

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 18, 2023
Project Site				Start Time	12:05 PM
Sampler Number	TSP No.14	Transfer Standard Type	Orifice	Stop Time	11:15 AM
Motor Serial Number	BL-14	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

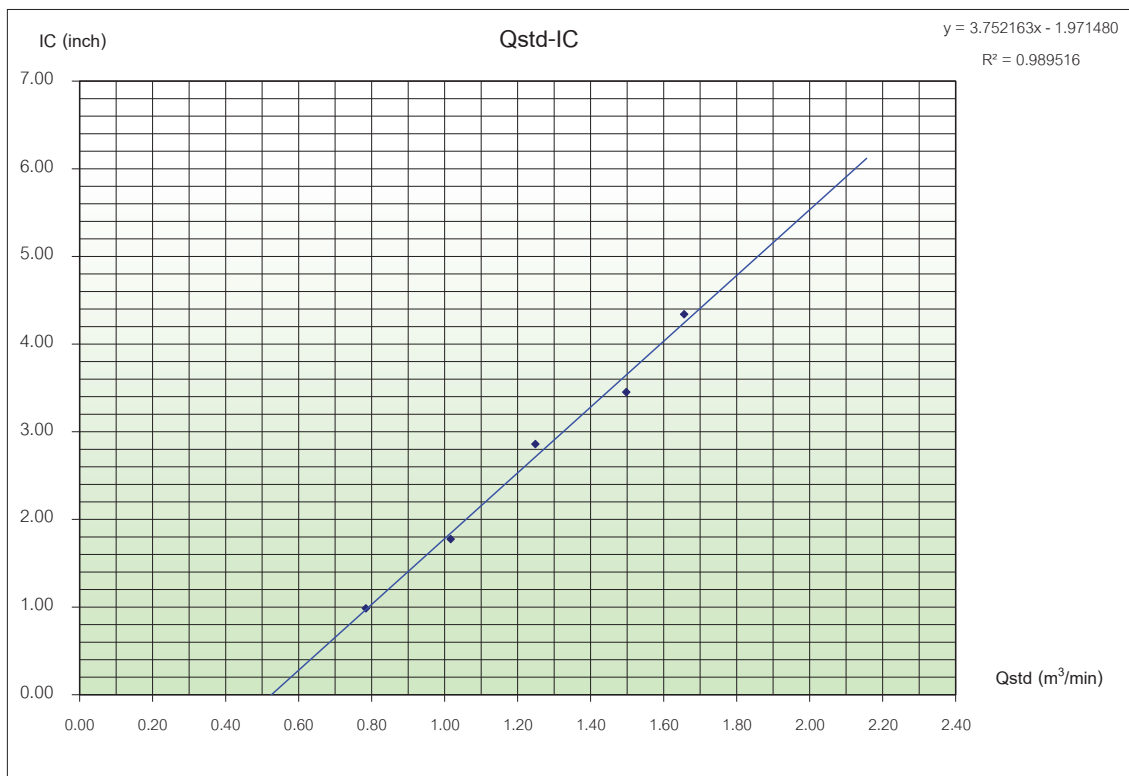
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)					
5	1.2	1.2	2.4	1.52829	0.78422	1.0	0.99	305.0	757.0		
7	2.0	2.0	4.0	1.97301	1.01664	1.8	1.78	305.0	757.0		
10	3.0	3.0	6.0	2.41643	1.24838	2.9	2.86	305.0	757.0		
13	4.3	4.3	8.6	2.89300	1.49744	3.5	3.45	305.0	757.0		
18	5.2	5.3	10.5	3.19664	1.65612	4.4	4.34	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	1.91345	Linear Equation		Average	305.0	757.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r ²	0.963579	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate (I)	0	r	0.9816206	T _{NTP}	298.0	
Result								$C=(Pa/P_{std})(T_{std}/Ta)^{0.5}$	
								0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By ...

Field Environmental

Approved By

Division Manager



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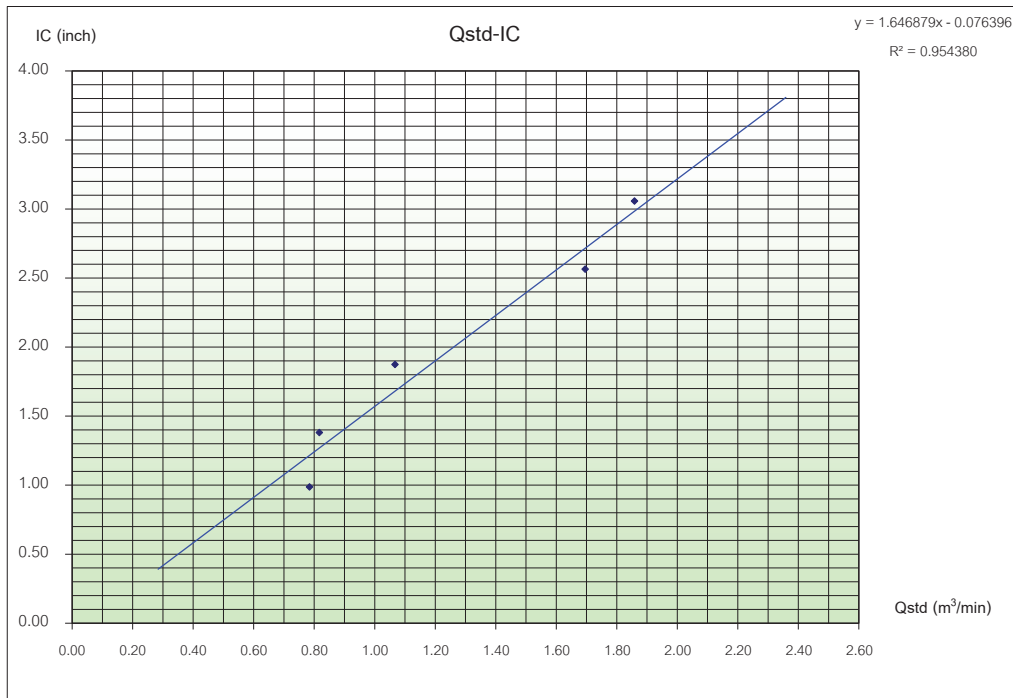
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 18, 2023
Project Site				Start Time	10:00 AM
Sampler Number	TSP No.1	Transfer Standard Type	Orifice	Stop Time	9:10 AM
Motor Serial Number	BL-01	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A)-(b)]$	sample Flow Rate Indication	$IC = [(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)			
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)						
5	1.2	1.2	2.4	1.52829	0.78422	1.0	0.99	305.0	757.0			
7	1.3	1.3	2.6	1.59069	0.81683	1.4	1.38	305.0	757.0			
10	2.2	2.2	4.4	2.06931	1.06696	1.9	1.87	305.0	757.0			
13	5.5	5.5	11.0	3.27187	1.69544	2.6	2.56	305.0	757.0			
18	6.6	6.6	13.2	3.58415	1.85864	3.1	3.06	305.0	757.0			
Linear Regression Y ON X : Y= mX + b								Average	305.0	757.0		
1	Slope (m)			1.91345	Linear Equation			r^2	0.992314	Pstd(mmHg)	760	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9961496	T _{NTP}	298	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.973192407		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By
 Field Environmental

Approved By
 Division Manager



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.

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TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 18, 2023
Project Site				Start Time	1:15 PM
Sampler Number	TSP No.13	Transfer Standard Type	Orifice	Stop Time	12:20 PM
Motor Serial Number	BL-13	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

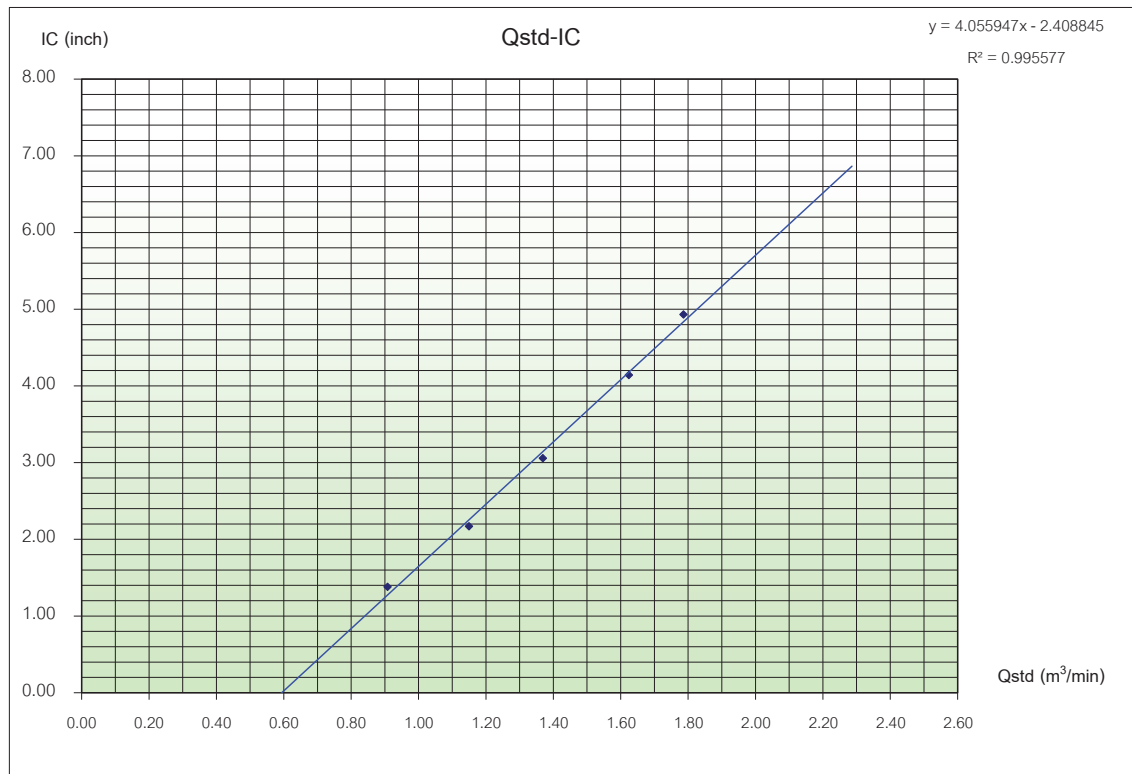
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$				
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)		(°K = °C+273)	(mmHg)		
5	1.6	1.6	3.2	1.76471	0.90778	1.4	1.38	305.0	757.0		
7	2.5	2.6	5.1	2.22784	1.14981	2.2	2.17	305.0	757.0		
10	3.6	3.6	7.2	2.64707	1.36891	3.1	3.06	305.0	757.0		
13	5.0	5.1	10.1	3.13516	1.62399	4.2	4.14	305.0	757.0		
18	6.1	6.1	12.2	3.44571	1.78629	5.0	4.93	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

			Average			
1	Slope (m)	1.91345	Linear Equation		r^2	0.930028
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9643796
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate (I)	0	(Pa/Pstd)*(Tstd/Ta)	0.973192407
Result					$C=(Pa/Pstd)*(Tstd/Ta)^{0.5}$	0.986505148

COMMENT

Andersen Instruments, Inc.



