

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ภาคผนวกที่ 6.1 เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ

ภาคผนวกที่ 6.2 เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงทั่วไป

ภาคผนวกที่ 6.3 เอกสารสอบเทียบเครื่องมือตรวจวัดความสั่นสะเทือน

ภาคผนวกที่ 6.4 เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

ภาคผนวกที่ 6.1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ

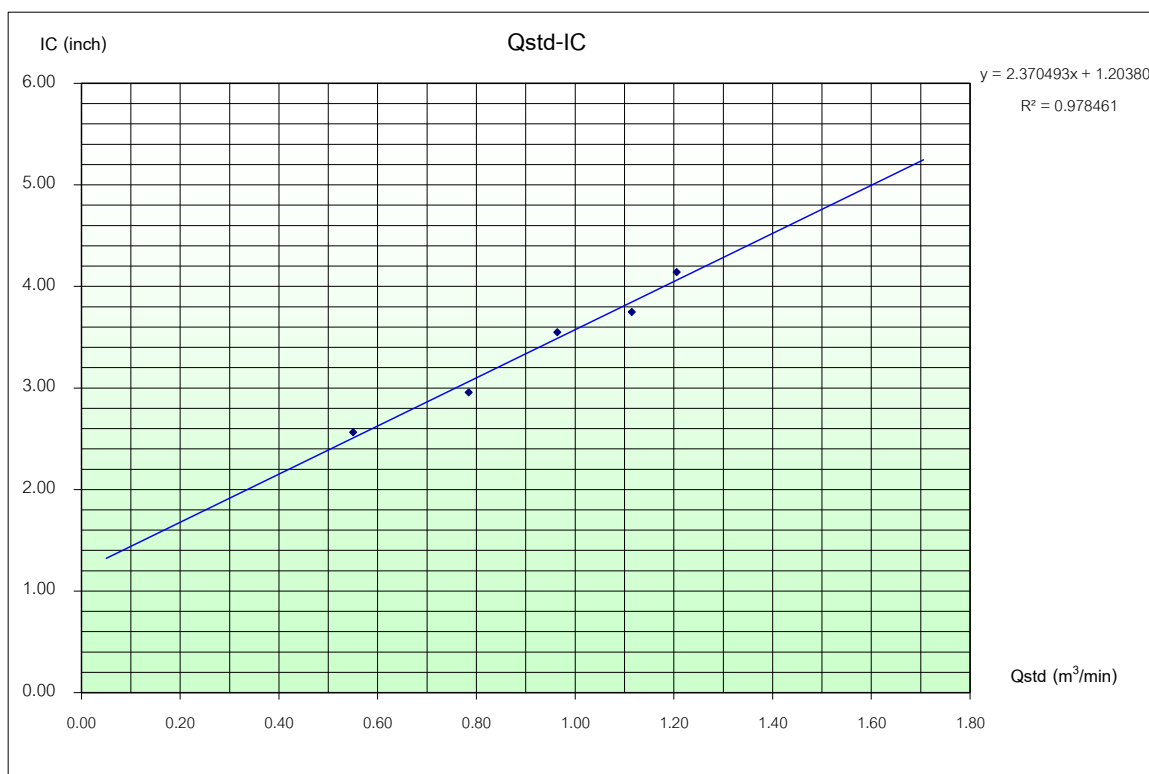
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	May 14, 2021
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.4	Transfer Standard Type	Orifice	Stop Time	9:35 AM
Motor Serial Number	BL-04	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	0.6	0.6	1.2	1.08066	0.55028	2.6	2.56	305.0	757.0		
7	1.2	1.2	2.4	1.52829	0.78422	3.0	2.96	305.0	757.0		
10	1.8	1.8	3.6	1.87176	0.96372	3.6	3.55	305.0	757.0		
13	2.4	2.4	4.8	2.16132	1.11505	3.8	3.75	305.0	757.0		
18	2.8	2.8	5.6	2.33450	1.20555	4.2	4.14	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	0.978461	Pstd(mmHg)	760.0
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.98917188	T _{NTP}	298.0
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 Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By A. Ggn.
(Mr.Jarung Jammongbut)
Division Manager

