

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ



Certificate of Calibration

Calibration Certification Information			
Cal. Date:	June 28, 2021	Rootmeter S/N: 438320	Ta: 297 °K
Operator:	Jim Tisch		Pa: 753.6 mm Hg
Calibration Model #:	G25A	Calibrator S/N:	11MX

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3910	3.3	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8430	9.0	5.50
5	9	10	1	0.6970	12.9	8.00

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)
0.9906	0.7121	1.4106	0.9956	0.7158	0.8878
0.9865	0.9975	1.9949	0.9915	1.0025	1.2555
0.9844	1.1123	2.2304	0.9894	1.1179	1.4037
0.9831	1.1661	2.3393	0.9881	1.1721	1.4723
0.9779	1.4030	2.8213	0.9829	1.4102	1.7756
QSTD		m= 2.04215	QA		m= 1.27876
		b= -0.04258			b= -0.02680
		r= 1.00000			r= 1.00000

Calculations			
Vstd=ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)		Va=ΔVol((Pa-ΔP)/Pa)	
Qstd=Vstd/ΔTime		Qa=Va/ΔTime	
For subsequent flow rate calculations:			
Qstd= 1/m($\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$)-b		Qa= 1/m($\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$)-b	

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	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com

TOLL FREE: (877)263-7610

FAX: (513)467-9009

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3	Reference Number: 122-402135167-1
Cylinder Number: EB0143262	Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC	Cylinder Pressure: 2015 PSIG
PQVP Number: B22021	Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN	Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-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 molar 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	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.58 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D85025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40124383102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration	
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021	

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

[Signature]

Approved for Release



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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140



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Certificate of Calibration

Customer

Name	: UNITED ANAL/M & ENGINEERING CONSULTANT CO.,LTD.	Certificate No : 22-ACT-101
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	Request No : Req-2022-0231

Unit Under Calibration Details

Measurement item :	: Sound Level Meter	Microphone Class : 2
Manufacturer	: LARSON DAVIS	Microphone Model : 375A04
Model	: LXT2	Microphone S/N : 329360
Serial Number	: 0005405	Preamplifier Model : PRMLxT2C
ID	: UAE.EFM.041/2564	Preamplifier S/N : 073800
Resolution	: 0.1 dB	Instrument Status : Used

Calibration Environment and Details

Temperature	: 23 °C ± 2 °C
Humidity	: 50 %RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 31 January 2022
Calibrated Date	: 11 February 2022
Calibration Procedure	: In-house method CP-SLM-01 based on IEC 61672-3: 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration	: Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibrated By : *[Signature]*
Mr. Noppadon Luangart
Calibration Officer

Approved By : *[Signature]*
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140



Page: 2/6

Certificate No : 22-ACT-101

Request No : Req-2022-0231

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	27.3	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	27.6	0.10
C	27.3	0.10
Z	33.2	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.2	0.2	0.60	3.0
8000 Hz	-0.1	-0.1	0.0	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VUPVTC21

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

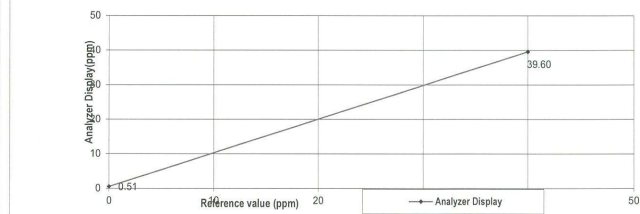
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	0.51	0.51	0.51	0.51
Level 2 80.00%	40.00	-0.40	-1.01	1.01
Remark : Measuring Range 50.00 ppm		Average Difference (%)		0.76

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Signature
9/3/25

Approve by

Signature
9/Mar/2022

MULTI-POINT GAS TEST REPORT

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : PDXEGXF7

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

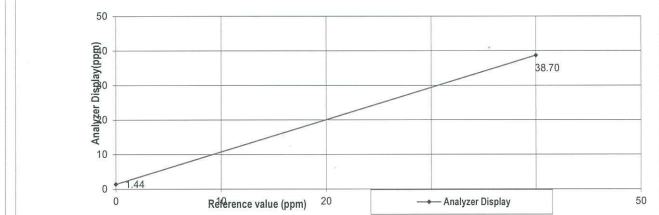
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	1.44	1.44	1.44	1.44
Level 2 80.00%	40.00	-1.30	-3.36	3.36
Remark : Measuring Range 50.00 ppm		Average Difference (%)		2.40

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Signature
9/3/25

Approve by

Signature
9/Mar/2022

MULTI-POINT GAS TEST REPORT

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : SSGEYBJ

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

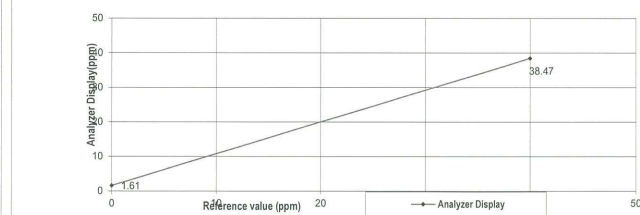
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	1.61	1.61	1.61	1.61
Level 2 80.00%	40.00	-1.53	-3.98	3.98
Remark : Measuring Range 50.00 ppm		Average Difference (%)		2.79

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Signature
9/3/25

Approve by

Signature
9/Mar/2022

MULTI-POINT GAS TEST REPORT

Test Date : Mar 21, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VV2FY3R3

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

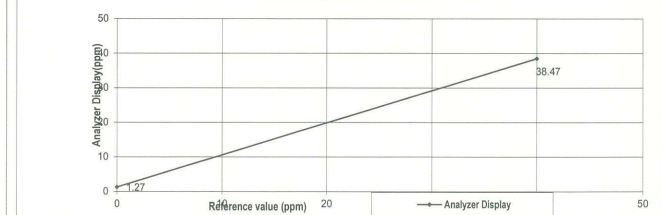
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	1.27	1.27	1.27	1.27
Level 2 80.00%	40.00	-1.53	-3.98	3.98
Remark : Measuring Range 50.00 ppm		Average Difference (%)		2.62