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Field Environmental

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Division Manager



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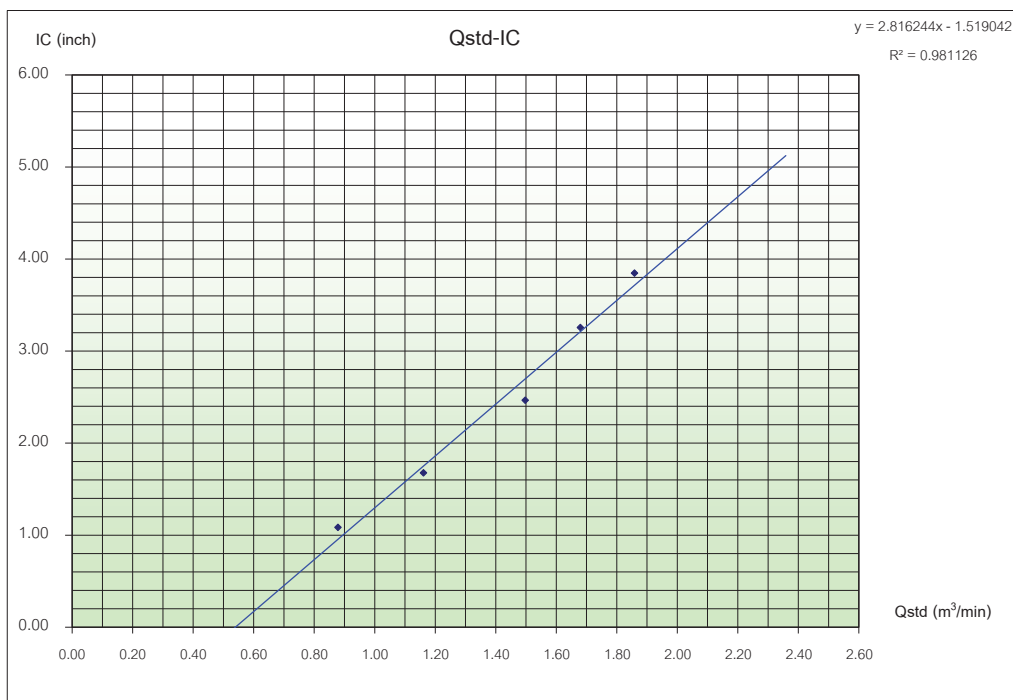
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 18, 2023
Project Site				Start Time	10:45 AM
Sampler Number	TSP No.10	Transfer Standard Type	Orifice	Stop Time	10:00 AM
Motor Serial Number	BL-10	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	sample Flow Rate Indication (inch)	$IC = [(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O								
5	1.5	1.5	3.0	1.70868	0.87849	1.1	1.09	305.0	757.0		
7	2.6	2.6	5.2	2.24958	1.16117	1.7	1.68	305.0	757.0		
10	4.3	4.3	8.6	2.89300	1.49744	2.5	2.47	305.0	757.0		
13	5.4	5.4	10.8	3.24199	1.67982	3.3	3.26	305.0	757.0		
18	6.6	6.6	13.2	3.58415	1.85864	3.9	3.85	305.0	757.0		
Linear Regression Y ON X : Y= mX + b							Average	305.0	757.0		
1	Slope (m)			1.91345	Linear Equation			r ²	0.9857	Pstd(mmHg)	760
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9928243	T _{NTP}	298
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)^0.5		0.973192407	
Result		C=(Pa/Pstd)*(Tstd/Ta)^0.5 0.986505148									

COMMENT

Andersen Instruments, Inc.



Calibrated By
Field Environmental

Approved By
Division Manager

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 601114773
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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

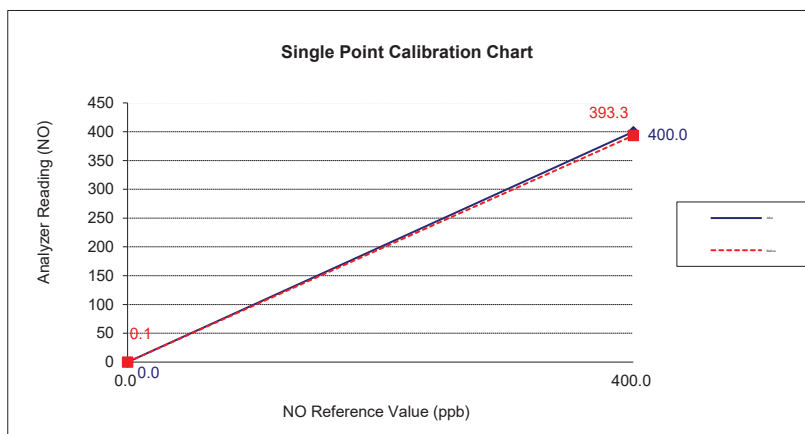
Humidity: 51 %RH

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	396.4	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 :

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 72706371
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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

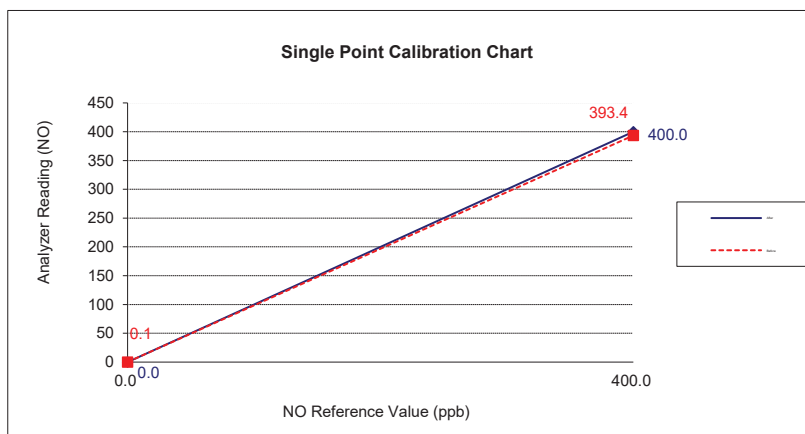
Humidity: 51 %RH

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	396.7	400.0	-0.8

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 :

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 40	Manufacturer ECOTECH S/N: E020040
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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

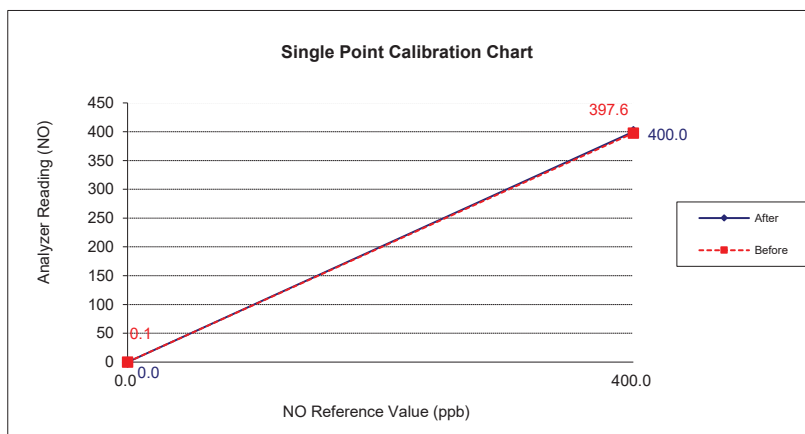
Humidity: 51 %RH

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	397.6	400.0	-0.6
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 :

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 72706374
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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 46.05 PPM SO2 Conc 46.01 PPM CO Conc 4,487 PPM Cylinder number CC507080 Expire Date: 23 Jul. 2025

Environment: Temperature 25.5 °C

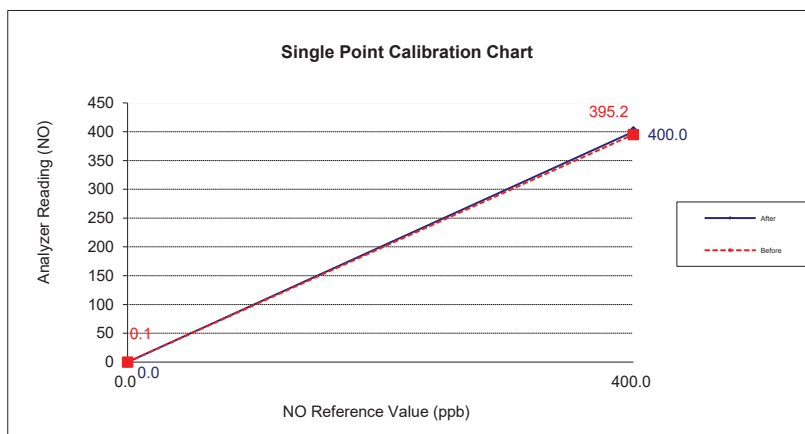
Humidity: 51 %RH

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	395.2	400.0	-1.2
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 :

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: 193
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Calibration System

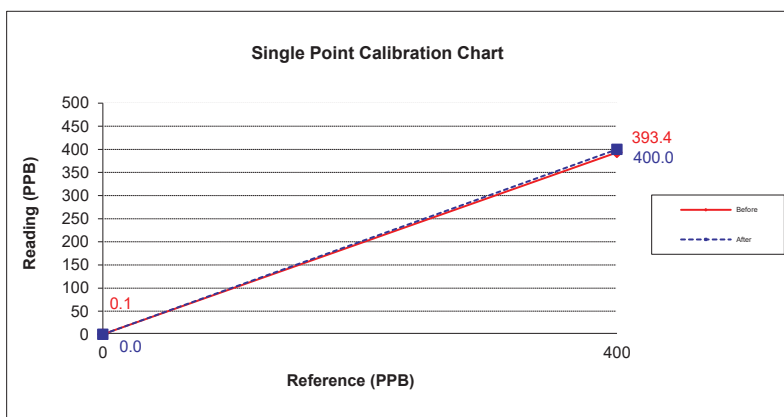
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By





บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: SO2 Analyzer Model: 50	Manufacturer ECOTECH S/N: E020050
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Calibration System

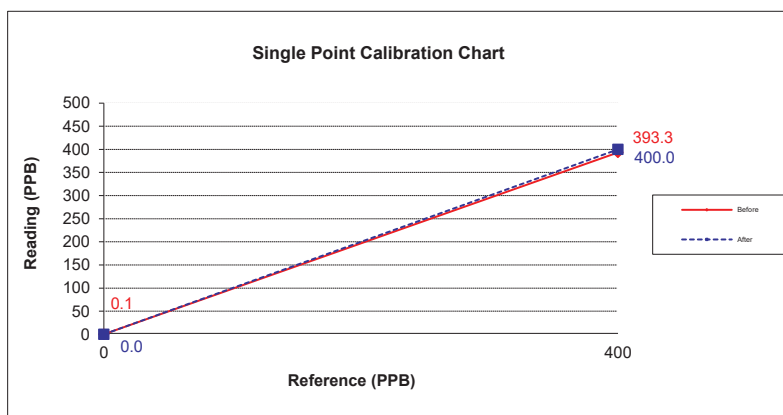
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 71354368
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Calibration System

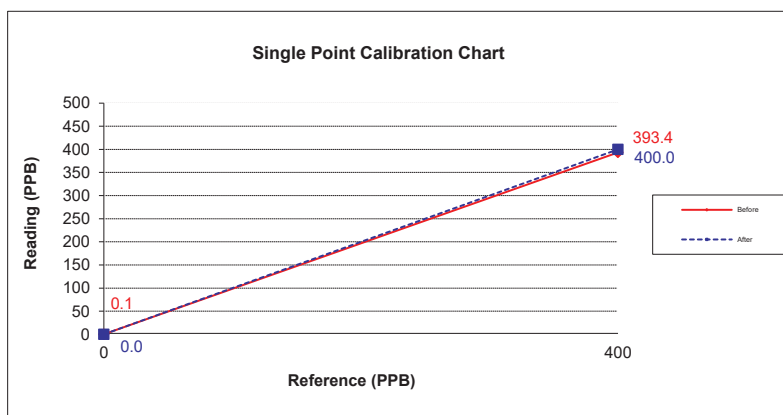
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 17 April 2023

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 335003719
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Calibration System

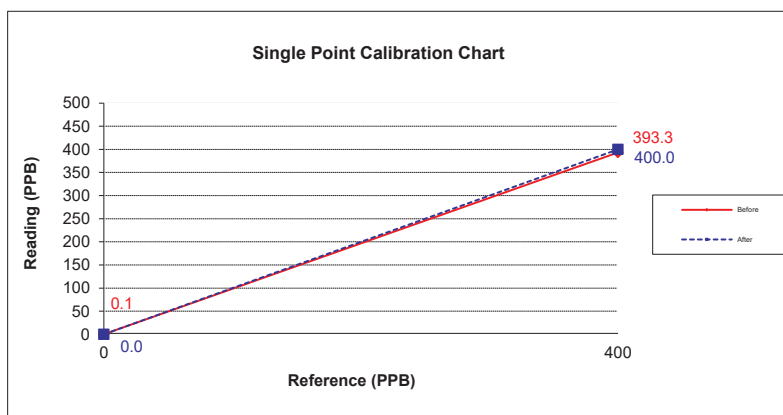
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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 :



Calibration Report

Certificate Number : SPR22020541-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Measuring Receiver	8902A	2950A02471	EF-0005-22	01 Feb 2023
AUDIO Analyzer	8903B	3011A09975	EL05615/22	22 Feb 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
NIMT - The National Institute of Metrology, Thailand.

