

ภาคผนวก ง.

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด



TSP High Volume Sampler Calibration

Verification Report No.

A6506 -TSP 02

☒ PM ☐ Onsite

Site: บริษัท เอนไวแล็บ จำกัด

UTM : 47P N1514475 E654269

Sampler: ETSP#04

Recorder: ECRANG15315224

Date: 1 Jul 22

Technical: Wisan R.

Approval: Sarawut K.

CONDITIONS

Barometric Press. (hPa): 1000.8

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 750.7

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5028A

Serial#: 1328

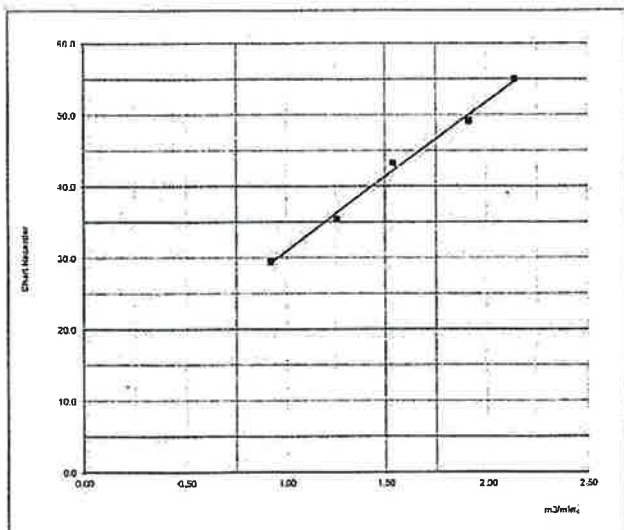
Qstd Slope: 1.63957

Qstd Intercept: -0.01202

Date Certified: 19 Jan 22

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.25	2.104	56.0	55.01	Slope = 21.5886
2	9.64	1.868	50.0	49.12	Intercept = 9.0830
3	7.64	1.663	46.0	45.19	Corr. coeff. = 0.9952
4	4.55	1.285	36.0	35.37	# of Observations: 5
5	2.67	0.986	32.0	31.44	Range of Chart at 1.1 - 1.7 m3/min. 34
					46



Calibrated by :

(Wisan Ritthikamon)

1 July 2022

Approved by :

(Sarawut Keawsinual)

1 July 2022

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Envilab Co., Ltd. 54253/1 อ.เมือง จ.นนทบุรี 11000
Tel : 02-502-9577-8 Fax : 02-502-9577 E-mail : envilab@evl.com



PM10 High Volume Sampler Calibration

Verification Report No.

A6506 -PM 01

☒ PM ☐ Onsite

Site: บริษัท เอ็นไวแล็บ จำกัด

UTM : 47P N1514475 E654269

Sampler: NPM#06

Recorder: ECRDS01618124

Date: 1 Jul 22

Technical: Wisan R.

Approval: Sarawut K.

CONDITIONS

Barometric Press. (hPa): 1000.8

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 750.7

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5028A

Serial#: 1328

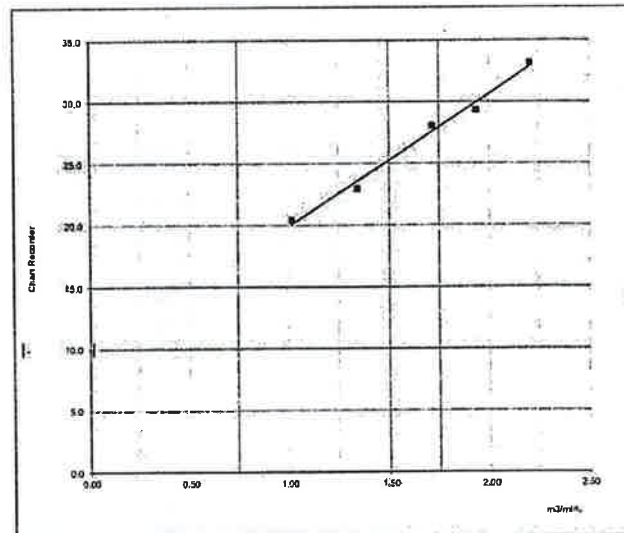
Slope: 1.02667

Intercept: -0.00753

Date Certified: 19 Jan 22

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.54	2.206	52.0	33.15	Slope = 10.7424
2	9.64	1.935	46.0	29.32	Intercept = 9.1207
3	7.58	1.717	44.0	28.05	Corr. coeff. = 0.9944
4	4.62	1.342	36.0	22.95	SFR = 1.151
5	2.64	1.016	32.0	20.40	SSP = 33.71
					# of Observations: 5
					Range of Chart 33
					at SFR $\pm 10\%$ 35



Calibrated by :

(Wisan Ritthikamon)
1 July 2022

Approved by :

(Sarawut Keawsrinual)
1 July 2022

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Environment responsibility with accuracy measurement

PL-0017-22 Rev.0001/04/22



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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6506009

Page:1/1

Calibrated Date: 1-Jun-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO,43C	Manufacturer THERMO S/N: ESOTE43C103362
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Calibration System

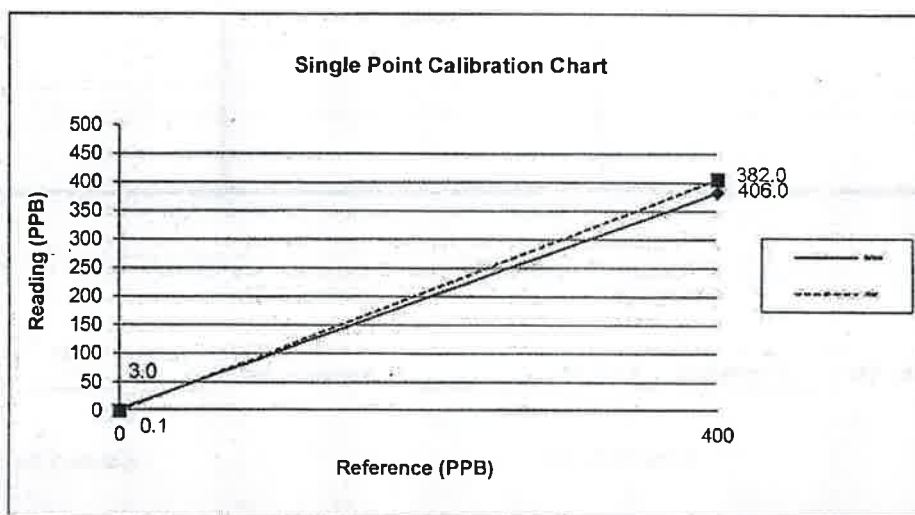
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 26.4 °C

Humidity: 47 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	3.0	3.0	400.0	382	-4.5
After	0.0	0.1	0.1	400.0	406	1.5



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Tel. 02-802-3980-2 Fax. 02-802-3988 E-mail: neediss.com



MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-07-2022

S/N : ESOTE43C103362

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	49	49
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By :

Sirirat Poonlak

Approve By :

Sarawat Keawsrinual

Sirirat Poonlak

Sarawat Keawsrinual

Date:

1-Jun-22

Date:

1-Jun-22

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Tel. 02-602-3780-2 Fax. 02-602-3788 E: info@neediss.com



NOx Analyzer Verification Test Report

Calibration Report No.: 6507008

Page:1/2

Calibrated Date: 1-Jul-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer THERMO S/N: ENOTE42C671356
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO ₂ Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 27.9 °C