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Signature
21/3/25

Approve by

Signature
21/Mar/2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 4, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : T4FG19AN

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

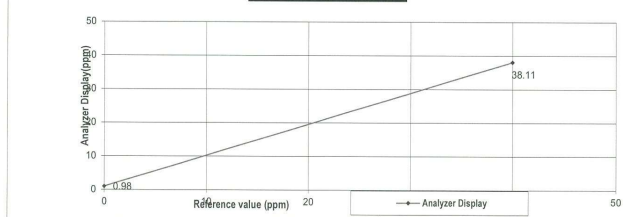
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	0.98	0.98	0.98
Level 2 80.00%	40.00	38.11	-1.89	-4.96
Remark : Measuring Range 50.00 ppm		Average Difference (%)	2.97	

:Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



Calculate by

4/04/22

Approve by

4 Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Mar 21, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : HAMEHUSM

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

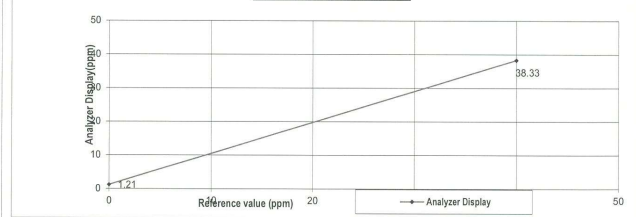
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	1.21	1.21	1.21
Level 2 80.00%	40.00	38.33	-1.67	-4.36
Remark : Measuring Range 50.00 ppm		Average Difference (%)	2.78	

:Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



Calculate by

21/3/22

Approve by

21 Mar. 2022

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03AI99E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2016 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH4,PPN,BALA Certification Date: Oct 16, 2020
Expiration Date: Oct 16, 2028

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
METHANE	4000 PPM	4019 PPM	G1	+/- 1.0% NIST Traceable	10/16/2020
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable	10/09/2020
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	02010405	K010090	4976 PPM PROPANE/NITROGEN	+/- 0.6%	Dec 02, 2021
NTRM	170608	CC160290	0.997 % METHANE/NITROGEN	+/- 0.4%	Aug 22, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CH4 - 00028781	FTIR	Oct 14, 2020
Nicolet 6700 APW1100391 C3H8	FTIR	Sep 18, 2020

Triad Data Available Upon Request

NOTES: NET WEIGHTS: 4.865kg
GROSS WEIGHTS: 27.365kg
PO#: 5220003825



Approved for Release



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 5 April, 2022

Certification No. 185/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 821

Serial No. : Dato Logger 20070023 wind speed and wind direction 20040188

ID No. : No.17

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.0 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0600.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : Watchapol

Signed :

Mr. Watchapol Subwat

Mr. Pisod Promsut

Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 185/22

5April, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacumm inches	Pressure inches	Velocity hPa	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.5	0.50
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.6	0.42
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.7	0.31
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	16.6	0.42
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 5April, 2022

Certification No. 186/22

Page : 1 of 2

Object : Wind speed and wind direction
Manufacturer : LSI
Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 821
Serial No. : Dato Logger 20080020 wind speed and wind direction 20040192
ID No. : No.18
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisood Promsut

(Authorised Signatory)
for the Chief
Sub-Standard Instrument
เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 186/22

5April, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacumm inches	Pressure inches	Velocity hPa	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.6	0.40
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.6	0.42
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.7	0.31
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	16.6	0.42
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 12 April, 2022

Certification No. 205/22

Page : 1 of 2

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา
Manufacturer : LSI
Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 821
Thermogrometers DMA875 Barometer DQA 801
Mfg Code : Dato Logger 20100019 wind speed and wind direction 20010220
Thermogrometers 19100289 Barometer 20030057
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1014.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. W1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisood Promsut

(Authorised Signatory)
for the Chief
Sub-Standard Instrument
เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Wind Speed And Wind Direction Certification No. 205/22
12 April, 2022 Model DNA821 S/N 20010220 Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	hPa	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.8	0.24
9.02	-	-	-	8.5	0.52
11.02	-	-	-	10.8	0.22
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.8	0.22

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 14 April, 2022

Certification No. 212/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG

Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 79468 Basic Datalogger : 30905375

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisood Promsut

(Authorised Signatory)
for the Chief
Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 212/22
14 April, 2022 Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	hPa	m/sec
1.00	-	-	-	0.81	0.19
3.02	-	-	-	2.81	0.21
5.00	-	-	-	4.81	0.19
7.04	-	-	-	7.00	0.04
9.02	-	-	-	9.00	0.02
11.01	-	-	-	11.00	0.01
13.01	-	-	-	13.00	0.01
15.01	-	-	-	15.06	-0.05
17.02	-	-	-	17.00	0.02
20.02	-	-	-	20.19	-0.17

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	90
180.0	180
270.0	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 14 April, 2022

Certification No. 213/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG

Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 53235 Basic Datalogger : 309011880

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisood Promsut

(Authorised Signatory)
for the Chief
Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 213/22

14 April, 2022

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	hPa	m/sec
1.00	-	-	-	0.90	0.10
3.02	-	-	-	2.91	0.11
5.00	-	-	-	4.84	0.16
7.04	-	-	-	6.94	0.10
9.02	-	-	-	8.82	0.20
11.01	-	-	-	10.91	0.10
13.01	-	-	-	12.83	0.18
15.01	-	-	-	14.94	0.07
17.02	-	-	-	16.99	0.03
20.02	-	-	-	20.03	-0.01

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	90
180.0	180
270.0	270

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 14 April, 2022

Certification No. 214/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG

Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 79424 Basic Datalogger : 309019236

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

Authorized Signatory

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 214/22

14 April, 2022

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	hPa	m/sec
1.00	-	-	-	0.90	0.10
3.02	-	-	-	3.00	0.02
5.00	-	-	-	4.98	0.02
7.04	-	-	-	7.02	0.02
9.02	-	-	-	8.94	0.08
11.01	-	-	-	10.98	0.03
13.01	-	-	-	12.96	0.05
15.01	-	-	-	15.00	0.01
17.02	-	-	-	17.04	-0.02
20.02	-	-	-	20.10	-0.08