PCAL - Professional Calibration & Services Co.,Ltd



Result of Calibration

Certificate No. : SPR22020541-6

Page : 3 of 3

Function : Sound Level

UUC Setting (\pm dB)	Standard Reading (dB)	Error (dB)	Uncertainty (\pm dB)
94	94.04	-0.04	1.5
114	113.95	0.05	1.5

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The 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 -



Certificate of Calibration

Certificate Number : SPR23010010-1

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial Number : 00722042

ID. Number : SLM-46

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 04 Jan 2023

Calibration Date : 06 Jan 2023

Recommend Due Date : 06 Jan 2024

Date of Issue : 07 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23010010-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Certificate of Calibration

Certificate Number : SPR23010010-3

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 79210

ID. Number : SLM-39

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 04 Jan 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 06 Jan 2023

Location of Calibration : In-Lab

Recommend Due Date : 06 Jan 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 07 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23010010-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23010010-3

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

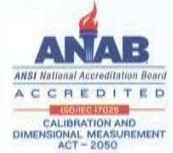
Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The 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 -



Certificate of Calibration

Certificate Number : SPR23010010-4

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 76239

ID. Number : SLM-35

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 04 Jan 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 06 Jan 2023

Location of Calibration : In-Lab

Recommend Due Date : 06 Jan 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 07 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23010010-4

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23010010-4

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The 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 -



Certificate of Calibration

Certificate Number : SPR23010010-5

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 76238

ID. Number : SLM-47

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 04 Jan 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 06 Jan 2023

Location of Calibration : In-Lab

Recommend Due Date : 06 Jan 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 07 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23010010-5

Page : 2 of 3

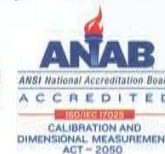
Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23010010-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The 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 -

Certificate of Calibration

Certificate No. : 66-200067-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance

Manufacturer : METTLER TOLEDO **Model :** AG285

Serial No. : 1122140126 **ID No. :** MET-EB01/46

Capacity : 210 g **Resolution :** 0.00001g/81g, 0.0001g/210g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (26.4 to 26.8) °C

Relative Humidity : (54.9 to 58.8) %

Air Pressure : 1013.0 mbar

Date of Received : 02 March 2023

Date of Calibration : 02 March 2023

Date of Issue : 13 March 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 66-200067-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.01	0.00001	0.000020
0.1	0.00000	0.000019
1	-0.00002	0.000031
5	-0.00004	0.000043
10	-0.00008	0.000054
20	-0.00027	0.000071
50	-0.00059	0.00011
100	-0.0009	0.00023
150	-0.0012	0.00038
200	-0.0019	0.00040

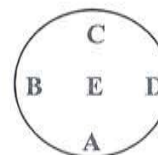
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.43$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E
0.00055 0.00027 -0.00015 -0.00018 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.000053 g

- oOo -



Certificate of Calibration

Certificate No. : 65-400424-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)
Manufacturer : Binder Model : ED53
Range : N/A °C Resolution : 1 °C
Serial No. : 13-07419 ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (27.0 to 28.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400272-1	24 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 65-400424-2

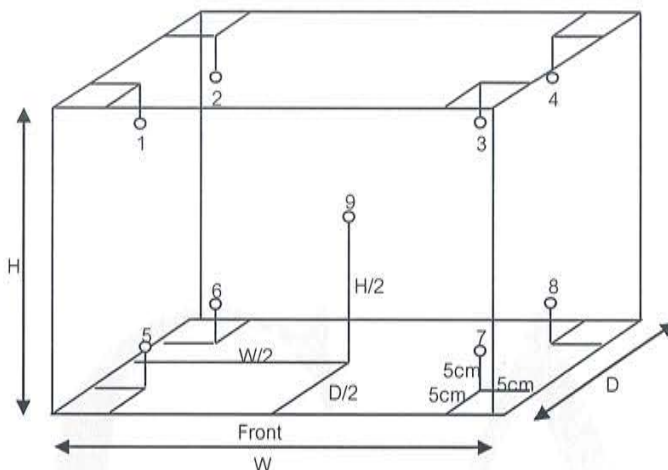
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	105.0	105.0	104.7	105.0	104.4	104.5	104.0	103.7	104.2	0.95
180	184	184	180.8	182.0	179.4	180.8	180.8	180.8	180.3	180.0	180.0	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.0	0.2	1.7
180	184	184	2.3	0.3	3.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -





Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06220514
Model:	SP-2100	Issued Date:	17 October 2022
Serial No. (or ID.):	KJ0G05083001 (MET-SP 01/46)	Job No.:	KSPR2212976
Manufacturer:	Spectrum	Page:	1 of 2
Condition:	In Condition		

Customer: M E T CO.,LTD.
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand

Environment Condition:

Temperature	23.9	°C	±	0.2	°C
Humidity	60.5	%RH	±	1.8	%RH

Calibration Place: M E T CO.,LTD. (Laboratory Room)
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand

Calibration By: Mr. Atachai Ngamchanat
Calibration Date: 17 October 2022
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.
The standard for Wavelength Certificate No. 103124 and 103123
The standard for Photometric Certificate No. 9112739



Person in charge



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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 4 nm and UUC at 4 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
334.22	334	0.22	0.59
418.48	419	-0.52	0.59
536.90	537	-0.10	0.59
637.94	638	-0.06	0.59
748.28	748	0.28	0.59
879.70	879	0.70	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2899	0.287	0.0029	0.0045
	0.5170	0.514	0.0030	0.0045
	1.0286	1.026	0.0026	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2837	0.280	0.0037	0.0045
	0.5074	0.505	0.0024	0.0045
	1.0071	1.005	0.0021	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2487	0.246	0.0027	0.0045
	0.4593	0.457	0.0023	0.0045
	0.9322	0.929	0.0032	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2434	0.241	0.0024	0.0045
	0.4649	0.462	0.0029	0.0045
	0.9457	0.941	0.0047	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2570	0.256	0.0010	0.0045
	0.5035	0.502	0.0015	0.0045
	1.0022	0.999	0.0032	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2560	0.255	0.0010	0.0045
	0.4968	0.495	0.0018	0.0045
	0.9713	0.969	0.0023	0.0045

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212976

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: SP-2100

หมายเลขเครื่อง: KJ0G05083001

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
17 Oct 2022			17 Oct 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		<i>General</i>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<i>Spectrophotometer</i>			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<i>pH Meter and Conductivity Meter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Turbidimeter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Automatic titrator</i>			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Service Engineer

METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING REFERENCE METER # WET TEST METER W-NK5A No. 546321
5-POINT METRIC UNIT SMILE LABORATORY Co.,Ltd.

☒ Preventive maintenance and check

Meter Console Information	
Console Model Number	XC572
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032

Calibration Conditions	
Date	13-Jan-2023
Calibration Reference No.	3APE660015
Barometric Pressure	758
Calibration Meter Gamma	1.0010
	mm Hg
	unitless

Factors/Conversions	
Std Temp	293
Std Press	760
K ₁	0.386
Console Leak Check	
	PASS

Calibration Data									
Metering Console				Calibration Meter					
Run Time	DGM Orifice ΔH	Volume Initial (V _{mi})	Volume Final (V _{mf})	Outlet Temp Initial (t _{mi})	Outlet Temp Final (t _{mf})	Volume Initial (V _{wi})	Volume Final (V _{wf})	Outlet Temp Initial (t _{wi})	Outlet Temp Final (t _{wf})
Elapsed (θ) min	(P _{mi}) mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	4058.4148	4058.5657	24	24	333.84384	334.01994	24.8	24.9
10.00	25.0	4058.5657	4058.7124	24	24	334.01994	334.17503	24.9	25.0
8.00	50.0	4058.7124	4058.8827	24	24	334.17503	334.34383	25.0	25.1
7.00	80.0	4058.8827	4059.0772	24	24	334.34383	334.52497	25.1	25.2
5.00	120.0	4059.0772	4059.2498	24	24	334.52497	334.68887	25.2	25.3

Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		ΔH @	
(V _{ref}) m ³	(Q _{ref}) m ³ /min	(V _{wi}) m ³	(Q _{wi}) m ³ /min	Value (Y)	Variation (ΔY)	Std & Corr (Q _{mp}) m ³ /min	Std & Corr (ΔH) mm H ₂ O	Variation ($\Delta \Delta H$)	
0.149	0.010	0.173	0.012	1.16341	0.152	0.012	43.5	-7.0	
0.145	0.014	0.152	0.015	1.05231	0.041	0.015	48.1	-2.4	
0.168	0.021	0.166	0.021	0.98391	-0.027	0.021	52.3	1.7	
0.193	0.028	0.178	0.025	0.92149	-0.090	0.025	56.0	5.4	
0.172	0.034	0.161	0.032	0.93569	-0.076	0.032	52.7	2.2	
				1.01136	Y Average		50.5	ΔH @ Average	