Humidity: 44 %RH

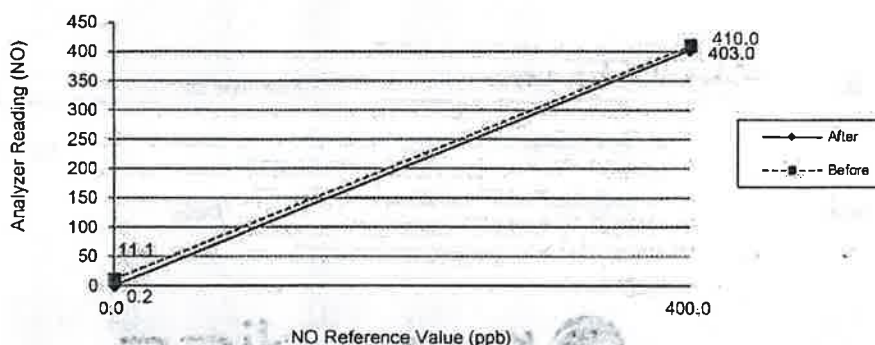
Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	11.1	0.0	11.1	410	400.0	1.2
NO ₂	4.3	0.0	4.3	6.0	0.0	0.7
NO _x	15.4	0.0	15.4	416	400.0	2.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	403	400.0	0.4
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NO _x	0.5	0.0	0.5	405	400.0	0.6

Single Point Calibration Chart



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Tel. 02-802-3980-2 Fax. 02-802-3988 E.info@neediss.com

MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-07-2022

S/N : ENOTE42C671356

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	43	43
CHAMBER TEMP 47 - 51 C	49	50
COOLER TEMP -5 - (-2) DEG C	-2	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

Approve By :

Sirirat Poonlak

Sarawut Keawsrinual

Date:

1-Jul-22

Date:

1-Jul-22

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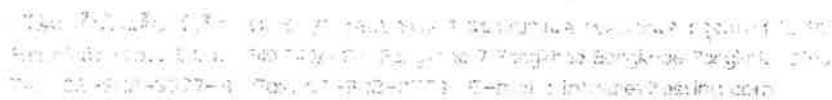
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ผู้จัดการฝ่ายควบคุมคุณภาพ



Report No.:

6506 -SLM 02

☒ PM ☐ Onsite UTM : 47P N 1514462 E 654258

Calibrated Date: 1 July 2022

Site : บริษัทเอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: NEEDISS

Model: NDSM 309

Serial : 8008

Environment: Temperature 25 °C Humidity 58 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March.21, 2022

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.54	-0.12	93.66

Calibrated By:

(Wisan Ritthikamon)

Date: 1 July 2022

Approve By:

(Sarawut Keawsrinual)

Date: 1 July 2022

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Er: experimental reproducibility with accuracy measurement

Envilab Co., Ltd.

FE-MNT-27 Rev 00.0

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TSP High Volume Sampler Calibration
EnviLab Co., Ltd. 54/540/1 ซอย ดงสุพรรณ 7 บางกะปิ กรุงเทพมหานคร 10310
Tel: 02-507-1021-5 Fax: 02-507-1021 E-mail: envilab@envilab.com



TSP High Volume Sampler Calibration

Verification Report No.

C6506 -TSP 01

☐ PM ☒ Onsite

Site: บริษัท เ็นไวแล็บ จำกัด

UTM: 47P N1514475 E654269

Sampler: ETSP#31

Recorder: ECRANG15315224

Date: 1 Jul 22

Technical: Wisan R.

Approval: Sarawut K.

CONDITIONS

Barometric Press. (hPa): 1000.7

Temperature (deg C): 31.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 750.6

Temperature (deg K): 304.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5028A

Serial#: 1328

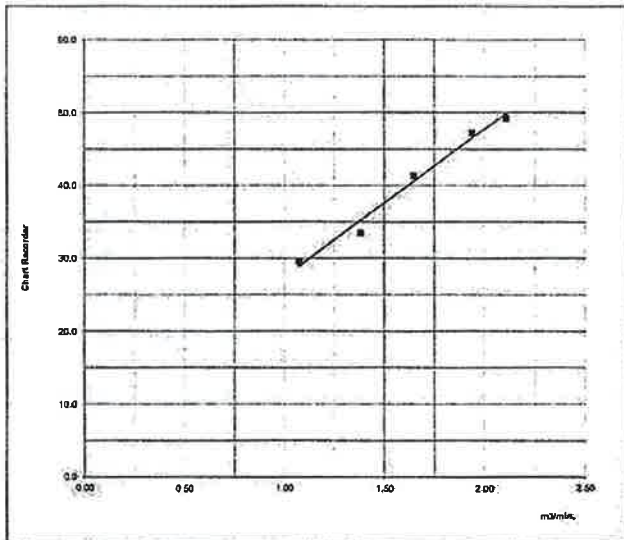
Qstd Slope: 1.63957

Qstd Intercept: -0.01202

Date Certified: 19 Jan 22

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.21	2.104	50.0	49.20	Slope = 20.2672
2	10.35	1.938	48.0	47.23	Intercept = 7.1631
3	7.44	1.644	42.0	41.33	Corr. coeff.= 0.9913
4	5.24	1.381	34.0	33.45	# of Observations: 5
5	3.13	1.069	30.0	29.52	Range of Chart 30
					at 1.1 - 1.7 m3/min. 42



Calibrated by:

(Wisan Ritthikamon)
1 July 2022

Approved by:

(Sarawut Keawsrinual)
1 July 2022

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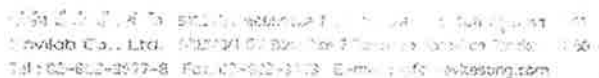
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Environmental responsibility with accuracy measurements

FE-MNT-23 Rev.00.01/04/03



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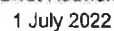


C6506 -PM 01

Approval: Sarawut K.

Average Temp. (deg K): 303.0

Date Certified: 19 Jan 22

at SFR $\pm 10\%$ 33

FE-MNT-29 Rev.00:01/08/63





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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6507006

Page:1/1

Calibrated Date: 1-Jul-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO ₂ Analyzer Model: THERMO.,43C	Manufacturer THERMO S/N: ESOTE43C069871
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Calibration System

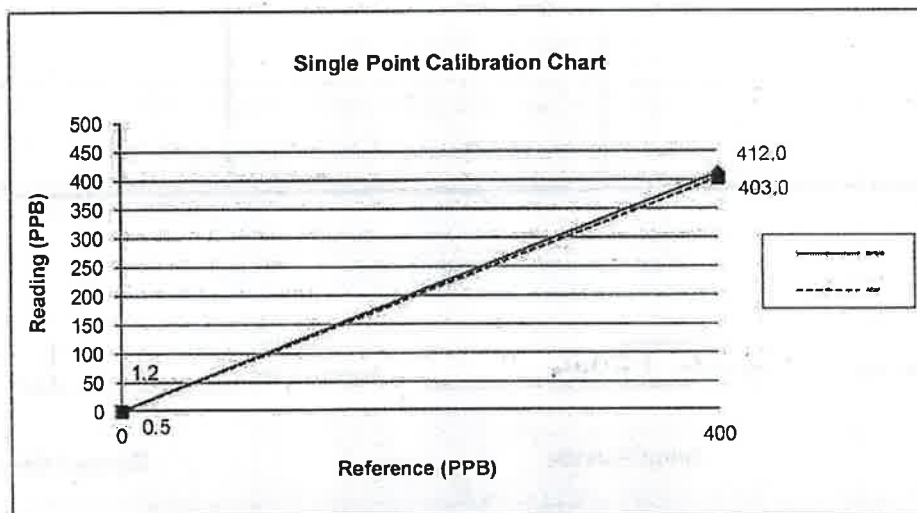
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO ₂ Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 27.2 °C

Humidity: 45 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	1.2	1.2	400.0	412	3.0
After	0.0	0.5	0.5	400.0	403	0.8



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Tel: 02-802-3980-2 Fax: 02-802-3988 E: info@neediss.com



MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-07-2022

S/N : ESOTE43C069871

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	49	49
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By : Sirrat Poonlak

Approve By : K

Sirrat Poonlak

Sarawat Keawsrinual

Date:

1-Jul-22

Date:

1-Jul-22

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NOx Analyzer Verification Test Report

Calibration Report No.: 6507006

Page:1/2

Calibrated Date: 1-Jul-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: ENOTE42CD75279
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 28.3 °C