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	91
180.0	182
270.0	271

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTANAKORN 11 TAMBON BANG KAE0.
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Certificate No : 21-ACT-326

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Request No : Req-2021-0994

Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : SVANTEK

Range : 94 , 114 dB / 1000 Hz

Model : SV36

Instrument Status : Used

Serial Number : 107224

ID : UAE.EFM.171/2564

Calibration Environment and Details

Temperature : (23 ± 2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ± 10.0 hPa)

Received Date : 22 July 2021

Calibration Date : 24 August 2021

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EI	14 May 2022
THD Multimeter	2015	1047765	NIMT	21 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 24 August 2021

Certificate No : 21-ACT-326
Request No : Req-2021-0994

Sound pressure level		Calibration Results : Without Adjustment				
Calibration Range	Without Adjustment (dB)	Adjustment (dB)		Uncertainty	Acceptance limit	
(dB)	Measured	Error	Measured	Error	(± dB)	Class 1 (± dB)
94 dB / 1000 Hz	94.08	0.08	-	-	0.11	0.25
114 dB / 1000 Hz	114.13	0.13	-	-	0.11	0.25

Frequency of Sound pressure level						
Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.96	0.004	-	-	0.10	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.10	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)				
Calibration Range	Without Adjustment	Adjustment	Uncertainty	Acceptance limit
(Hz)	Measured (%)	Measured (%)	(± %)	Class 1 (± %)
94 dB / 1000 Hz	0.43	-	0.40	2.5
114 dB / 1000 Hz	0.35	-	0.40	2.5

- Note :
- Acceptance limit was IEC60942:2017 Class 1
 - The calibration results exclude the calibrator pressure correction
 - The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority (C-148)
เอกสารไม่ควบคุม doc 01/07/19

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-248
Request No : Req-2022-0628

Unit Under Calibration Details
Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005344
ID : UAE.EFM.041/2563
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329362
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 071494
Instrument Status : Used
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	SvanteK	Svan401	131	18 October 2022	WK Electric

Note
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangrat
Calibration Officer
Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority (C-148)
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Certificate No : 22-ACT-248
Request No : Req-2022-0628

1. Indication at the calibration check frequency							
UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.7	-0.15	113.9	0.05	0.20	0.3

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed		
UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	29.1	(± dB)
		0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.8	0.10
C	28.4	0.10
Z	32.6	0.10

4. Acoustic signal test of frequency weightings (Without Windscreens)		Deviation from various Frequency		UNCERTAINTY	Acceptance
UUC Setting	Weighting	A	C	Z	Limit
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting					
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.2	0.2	0.60	3.0
8000 Hz	0.0	0.0	0.1	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority (C-148)
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Certificate No : 22-ACT-248
Request No : Req-2022-0628

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz		Deviation from various Frequency		UNCERTAINTY	Acceptance
UUC Setting	Weighting	A	C	Z	Limit
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting					
63 Hz	-0.2	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	0.0	0.2	1.5
250 Hz	-0.1	0.0	0.0	0.2	1.5
500 Hz	-0.1	0.0	0.0	0.2	1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.0	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	-0.1	-0.1	0.0	0.2	5.0
16000 Hz	-0.1	-0.1	-0.1	0.2	+5, -INF.

6. Frequency and time weightings at 1kHz		STD	Measured	UNCERTAINTY	Acceptance
UUC Setting	REF	UUC	ERR	(± dB)	Limit
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
UUC Weighting					
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0	0.2	0.2

UUC Setting		STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(± dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0	0.2	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority (C-148)
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Certificate No : 22-ACT-248
Request No : Req-2022-0628

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)		
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	98.9	-0.1		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.4	0.4		1.1
38.00	38	38.5	0.5		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Instrument Calibration Laboratory Co., Ltd.
เอกสารไม่ควบคุม
Date: 01/07/19

Certificate No : 22-ACT-248
Request No : Req-2022-0628

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)		
37-139	44.2	44.4	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A / 37-139	Toneburst	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	129.0	129.1	+0.1		1.0
	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / C / 95-142	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Instrument Calibration Laboratory Co., Ltd.
เอกสารไม่ควบคุม
Date: 01/07/19

Certificate No : 22-ACT-248
Request No : Req-2022-0628

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Positive one-half cycle	143.2		
Negative one-half cycle	143.1		
Deviated	0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Instrument Calibration Laboratory Co., Ltd.
เอกสารไม่ควบคุม
Date: 01/07/19

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-034
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0092
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LxT2 Microphone S/N : 329361
Serial Number : 0005394 Preamplifier Model : PRMLxT2C
ID : UAE.EFM.031/2564 Preamplifier S/N : 073810
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C \pm 2 °C
Humidity : 50 %RH \pm 20 %RH
Barometric Pressure : 1013 hPa \pm 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

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เอกสารไม่ควบคุม
Date: 01/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0092

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	27.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.3	0.2	0.60	3.0
8000 Hz	-0.3	-0.3	-0.3	0.70	5.0

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วันที่ 01/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0092

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	-0.1	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(± dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(± dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

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วันที่ 01/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0092

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(± dB)	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	69.0	0.0		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		0.8
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
38.00	38	38.3	0.3		1.1
37.00	37	37.5	0.5		1.1

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วันที่ 01/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0092

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	42.8	43.0	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.9	-0.1		+1.0, -5.0
	0.25	109.0	109.1	+0.1		+1.0, -2.5
SEL	200	129.0	129.0	0.0		1
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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วันที่ 01/07/19

Certificate No : 22-ACT-034
Request No : Req-2022-0092

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-247
Request No : Req-2022-0627

Unit Under Calibration Details

Measurement item : Sound Level Meter
Microphone Class : 2
Manufacturer : LARSON DAVIS
Microphone Model : 375A04
Model : LxT2
Microphone S/N : 329355
Serial Number : 0005395
Preamplifier Model : PRMLxT2C
ID : UAE.EFM.032/2564
Preamplifier S/N : 073797
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	SvanteK	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangrat
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควรถูกเผยแพร่โดยไม่ได้รับอนุญาต
Date 01/07/19