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

Note: For ΔH_{10} , orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

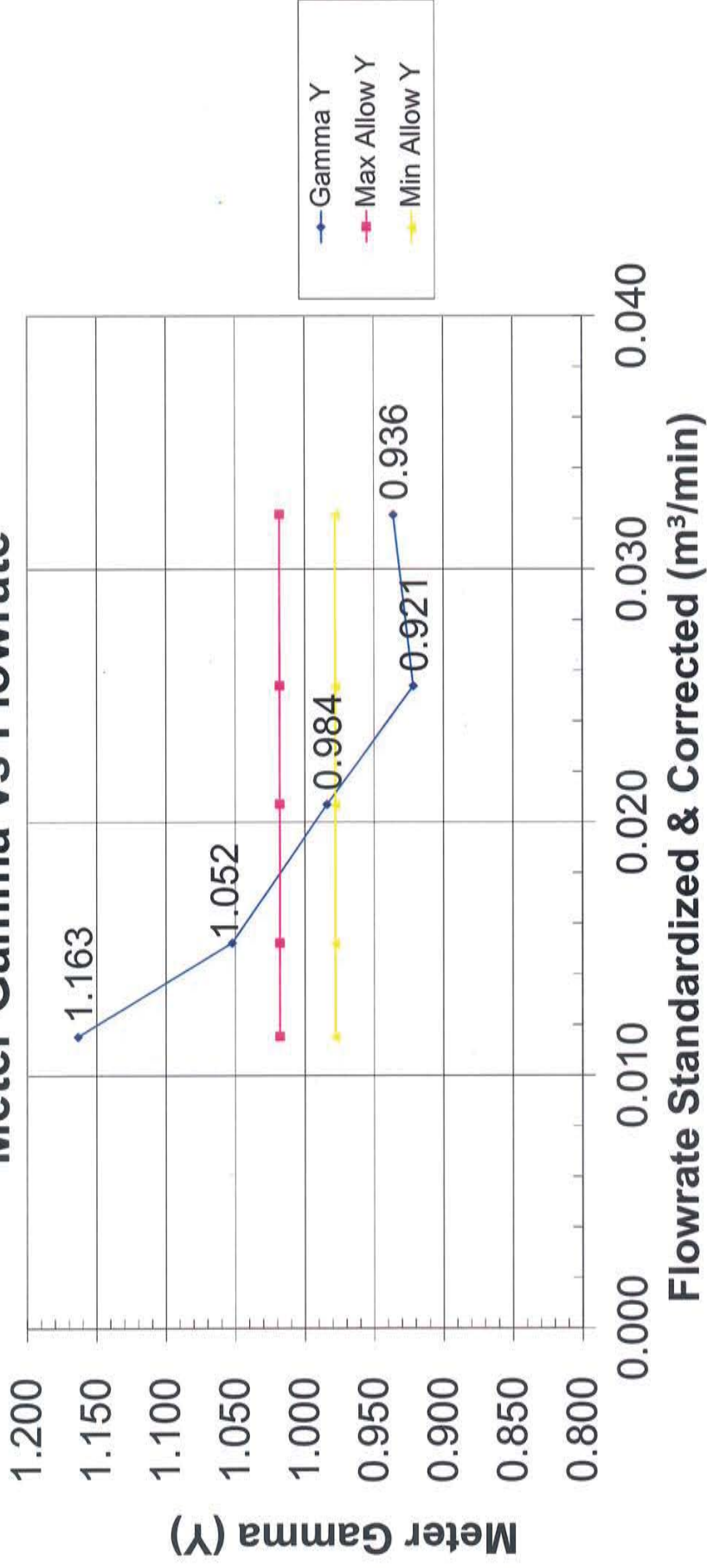
Signature _____

Service Engineer

Date _____

13 / 1 / 66

Meter Gamma vs Flowrate



Meter Pressure vs Flowrate



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Meter Box Model Number	JENCO
Meter Box Serial Number	

Calibration Conditions			
Date	Time	13-Jan-23	11:00 AM
Calibration Reference No.		3APE660015	
Barometric Pressure		758	mm Hg
Reference Thermometer		FLUKE 714	
Serial Number		9038005	

Results												
Console Thermocouple Simulator												
Channal and test point	Meter Box Channal Temperature Reading (°C)											
	-18.0	0.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-17	0.0	25	37	92	148	258	372	483	595	817	1038
Probe	-17	0.0	25	37	92							
Filter	-17	0.0	25	37	92							
Aux	-17	0.0	25	37	92							
Exit	-17	0.0	25	37	92							

Tolerance Range

Stack ± 1.50% Absolute
 Probe ± 3.0 °C
 Filter ± 3.0 °C
 DGM Outlet ± 2.0 °C

Aux ± 3.0 °C
 Imp. Outlet ± 2.0 °C
 DGM Inlet ± 2.0 °C

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HEATER SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Probe Heater	Standard Method 5 Assemblies
Heated Filter Box Model	-

Calibration Conditions			
Date	Time	13-Jan-23	11:00 AM
Calibration Reference No.	3APE660015		
Barometric Pressure	758	mm Hg	

Results				
System Heat	Control Acceptance	Reference thermometer temperature	Thermocouple potentiometer temperature	Temperature difference
	°C	°C	°C	%
Probe Heater System for 6ft. Probe	120 °C \pm 14 °C	117	120	-0.77
Filter Holder	121 °C \pm 14 °C	113	120	-1.81

Note: Check Acceptance Limits, capable of maintaining 120 °C \pm 14 °C at 20-lpm flow rate

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PITOT TUBE CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Pitot tube Number	

Calibration Conditions			
Date	Time	13-Jan-23	11:00 AM
Calibration Reference No.	3APE660015		
Barometric Pressure	758	mm Hg	
Pitot Tube Type	S		
size (OD)	3/8	inch	
Standard Pitot Tube ID Number	160-12		
C _p (std)	0.84		

Results				
"A" SIDE CALIBRATION				
RUN No.	Δp std	Δp (s)	Cp (s)	DEVIATION Cp(s)-Cp(A)
	mm	mm		
1	7.4	7.37	0.842	-0.002
2	11.2	11.04	0.846	0.003
3	15.5	15.43	0.842	-0.001
	AVERAGE	Cp (SIDE A)	0.843	0.001

Results				
"B" SIDE CALIBRATION				
RUN No.	Δp std	Δp (s)	Cp (s)	DEVIATION Cp(s)-Cp(B)
	mm	mm		
1	7.4	7.13	0.856	0.021
2	11.2	11.88	0.816	-0.019
3	15.5	15.76	0.833	-0.002
	AVERAGE	Cp (SIDE B)	0.835	0.001

$$[CpA (SIDE A) - Cp (SIDE B)] = 0.008 \quad (\text{must be } \leq 0.01)$$

Note: Average deviation must be < 0.01

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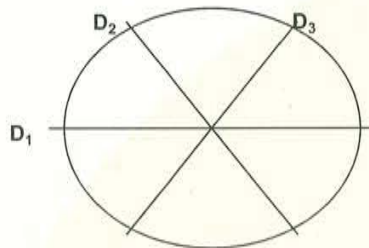
Web site : www.sithiphorn.com # E-mail: service2-env@sithiphorn.com

NOZZLE CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC572V	Date	Time	13-Jan-23	11:00 AM
Console Serial Number	0509047	Calibration Reference No.		3APE660015	
DGM Model Number	SK25	Barometric Pressure		758 mm Hg	
DGM Serial Number	8001032	Calibration		Vernier ,0-150mm	0.01 mm increments
		Method Reference		US.EPA Method	

Calibration Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
4	3.2	2.98	2.97	2.99	0.020	2.980
6	4.8	3.96	3.99	3.97	0.030	3.973
8	6.4	5.98	5.95	5.98	0.030	5.970
10	8.0	7.07	7.27	7.18	0.200	7.173
12	9.5	8.99	9.20	9.46	0.470	9.217
14	11.1	10.40	10.90	10.52	0.500	10.607
16	12.7	12.31	12.34	12.49	0.180	12.380

D₁, D₂, = There difference nozzle diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm
ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm
Davg = $(D_1 + D_2 + D_3) / 3$



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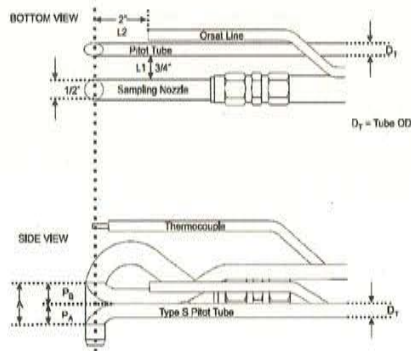
Sampling Probe and Pitot validation

Sampling System Equipment Information	
Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	N/A
Pitot tube Number	N/A
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe validation, with pitot tubs (S)

Calibration Conditions and Equipment	
Reference No.	
Digital Calipers	0-150 mm.
Digital Inclinator	Laserline s/n. ADJ21L0270
Temperature	25.0 °C
Relative Humidity	60.0 % RH
Validation Date	15 Sep. 2023

Sampling Probe Validation with Tune up

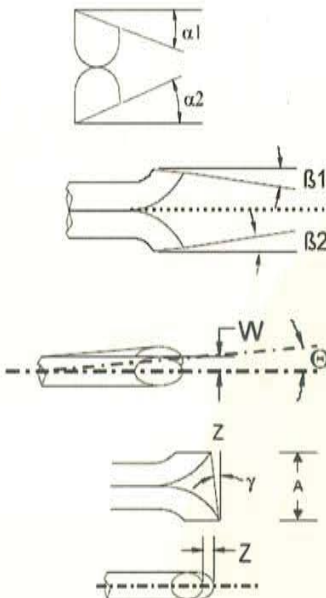
☒ : Measure and Alinment with 1/2" Sampling Nozzle(12.7 mm)



Measured	Standard Range	
L1 =	19.24 mm.	(19.05 mm. or 3/4 in.)
L2 =	53.74 mm.	(50.8 mm. or 2.0 in.)
DT =	9.6 mm.	(9.525 mm., 3/8 in.)
A =	21.64 mm	(2.1 DT ≤ A ≤ 3DT)
A/2DT =	1.127 mm.	(1.05 PA / DT ≤ A ≤ 1.5)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



	PB Size	Standard Range	
α1 =	0.5 °	≤ 10°	
β1 =	0.7 °	≤ 5°	
	PA Size		
α2 =	0.3 °	≤ 10°	
β2 =	0.1 °	≤ 5°	
Engles measurement		Calculated Result	Standard Range
W =	0.9 °	0.354 mm	W < 0.794 mm (1/32 in.)
Z =	0.4 °	0.151 mm	Z < 3.175 mm (1/8 in.)

Can be use 0.84 for Cp(s) if the type of face-opening misafgnment show above with not affect the base line value of Cp(s)
Solong as standard range.