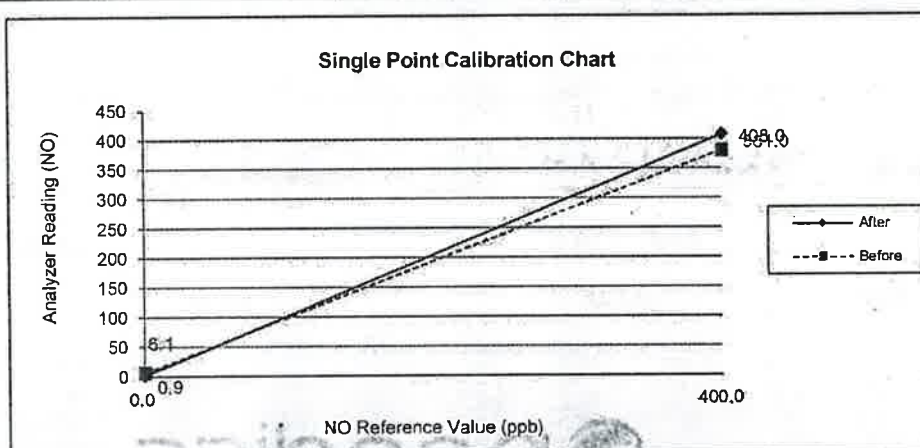
Humidity: 48 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	6.1	0.0	6.1	381	400.0	-2.4
NO ₂	2.2	0.0	2.2	34.0	0.0	4.3
NOx	8.3	0.0	8.3	415	400.0	1.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.9	0.0	0.9	408	400.0	1.0
NO ₂	0.6	0.0	0.6	2.0	0.0	0.2
NOx	1.5	0.0	1.5	410	400.0	1.2



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MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-07-2022

S/N : ENOTE42CD75279

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	43	43
CHAMBER TEMP 47 - 51 C	49	50
COOLER TEMP -5 - (-2) DEG C	-2	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By : Sirirat Poonlak

Approve By : K.

Sirirat Poonlak

Sarawut Keawsrinul

Date: 1-Jul-22

Date: 1-Jul-22

neediss

Neediss Supply Instrument Co., Ltd.



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ผู้จัดการฝ่ายควบคุมคุณภาพ

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6506 -SLM 05

47P N 1514462 E 654258

Serial : 5001

Environment: Temperature 25 °C Humidity 58 %RH

Date of Calibration : March.21, 2022

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.56	-0.10	93.66

1 July 2022

1 July 2022

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บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Needliss Supply Instrument Co., Ltd.
536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok
Tel. 02-802-3980-2 Fax: 02-802-3988 E: info@needliss.com



Verification Report of Ambient Air Sampling



PM



Onsite UTM :

Report No :

6507017

Instrument :

PM-2.5 Sample Single

Validation Date:

2-Jul-22

Manufacturer :

Rupprecht, Patashnick

Model :

200-H

Serial/ID No. :

EP2RP200049702

Environment :

Humidity(%RH) : 51

Temperature (°C) : 27.4

Pressure (mmHg) : 753

Reference Standard:

Temperature Calibrator : DIGICON, model: CC-VTR-SH, Serial No.091109269

Flow Calibrator: Mesalabs Defender, model : 520-H , Serial No.164578

Leak Test : Pass

Diagnostic Check:

PM-10 Inlet	PM-2.5 Size Selective	Filter Cassette	Fan	Valve	Pump %
Pass	Pass	Pass	Pass	Pass	Pass

Result of Instrument Validation :

Calibrator Simulator					Temperature Measurement	
Temperature Audit and Adjust with Calibrator (°C)					Instrument	Reference
Set point	-10.0	0.0	20.0	45.0	Reading(Avg.)	TC Reading
ambient	-10.0	0.0	20.0	45.0	27.4	27.3

Flow Control :

Calibration mode : AMB Flow Device

Flow set : 16.67 LPM

Avg. Pressure at Ref. : 746 mmHg

Flow Measure (Avg.)	Flow Calibrator(Avg.10)	Flow Difference
16.67 LPM	16.66 LPM	0.01 LPM

Engineer :

Phanuwat Suanbubpha

Approve By:

Sarawut Keawsrinual

Issu Date:

2-Jul-22

Date:

2-Jul-22

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**neediss**บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.536 ซอยบางนา 7 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok
Tel. 02-802-3980-2 Fax. 02-802-3988 E:info@neediss.com

Verification Report of Ambient Air Sampling



PM



Onsite UTM :

Report No :

6507004

Instrument :

PM-2.5 Sampler SINGLE

Validation Date:

2-Jul-22

Manufacturer :

Tisch Environmental

Model :

TE-Wilbur 2.5

Serial/ID No. :

NP2TIWILBU0426

Environment :

Humidity(%RH) : 48

Temperature (°C) : 26.5

Pressure (mmHg) : 747

Reference Standard:

Temperature Calibrator : DIGICON, model: CC-VTR-SH, Serial No.091109269

Flow Calibrator: Mesalabs Defender, model : 520-H , Serial No.164578

Leak Test : Pass

Diagnostic Check:

PM-10 Inlet	PM-2.5 Size Selective	Filter Cassette	Fan	Valve	Pump %
Pass	Pass	Pass	Pass	Pass	Pass

Result of Instrument Validation :

Calibrator Simulator					Temperature Measurement	
Temperature Audit and Adjust with Calibrator (°C)					Instrument	Reference
Set point	-10.0	0.0	20.0	45.0	Reading(Avg.)	TC Reading
ambient	-10.0	0.0	20.0	45.0	26.5	26.5
Filter	-10.0	0.0	20.0	45.0	26.6	26.4

Flow Control :

Calibration mode : AMB Flow Device

Flow set : 16.67 LPM

Avg. Pressure at Ref. : 746 mmHg

Flow Measure (Avg.)	Flow Calibrator(Avg.10)	Flow Difference
16.67 LPM	16.66 LPM	0.01 LPM

Engineer :

Phanuwat Suanbubpha

Approve By:

Sarawut Keawsrinal

Issu Date:

2-Jul-22

Date:

2-Jul-22

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Certificate of Calibration

Calibration Certification Information

Cal. Date: January 19, 2022 Rootmeter S/N: 438320 Ta: 294 °K
 Operator: Jim Tisch Pa: 749.05 mm Hg
 Calibration Model #: TE-5028A Calibrator S/N: 1328

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3190	3.7	1.50
2	3	4	1	1.0220	6.2	2.50
3	5	6	1	0.9290	7.5	3.00
4	7	8	1	0.8590	8.7	3.50
5	9	10	1	0.6530	14.8	6.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9941	0.7536	1.2241	0.9951	0.7544	0.7673
0.9907	0.9694	1.5803	0.9917	0.9704	0.9906
0.9890	1.0646	1.7312	0.9900	1.0656	1.0851
0.9874	1.1495	1.8699	0.9884	1.1506	1.1721
0.9793	1.4996	2.4483	0.9802	1.5011	1.5346
QSTD	m=	1.63957	QA	m=	1.02667
	b=	-0.01202		b=	-0.00753
	r=	0.99999		r=	0.99999

Calculations

Vstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va= $\Delta Vol((Pa-\Delta P)/Pa)$
Qstd= Vstd/ΔTime	Qa= Va/ΔTime

For subsequent flow rate calculations:

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

Standard Conditions

Tstd: 298.15 °K

Pstd: 760 mm Hg

Key

ΔH: calibrator manometer reading (in H2O)

ΔP: rootmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

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

Certificate of Calibration

Certificate No. : 65-200022-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Electronic Balance
Manufacturer : Sartorius Model : SECURA224-1S
Serial No. : 0034803270 ID No. : ELABBALANCEN04
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Balance Room, Envilab Co., Ltd.