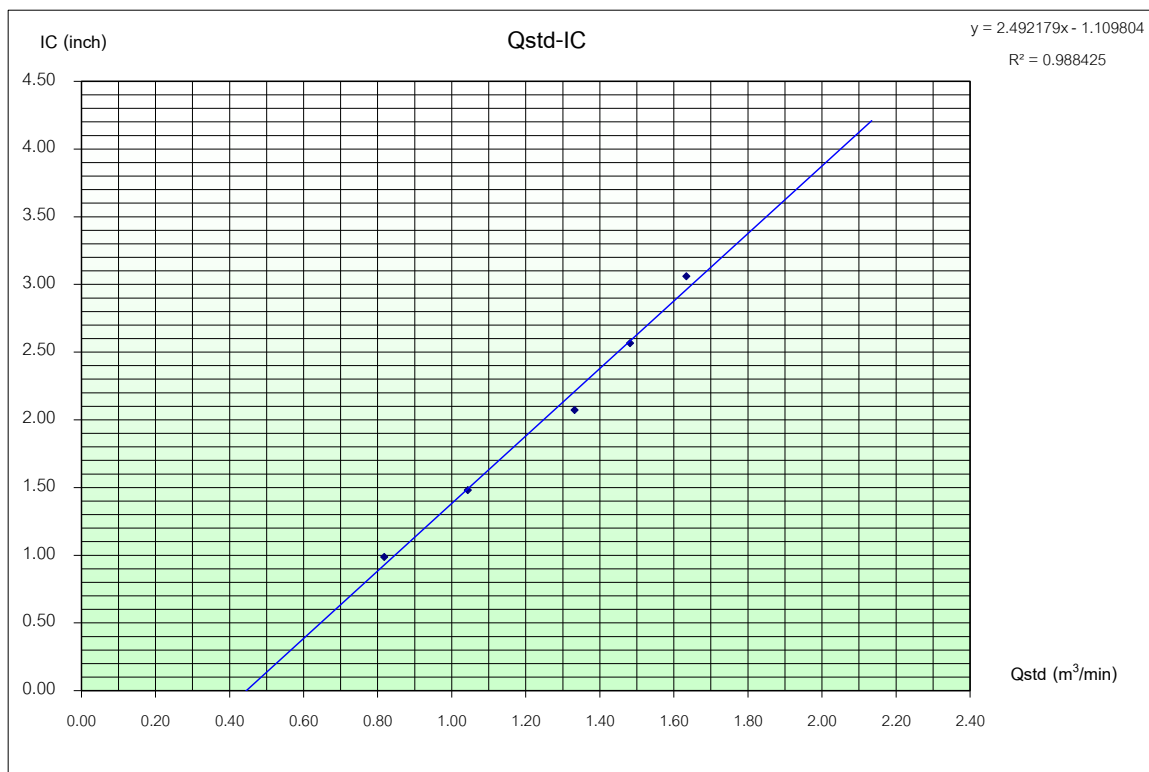
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location			Date	May 14, 2021	
Project Site			Start Time	9:30 AM	
Sampler Number	TSP No.13	Transfer Standard Type	Orifice	Stop Time	9:35 AM
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	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)			
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)						
5	1.3	1.3	2.6	1.59279	0.81793	1.0	0.99	305.0	757.0			
7	2.1	2.1	4.2	2.02440	1.04349	1.5	1.48	305.0	758.0			
10	3.4	3.4	6.8	2.57589	1.33171	2.1	2.07	305.0	759.0			
13	4.2	4.2	8.4	2.86294	1.48173	2.6	2.57	305.0	760.0			
18	5.1	5.1	10.2	3.15480	1.63426	3.1	3.06	305.0	761.0			
Linear Regression Y ON X : Y= mX + b							Average	305.0	759.0			
1	Slope (m)			1.91345	Linear Equation			r ²	0.988425	Pstd(mmHg)	760.0	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.99419565	T _{NTP}	298.0	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)			0.975763589	
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.987807466

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Jarung
(Mr.Jarung Jammongbut)
Division Manager

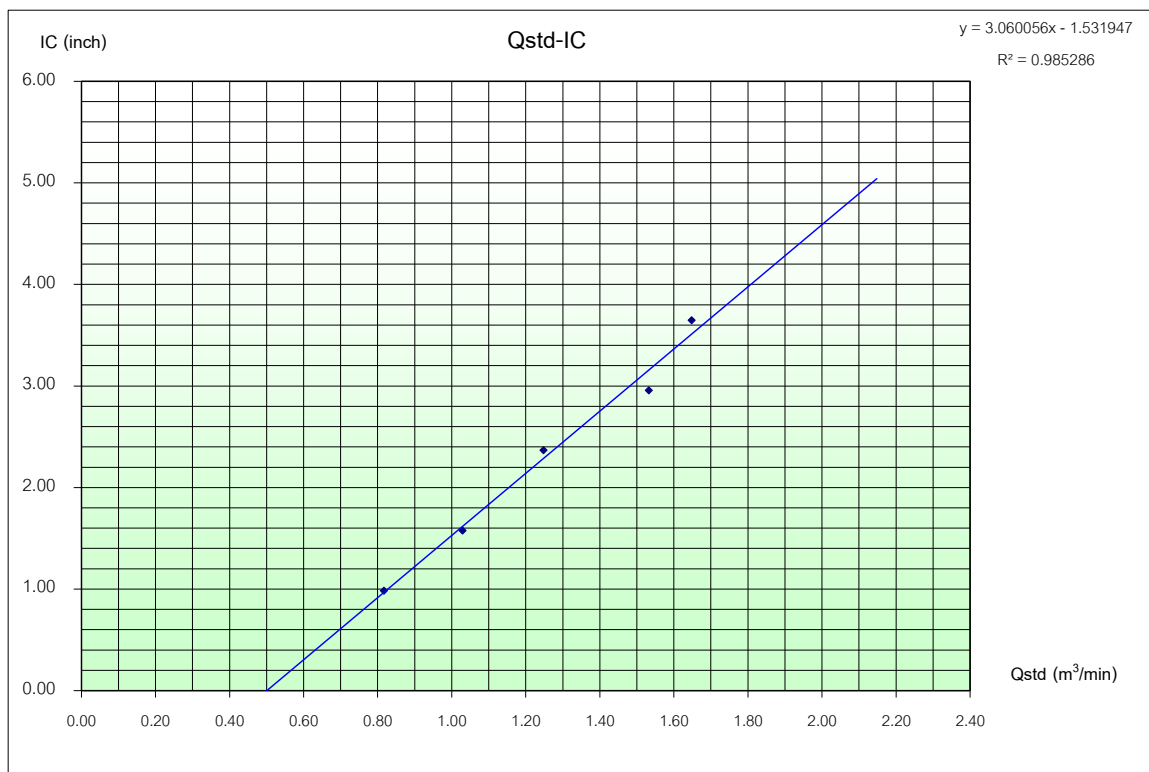
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	May 14, 2021
Project Site				Start Time	13:10:00 AM
Sampler Number	PM-10 No.13	Transfer Standard Type	Orifice	Stop Time	13:15:00 AM
Motor Serial Number	HVL-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	$IC = I[(Pa/P_{std})/(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O		(m ³ /min)	(inch)					
5	1.3	1.3	2.6	1.59069	0.81683	1.0	0.99	305.0	757.0		
7	2.0	2.1	4.1	1.99752	1.02944	1.6	1.58	305.0	757.0		
10	3.0	3.0	6.0	2.41643	1.24838	2.4	2.37	305.0	757.0		
13	4.5	4.5	9.0	2.95952	1.53220	3.0	2.96	305.0	757.0		
18	5.2	5.2	10.4	3.18138	1.64815	3.7	3.65	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	0.985286	Pstd(mmHg)	760.
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.99261574	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 Preecha Sr.