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Date 01/07/19

Certificate No : 22-ACT-247
Request No : Req-2022-0627

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.8	-0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.4	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.1	0.10
C	27.7	0.10
Z	32.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)		
STD Setting	0.0	0.1	0.1	0.50	2.0
125 Hz	0.0	0.0	0.0	0.60	1.0
1000 Hz	0.4	0.5	0.5	0.60	3.0
8000 Hz	0.2	0.1	0.3	0.70	5.0

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting	(dB)	(dB)	(dB)		
63 Hz	-0.2	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)		
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

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เอกสารไม่ควรถูกเผยแพร่โดยไม่ได้รับอนุญาต
Date 01/07/19

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Date 01/07/19

Certificate No : 22-ACT-247
Request No : Req-2022-0627

Certificate No : 22-ACT-247
Request No : Req-2022-0627

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	94.0	0.0	1.1
89.00	89	89.0	0.0	1.1
84.00	84	84.0	0.0	1.1
79.00	79	79.0	0.0	1.1
74.00	74	74.0	0.0	1.1
69.00	69	69.0	0.0	1.1
64.00	64	64.0	0.0	1.1
59.00	59	59.0	0.0	1.1
54.00	54	54.0	0.0	1.1
49.00	49	49.0	0.0	1.1
44.00	44	44.1	0.1	1.1
39.00	39	39.3	0.3	1.1
38.00	38	38.4	0.4	1.1

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	43.4	43.5	0.1	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	134.9	-0.1	1.0
	2	118.0	117.8	-0.2	+1.0, -2.5
	0.25	109.0	108.7	-0.3	+1.5, -5.0
Slow	200	128.6	128.4	-0.2	1.0
	2	109.0	108.8	-0.2	+1.0, -5.0
SEL	200	129.0	129.0	0.0	1.0
	2	109.0	109.1	+0.1	+1.0, -2.5
	0.25	100.0	99.9	-0.1	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

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เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

Certificate No : 22-ACT-036
Request No : Req-2022-0095

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.2		
Negative one-half cycle	142.2		
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005400
ID : UAE.EFM.037/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 328676
Preamplifier Model : PRMLXT2C
Preamplifier S/N : 073803
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-036
Request No : Req-2022-0095

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	29.0	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	28.8	0.10
C	28.2	0.10
Z	32.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
125 Hz	-0.1	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.5	0.5	0.6	0.60	3.0
8000 Hz	0.4	0.4	0.5	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and Management Co., Ltd.
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5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
63 Hz	-0.2	-0.1	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	0.0	0.0		5
16000 Hz	-0.1	-0.1	0.0		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(± dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(± dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)		
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

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Certificate No : 22-ACT-036
Request No : Req-2022-0095

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)		
Initial	114.0		
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(± dB)	Limit
STD dB	(dB)	(dB)	(dB)		
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	69.0	0.0		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		0.8
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
38.00	38	38.3	0.3		1.1
37.00	37	37.5	0.5		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and Management Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-036
Request No : Req-2022-0095

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)		
37-139	42.9	43.2	0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	0.25	109.0	109.0	0.0		+1.0, -2.5
SEL	200	129.0	129.0	0.0		1
	2	109.0	109.0	0.0		+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.9	-0.50	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and Management Co., Ltd.
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Certificate No : 22-ACT-036
Request No : Req-2022-0095

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.1		
Negative one-half cycle	141.9		
Deviated	0.2	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1607
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1F0002
ID No. : UAE.EFM.200/2564(EFM.pH.08/64)
Condition As-Received: Used Item
Received Date : 18 November 2021
Calibration Date : 19 November 2021
Reference : 2111-0736WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by :
Approved Signatory

() Malee Butkruea
() Sathip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 25 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 21CH1607
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21H1201	26 Oct 2022

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	761016	02 Aug 2023
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	(± mV)	k
pH Meter	4.00	177.48	177.4	0.058	2.00
S/N.: HA1F0002	7.00	0.00	-0.2	0.058	2.00
	7.00	0.00	-0.2	0.058	2.00
	10.00	-177.48	-177.6	0.058	2.00

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Cert.No.: 21CH1607
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.01	172	0.0071	2.00
S/N.: 991E0471	6.982	6.98	-4	0.011	2.00
	6.982	6.98	-4	0.011	2.00
	10.015	10.01	-181	0.011	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 991E0471
Dimension of probe;
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 22P802
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36W/M
Serial No.: -
ID No.: UAE.EMA2.031/2554

Condition As-Received: Used Item
Received Date: 03 March 2022
Calibration Date: 12 March 2022

Reference: 2203-0131WSC Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using * DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 * as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

2. This result of calibration was made on requested at the point specified by customer.

3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4. This instrument was used clean air as pressure media.

5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

7. The certificate is valid only to the item calibrated on date and place of calibration.

8. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarnee
Issue Date: 14 March 2022

Approved Signatory: Attapol P.

[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range: 0 inH₂O to 36 inH₂O

Scale Interval: 0.1 inH₂O (The Fifth Estimate)

UUC Indication				
Applied Pressure	High-port side	Low-port side	ΔP	Error
(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.92	1.92	-0.08
4.00	2.00	-1.92	3.92	-0.08
6.00	3.00	-2.92	5.92	-0.08
8.00	4.02	-3.92	7.94	-0.06
10.00	5.02	-4.94	9.96	-0.04
12.00	6.04	-5.94	11.98	-0.02
14.00	7.04	-6.94	13.98	-0.02
16.00	8.06	-7.94	16.00	0.00
18.00	9.06	-8.94	18.00	0.00
20.00	10.08	-9.96	20.04	0.04
22.00	11.08	-10.96	22.04	0.04
24.00	12.10	-11.96	24.06	0.06
26.00	13.10	-12.96	26.06	0.06
28.00	14.10	-13.98	28.08	0.08
30.00	15.10	-14.98	30.08	0.08
32.00	16.12	-15.98	32.10	0.10
34.00	17.12	-16.98	34.10	0.10
35.50	17.98	-17.86	35.84	0.34