Ambient Temperature : (23.7 to 23.8) °C

Relative Humidity : (57.1 to 58.0) %

Air Pressure : 1012.0 mbar

Date of Received : 02 February 2022

Date of Calibration : 02 February 2022

Date of Issue : 09 February 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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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-200022-1

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	0.0001	0.00011
0.1	0.0001	0.00011
1	0.0000	0.00011
2	0.0001	0.00011
5	0.0000	0.00012
10	0.0001	0.00012
20	-0.0001	0.00013
50	0.0000	0.00014
100	-0.0002	0.00020
200	-0.0004	0.00038

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

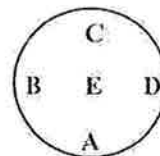
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.11$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

-0.0001 -0.0002 -0.0002 -0.0001 0.0000 g



Repeatability

Load test : 200 g

Stdev : 0.00005 g

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Certificate of Calibration

Certificate No. : 65-200022-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkok 10160

Equipment : Electronic Balance
Manufacturer : Sartorius Model : SECURA3102-1S
Serial No. : 0034409695 ID No. : ELABBALANCEN03
Capacity : 3100 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Balance Room, Envilab Co., Ltd.

Ambient Temperature : (23.7 to 24.2) °C

Relative Humidity : (57.6 to 57.8) %

Air Pressure : 1012.0 mbar

Date of Received : 02 February 2022

Date of Calibration : 02 February 2022

Date of Issue : 09 February 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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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasun 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-200022-2

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)
10	0.00	0.0082
20	0.00	0.0082
50	0.00	0.0082
100	0.00	0.0082
200	0.00	0.0083
500	-0.01	0.0085
1000	-0.01	0.0093
1500	-0.01	0.011
2000	-0.01	0.012
3000	-0.01	0.023

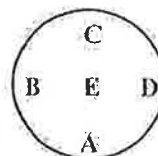
This result of calibration was found accurate as shown on date and place of calibration only.

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 : 1000 g

A	B	C	D	E	
0.00	0.01	0.02	0.00	0.00	g



Repeatability

Load test : 2000 g

Stdev. : 0.000 g

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Signature

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ผู้จัดการฝ่ายควบคุมคุณภาพ




Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EnviLab Co., Ltd.
Address: 540, 540/1 Soi Bang Khae 7, Bang Khae
City: Bang Khae Contact: Apornrat Aphidat
Zip / Postal: 10160
State / Province: Bangkok
Order Number: 

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XPR2 Asset Number: ELABBALANCEN07
Serial No.: C011158261 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 3 Terminal Asset No.: N/A
Room: Balance

Range	Max. Capacity	Readability (d)
1	2.1 g	0.000001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP/W002/20

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

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

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

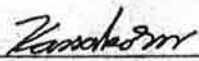
	Temperature		Humidity	
As Found	Start: 25.6 °C	End: 25.1 °C	Start: 65.9 %	End: 62.2 %

As Found Calibration Date: 24-Mar-2022
As Left Calibration Date: N/A
Issue Date: 25-Mar-2022


Calibrator:


Suphat Suksawad

Approved Signatory:


☒ Kassakorn Tassanachaisakul
☐ Santi Jitniyom
☐ Surachet Sukkate




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Measurement Results

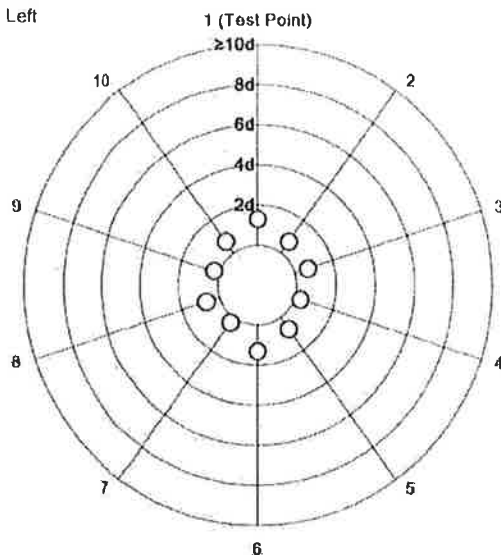
Repeatability

Test Load: 1 g

	As Found	As Left
1	0.999992 g	N/A
2	0.999994 g	N/A
3	0.999994 g	N/A
4	0.999993 g	N/A
5	0.999994 g	N/A
6	0.999992 g	N/A
7	0.999993 g	N/A
8	0.999994 g	N/A
9	0.999993 g	N/A
10	0.999994 g	N/A

Standard Deviation	0.0000008 g	N/A
--------------------	-------------	-----

○ As Found
◆ As Left



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

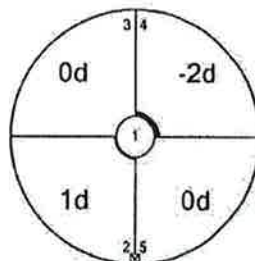
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 1 g

Position	As Found	As Left
1	0.999992 g	N/A
2	0.999993 g	N/A
3	0.999992 g	N/A
4	0.999990 g	N/A
5	0.999992 g	N/A

Maximum Deviation	0.000002 g	N/A
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As Found

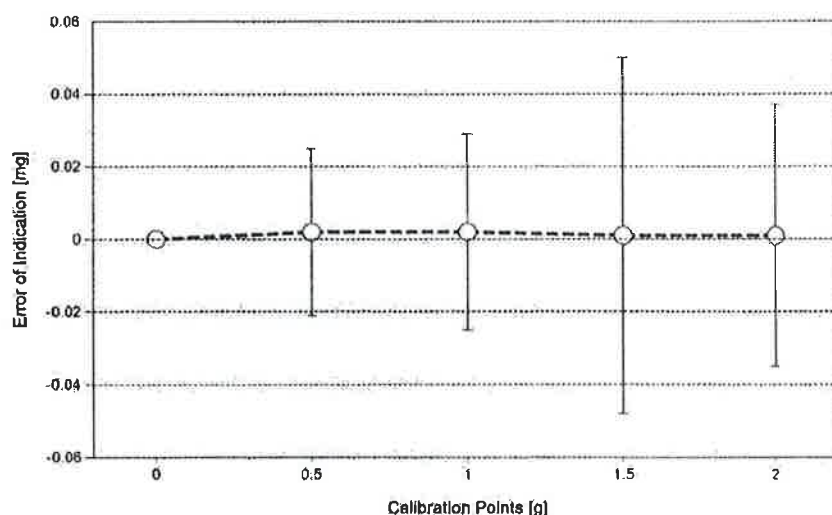
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1 *	0.000000 g	0.000000 g	0.000000 g	0.0054 mg	2
2	0.001000 g	0.001001 g	0.000001 g	0.0056 mg	2
3	0.005000 g	0.005000 g	0.000000 g	0.0056 mg	2
4	0.009999 g	0.010000 g	0.000001 g	0.0073 mg	2
5	0.019999 g	0.019999 g	0.000000 g	0.0091 mg	2
6 *	0.050000 g	0.050000 g	0.000000 g	0.011 mg	2
7 *	0.100000 g	0.099999 g	-0.000001 g	0.015 mg	2
8 *	0.500004 g	0.500006 g	0.000002 g	0.023 mg	2
9 *	0.999990 g	0.999992 g	0.000002 g	0.027 mg	2
10	1.499994 g	1.499995 g	0.000001 g	0.049 mg	2
11 *	1.999977 g	1.999978 g	0.000001 g	0.036 mg	2

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



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: WS01 Date of Issue: 03-May-2021
Certificate Number: 172902 Calibration Due Date: 29-Oct-2022

Thermo Hygrometer

Equipment No.: IN284 Date of Issue: 25-May-2021
Certificate Number: 21H1103 Calibration Due Date: 10-May-2022

Remarks

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

End of Accredited Section

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



Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.0 \cdot 10^{-5} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $4 K$