(Mr.Preecha Srisuk)
Field Environmental

Approved By A. Jarung

(Mr.Jarung Jammongbut)
Division Manager

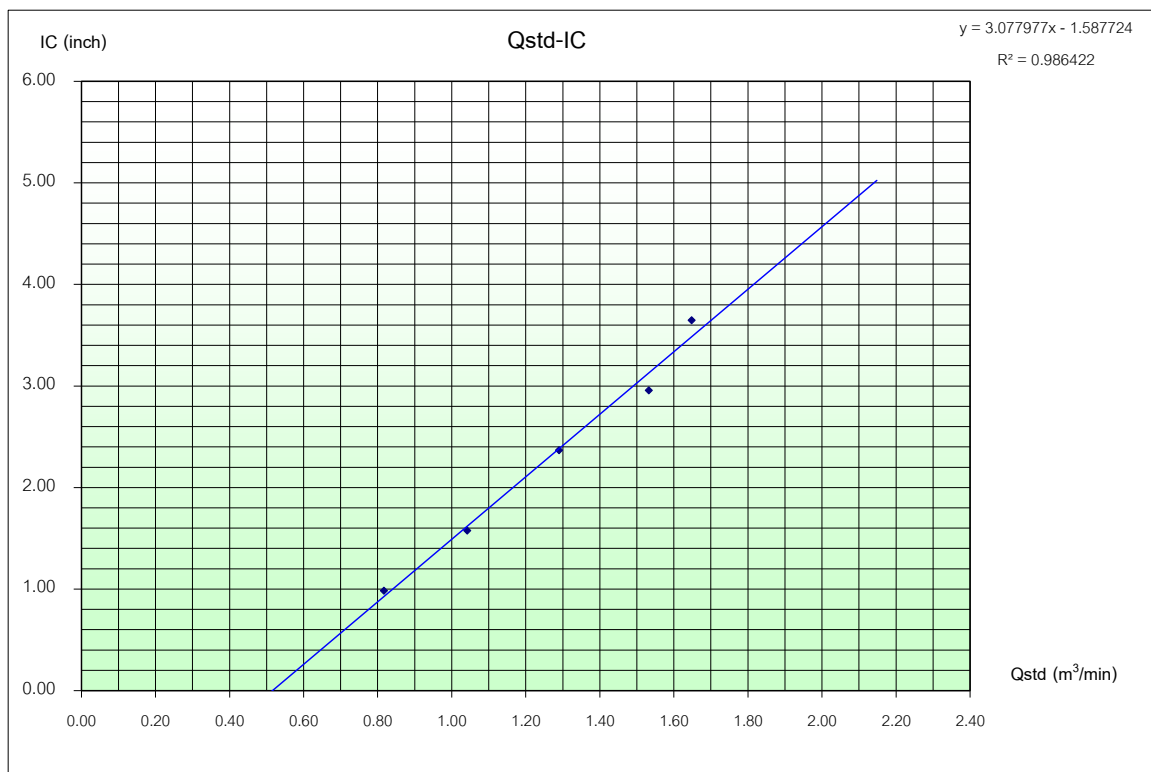
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	May 14, 2021
Project Site				Start Time	13:10:00 AM
Sampler Number	PM-10 No.14	Transfer Standard Type		Stop Time	13:15:00 AM
Motor Serial Number	HVL-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	1.3	1.3	2.6	1.59069	0.81683	1.0	0.99	305.0	757.0			
7	2.1	2.1	4.2	2.02173	1.04210	1.6	1.58	305.0	757.0			
10	3.2	3.2	6.4	2.49568	1.28979	2.4	2.37	305.0	757.0			
13	4.5	4.5	9.0	2.95952	1.53220	3.0	2.96	305.0	757.0			
18	5.2	5.2	10.4	3.18138	1.64815	3.7	3.65	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	0.986422	Pstd(mmHg)	760.0	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9931878	T _{NTP}	298.0	
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 Preecha Sr.