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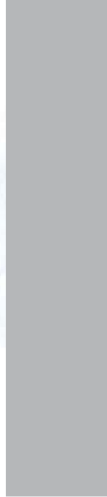
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กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

ขอมอบประกาศนียบัตรนี้เพื่อแสดงว่า



ได้ผ่านการฝึกอบรมและทดสอบผู้ตรวจวัดความที่บแสงของเขม่าควันด้วยสายตา
และการใช้แผนภูมิเขม่าควันของริงเกลมานน์ ประจำปี ๒๕๖๑

ระหว่างวันที่ ๒๒ - ๒๓ มีนาคม ๒๕๖๑

จัดโดย สำนักจัดการคุณภาพอากาศและเสียง กรมควบคุมมลพิษ
ให้ไว้ ณ วันที่ ๒๓ มีนาคม ๒๕๖๑



อธิบดีกรมควบคุมมลพิษ

GC-OQ

System ID: CN2138A118_MET
Organization Name: MET Company Limited
Organization Location: 36/659 Moo 6 Tambol Bangrakpattana Nonthaburi 11110 Thailand

Date: March 28, 2023 1:45:04 PM
EQP Name: AgilentRecommended
EQP Revision: GC.02.52
Overall Qualification Status: Pass

Logon: Saenguthai Tarak

Overall CDS Logon Verification - GC Test Status

Pass

Name: 8890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Name: 8890

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi /5 minutes

Agilent Recommended: ≥ -2.0 and ≤ 0.5

Date: March 28, 2023 1:45:04 PM

System ID: CN2138A118_MET

Overall Inlet Pressure Decay Test Status

Pass

Name: 8890
Front 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

Name: 8890
Front FID

Setpoint Status: Pass

Flow Type:	Fuel				
Setpoint:	30.0	mL/min	Measured Flow:	30.1	mL/min
Accuracy:		0.1	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:	389.2	mL/min
Accuracy:		10.8	mL/min		
Agilent Recommended:		<= 10.0	% setpoint	(40.0	ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: \leq 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

Name: 8890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.3 °C

Accuracy: 0.3 °C

Agilent Recommended: \geq -1.0 % setpoint in K (-5.0 °C)

\leq 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.3 °C

Accuracy: 0.3 °C

Agilent Recommended: \geq -1.0 % setpoint in K (-3.7 °C)

\leq 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

Name: 8890

Setpoint Average

Temperature: 100.0 100.2167 °C
Stability: 0.1 °C
Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Tested Combination1 Front SSL / Front FID
Injection Tower
Name: 7693A

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Tested Combination1 Front SSL / Front FID
Name: 8890

Setpoint Status: Pass

Base Signal: 8.9 pA

ASTM Noise

Drift

pA

pA/Hr

0.05

0.94

Agilent Recommended: <= 0.10

<= 2.50

Status: Pass

Pass

Overall Noise and Drift Test Status

Pass

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Tested Combination1	Front	SSL	/ Front	FID
Name:	7693A			
Setpoint Status:	Pass			
Injection Volume on Column:	1.0	uL		
Area RSD:	0.44	%	Retention Time RSD:	0.17 %
Agilent Recommended:	<= 3.00		<= 1.00	

Overall Injection Precision Test Status

Pass

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	8890			
Setpoint Status:	Pass			
Signal to Noise:	2198451			
Agilent Recommended:	>= 300000			

Overall Signal to Noise Test Status

Pass

This section describes the as found system configuration.

System

System ID	CN2138A118_MET
Manufacturer	Agilent Technologies
Name	8890
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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4514A
Serial Number	CN22047055
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN22047055
Firmware Revision	A.11.03
Vial Heater	Not installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	8890
Model Number	G3540A
Serial Number	CN2138A118
Firmware Revision	2.5.1.9
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	8890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	8890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

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Date:	March 28, 2023 1:45:04 PM
System ID:	CN2138A118_MET

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:26:58 PM	Audit	SessionCreated	Session	None
March 28, 2023 12:26:58 PM	Audit	Entitlement	Licensing	Session identifier generated: 0800-0002-0000-08HM-Q85 G
March 28, 2023 12:26:58 PM	Start	Configuration	Session	None
March 28, 2023 12:32:02 PM	Audit	Entitlement	Licensing	Successfully unlocked session identified by 0800-0002-0000-08HM-Q85 G with unlock code: xb1b-ckbx-4v0e-kzg1-0c4g
March 28, 2023 12:39:59 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended].Protocol Revision :[Gc.02.52]
March 28, 2023 12:40:04 PM	End	Configuration	Session	None
March 28, 2023 12:40:11 PM	Start	Qualification	Session	OQ
March 28, 2023 12:40:12 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
March 28, 2023 12:43:12 PM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
March 28, 2023 12:43:15 PM	Start	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	None

Page 1 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 9 / 14

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:43:31 PM	End	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	Run Count : 1
March 28, 2023 12:43:34 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 28, 2023 12:43:41 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
March 28, 2023 12:43:43 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 28, 2023 12:43:48 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 28, 2023 12:43:50 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:44:12 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 28, 2023 12:44:20 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:44:22 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:44:42 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

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Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

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CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:44:47 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:44:52 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:45:03 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 28, 2023 12:45:07 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:45:09 PM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 28, 2023 12:45:28 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 28, 2023 12:45:30 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 28, 2023 12:45:31 PM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 28, 2023 12:45:48 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:45:51 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 28, 2023 12:45:53 PM	Start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 28, 2023 12:46:53 PM	Audit	Data	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 28, 2023 12:46:57 PM	End	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 28, 2023 12:47:01 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 28, 2023 12:50:08 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 28, 2023 12:51:05 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\Data\SC011.D\FID1A.ch
March 28, 2023 12:51:52 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 28, 2023 12:51:57 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

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Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

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CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:52:26 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\Data\ND012.D\FID1A.ch
March 28, 2023 12:53:21 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 28, 2023 12:53:28 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0107.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0108.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0109.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0110.D\FID1A.ch
March 28, 2023 1:12:24 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0111.D\FID1A.ch

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Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

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CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 1:12:25 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0112.D\FID1A.ch
March 28, 2023 1:13:38 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
March 28, 2023 1:13:49 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 28, 2023 1:16:08 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\Data\SN01.D\FID1A.ch
March 28, 2023 1:17:06 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 28, 2023 1:17:14 PM	End	Qualification	Session	OQ
March 28, 2023 1:17:14 PM	Start	Reporting	Session	None
March 28, 2023 1:43:49 PM	Audit	Reporting	Session	Report Generated : Certificate

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Metrohm

Compliance Service

Calibration Certificate (CC) for 925 Eco IC

Instrument details

Type:	19250020
Serial No.:	221685/ME (1925002004284)
Manufacturer:	Metrohm AG Ionenstrasse CH-9100 Herisau Switzerland
Firmware:	5.850.0113
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 08:45
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Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 925 Eco IC, Version 1.1
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Multimeter	Fluke	88490190	E1U222184	25/05/2023
High pressure gauge	Metrohm	05108	CAL0252-21Q0119	22/09/2022

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

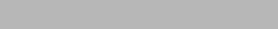
Conclusion of test results

	Yes	No
Instrument satisfies the specified technical requirements	<input checked="checked" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

Comments

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There is a thick grey header bar at the top, and the bottom edge of the paper is slightly irregular, suggesting it might be a scan of a physical document.

Metrohm representative

Metrohm representative		Yes	No
Metrohm representative confirms correct execution of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Mr.Prutchaya Kumpaiee		

Customer representative

		Yes	No
Customer representative accepts results of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Khun Sasithorn Suwanwiko		

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Visual test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101	Safety test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102	LED		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103	Fan		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105	Column plug interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
106	IC pump				
106.1	Installation		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.2	Pump head detection		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.3	Dearate		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.4	Pump dynamics		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

No.	Title	Comments	Pass				
			Yes	No	N/A		
106.5 Pulsation	Standard pump head Macro pump head						
		Maximum [MPa]	Minimum [MPa]	Difference [%]			
		11.71	11.32	<5.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		N/A	N/A	<10.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.6 Pressure transducer							
	Nominal value [MPa]	Measured value [MPa]	Tolerance [%]				
	11.66	12	± 10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
106.7 Flow rate	Standard pump head Macro pump head						
		Nominal value [mL]	Measured value [mL]	Tolerance [mL]			
		4.0	4.0	± 0.2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		20.0	N/A	± 1.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.8 Shut off at minimum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.9 Shut off at maximum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.10 Leak test							
	Maximum [MPa]	Minimum [MPa]	Difference [MPa]				
	19.20	18.75	<1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

No.	Title	Pass		
		Yes	No	N/A
107	Injector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	107.1 Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Pass		
		Yes	No	N/A
108	MSM	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	108.1 Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
109	Peristaltic pump		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	109.1 Rotation CW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	109.2 Rotation CCW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	109.3 Speed control		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CC.925 Document history

Date	Version	Author	Description/Changes
14.12.2016	1.0	pr	Creation of document 8.925.3002EN
31.03.2021	1.1	pr	Test no. 103 Fan depends on the installed power supply version according C.3 notice of modification CRM-28908.

End of CC Document

Metrohm

Compliance Service

Calibration Certificate (CC) for 850.9010 Conductivity Detector

Instrument details

Type:	18509010
Serial No.:	221686/ME (1850901073408)
Manufacturer:	Metrohm AG, Ionenstrasse, CH-9100 Herisau Switzerland
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Control device details

Type:	19250020
Serial No.:	1925002004284
Firmware:	5.850.0113

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 08:45
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Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 850.9010 Conductivity Detector, Version 1.3
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Temperature meas. Instr.	Fluke	82090101	TMU221923	10/06/2023
Conductivity standard (opt.)	Metrohm	20590015	12-0488	12/02/2023

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Yes	No
Instrument satisfies the specified technical requirements	<input checked="checked" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

[illegible]

		Yes	No
Metrohm representative confirms correct execution of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Mr.Prutchaya Kumpairee		

		Yes	No
Customer representative accepts results of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Khun Sasithorn Suwanwiko		

Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title					Pass		
101	Temperature absolute							
		Nominal value [°C]	Measured value [°C]	Tolerance [°C]				
	Temperature 1	34.999	35.3	± 1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Temperature 2	40.001	40.3	± 1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

No.	Title						Pass		
102	Temperature stability								
		Maximum t [°C]	Minimum t [°C]	Difference [°C]					
		40.001	39.998	< 0.010	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

No.	Title						Pass		
103	Signal noise								
		Drift compensated [nS/cm]		Tolerance [nS/cm]					
	1 M	0.188		< 0.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	20 k 5	5.221		< 10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

No.	Title	Comments	Pass		
			Yes	No	N/A
104	Conductivity dry test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

No.	Title	Pass		
		Yes	No	N/A
105	Conductivity cell (optional)			
105.1	System installation and preparation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105.2	Write a method	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105.3	Measurement			
	Nominal value [μS/cm]	Measured value [μS/cm]	Tolerance [%]	
	91.32	91.44	± 10	<input checked="" type="checkbox"/>

CC.850 Document history

Date	Article No.	Author	Description/Changes
26.04.2012	8.850.3022EN	Philipp Rüegg	Layout adapted to Metrohm Compliance Service

End of CC Document

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Metrohm

Compliance Service

Calibration Certificate (CC) for 863 Compact Autosampler

Instrument details

Type:	18630010
Serial No.:	221687/ME (1863001064113)
Manufacturer:	Metrohm AG Ionenstrasse CH-9100 Herisau Switzerland
Firmware:	5.863.0022
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 09:50
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Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 863 Compact Autosampler, Version 1.0
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Multimeter	Fluke	88490190	E1U222184	25/05/2023

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

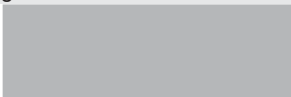
Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Conclusion of test results

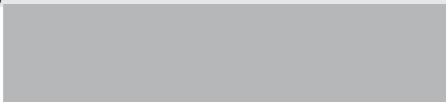
	Yes	No
Instrument satisfies the specified technical requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

Comments

Metrohm representative

	Yes	No
Metrohm representative confirms correct execution of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022	Mr.Prutchaya Kumpaiee	

Customer representative

	Yes	No
Customer representative accepts results of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022	Khun Sasithorn Suwanwiko	

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Visual check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101	Safety check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102	Getting started (system self test)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103	Serial number, date and time check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104	Prepare the instrument for diagnosis		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105	Display test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106	Keyboard test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
107	Prepare the instrument for service		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108	Contrast test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109	Remote test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
110	RS bridge test (USB-RS232-bridge)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RS-232/1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RS-232/2		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

No.	Title	Comments	Pass		
			Yes	No	N/A
111	Table test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
112	Lift test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
113	Peristaltic pump test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
115	Test end		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CC.863 Document history

Date	Article No.	Author	Description/Changes
03.08.2011	8.863.3003EN	Giuseppe Conte	Layout adapted to Metrohm Compliance Service