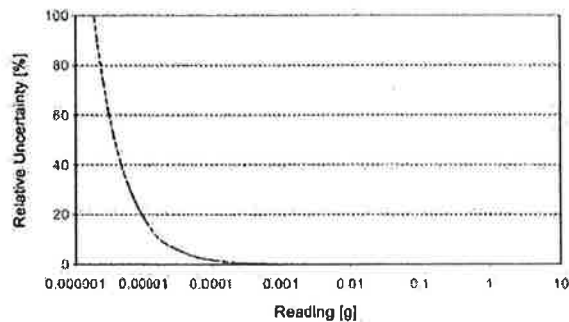
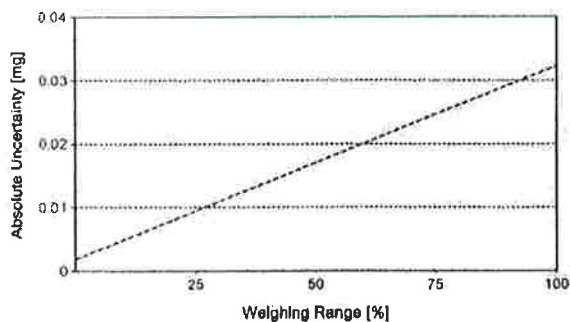
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.000001 g	2.1 g	$U_1 = 0.0018 \text{ mg} + 0.0145 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found		As Left	
0.000210 g	0.0018 mg	0.86%	N/A	N/A
0.002100 g	0.0018 mg	0.087%	N/A	N/A
0.021000 g	0.0021 mg	0.010%	N/A	N/A
0.210000 g	0.0048 mg	0.0023%	N/A	N/A
2.100000 g	0.032 mg	0.0015%	N/A	N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

The weighing device meets the given
process requirements.

Tests Performed:

☒ As Found

☐ As Left

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

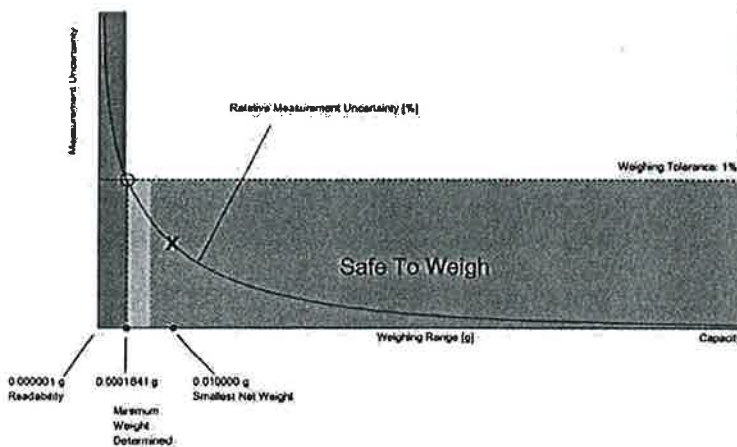
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.010000 g

Safety Factor: 2

Safe Weighing Range



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



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Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.0018649 g	0.0037855 g	0.0057642 g	0.0099072 g	0.0214935 g
0.2%	0.0009256 g	0.0018649 g	0.0028181 g	0.0047674 g	0.0099072 g
0.5%	0.0003686 g	0.0007394 g	0.0011124 g	0.0018649 g	0.0037855 g
1%	0.0001841 g	0.0003686 g	0.0005538 g	0.0009256 g	0.0018649 g
2%	0.0000920 g	0.0001841 g	0.0002763 g	0.0004611 g	0.0009256 g
5%	0.0000368 g	0.0000736 g	0.0001104 g	0.0001841 g	0.0003686 g



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

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.0018649 g	0.0037855 g	0.0057642 g	0.0099072 g	0.0214935 g
0.2%	0.0009256 g	0.0018649 g	0.0028181 g	0.0047674 g	0.0099072 g
0.5%	0.0003686 g	0.0007394 g	0.0011124 g	0.0018649 g	0.0037855 g
1%	0.0001841 g	0.0003686 g	0.0005538 g	0.0009256 g	0.0018649 g
2%	0.0000920 g	0.0001841 g	0.0002763 g	0.0004611 g	0.0009256 g
5%	0.0000368 g	0.0000736 g	0.0001104 g	0.0001841 g	0.0003686 g



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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 1 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.0000050 g	0.0000008 g	✓	0.0000008 g	✓
0.2%	0.0000100 g		✓		✓
0.5%	0.0000250 g		✓		✓
1%	0.0000500 g		✓		✓
2%	0.0001000 g		✓		✓
5%	0.0002500 g		✓		✓

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

Eccentricity

Test Load: 1 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.000500 g	0.0000002 g	✓	0.0000002 g	✓
0.2%	0.001000 g		✓		✓
0.5%	0.002500 g		✓		✓
1%	0.005000 g		✓		✓
2%	0.010000 g		✓		✓
5%	0.025000 g		✓		✓

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

Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.000000 g	0.000000 g	N/A	N/A	N/A	N/A	N/A	N/A
0.500004 g	0.000002 g	0.000250 g	0.000500 g	0.001250 g	0.002500 g	0.005000 g	0.012500 g
0.999990 g	0.000002 g	0.000500 g	0.001000 g	0.002500 g	0.005000 g	0.010000 g	0.025000 g
1.499994 g	0.000001 g	0.000750 g	0.001500 g	0.003750 g	0.007500 g	0.015000 g	0.037500 g
1.999977 g	0.000001 g	0.001000 g	0.002000 g	0.005000 g	0.010000 g	0.020000 g	0.050000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.000000 g	0.000000 g	N/A	N/A	N/A	N/A	N/A	N/A
0.500004 g	0.000002 g	0.000250 g	0.000500 g	0.001250 g	0.002500 g	0.005000 g	0.012500 g
0.999990 g	0.000002 g	0.000500 g	0.001000 g	0.002500 g	0.005000 g	0.010000 g	0.025000 g
1.499994 g	0.000001 g	0.000750 g	0.001500 g	0.003750 g	0.007500 g	0.015000 g	0.037500 g
1.999977 g	0.000001 g	0.001000 g	0.002000 g	0.005000 g	0.010000 g	0.020000 g	0.050000 g
Result		✓	✓	✓	✓	✓	✓

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

Service Date: 2022-03-24
 Document Number: TH2055-721-032422-LABBalanceHR
 EnviLab Co., Ltd.
 540, 540/1 Soi Bang Khae 7, Bang Khae, Bangkok 10160
 Arpornrat Aphidet

METTLER TOLEDO

Balance Health Report

Device Details

System Details			
Manufacturer:	Mettler Toledo	Accessory 1:	
Model:	XPR2	Accessory 2:	
Serial number:	C011158261	Weight set for routine testing:	Yes /
Firmware:	2.0.205.6		

History

Device History		Service History	
Instrument in use:	Yes	Last preventive maintenance:	1-3 years
Instrument age:	< 3 years	Last instrument calibration:	1-3 years
Spare parts available:	Yes	Last minimum weight determination:	
Regulations:	ISO	Routine testing performed:	Yes
Process tolerance in %:	1%		
Smallest sample net weight:	0.001g		

Check List

Environmental Conditions		General & Functional Checks	
Room temperature fluctuation	✓	Levelling	✓
Exposure to direct sun	✓	Cleanliness	✓
Vibrations	✓	Completeness - missing parts see additional remarks	✓
Draft	✓	Settings optimized for operating environment	✓
Dirt or dust	✓	Other - objections noted as additional remarks	—
Static	✓	Electrical Component Checks	
Mechanical Component Checks		Power supply	✓
Draft shield	✓	Sliding door drive	✓
Weighing pan position	✓	Internal weight drive	✓
Housing	✓	Display	✓
Other - objections noted as additional remarks	—	Other - objections noted as additional remarks	—

Recommendations

Measurement Result Quality		Process Efficiency	
Instrument calibration		Uninstall instrument	
Identify safe weighing range		Replace instrument	
GWP verification / risk assessment		Replace / add parts (see additional remarks)	
Preventive maintenance		Onsite repair	
Perform routine testing with test weights		Depot repair	
User training		Use of accessories (see additional remarks)	
Contact	Name: Arpornrat Aphidet	Position: N/A	Phone: 098-8973884
			Email: Tec@evitestng.com
Additional Remarks & Recommendations			Engineer Details
			Date: 24-Mar-2022
			Name: Suphat Suksawad
			Signature: <i>Suphat</i>

This is not a certificate.