(Mr.Preecha Srisuk)
Field Environmental

Approved By G. Jarung

(Mr.Jarung Jamnongbut)
Division Manager



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, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-71354-368
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Calibration System

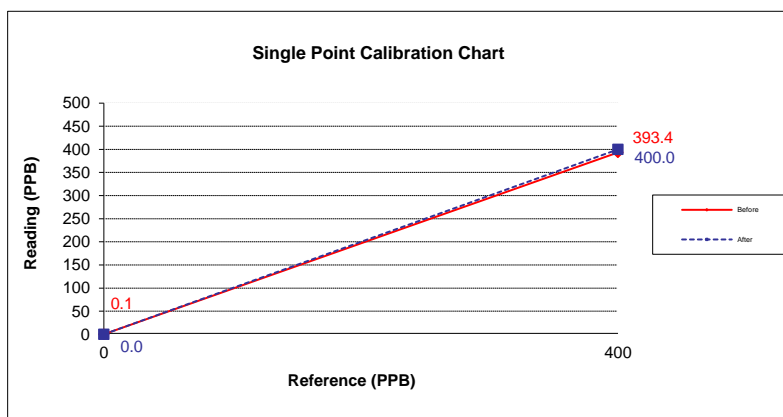
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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 :

Mr.PASAGORN SAMOL



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

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

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

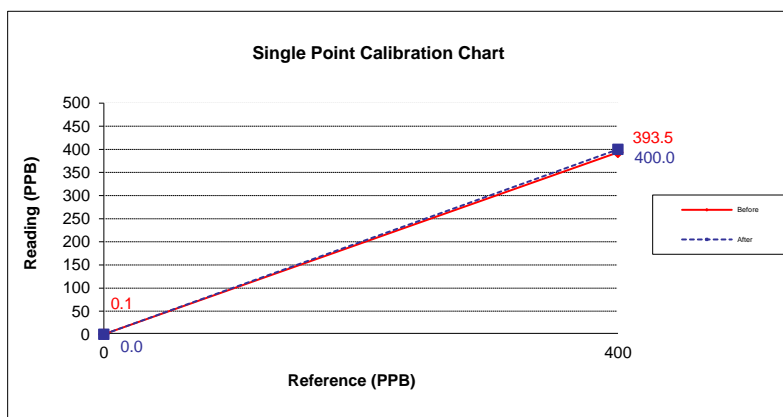
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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	393.5	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL



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ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-33500-371
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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

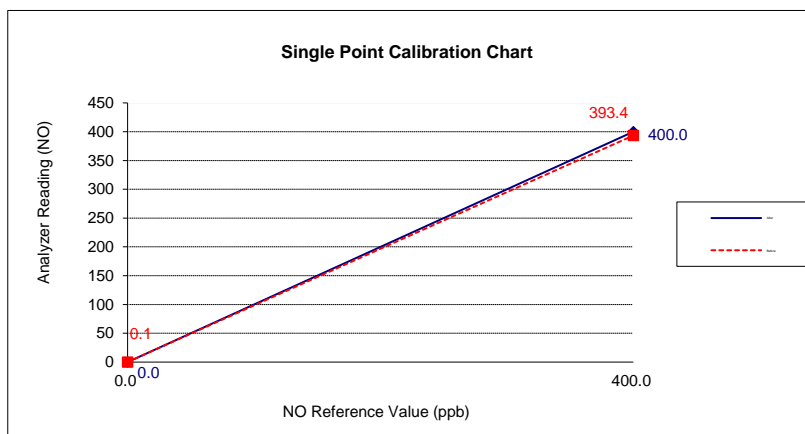
Humidity: 51 %RH

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 : Mr. Pasagorn Samol



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

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-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 SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

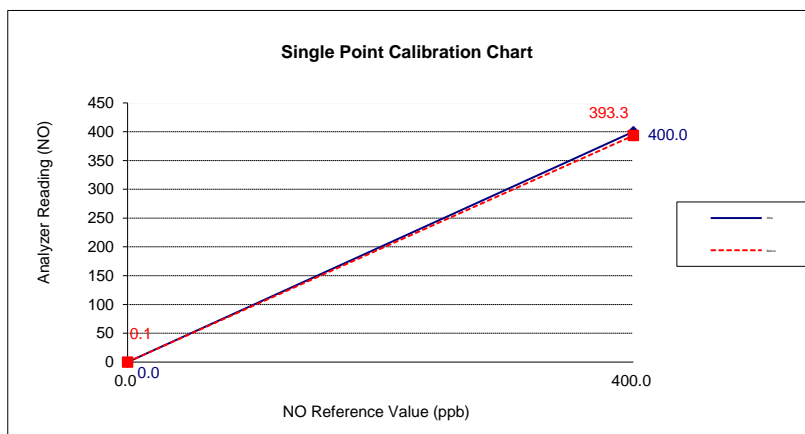
Humidity: 51 %RH

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
NO _x	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
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



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ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 300	Manufacturer API S/N: 200-S
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Calibration System

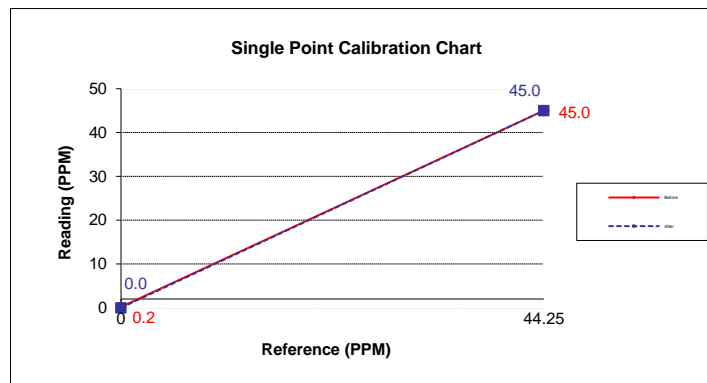
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.3	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL



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ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 300	Manufacturer API S/N: 203-S
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Calibration System