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

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Cert.No.: 21TW248
Page.: 1 of 2

Certificate of Testing

Equipment: DO Meter
Manufacturer: Horiba
Model: LAQUA-DO210
Serial No.: HE1D0007
ID No.: UAE.EFM.206/2564(EFM.DO.08/64)

Received Date: 18 November 2021

Test Date: 19 November 2021

Reference: 2111-0736WSC-7

Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

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: Walaiak Sirithan

Approved by: Mali
Approved Signatory

(x) Ma'ee Butkruea
() Saithip Meangmai
() Warakorn Lerngagatrakul

Issue Date: 25 November 2021

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Result: Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K1B0013

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.16	8.16	0.000

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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Cert. No.: 21LM19
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0007
ID No. : UAE.EFM.206/2564(EFM.DO.08/64)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 18 November 2021
Calibrated Date : 26 November 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Malee Butkruea

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Suwit Imjai

Issue Date : 2 December 2021

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2111-0736WSC-8

Cert. No.: 21LM19
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	2111273	22 Nov 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K1B0013

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	60	25.001	25.0	-0.001	0.16	2.00
30.0	60	30.000	30.0	0.000	0.16	2.00
35.0	60	35.002	35.0	-0.002	0.16	2.00

UUC* : Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 21P2504
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.ANV.153/2550
Condition As-Received: Used Item
Received Date: 20 July 2021
Calibration Date: 21 July 2021
Reference: 2107-0570WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1009 mbar
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0053-21	08 Apr 2022

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.This instrument was used clean air as pressure media.

5.The certificate is valid only to the item calibrated on date and place of calibration.

6.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree
Issue Date : 22 July 2021

Approved Signatory :
[] Phalinee Prabpaipal
[] Sura Suwannasri
✓ Attapol Panurach

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Cert.No.: 21P2504
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa

Scale Interval: 1 hPa(The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	960.74	971.53	981.35	991.07	1000.85	1010.74	1020.50	1030.18
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-0.74	-1.53	-1.35	-1.07	-0.85	-0.74	-0.50	-0.18

Decreasing Pressure

Applied Pressure (hPa)	1030.12	1020.39	1010.65	1000.74	990.89	981.24	971.35	960.68
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.12	-0.39	-0.65	-0.74	-0.89	-1.24	-1.35	-0.68

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No. : 22H768
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022

Reference: 2203-1124WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison
with standard chilled mirror sensor for humidity measurement function and comparison with standard
temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10203027	TH-0063-21	01 Jul 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Somchai Dumwong
Issue Date : 08 April 2022

Approved Signatory :

- ☒ Chakrit Waewanjua
- ☐ Pornthippa Tameyakul
- ☐ Viporn Tantiyawutti

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B 0285420



Cert. No.: 22H768
Page.: 2 of 2

Result of Calibration:-

Without Adjustment
Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	62	2.0	1.8
25.0	80.0	76	-4.0	2.0

Result of Calibration:-

Without Adjustment
Function: Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.0	-0.02	0.72
29.98	30.0	0.02	0.72
40.03	39.5	-0.53	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

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a 1104144



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
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3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaconsultant.com E-mail: uae@uaconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Electron Corporation
Model : 42C
Serial Number : 42C-0508011076

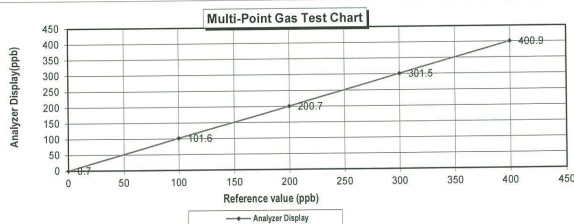
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	45.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	101.6	1.60	1.57	1.57
Level 3 40.00%	200.7	0.70	0.35	0.35
Level 4 60.00%	301.5	1.50	0.50	0.50
Level 5 80.00%	400.9	0.90	0.22	0.22
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.67	
:Acceptable Limit ± 5%				



Calculate by

Somchai Dumwong
21/10/21

Approve by

Chakrit Waewanjua
22 Oct 2021

MULTI-POINT GAS TEST REPORT

Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Environmental Instruments
Model : 42C
Serial Number : 42C-76412-383

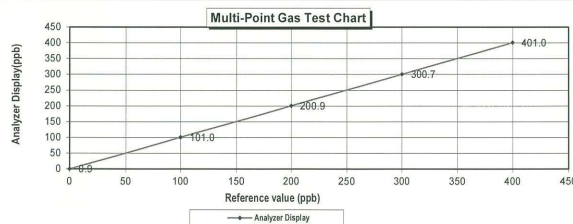
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.9	0.90	0.90
Level 2 20.00%	101.0	1.00	0.99	0.99
Level 3 40.00%	200.9	0.90	0.45	0.45
Level 4 60.00%	300.7	0.70	0.23	0.23
Level 5 80.00%	401.0	1.00	0.25	0.25
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.56	
:Acceptable Limit ± 5%				



Calculate by

Somchai Dumwong
21/10/21

Approve by

Chakrit Waewanjua
22 Oct 2021

MULTI-POINT GAS TEST REPORT

Test Date : July 19, 2021

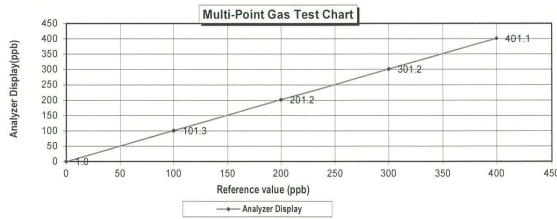
Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1180540062

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]	
Level 1	Zero	0.0	1.0	1.00	1.00	1.00	
Level 2	20.00%	100.0	101.3	1.30	1.28	1.28	
Level 3	40.00%	200.0	201.2	1.20	0.60	0.60	
Level 4	60.00%	300.0	301.2	1.20	0.40	0.40	
Level 5	80.00%	400.0	401.1	1.10	0.27	0.27	
Remark : Measuring Range			500.0 ppb		Average Difference (%)		0.71