It should not be used to interpret final results for the testing of these devices.

Legend:



Good/Pass



Needs Attention



Bad/Fail



Not Applicable

846/4 - 846/5 Lasaie Rd., Bangna Tai Sub-District, Bangna District, Bangkok 10260, +66 2723 0382
 MT-TH.ServiceSupport@mt.com
 www.mt.com

METTLER TOLEDO Service

Report Version: 1.13; Software Version 4.27.1.13; Page 1/1; © METTLER TOLEDO



รับรองสำเนาถูกต้อง
 ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0383

MTC No. EEL. BP. 59/0365

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

Address : 540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok, 10160, Thailand.

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Bruel&Kjaer

Model : 4230

Serial No. : 1351075

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Keithley 2015-P S/N 4106495.
 7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 10 Mar. 2022

Date of Calibration : 21 Mar. 2022

1 / 2

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

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office

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Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
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Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



รับรองผลการสอบเทียบ
ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0383

MTC No. EEL. BP. 59/0365

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.66	-0.34	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	997.8	-2.2	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.55	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


.....

(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Kluyapa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Mar. 2022

Date of Issue : 22 Mar. 2022

Ref : 2011265031501147002

End of Certificate

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

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FM.BL.MTC.002 Rev.4

Head Office

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Fax. (66) 0 2323 9165
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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



รับตรวจวัดและสอบเทียบ
ผู้จัดทำรายงานคุณวุฒิ

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
LTD
Part Number: E05NI91E15A0003
Cylinder Number: EB0146406
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,CO2,NO,NOX,SO2,BALN
Reference Number: 160-402305646-1
Cylinder Volume: 148.7 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Jan 03, 2022

Expiration Date: Jan 03, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	12/27/2021, 01/03/2022
CARBON MONOXIDE	100.0 PPM	98.02 PPM	G1	+/- 0.5% NIST Traceable	12/27/2021
NITRIC OXIDE	100.0 PPM	100.1 PPM	G1	+/- 1.0% NIST Traceable	12/27/2021, 01/03/2022
SULFUR DIOXIDE	100.0 PPM	100.2 PPM	G1	+/- 1.0% NIST Traceable	12/27/2021, 01/03/2022
CARBON DIOXIDE	8.000 %	7.962 %	G1	+/- 0.9% NIST Traceable	12/27/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010241	KAL004894	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	200610-56	CC733475	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.6%	Oct 06, 2026
GMIS	124206889119	CC322885	4.294 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010419	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023
NTRM	08010636	K019200	13.94 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 30, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Dec 02, 2021
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Dec 09, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Dec 16, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Dec 29, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Dec 23, 2021

Triad Data Available Upon Request

NOTES: Gross Weight: 28.1 Kg, Net Weight: 5.1 Kg.

UF0X5CX



[Signature]
Approved for Release



[Signature]
รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



Supplement to Calibration Certificate No. Q22008274

CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM14630/UM14630[EVMINMMATE4630]
CLID. NO.	:	252200216
JOB CONTROL NO.	:	220125008274

CUSTOMER : **ENVILAB CO., LTD. [HEAD OFFICE]**
540,540/1 SOI BANGKHAE 7,
BANGKHAE, BANGKHAE BANGKOK 10160

DATE OF RECEIVED : 25 January 2022

DATE OF ISSUED : 04 February 2022

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : **Suwit Phuanbusabong**
Calibration Engineer

Approved By : **Mongkol Yotsoontorn**
Authorized Signatory
04. February 2022



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q22008274A1

F3-012-04/01-12

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Om
รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM14630/UM14630[EVMINMMATE4630]
DATE OF CALIBRATION	:	26 January 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Agilent Technologies Model 34401A S/N. US36044686.
2. Universal Counter, Hewlett Packard Model 5315A S/N. 2448A13042.
3. Portable Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0070-21, Due Date 23 July 2022.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0073/21, Due Date 14 May 2022.
3. The measurements are traceable to International System of Units (SI), through The Modal Shop, Inc. Certificate No. 2649.01, Due Date 10 November 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q22008274

F3-011-04/01-12

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
1	50 Hz	peak	1.000	1.038	-0.038	1.1
2	50 Hz		2.000	2.071	-0.071	1.0
3	50 Hz		3.000	3.097	-0.097	1.0

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
10	50 Hz	peak	10.000	10.082	-0.082	2.3
20	50 Hz		20.000	20.145	-0.145	1.8
30	50 Hz		30.000	30.542	-0.542	1.0

*3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.01	50 Hz	peak	0.010	0.010	0.000	7.8
0.02	50 Hz		0.020	0.021	-0.001	3.1
0.03	50 Hz		0.030	0.031	-0.001	2.7

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 54

* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q22008274

F3-011-04/01-12

page 3 of 3



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ




@clccalibration

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EnviLab Co., Ltd.
Address: 540, 540/1 Soi Bang Khae 7, Bang Khae
City: Bang Khae Contact: Ngarmthip Sampanpuang
Zip / Postal: 10160
State / Province: Bangkok
Order Number:  0331907240

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XSR205DU Asset Number: N/A
Serial No.: B911363567 Terminal Model: SRAT
Building: N/A Terminal Serial No.: B911363567
Floor: 3 Terminal Asset No.: N/A
Room: B304

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW002/20

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

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

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

As Found	Temperature		Humidity	
	Start: 22.2 °C	End: 22.6 °C	Start: 58.3 %	End: 59.7 %

As Found Calibration Date: 02-Mar-2022
As Left Calibration Date: N/A
Issue Date: 03-Mar-2022

Calibrator:

Naruephon C.

Naruephon Chonprasertsuk

Approved Signatory:

- ☒ Kassakorn Tassanachaisakul
☐ Sanit Jitnyom
☐ Surachet Sukkate



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Measurement Results

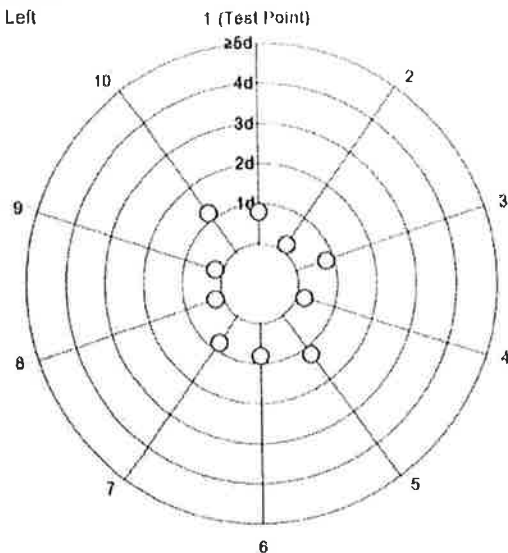
Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00001 g	N/A
2	70.00002 g	N/A
3	70.00001 g	N/A
4	70.00002 g	N/A
5	70.00003 g	N/A
6	70.00001 g	N/A
7	70.00001 g	N/A
8	70.00002 g	N/A
9	70.00002 g	N/A
10	70.00003 g	N/A