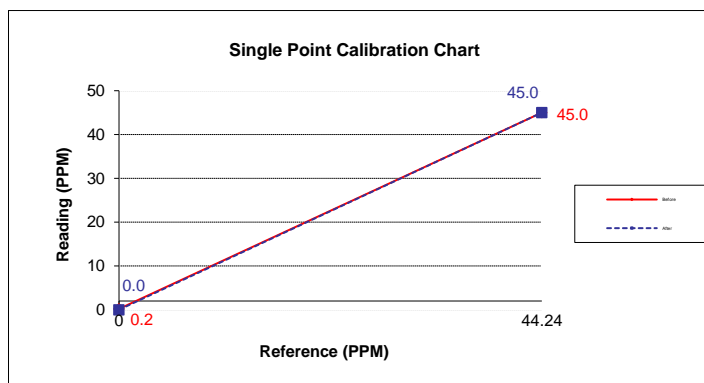
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL



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

Analyzer Performance Test

Calibrated Date: 29 December 2020

Instruments Information

Analyzer Type: Total Hydrocarbon Analyzer Model: 51C-LT	Manufacturer Thermo Environmental S/N: 0710321324
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	Methane 180 PPM Propane 181 PPM Cylinder AAL5888 Expire Date: 30 June, 2022

Environment: Temperature 25 °C

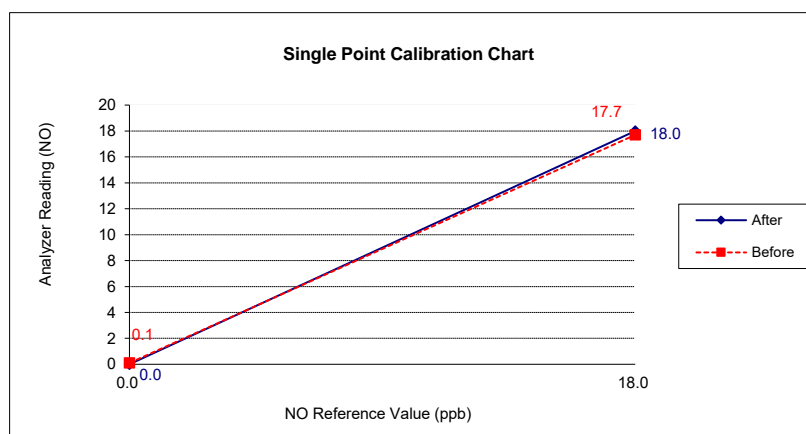
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift%
NH4	0.1	0.0	0.1	17.7	18.0	-1.7
NMHC	0.1	0.0	0.1	17.7	18.0	-1.7

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppb)	Drift%
NH4	0.0	0.0	0.0	18.0	18.0	0.0
NMHC	0.0	0.0	0.0	18.0	18.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Certificate of Calibration

Certificate No. : 65-200064-1

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 : (26.2 to 26.8) °C
Relative Humidity : (55.3 to 64.1) %
Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 2022

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02213103	18 Nov 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-200064-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

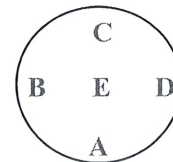
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.01	0.00000	0.000016
0.1	0.00001	0.000021
1	-0.00001	0.000029
5	-0.00002	0.000043
10	-0.00006	0.000053
20	-0.00015	0.000071
50	-0.00035	0.00011
100	-0.0006	0.00021
150	-0.0009	0.00038
200	-0.0012	0.00038

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 $k = 2.23$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g

A	B	C	D	E	
0.00044	0.00006	-0.00052	-0.00019	0.00000	g



Repeatability Load test : 200 g

Stdev. : 0.000052 g

- oOo -



Certificate of Calibration

Certificate No. : 65-200064-2

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 : AND Model : FX-2000i
Serial No. : 15639789 ID No. : MET-EB03/61
Capacity : 2200 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.1 to 26.2) °C
Relative Humidity : (55.5 to 61.9) %
Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 2022

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
F181-F1821	65-210044-1	31 Jul 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-200064-2

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)	Error before Adjustment (g)
200	0.00	0.0083	-0.08
500	0.00	0.0085	-0.20
600	0.00	0.0086	-0.24
700	0.00	0.0087	-0.28
800	0.00	0.0089	-0.34
1000	0.01	0.0093	-0.41
1200	0.01	0.011	-0.50
1500	0.01	0.011	-0.61
2000	0.00	0.012	-0.79
2200	0.00	0.023	-0.87

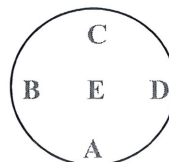
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 500 g

A	B	C	D	E	
0.00	0.01	0.00	0.00	0.00	g



Repeatability

Load test : 2000 g

Stdev. : 0.000 g

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ภาคผนวกที่ 6.2

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงทั่วไป



National Institute of Metrology (Thailand)

Certificate of Calibration

Certificate No. : AA-2013-21
Issued by : Acoustics Laboratory
Acoustics and Vibration Group



Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator
MANUFACTURER : RION
MODEL/TYPE : NC-75
SERIAL NUMBER : 34480442
CUSTOMER : MET Co., Ltd.
36/659 Moo 6, T. Bangrakphatthana,
Bangbuathong, Nonthaburi 11110
MEASUREMENT DATE : 6 September 2021

*The calibration results only marked with an asterisk * in this certificate are not included in Appendix C of the MRA drawn up by the CIPM.*

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. This calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference
AUV084-01/21

Date
6 September 2021

Authorized Signatory

(Pairoj Rattanangul)

Person in charge

(Yada Juntarapaso)

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation

3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659
75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



UNCERTAINTY OF MEASUREMENT

The stated uncertainty is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$. It has been determined in accordance with EA publication EA-4/02 M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of measurement data --Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measured lies within the assigned range of value with a probability of 95 %.