End of CC document

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Metrohm

Compliance Service

Calibration Certificate (CC) for 925 Eco IC

Instrument details

Type:	19250020
Serial No.:	221685/ME (1925002004284)
Manufacturer:	Metrohm AG Ionenstrasse CH-9100 Herisau Switzerland
Firmware:	5.850.0113
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 08:45
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Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 925 Eco IC, Version 1.1
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Multimeter	Fluke	88490190	E1U222184	25/05/2023
High pressure gauge	Metrohm	05108	CAL0252-21Q0119	22/09/2022

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Conclusion of test results

	Yes	No
Instrument satisfies the specified technical requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

Comments

[illegible]

Metrohm representative

Metrohm representative		Yes	No
Metrohm representative confirms correct execution of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Mr.Prutchaya Kumpaiee		

Customer representative

		Yes	No
Customer representative accepts results of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Khun Sasithorn Suwanwiko		

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Visual test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101	Safety test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102	LED		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103	Fan		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105	Column plug interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
106	IC pump				
106.1	Installation		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.2	Pump head detection		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.3	Dearate		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.4	Pump dynamics		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

No.	Title	Comments	Pass				
			Yes	No	N/A		
106.5 Pulsation	Standard pump head Macro pump head						
		Maximum [MPa]	Minimum [MPa]	Difference [%]			
		11.71	11.32	<5.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		N/A	N/A	<10.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.6 Pressure transducer							
	Nominal value [MPa]	Measured value [MPa]	Tolerance [%]				
	11.66	12	± 10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
106.7 Flow rate	Standard pump head Macro pump head						
		Nominal value [mL]	Measured value [mL]	Tolerance [mL]			
		4.0	4.0	± 0.2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		20.0	N/A	± 1.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.8 Shut off at minimum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.9 Shut off at maximum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.10 Leak test							
	Maximum [MPa]	Minimum [MPa]	Difference [MPa]				
	19.20	18.75	<1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

No.	Title	Pass		
		Yes	No	N/A
107	Injector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
107.1	Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Pass		
		Yes	No	N/A
108	MSM	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108.1	Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
109	Peristaltic pump		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109.1	Rotation CW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109.2	Rotation CCW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109.3	Speed control		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CC.925 Document history

Date	Version	Author	Description/Changes
14.12.2016	1.0	pr	Creation of document 8.925.3002EN
31.03.2021	1.1	pr	Test no. 103 Fan depends on the installed power supply version according C.3 notice of modification CRM-28908.

End of CC Document

Metrohm

Compliance Service

Calibration Certificate (CC) for 850.9010 Conductivity Detector

Instrument details

Type:	18509010
Serial No.:	221686/ME (1850901073408)
Manufacturer:	Metrohm AG, Ionenstrasse, CH-9100 Herisau Switzerland
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Control device details

Type:	19250020
Serial No.:	1925002004284
Firmware:	5.850.0113

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 08:45
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Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 850.9010 Conductivity Detector, Version 1.3
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Temperature meas. Instr.	Fluke	82090101	TMU221923	10/06/2023
Conductivity standard (opt.)	Metrohm	20590015	12-0488	12/02/2023

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

	Yes	No
Instrument satisfies the specified technical requirements	<input checked="checked" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

[illegible]

		Yes	No
Metrohm representative confirms correct execution of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Mr.Prutchaya Kumpairee		

		Yes	No
Customer representative accepts results of instrument calibration		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature	
12/07/2022	Khun Sasithorn Suwanwiko		

Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title					Pass		
101	Temperature absolute							
		Nominal value [°C]	Measured value [°C]	Tolerance [°C]				
	Temperature 1	34.999	35.3	± 1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Temperature 2	40.001	40.3	± 1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

No.	Title						Pass		
102	Temperature stability								
		Maximum t [°C]	Minimum t [°C]	Difference [°C]					
		40.001	39.998	< 0.010	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

No.	Title						Pass		
103	Signal noise								
		Drift compensated [nS/cm]		Tolerance [nS/cm]					
	1 M	0.188		< 0.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	20 k 5	5.221		< 10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

No.	Title	Comments	Pass		
			Yes	No	N/A
104	Conductivity dry test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 850.9010 Conductivity Detector
Document ID	CC.850 Version 1.3 / 8.850.3022EN

No.	Title	Pass		
		Yes	No	N/A
105	Conductivity cell (optional)			
105.1	System installation and preparation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105.2	Write a method	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105.3	Measurement			
	Nominal value [μS/cm]	Measured value [μS/cm]	Tolerance [%]	
	91.32	91.44	± 10	<input checked="" type="checkbox"/>

CC.850 Document history

Date	Article No.	Author	Description/Changes
26.04.2012	8.850.3022EN	Philipp Rüegg	Layout adapted to Metrohm Compliance Service

End of CC Document

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Metrohm

Compliance Service

Calibration Certificate (CC) for 863 Compact Autosampler

Instrument details

Type:	18630010
Serial No.:	221687/ME (1863001064113)
Manufacturer:	Metrohm AG Ionenstrasse CH-9100 Herisau Switzerland
Firmware:	5.863.0022
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 09:50
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Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used:	C.1 Test instructions for 863 Compact Autosampler, Version 1.0
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Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Multimeter	Fluke	88490190	E1U222184	25/05/2023

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

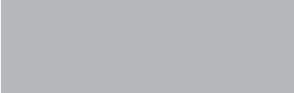
Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Conclusion of test results

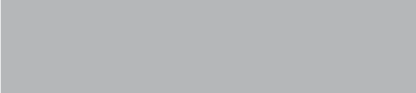
	Yes	No
Instrument satisfies the specified technical requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

Comments

Metrohm representative

	Yes	No
Metrohm representative confirms correct execution of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022	Mr.Prutchaya Kumpaiee	

Customer representative

	Yes	No
Customer representative accepts results of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022	Khun Sasithorn Suwanwiko	

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Visual check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101	Safety check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102	Getting started (system self test)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103	Serial number, date and time check		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104	Prepare the instrument for diagnosis		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105	Display test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106	Keyboard test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
107	Prepare the instrument for service		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
108	Contrast test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
109	Remote test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
110	RS bridge test (USB-RS232-bridge)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RS-232/1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RS-232/2		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 863 Compact Autosampler
Document ID	CC.863 Version 1.0 / 8.863.3003EN

No.	Title	Comments	Pass		
			Yes	No	N/A
111	Table test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
112	Lift test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
113	Peristaltic pump test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
115	Test end		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CC.863 Document history

Date	Article No.	Author	Description/Changes
03.08.2011	8.863.3003EN	Giuseppe Conte	Layout adapted to Metrohm Compliance Service

End of CC document

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210130
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : 

Date :

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210131
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.2	-0.2	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.9	0.1	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210132
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.9	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer

Date :

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210133
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210134
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210135
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30%RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210136
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	25.2	-0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.8	0.2	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK0000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210137
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30%RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210138
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.9	0.1	0.2
	45.0	45.2	-0.2	0.2
GLOBE	25.0	25.1	-0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210139
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210130
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer

Date

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210131
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.2	-0.2	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.9	0.1	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer :

Date :

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210132
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.9	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer

Date

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210133
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210134
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No. : RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210135
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30%RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210136
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	25.2	-0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.8	0.2	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK0000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210137
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30%RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,
Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210138
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.9	0.1	0.2
	45.0	45.2	-0.2	0.2
GLOBE	25.0	25.1	-0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____

Factory Calibration Certificate

Instrument information

Name	WET BULB GLOBE TEMPERATURE (WBGT) METER
Series No	3522210139
Type	JT2011-E2A

Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

Calibration Results

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,

Calibrated Date : 30 March 2022, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : _____

Date : _____



GIIC Calibration Laboratory

700/20-21 Phaholyothin Rd., Samsennai, Phayathai,
Bangkok 10400 Thailand

Tel : +66 (02) 615 4999

Fax : +66 (02) 615 4644

E-mail : cal@giic.co.th



NSC-TISI-TIS 17025
CALIBRATION 0256

CERTIFICATE No.: CAL00007-23

PAGE :

1

OF :

3

Certificate of Calibration

Equipment : DIGITAL LIGHT METER

Manufacturer : DIGICON

Model / Type : LX-73

Serial No. : T.017761

ID No. : -

Customer : M E T CO., LTD.
36/659 Moo 6 T.Bangrakpattana A.Bangbuathong Nonthaburi
11110.

C.S.R. No. : L0000010-23

Received Date : 04 January 2023

Calibration Date : 04 January 2023

Calibrated By : TONTRAKARN SRIKACHA

Approved By : NATTAPOL KINGKAEW

Issue Date : 04 January 2023

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

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

CERTIFICATE No.: CAL00007-23

PAGE: 2

OF: 3

CALIBRATION REPORT

Condition of this calibration result :

1. Environment : Temperature : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

2. Reference / Procedure Used :

- This Instrument was calibrated by substitution with reference illuminance meter, the Instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement. Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GLIC Calibration Laboratory calibration procedure No.GLICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	25531 / 025000	TP-1018-22	21-Jul-23

4. This Certification is traceable to the SI unit through :

- The National Institute of Metrology (Thailand) .

5. Uncertainty :

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



CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement

U.U.C. Range (lux)	Standard Setting (lux)	U.U.C. Reading (lux)	Error (lux)	Uncertainty of measurement \pm (lux)
400	0	0.0	0.0	0.60
	50	50.5	0.5	1.6
	250	253.1	3.1	6.5
4000	500	502	2	13
	1000	1011	11	26
	1500	1513	13	36
	2000	2028	28	48
	3000	3038	38	72
40000	4000	4030	30	96
	5000	5030	30	0.12 klux

- U.U.C. = Unit Under Calibration

This result of calibration was found accurate as show on data and place of calibration only.

- END -

Certificate of Calibration

Certificate No. : 65-400424-3

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : YPR-068S

Range : N/A °C

Resolution : 1 °C

Serial No. : YPR0659S-141200060R

ID No. : MET-RE03/59

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (29.8 to 31.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.8 to 222.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400023

65-400157-1

02 Oct 2022

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400424-3

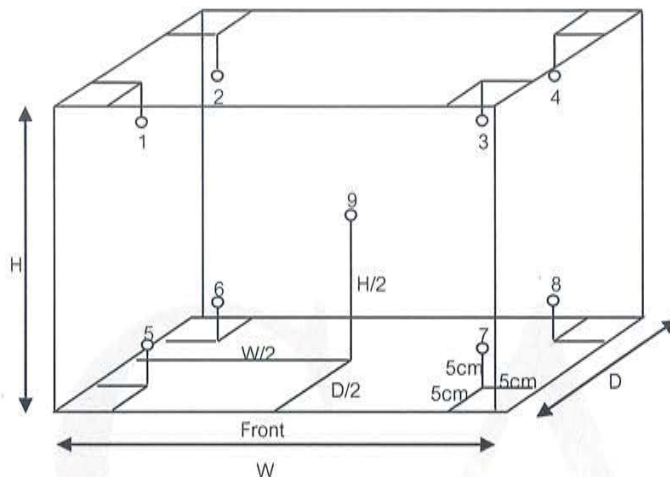
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	2	2	3.7	3.7	4.0	3.7	3.0	3.5	2.8	3.4	2.9	0.84

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.2	0.2	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 65-400666-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1022

ID No. : MET-BI02/64

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (25.2 to 25.5) °C

Relative Humidity : (40 to 45) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 27 December 2022

Date of Calibration : 27 December 2022

Date of Issue : 28 December 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	65-400552-1	25 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400666-1