Standard Deviation	0.000008 g	N/A
--------------------	------------	-----

○ As Found
◆ As Left



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

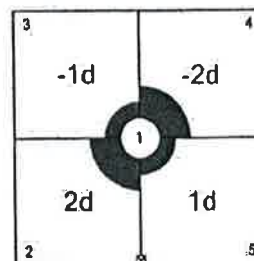
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0002 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
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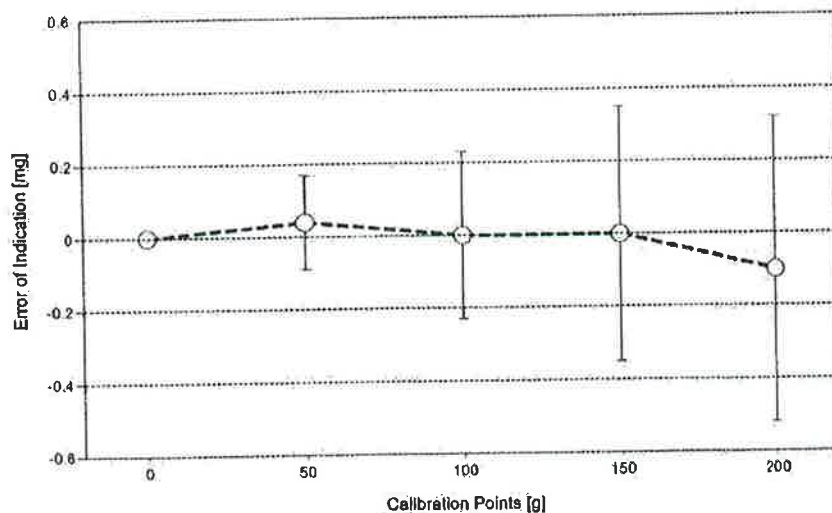
As Found

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

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
3	0.50000 g	0.50001 g	0.00001 g	0.028 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.032 mg	2
5	1.99999 g	2.00000 g	0.00001 g	0.040 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.048 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.062 mg	2
8	49.99998 g	50.00002 g	0.00004 g	0.13 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.23 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.42 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS22	Date of Issue:	06-Jan-2022
Certificate Number:	177036	Calibration Due Date:	03-Jul-2023

Weight Set 2: OIML E2

Weight Set No.:	WS76	Date of Issue:	31-Jan-2022
Certificate Number:	C205470237	Calibration Due Date:	12-Jul-2023

Thermo Hygrometer

Equipment No.:	IN193	Date of Issue:	14-Jun-2021
Certificate Number:	21H1221	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

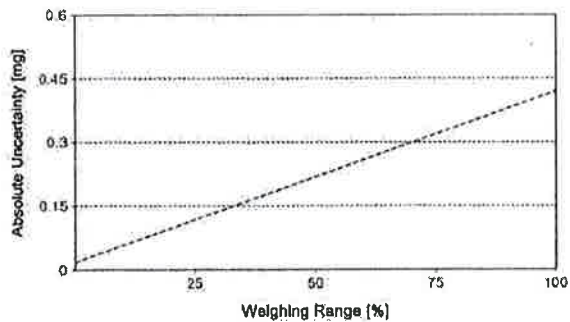
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00497 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00492 \text{ mg/g} \cdot R$	N/A

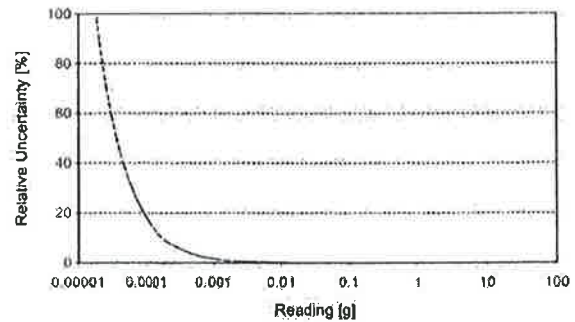
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0087%	N/A	N/A
2.20000 g	0.029 mg	0.0013%	N/A	N/A
220.0000 g	1.1 mg	0.00052%	N/A	N/A



As Found



As Left

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



S K SALES AND SERVICE CO.,LTD.
194/56, 194/57 Thakham Rd. Samce Dom
Bang Khun Thon Bangkok 10150
Tel. : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : 4182/2202-017
Customer : Envilab Co., Ltd. (Head Office)
: 540, 540/1 Soi Bangkhuae 7, Bangkhuae,
: Bangkhuae Bangkok 10160
Equipment : Digital Thermo-Hygrometer
Manufacturer : Testo
Model : 608-H1
Serial No. : 83353607
ID No. : -
Received Date : 7 March 2022
Calibrated Date : 9 March 2022
Issued Date : 15 March 2022

Certificate No. : L2203-290

Page 1 of 2

Environment	Start Calibration	Stop Calibration
Ambient Temperature (°C)	24.7	25.5
Relative Humidity (% RH)	51	52

Calibrated by : Mr. Nattawut Reangdech

Calibration Method

In-house method : by comparison with standard hygrometer for humidity measurement function
and comparison with standard thermometer for temperature measurement function into humidity/temperature chamber

Condition of this result of calibration

1. Reference standard instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygrometer	HL-NT2-D	61468576	QR21-0851	13 May 22
2) Digital Thermometer With Probe	GT11	08000089	PSL-T 0072/65	14 November 2022

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)
- Through Quality Reborn Co.,Ltd.

Approved by : Ep.

☐ Mr.Suphachai Saksri ☐ Mr.Phayak Toolit ☒ Miss Tantaraporn Peltong

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

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บริษัท สก ซาลส์ แอนด์ เซอร์วิส จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ

Result of Calibration

Function : Humidity Measurement Reference Temperature at 25 °C

STD Reading (% RH)	UUC Reading (% RH)	UUC Error (% RH)	Measurement Uncertainty (\pm % RH)
50.00	49.0	-1.00	2.3

Function : Temperature Measurement

STD Reading (°C)	UUC Reading (°C)	UUC Error (°C)	Measurement Uncertainty (\pm °C)
25.012	25.0	-0.012	0.35

Resolution : 0.1 (°C) , 0.1 % RH

STD= Standard

UUC= Unit Under Calibration

** End of Calibration Report **



Envilab Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

ep.

Certificate of Calibration

Certificate No. : 65-420020-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABPHHB74BW01

Electrode

Model : 9615S

Serial No. : 9X1K0003

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (23.5 to 24.8)° C

Relative Humidity : (50 to 55) %

Date of Received : 02 March 2022

Date of Calibration : 02 March 2022

Date of Issue : 05 March 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
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61235182	795894	14 Feb 2024	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
10.008	61244986	795895	25 Feb 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor

รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420020-1

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	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.5	0.0	0.12

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	4.005	0.003	0.0084
	6.985	7.001	-0.016	0.010
	10.008	10.009	-0.001	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%

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 22TW70

Page.: 1 of 2

Certificate of Testing

Equipment :	Dissolved Oxygen Meter
Manufacturer :	Hanna
Model :	HI 9147
Serial No. :	H0007030
ID No. :	ELABDOHI914701
Received Date :	15 March 2022
Test Date :	18 March 2022
Reference :	2203-0566DN-1
Submitted by :	Envilab Co.,Ltd (Head office) 540, 540/1 Soi Bangkhæ 7, Bangkhæ, Bangkhæ, Bangkok 10160
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean

Approved by:

Malee

Approved Signatory

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lerngagtrakul

Issue Date :

22 March 2022



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ผู้จัดการฝ่ายควบคุมคุณภาพ



Cert.No.: 22TW70
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: KC3N0639K

Titration Method (Azide Modification Method) (mg/L)	Dissolved Oxygen Meter Reading (mg/L)	Standard Deviation (mg/L)
8.04	8.1	0.045

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

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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Certificate of Calibration

Certificate No. : 64-400527-3

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkok 10160

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 100613-0

ID No. : ELABREFRIG140L

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (24.5 to 25.0) °C

Relative Humidity : (55 to 58) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 15 October 2021

