.D\DATA.MS
September 7, 2021 4:13:28 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SN_F1_001.D\DATA.MS
September 7, 2021 4:15:40 PM	Audit	AceClosed	Session	None
September 7, 2021 4:16:47 PM	Audit	AceRestarted	Session	None
September 7, 2021 4:16:48 PM	Audit	SessionReloaded	Session	None
September 7, 2021 4:16:53 PM	Start	Qualification	Session	OQ
September 7, 2021 4:16:53 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQQCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 4:17:12 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SN_F1_002.D\DATA.MS
September 7, 2021 4:17:21 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SN_F1_001.D\DATA.MS
September 7, 2021 4:17:38 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OQPV2021\SNF1_01.D\DATA.MS
September 7, 2021 4:19:10 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\SN_F1_001.D\DATA.MS
September 7, 2021 4:20:24 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 1
September 7, 2021 4:20:42 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Deviation filed for Run Count : 1
September 7, 2021 4:20:42 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
September 7, 2021 4:20:53 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\SN_F1_001.D\DATA.MS

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 4:21:20 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 2
September 7, 2021 4:21:33 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Deviation filed for Run Count : 2
September 7, 2021 4:21:38 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
September 7, 2021 4:21:45 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\SN_F1_001.D\DATA.MS
September 7, 2021 4:23:25 PM	Audit	AceClosed	Session	None
September 7, 2021 4:23:57 PM	Audit	AceRestarted	Session	None
September 7, 2021 4:23:58 PM	Audit	SessionReloaded	Session	None
September 7, 2021 4:24:03 PM	Start	Qualification	Session	OQ
September 7, 2021 4:24:03 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
September 7, 2021 4:26:28 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\SN_001.D\DATA.MS

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User Name: adirek.rattanawijit
Hostname: DESKTOP-85M7VB6

System Id: CN10630014
Print Date: September 8, 2021 11:48:08 AM

SPS_OQGCMS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 7, 2021 4:27:56 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : K:\SPS\OFN_SN_F1_001.D\DATA.MS
September 7, 2021 4:30:00 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 3
September 7, 2021 4:30:10 PM	Audit	AceClosed	Session	None
September 8, 2021 11:31:05 AM	Audit	AceRestarted	Session	None
September 8, 2021 11:31:07 AM	Audit	SessionReloaded	Session	None
September 8, 2021 11:31:15 AM	Start	Qualification	Session	OQ
September 8, 2021 11:31:32 AM	End	Qualification	Session	OQ
September 8, 2021 11:31:32 AM	Start	Reporting	Session	None
September 8, 2021 11:46:01 AM	Audit	Reporting	Session	Report Generated : Certificate

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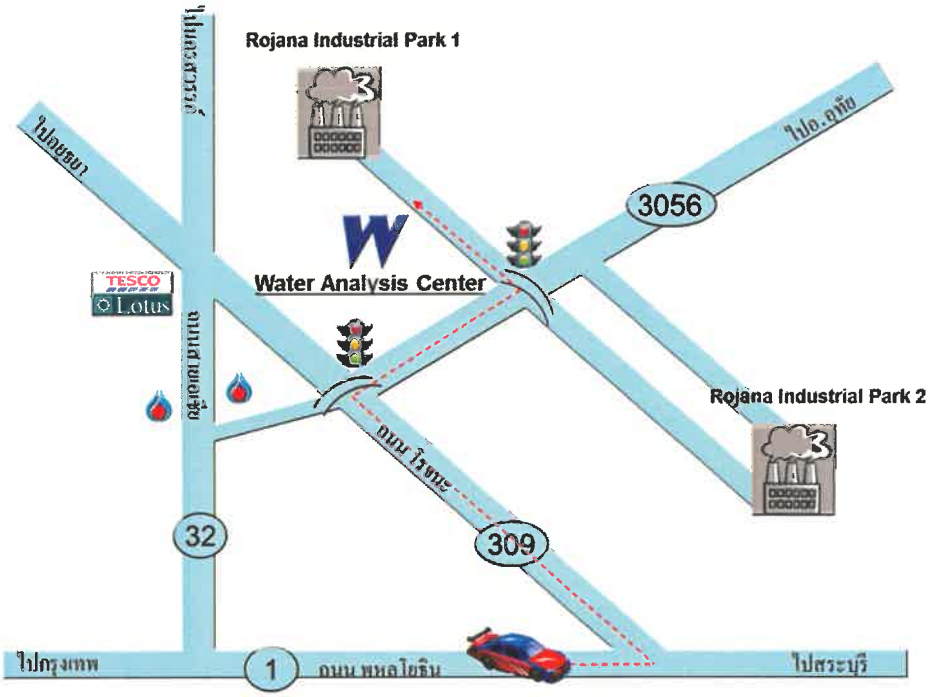

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด

1/94 หมู่ที่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210

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