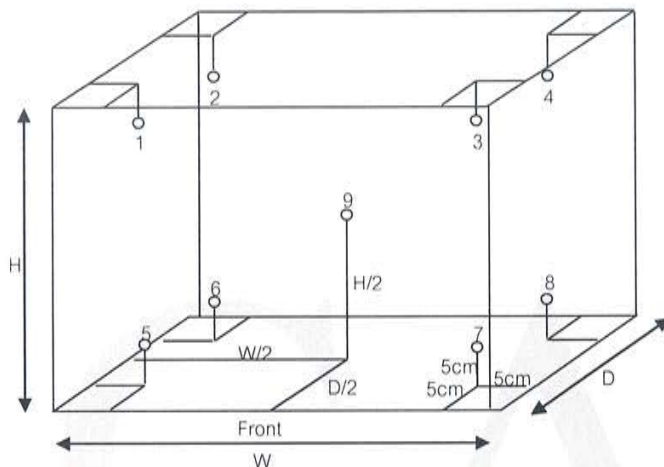
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor No.									Uncertainty (± ° C)
			1	2	3	4	5	6	7	8	9	
20.0	19.5	19.5	19.83	19.70	20.05	19.92	20.28	20.16	20.04	20.14	20.30	0.34

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
20.0	19.5	19.5	0.65	0.05	0.7

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 66-420023-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : pH 150

Range : N/A pH Resolution : 0.01 pH

Serial No. : 2943538 ID No. : MET-PH06/63

Electrode

Model : N/A Serial No. : 66365

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

Relative Humidity : $(50 \pm 15) \%$

Date of Received : 02 March 2023

Date of Calibration : 04 March 2023

Date of Issue : 04 March 2023

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
440001	21E997	17 Mar 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

<u>pH</u>	<u>Cert. No.</u>	<u>Lot No.</u>	<u>Exp. Date</u>	<u>Traceability</u>
4.008	61235182	857394	11 Dec 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	857395	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	857396	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420023-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.4	0.1	0.060
	0.0000	7	7.00	-0.1	0.1	0.058
	-177.4800	10	10.00	-177.6	0.1	0.060

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

- oOo -



Certificate of Calibration

Certificate No. : 66-400012-1

Page : 1 of 2

Submitted by : M E T Company Limited

6/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Digital Thermometer with Thermistor Probe

Temperature Indicator

Manufacturer : Thermo Scientific

Model : pH 150

Range : N/A

Resolution : 0.1 °C

Serial No. : 2657036

ID No. : MET-PH04/60

Thermistor Probe

Model : PHWPTEM01W

Sheath Material : Stainless

Diameter : 3 mm.

Length : 85 mm.

Serial No. : 237

ID No. : MET-PH04/60

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 05 January 2023

Date of Calibration : 11 January 2023

Date of Issue : 11 January 2023

Calibrated by : Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400012-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
85	10.0035	9.8	0.2	0.11
85	50.0025	50.0	0.0	0.11

Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -



Certificate of Calibration

Certificate No. : 64-400425-5

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)
Manufacturer : M-LAB Model : BIC-140
Range : N/A °C Resolution : 0.1 °C
Serial No. : 240412 ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (27.0 to 28.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	65-400274-1	25 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. :64-400425-5

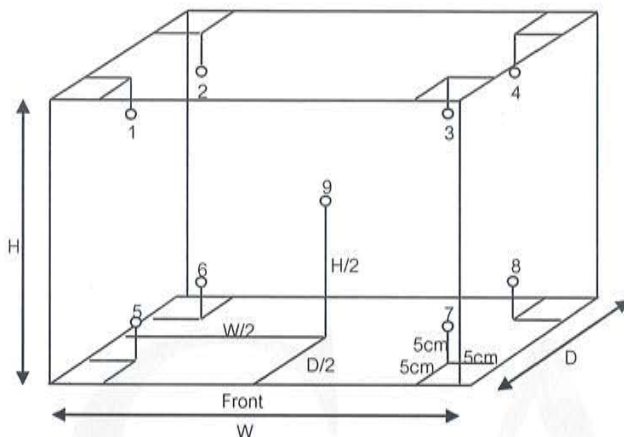
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.8	19.7	19.6	19.6	20.4	20.2	20.3	19.8	19.9	0.54

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.6	0.1	1.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Certificate of Calibration

Certificate No. : 65-400424-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)
Manufacturer : Binder Model : ED53
Range : N/A °C Resolution : 1 °C
Serial No. : 13-07419 ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (27.0 to 28.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400272-1	24 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400424-2

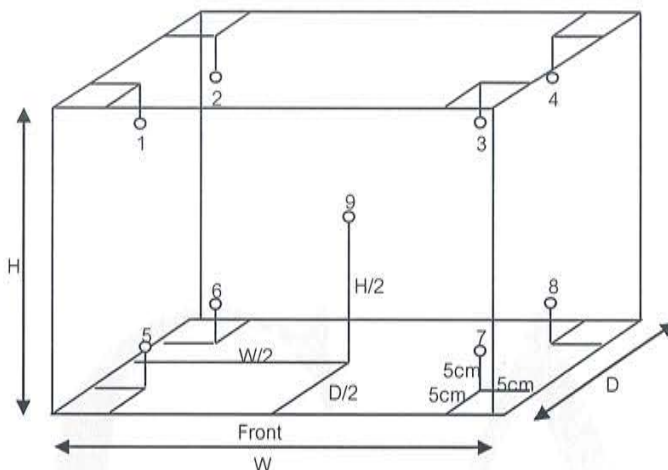
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	105.0	105.0	104.7	105.0	104.4	104.5	104.0	103.7	104.2	0.95
180	184	184	180.8	182.0	179.4	180.8	180.8	180.8	180.3	180.0	180.0	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.0	0.2	1.7
180	184	184	2.3	0.3	3.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Calibration Certificate

Cert. No. : CT-23-05-23470

Page : 1 of 4

Issued date : 08 May 2023

Equipment : COD Reader , Manufacturer : MLAB , Model : DB1602
S/N = 0169 , Customer ID = -

Client : M E T COMPANY LIMITED.
36/659 M.6 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 03 May 2023 Ref. Job No. : SO6605-00001
Calibrate by : Mr.Pramot Srisukum Cert. prepare by : Ms.Nattanicha Panumram
Calibrated Date : 03 May 2023 Approved by : Mr.Montree Ruschasetkul

Calibration Place : Laboratory room
Environment Condition : Temperature 28.6 ± 0.4 (°c) , Humidity 59.5 ± 3.5 (%RH)

Calibration Method : Measure temperature distribution by 9 channel in flat level. , (MTEC WI No. # WICAL-02-005-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Datalogger	MTEC-CE-0180	MLAB	10/2023
2	Thermo Hygrometer	MTEC-CE-0181	TH-03A	06/2023

Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated.
, (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k =$ (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

Certificate No. : CT-23-05-23470

Page : 2 of 4

Calibration Result :

Condition of UUC :

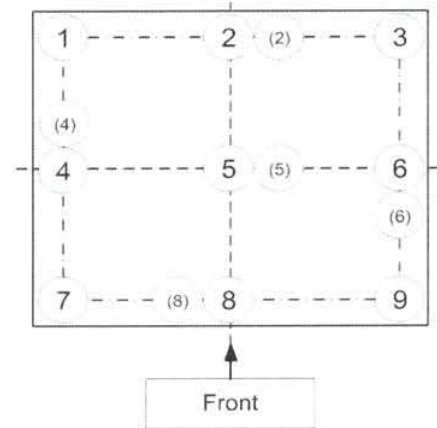
- 1) Without Adjustment
- 2) Immersion : 1/2 of the depth of the hole

(1) The quoted uncertainty include with "Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching stied state.

(3) Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.



Pic 1 : Position of each sensor No.

Section 1 : Report of Temperature distribution

Unit : (°c)

Calibration Point	UUC Setting ^(*)	UUC Reading ^(*)	Measured Temperature @ Sensor No.									Uncertainty (±)	k ^(**)
			#1	#2	#3	#4	#5	#6	#7	#8	#9		
150	150	150	150.51	149.89	150.16	149.93	150.56	150.67	149.80	150.25	149.76	0.627	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°c)

Calibration Point	UUC Setting	UUC Reading ^(*)	Temperature Uniformity	Temperature Stability (± °c)	Temperature Overall Variation
150	150	150	1	0.05	1

(*) = The average of 30 values in each point

Approved Signatory : _____

Certificate No. : CT-23-05-23470

Page : 3 of 4

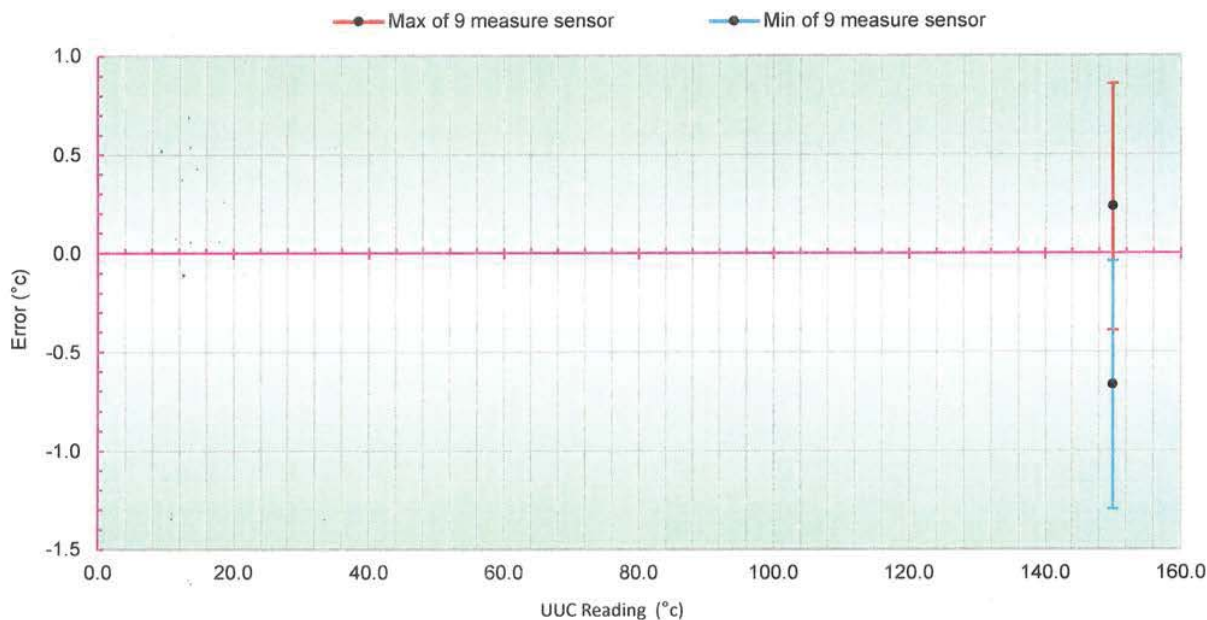
Section 3 : Possible of temperature. Show minimum and maximum of the average values and Include with uncertainty of measurement. The average values is average of each position standard sensor throughout observation time.