Calculate by
Siriwan Y.
19/07/2021

Approve by
Siriwan Y.
19/07/2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 19, 2022

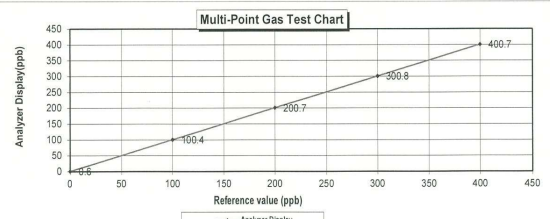
Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-78933-390

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60	0.60
Level 2	20.00%	100.0	100.4	0.40	0.40	0.40
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.7	0.70	0.17	0.17
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.36



Calculate by
Siriwan Y.
19/04/2022

Approve by
Siriwan Y.
19/04/2022

Page 1 of 1

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04NI9E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143282 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/831, 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.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.86 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.6 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708068	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 02, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Jun 17, 2022
NTRM	16011043	CC473277	48.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request
NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



CERT 3082.01
เอกสารไม่ควบคุม

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 30, 2021

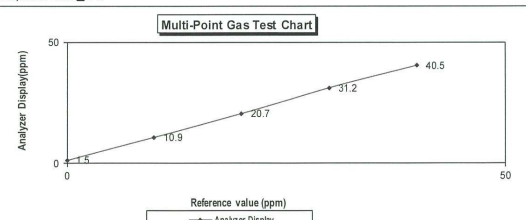
Equipment : Gas Analyzer (CO) Model : 48I
Manufacturer : Thermo Scientific Serial Number : 1201497733

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.5	1.5		1.5
Level 2	20.00%	10.0	10.9	0.9	8.3	8.3
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
Level 4	60.00%	30.0	31.2	1.2	3.8	3.8
Level 5	80.00%	40.0	40.5	0.5	1.2	1.2
Remark : Measuring Range			50.0 ppm	Average Difference (%)		3.64



Calculate by
Siriwan Y.
30/11/2021

Approve by
Siriwan Y.
30/11/2021

MULTI-POINT GAS TEST REPORT

Test Date : July 19, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1180540062

Standard Gas Concentration

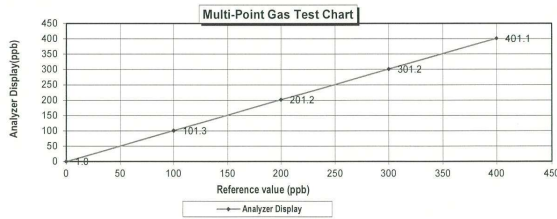
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]	
Level 1	Zero	0.0	1.0	1.00	1.00	1.00	
Level 2	20.00%	100.0	101.3	1.30	1.28	1.28	
Level 3	40.00%	200.0	201.2	1.20	0.60	0.60	
Level 4	60.00%	300.0	301.2	1.20	0.40	0.40	
Level 5	80.00%	400.0	401.1	1.10	0.27	0.27	
Remark : Measuring Range			500.0 ppb		Average Difference (%)		0.71



Calculate by

Sirichan Y.
19/07/2021

Approve by

Phrakhanong U.
19/07/2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1201778117

Standard Gas Concentration

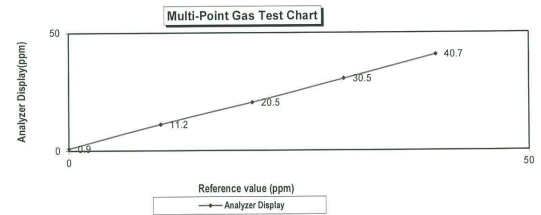
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9	0.9
Level 2	20.00%	10.0	11.2	1.2	10.7	10.7
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	40.7	0.7	1.7	1.7
Remark : Measuring Range			50.0 ppm	Average Difference (%)		3.48



Calculate by

Sirichan Y.
21/12/2021

Approve by

Phrakhanong U.
21/12/2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : July 9, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920008

Standard Gas Concentration

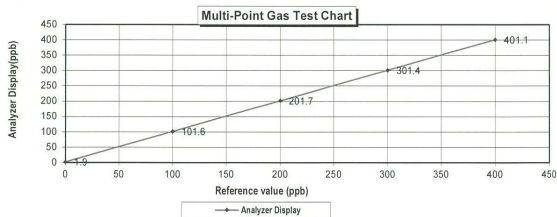
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.9	1.90	1.90	1.90
Level 2	20.00%	100.0	101.6	1.60	1.57	1.57
Level 3	40.00%	200.0	201.7	1.70	0.84	0.84
Level 4	60.00%	300.0	301.4	1.40	0.46	0.46
Level 5	80.00%	400.0	401.1	1.10	0.27	0.27
Remark : Measuring Range			500.0 ppb	Average Difference (%)		1.01



Calculate by

Sirichan Y.
09/07/2021

Approve by

Phrakhanong U.
09/07/2021

Page 1 of 1

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143282 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

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.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.86 PPM	G1	+/- 1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.6 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Jun 16, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143282 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/831, 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.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	884.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708088	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D585025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40142338102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Oct 14, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540068

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

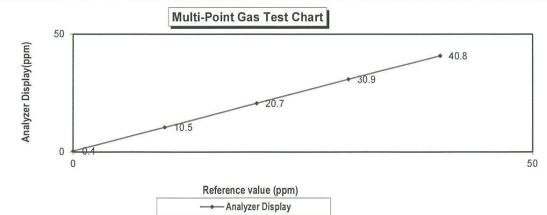
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.4	0.4	0.4
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	20.7	0.7	3.4
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.8	0.8	2.0

Remark : Measuring Range 50.0 ppm

:Acceptable Limit $\pm 5\%$



Calculate by
Srichai y.
14.10.21

Approve by
Pakorn h.
14. oct 2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 25, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GY21PTED