Parameter	Uncertainty at SPL94 dB	Maximum-permitted uncertainty of measurement for a coverage probability of 95%
1.Sound Pressure level	0.08	0.15
2. Frequency	0.1	0.2
3. THD+N	0.2	0.5

TRACEABILITY

This certificate provides traceability of measurement to recognized national standards, and to the realization of the International System of Units (SI).

NIMT



ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature	:	(23.0 ± 1.0)	°C
Pressure	:	(101.325 ± 1.500)	kPa
Relative Humidity	:	(50.0 ± 15.0)	%

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

Calibration Condition

Preconditionings : 16 hours at ambient conditions.

Measurement Con : The average values during measurement are
 (100.965 ± 0.013) kPa, (22.3 ± 0.3) °C and (62.2 ± 2.6) %RH

MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

Reference Microphone

B&K Type 4180 serial no.1395446

TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 µPa are corrected to the values under the reference environmental conditions.

The microphone volume corrections and the calibrator pressure corrections are excluded in the calibration results.



MEASUREMENT RESULTS

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance Limit (dB)
Microphone 4180 Serial No.1395446			
94	94.12	0.12	0.25

Note ^[1] : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

2. Frequency*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance Limit (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	0.7

Note ^[2] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.



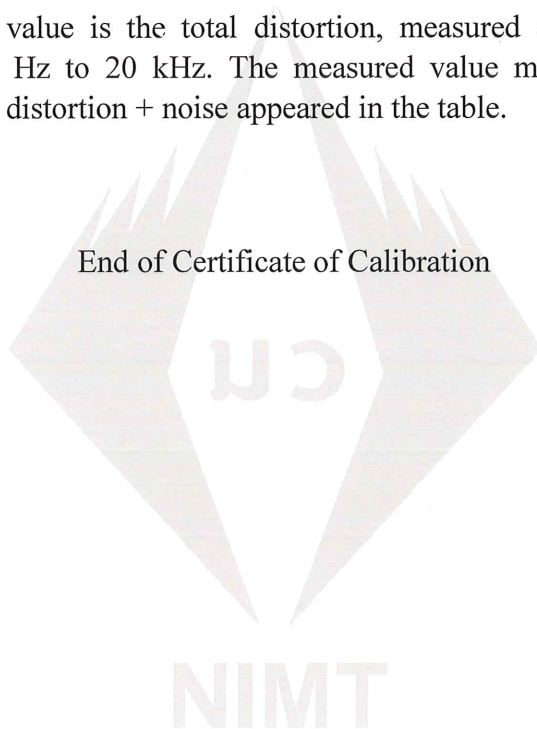
3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

Measured value ^[3] (%)	Maximum total distortion + Noise (%)
At the sound pressure level of 94 dB	
1.5	2.5

Note ^[3]: The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz. The measured value must not exceed the maximum total distortion + noise appeared in the table.