Unit : (°C)

Calibration Point	UUC Setting ^(*)	UUC Reading ^(*)	Possible of Minimum temperature	Possible of Maximum temperature
150	150	150	149.14	151.30

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy

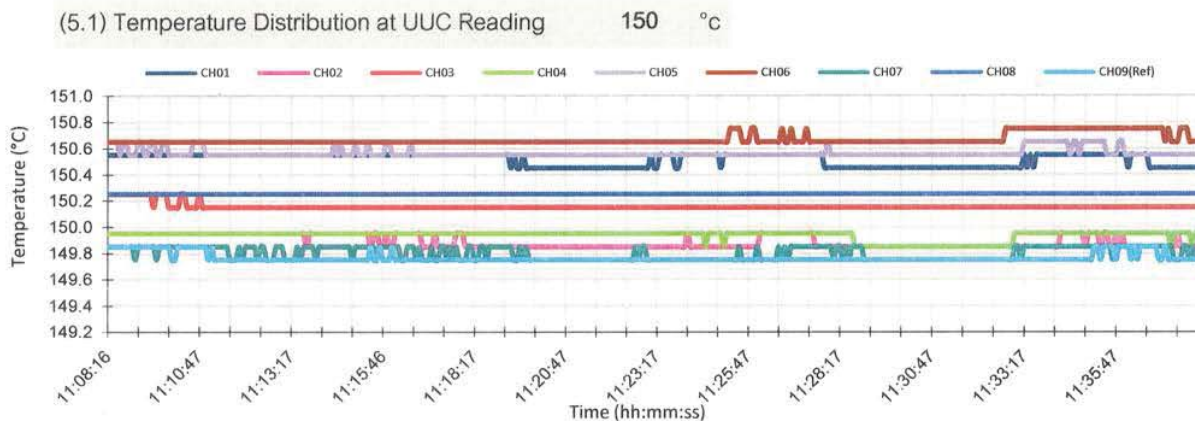


Approved Signatory : _____

Certificate No. : CT-23-05-23470

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement



Approved Signatory :

Packing List

Unit : K-446 Kjeldigester standard



151111112791000281006111

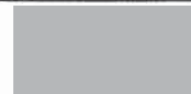
Serial Number

1000281006

Page 1(1)

Item	Pieces	Description		
11059833	1.0000	Packing parts Kjeldigester K-446/K-449 Beipackteile K-446/K-449		✓ OK
037377	5.0000	Sample tubes 300 ml (set of 4) Probengläser 300 ml (Set à 4 Stück)		✓ OK
11059754	1.0000	Rack 20 cpl. Rack 20 kpl.		✓ OK
11058955	1.0000	Aspiration device Kjeldigester K-446/K-449 cpl. Absaugeinheit K-446/K-449		✓ OK
040444	1.0000	Weighing boat 20pcs. Wägeschiffchen 20 Stk.		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11058825	1.0000	Fume collection tube with ball joint Dampfsammelrohr mit Kugelschliff		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
11593546	1.0000	Operation Manual K-446/K-449 english Bedienungsanleitung K-446/K-449 englisch		✓ OK
11593635	1.0000	Supplementary sheet Kjeldigester K-446/K-449 Beiblatt K-446/K-449		✓ OK

Packed by





BUCHI Certificate Final Test Inspection

Unit : BÜCHI KjelDigester K-446

Serial number 1000281006

Examination Procedure

- | | |
|---|------|
| 1. Visual control of the glass parts and the unit
- No scratches on the coated surface
- Mounted in accordance to the specific drawing | ✓ OK |
| 2. Security tests
- High voltage test in accordance with EN 61010-1 (IEC 1010)
- Ground connection test in accordance with EN 61010-1 (IEC 1010) | ✓ OK |
| 3. Functional tests
Operating panel
- All buttons are working
- Cooling system is working after the instrument has been switched on | ✓ OK |
| Connector plugs
- Scrubber connector is working | ✓ OK |
| Heating element
- Heating-up temperature 420 °C is reached after 40 minutes
- Temperature calibration at 420 °C (3 measuring points) | ✓ OK |
| 4. Completeness of order checked | ✓ OK |

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



H.-P. Gohn, Quality Manager

Signature, Date:



Packing List

Unit : K-415 TripleScrub 230V



151111112781000281005111

Serial Number

1000281005

Page 1(1)

Item	Pieces	Description		
11057332	1.0000	Tray for adsorption storage Ablage für Adsorption		✓ OK
048355	1.0000	Silicone hose D6/9 L=3m Silikonschlauch D6/9 L=3.0m		✓ OK
033701	1.0000	Glass wool 30g Glaswolle 30g		✓ OK
028737	2.0000	Hose clamp Anschlussklemme		✓ OK
11064971	1.0000	Activated Charcoal 2-6mm, 150g Aktivkohle 2-6mm, 150g		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11593505	1.0000	Operation Manual K-415 english Bedienungsanleitung K-415 english		✓ OK

Packed by





BUCHI Certificate Final Test Inspection

Unit : BÜCHI Scrubber K-415

Serial number 1000281005

Examination Procedure

1. **Visual control of the glass parts and the unit**

✓ OK

- No scratches or splinters on the glass parts
- Mounted in accordance to the specific drawing

2. **Security tests**

✓ OK

- High voltage test in accordance with EN 61010-1 (IEC 1010)
- Ground connection test in accordance with EN 61010-1 (IEC 1010)

3. **Functional tests**

Vacuum test

✓ OK

- Bypass valve open: Pressure is 0 - 65 mbar below the atmospheric pressure
- Bypass valve closed: Pressure is 400 mbar (+/- 10 %) below the atmospheric pressure

4. **Completeness of order checked**

✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications

H.-P. Gohn, Quality Manager

Signature, Date:

Packing List

Unit : K-360 Plastik Basic



151111113001000281014111

Serial Number

1000281014

Page 1(1)

Item	Pieces	Description		
043410	3.0000	Canister 10L thin-walled Kanister 10L dünnwandig	✓	OK
043603	1.0000	Packing parts K-360 Beipackteile K-360		✓ OK
047871	1.0000	Suppl. sheet distillation unit Beiblatt Distillation Unit		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
093176	1.0000	Operation Manual K-360 english Bedienungsanleitung K-360 englisch		✓ OK

Packed by





BUCHI Certificate Final Test Inspection

Unit : BÜCHI BÜCHI KjeIFlex K-360

Serial number 1000281014

Examination Procedure

1. **Visual control of the glass parts and the unit** ✓ OK

 - No scratches on the coated surface or splinters on the glass parts
 - Mounted in accordance to the specific drawing
2. **Security tests** ✓ OK

 - High voltage test in accordance with EN 61010-1:2002 (IEC 61010-1,VDE 0411)
 - Ground connection test in accordance with EN 61010-1:2002 (IEC 61010-1,VDE 0411)
 - Safety door sensor checked
3. **Functional tests** ✓ OK

Electronics

 - Electronic modul is tested with the checking device PG157
 - Connector plugs are working

Operating panel ✓ OK

 - Display is working
 - All buttons of the keypad are working

Pump testing ✓ OK

 - All pumps are working
 - All pumps (exception: water pump of the steam generator) are precalibrated

Valve testing ✓ OK

 - All valves are working

Steam generator testing ✓ OK

 - The steam generator is filled with water
 - The steam generator valve is working
 - The amount of distillate corresponds to specifications

Further testing ✓ OK

 - Beeper is working
4. **Unit configuration and completeness of order checked** ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications


H.-P. Gohn, Quality Manager

Signature, Date: 

Certificate of Calibration

Certificate No. : 65-400424-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)
Manufacturer : Memmert Model : UM 100
Range : N/A °C Resolution : 0.1 °C
Serial No. : b197.0985 ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (27.0 to 28.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	65-400274-1	25 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 65-400424-1

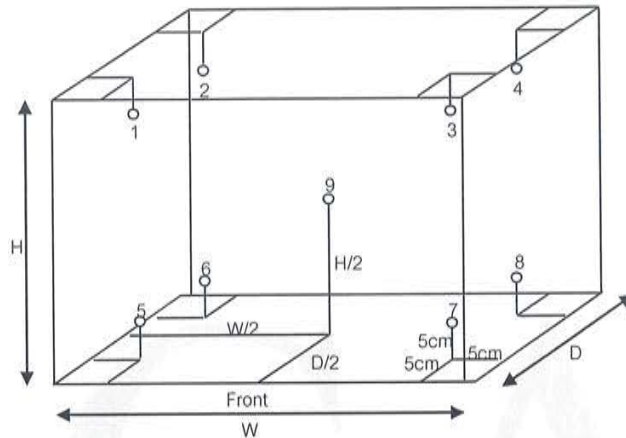
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.32 m

D = 0.18 m

H = 0.24 m

Capacity = 0.01 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	181.2	181.3	180.6	180.4	179.9	181.0	179.5	179.1	180.0	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.4	0.3	2.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



Optima8000 Preventive Maintenance Report

Company Name: MET Company Limited.

Instrument Location: 36 659 Soi Mu Ban Monwadi Park 6,
Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Instrument Serial No.: 078S1407053C

Date: 07-Jun-2023

ICP-OES/Optima8000 Preventive Maintenance (PM)

Company Name:	MET Company Limited.		
Address (Instrument Location):	Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110		
Serial Number:	078S1407053C	PM Number:	2 of 2
Customer Name (if applicable):	K. Sasithon	Telephone Number:	065 850 0726
Service Engineer Name:	Khwanchai	Service Order Number:	WO-02244312
Date PM Performed: (DD-MMM-YYYY)	07-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	07-Dec-2023
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
09370140 Rev.5	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Optima8000 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
Optima8000	078S1407053C	Winlab V 5.5.0.0714
S10 Autosampler		

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	N/A
N077520	Air Filter-RF Generator	N/A
09992731	Axial Window	N/A
B0810377	Radial Window	N/A
N0770438	O-ring kit, injector support adapter	N/A
N0780437	O-ring kit, torch	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	58-146CRX1	Oct-2023
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	58-169CRY1	Nov-2023

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ✓ Ask customer about unit's performance since last visit.
- ✓ Check incoming AC line voltage under load for proper levels and grounding.
- ✓ Is the instrument operational?

2. Mechanical:

- ✓ Inspect and clean all fans and filters.
- ✓ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No

If yes, list components replaced:

- ✓ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No

If yes, list tubing replaced:

- ✓ Inspect the peristaltic pump for proper operation.
- ✓ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ✓ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	35psi

- ✓ Check the shear gas nozzle for blockages and proper, uniform flow.
- ✓ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ✓ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ✓ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ✓ Drain air compressor surge tank.
- ✓ Clean exterior of instrument.

3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
 - ☒ Check all RF generator and spectrometer power supply voltages.
 - ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

Spectrometer:

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☒ Yes ☐ No

Radial Window Replaced: ☒ Yes ☐ No

5. Post PM Performance Tests:

- ☒ Perform View Align.

5.1 Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.00721	Passed
Ni 231.604 - Resolution	≤0.011	0.00878	Passed
Ni 341.476 - Resolution	≤0.015	0.01273	Passed
Ba 455.403 - Resolution	≤0.020	0.01590	Passed

5.2 Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD \leq 1 %	0.71	Passed
Mg 280.856	%RSD \leq 1 %	0.55	Passed
Mg 285.207	%RSD \leq 1 %	0.74	Passed
Ba 455.403	%RSD \leq 1 %	0.40	Passed

5.3 Mn BEC:

- ☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2%HNO3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC: $BEC = (IB * Conc\ of\ Std) / (IS - IB)$. Where Conc of Std = 1,000 PPB


Element	Mode	Conc.	IB	IS	
Mn 257.610	Radial	1,000 ppb	11658.2	1135839	
Mn 257.610	Axial	1,000 ppb	45267.9	9443358.7	
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial	11658200	1124180.8	10.37	<30 PPB	Passed
Axial	45267900	9398090.8	4.82	<30 PPB	Passed

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM



Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Optima8000 have been completed.

This ICP-OES/Optima8000 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Date:

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

(DD-MMM-YYYY)