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

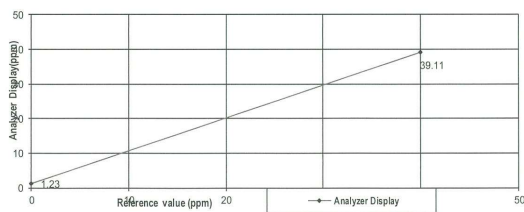
	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.23	1.23	1.23
Level 2	80.00%	40.00	39.11	-0.89	-2.28

Remark : Measuring Range 50.00 ppm

:Acceptable Limit $\pm 5\%$

Average Difference (%) 1.75

Multi-Point Gas Test Chart



Calculate by
Srichai y.
25.04.22

Approve by
Pakorn h.
25. Apr 2022

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Oct 14, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM08140004

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

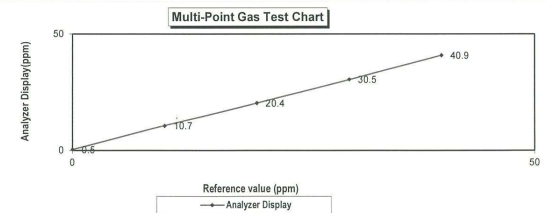
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.5	0.5
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.4	0.4	2.0
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.9	0.9	2.2

Remark : Measuring Range 50.0 ppm

:Acceptable Limit $\pm 5\%$



Calculate by
Srichai y.
14.10.21

Approve by
Pakorn h.
14. Oct 2021

Page 1 of 1

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MULTI-POINT GAS TEST REPORT

Test Date : Mar 21, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GAL13KSE

Standard Gas Concentration

Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

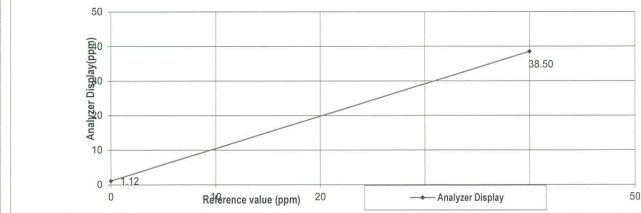
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	1.12	1.12	1.12
Level 2 80.00%	40.00	-1.50	-3.90	3.90
Remark : Measuring Range	50.00 ppm	Average Difference (%)	2.51	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Sirichar Y.
21/3/2022

Approve by

Phrakhanong U.
21/3/2022

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200636465

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

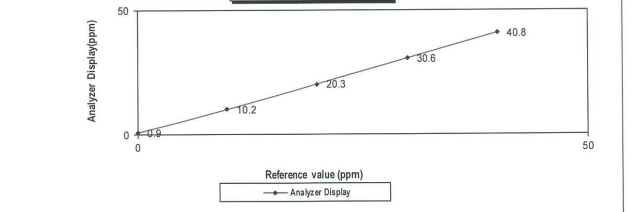
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.9	0.9	0.9
Level 2 20.00%	10.0	10.2	0.2	2.0
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.8	0.8	2.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.65	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

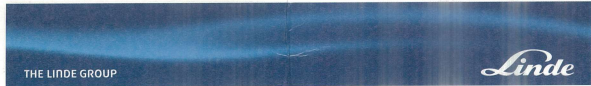


Calculate by

Sirichar Y.
24/11/2021

Approve by

Phrakhanong U.
24/11/2021



Certificate Of Analysis

Special Gases Mixture

Customer Details
Name: United Analyst & Engineering Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd, Bangkok, Khet Phra Khanong, Bangkok 10260
Customer Tag No.:

Certificate Details
Number: 3384/20
Date of Issue: 4-Aug-2020
Expiry date: 4-Aug-2028
Material Details
Production Order: 90161442
Material Code: 400400-AL-34
Cylinder No.: D824432
Gas content: 6.60 M³
Filling pressure: 137.0 bar
Valve: CGA 590 BRASS
Cylinder Owner: LINDE
Cylinder Material: Aluminum
Cylinder Size: 50L

Laboratory Report
Component: Methane
Normal Concentration: 40.0 ppm
Analysis Result¹: 39.8 ppm
Uncertainty²: $\pm 1\%$ relative
Method of Analysis³: (6) FID-352
Assay Date: 4-Aug-2020

Reference Standard used in Assay
Reference Standard: Methane
Cylinder number: 25599956
Concentration: 49.29 \pm 0.39 ppm
Expiry date: 4-Oct-2020

Analytical Instruments used in Assay
Instrument/Make/Model: FTIR Spectrometers Nicolet 550
Analytical Principle: FTIR-CH4
Last Multipoint Calibration: 4-Aug-2020

Recommend usage condition
Minimum utilization: 5% of actual content or before expiry date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments
When reordering, please quote the material number

Note:
1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol (EPA-600/8-12/531) for the Assay and Certification of Gaseous Calibration Standards using gravimetric G1.
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognized national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Page 1 of 1
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Linde (Thailand) Public Company Limited
15 Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trid Rd, 6.5 Road, Bangkok
Bangkok, Samutprakarn 10540, Tel: (66) 2338-6100 Fax: (66) 2338-6333
Wellgrow Plant: 105 Moo 5, 1 Bangnamak, A.Bangpakong, Chachoengsao 24180
Thailand, Tel: (66) 38-579-479-93 Fax: (66) 38-579-323

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200636466

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

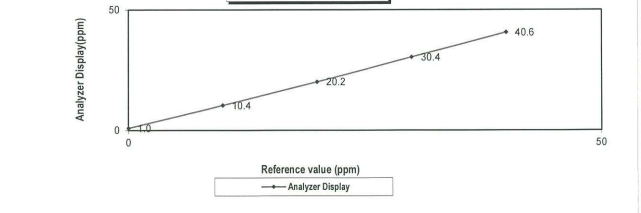
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.0	1.0	1.0
Level 2 20.00%	10.0	10.4	0.4	3.8
Level 3 40.00%	20.0	20.2	0.2	1.0
Level 4 60.00%	30.0	30.4	0.4	1.3
Level 5 80.00%	40.0	40.6	0.6	1.5
Remark : Measuring Range	50.0 ppm	Average Difference (%)	1.73	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Sirichar Y.
24/11/2021