End of Certificate of Calibration



ภาคผนวกที่ 6.3

เอกสารสอบเทียบเครื่องมือตรวจวัดความสั่นสะเทือน

Calibration Certificate

Part Number: 721A2601

Description: Micromate with DIN Geophone

Serial Number: UM17540

Calibration Date: NOV 24 2020

Calibration Reference Equipment: 714J7402

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: _____

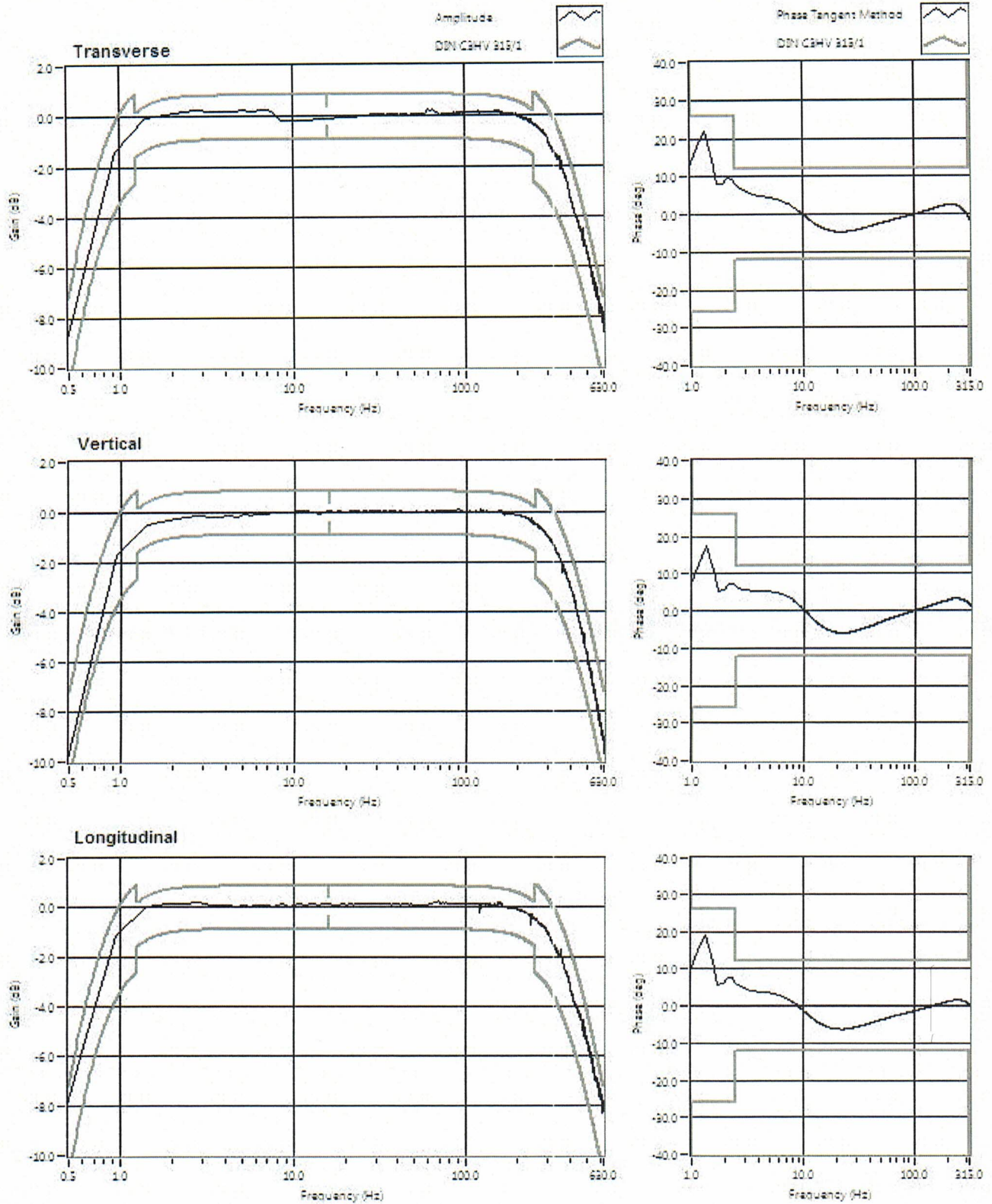
Xiaoming Yang



Instantel

309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642

Frequency Response of UM17540



Calibration Certificate

Part Number: 721A2601

Description: Micromate with DIN Geophone

Serial Number: UM18071

Calibration Date: **MAR 05 2021**

Calibration Reference Equipment: SRV-AFR 714J7401


Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: _____



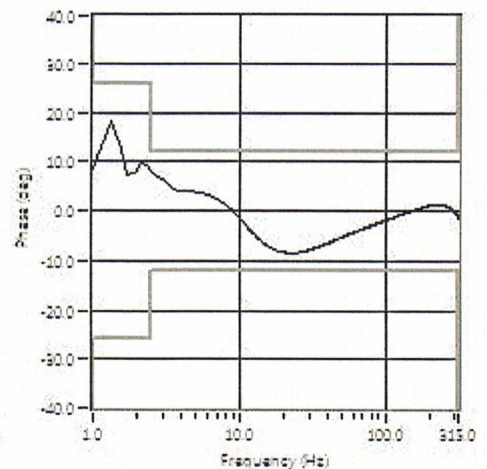
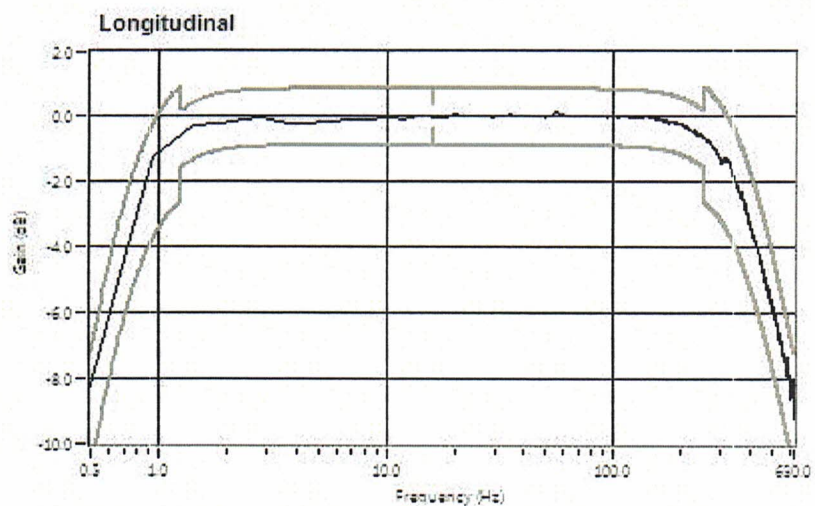
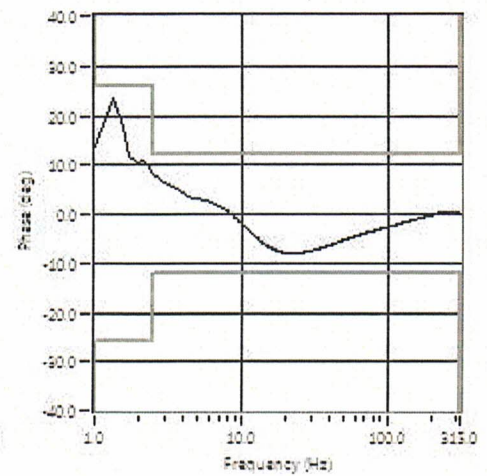
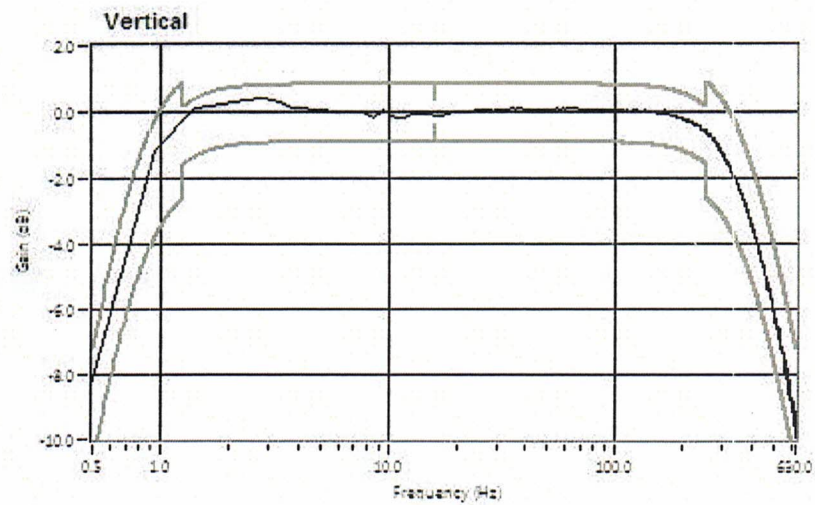
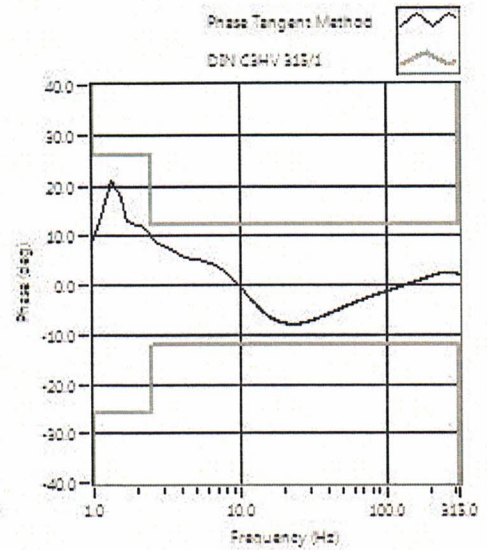
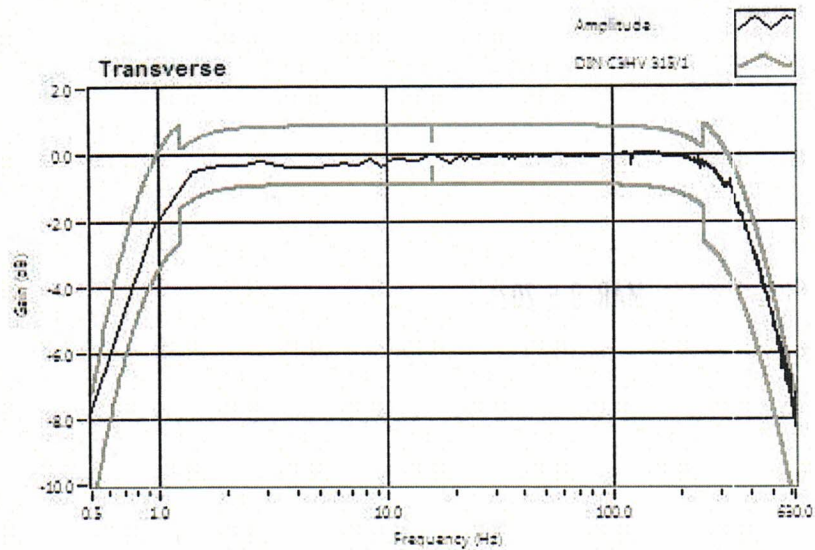
Xiaoming Yang