Date of Calibration : 15 October 2021

Date of Issue : 16 October 2021

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

64-400443-1

29 Mar 2022

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. : 64-400527-3

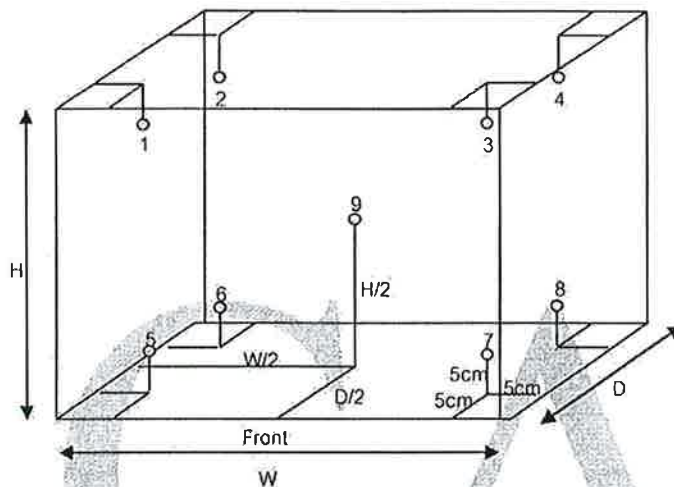
Page : 2 of 2

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 = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 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	19.9	19.8	19.8	19.9	19.9	19.9	20.0	19.8	20.1	0.53

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.4	0.1	0.4

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%

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Signature



Signature

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ผู้ตรวจฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 64-400569-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Air Chamber (Refrigerator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1011

ID No. : ELABBODC140N03

Environment : On site calibration was carried out at the Laboratory, Envilab Co.,Ltd.

Ambient Temperature : (23.0 to 23.8) °C

Relative Humidity : (55 to 60) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 12 November 2021

Date of Calibration : 12 November 2021

Date of Issue : 18 November 2021

Calibrated by : Bunjerd Masri

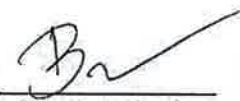
Calibration Method : CAL-M4004, TLAS G-20

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	64-400443-1	29 Mar 2022	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. : 64-400569-1

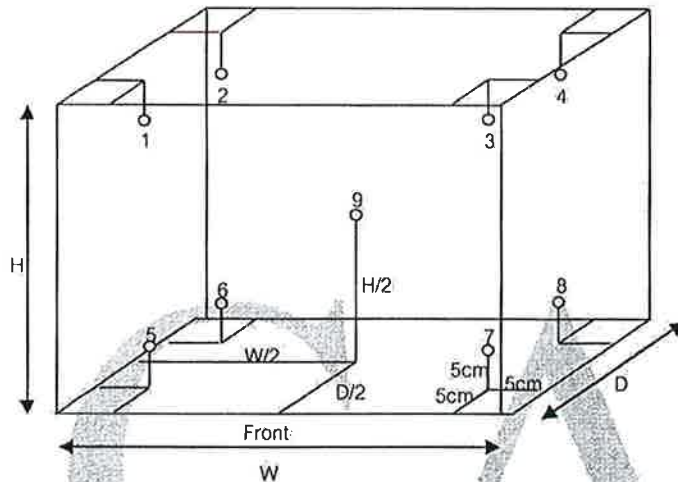
Page : 2 of 2

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 = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 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	
4.0	4.0	4.0	3.3	3.2	3.4	3.4	3.9	3.9	4.0	3.4	4.2	0.57

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	1.0	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%.

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Handwritten signature

บริษัท แคลบร่าเทค จำกัด
การสอบเทียบมาตรฐาน



Certificate of Calibration

Certificate No. : 65-400155-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Air Chamber (Oven)
Manufacturer : Memmert Model : UF 75
Range : N/A °C Resolution : 0.1 °C
Serial No. : B319.0600 ID No. : ELABHAOVEN0600

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (30.0 to 31.0) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 24 March 2022

Date of Calibration : 24 March 2022

Date of Issue : 29 March 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	64-400589-1	25 May 2022	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. : 65-400155-2

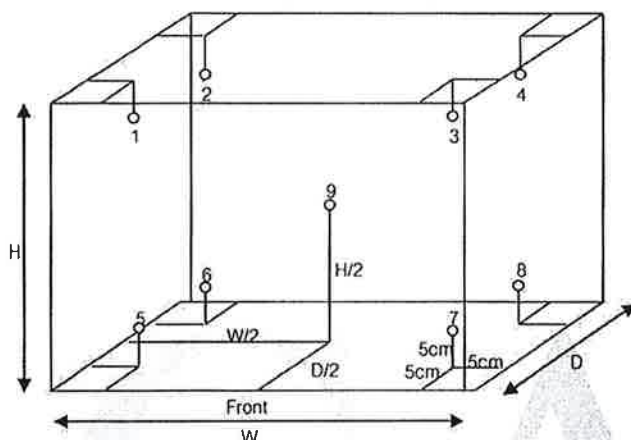
Page : 2 of 2

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 = 0.56 m

Capacity = 0.07 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	
104.0	103.5	103.5	103.9	104.2	104.2	104.2	104.1	104.0	103.7	104.2	104.3	0.69
110.0	109.5	109.5	110.0	110.3	110.3	110.2	110.2	110.0	109.7	110.2	110.3	0.69
180.0	179.0	179.0	179.1	180.0	180.0	180.1	180.1	179.8	179.0	180.1	180.3	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	103.5	103.5	0.7	0.1	0.8
110.0	109.5	109.5	0.7	0.1	0.8
180.0	179.0	179.0	1.5	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%

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Certificate of Calibration

Certificate No. : 65-400053-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB29

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L617.0156

ID No. : ELABWBWNB29N01

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (22.7 to 23.5) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 02 February 2022

Date of Calibration : 02 February 2022


Date of Issue : 07 February 2022

Calibrated by : Permpoon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
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 & 400031	64-400588-1	24 May 2022	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

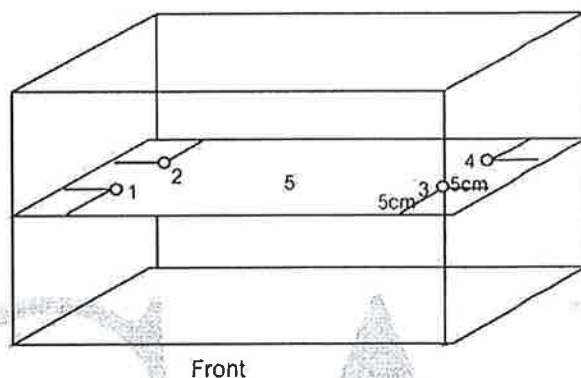
Certificate No. : 65-400053-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @					Uncertainty (±°C)	Measured Uniformity (°C)	Measured Stability (°C)
			Sensor No.							
			1	2	3	4	5			
95.0	95.0	95.0	95.35	95.45	95.51	95.66	95.56	0.19	0.27	0.06

Remark The uncertainty is not combine uniformity of the water bath

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

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

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Certificate of Calibration

Certificate No. : 65-300146-10

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-020/18

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

Relative Humidity : (50 ± 15) %

Air Pressure : 1002.0 mbar.

Date of Received : 09 March 2022

Date of Calibration : 21 March 2022

Date of Issue : 21 March 2022

Calibrated by : Areerat Sombun

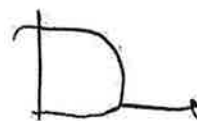
Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	64-200354-1	02 Jun 2022	National Institute of Metrology (Thailand) (NIMT)

Approved by :



(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-300146-10

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.79
50	49.73

Uncertainty of measurement with in \pm 0.054 ml

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%

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Certificate of Calibration

Certificate No. : 65-300147-4

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Cylinder

Manufacturer : ISOLAB

Class : A

Capacity : 1000 ml

Graduation : 10 ml

ID No. : C-WW-028/18

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

Relative Humidity : (50 ± 15) %

Air Pressure : 1002.0 mbar.

Date of Received : 09 March 2022

Date of Calibration : 21 March 2022

Date of Issue : 21 March 2022

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	64-200354-I	02 Jun 2022	National Institute of Metrology (Thailand) (NIMT)

Approved by :



(Wipa Tovadce)

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.



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com; calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-300147-4

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
500	501.84
1000	1001.39

Uncertainty of measurement with in \pm 0.17 ml

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%

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Ok