Approve by

Phrakhanong U.
24/11/2021

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd, hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0072

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.1	0.1	0.9 - 1.1	Pass
2.0	2.0	0.0	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.0	0.0	6.0 - 8.0	Pass
10.0	9.9	0.1	9.5 - 10.5	Pass
20.0	20.2	0.2	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	0	42 - 48	Pass
135°	135	0	132 - 138	Pass
225°	227	2	222 - 228	Pass
315°	314	1	312 - 318	Pass
0°	359	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.2	0.0	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions:

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by: *Jim Lim*

Certified by
Head of Engineering department

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist., Taipei City 106, Taiwan

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200636467

Standard Gas Concentration

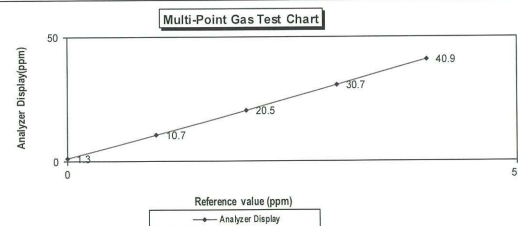
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.3	1.3	1.3	1.3
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.9	0.9	2.2	2.2
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.95



Calculate by
Simchar 16
24 / 11 / 64

Approve by
Patima u
24 / Nov / 2021

Page 1 of 1

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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd, hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2112DT0102

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9 - 1.1	Pass
2.0	2.0	0.0	1.8 - 2.2	Pass
5.0	4.9	0.1	4.7 - 5.3	Pass
7.0	7.3	0.3	6.0 - 8.0	Pass
10.0	9.9	0.1	9.5 - 10.5	Pass
20.0	20.1	0.1	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	0	42 - 48	Pass
135°	134	1	132 - 138	Pass
225°	224	1	222 - 228	Pass
315°	314	1	312 - 318	Pass
0°	0	0	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.8	0.6	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions:

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by: *Jim Lim*

Certified by
Head of Engineering department

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MULTI-POINT GAS TEST REPORT

Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200906880

Standard Gas Concentration

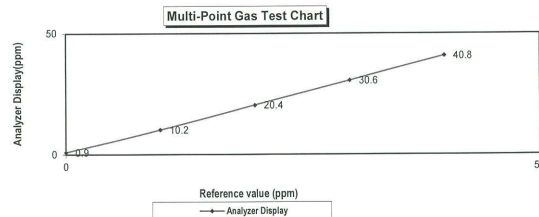
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9	0.9
Level 2	20.00%	10.0	10.2	0.2	2.0	2.0
Level 3	40.00%	20.0	20.4	0.4	2.0	2.0
Level 4	60.00%	30.0	30.6	0.6	2.0	2.0
Level 5	80.00%	40.0	40.8	0.8	2.0	2.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		1.75



Calculate by
Simchar 16
30 / 11 / 64

Approve by
Patima u
30 / Nov / 2021

Page 1 of 1

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Certificate of Calibration

Customer

Name

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Certificate No : 22-ACT-103

Address

: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Request No : Req-2022-0230

Unit Under Calibration Details

Measurement item :

Sound Level Meter

Microphone Class : 2

Manufacturer :

LARSON DAVIS

Microphone Model : 375A04

Model :

LxT2

Microphone S/N : 328668

Serial Number

: 0005402

Preamplifier Model : PRMLXT2C

ID

: UAE.EFM.038/2564

Preamplifier S/N : 071540

Resolution

: 0.1 dB

Instrumet Status : Used

Calibration Environment and Details

Temperature

: 23 °C ± 2 °C

Humidity

: 50 %RH ± 20 %RH

Barometric Pressure

: 1013 hPa ± 10 hPa

Received Date

: 31 January 2022

Calibrated Date

: 11 February 2022

Calibration Procedure

: In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration

: Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	SvanteK	Svan401	131	18 October 2022	WK Electric

Note


The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :



Mr. Noppadon Luangart
Calibration Officer

Approved By :



Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :



11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

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AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140



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AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140

Page : 2/6

Certificate No : 22-ACT-103

Request No : Req-2022-0230

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz: 114.00 dB	113.85	114.0	+0.15	113.9	0.05

Note :

Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN-58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.1	0.10
C	27.9	0.10
Z	34.4	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)



UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance		
FAST / 37-139	A	C	Z	Limit	
STD Setting	(dB)	(dB)	(dB)	(± dB)	
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.9	0.9	1.0	0.60	3.0
8000 Hz	0.7	0.7	0.8	0.70	5.0

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TEL: (6690-2116-5860-1 FAX: (6690-2116-7140

Page : 3/6

Certificate No : 22-ACT-103

Request No : Req-2022-0230

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance	
FAST / 37-139	A	C	Z	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
63 Hz	-0.2	0.0	0.0	2.0
125 Hz	-0.1	0.0	0.0	1.5
250 Hz	-0.1	0.0	0.0	1.5
500 Hz	-0.1	0.0	0.0	1.5
1000 Hz	0.0	0.0	0.0	1.0
2000 Hz	0.0	0.1	0.0	2.0
4000 Hz	0.0	0.0	0.0	3.0
8000 Hz	0.0	0.0	0.0	5.0
16000 Hz	-0.1	-0.1	-0.1	+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2



UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Leq	114.00	114.0	0.0	0.1

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AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140



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INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (6690-2116-5860-1 FAX: (6690-2116-7140

Page : 4/6

Certificate No : 22-ACT-103

Request No : Req-2022-0230

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	94.0	0.0	1.1
89.00	89	89.0	0.0	1.1
84.00	84	84.0	0.0	1.1
79.00	79	79.0	0.0	1.1
74.00	74	74.0	0.0	1.1
69.00	69	69.0	0.0	1.1
64.00	64	64.0	0.0	1.1
59.00	59	59.0	0.0	1.1
54.00	54	54.0	0.0	1.1
49.00	49	49.0	0.0	1.1
44.00	44	44.0	0.0	1.1
39.00	39	39.3	0.3	1.1
38.00	38	38.3	0.3	1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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