Instantel®

309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642

Frequency Response of UM18071



ภาคผนวกที่ 6.4

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ

Certificate of Calibration

Certificate No. : 65-420003-2

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. : 2913288 ID No. : MET-PH05/63

Electrode

Model : N/A Serial No. : 48393

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

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

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

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

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

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.004	61218215	769926	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.963	61208865	769928	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420003-2

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	177.5	0.0	0.060
	0.0000	7	7.00	0.2	-0.2	0.058
	-177.4800	10	10.00	-177.2	-0.3	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	4.004	4.01	0.00	0.011
	6.985	7.00	-0.01	0.011
	9.963	10.01	-0.04	0.016

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%

- o()o -

B



Certificate of Calibration

Certificate No. : 65-400021-2

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. :	2913288	ID No. :	MET-PH05/63
Thermistor Probe			
Model :	PHWPTEM01W	Sheath Material :	Stainless
Diameter :	3 mm.	Length :	85 mm.
Serial No. :	459	ID No. :	MET-PH05/63

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

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Chortip Samchusri

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 : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400021-2

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	10.0024	10.1	-0.1	0.11
85	50.0038	50.4	-0.4	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%

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B



**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com



CERTIFICATE No : 22T2574

REFERENCE No : 64386-8

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WPE 29

SERIAL No : L715.0400


ID No : WB 06/58

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22

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



CERTIFICATE No : 22T2574

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB 06/58
RECEIVED DATE : 11-Mar-22
AMBIENT TEMPERATURE : 24 °C ± 1 °C

MODEL : WPE 29
SERIAL NUMBER : L715.0400
CALIBRATION DATE : 11-Mar-22
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

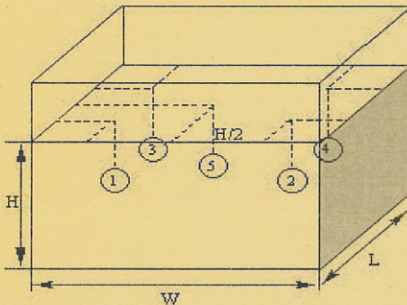
CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	21T6762	05-Jul-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 1.3
Overall Variation of Line Voltage (V) : 1
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 59*35*22 cm

BATH PERFORMANCE

Calibration Point (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
44.5	0.02	0.03	0.05	0.05

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
44.4	44.4	44.49	44.47	44.48	44.46	44.47	0.14

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

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

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

END OF CALIBRATION REPORT