

ภาคผนวก ฎ
เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Air & Noise Quality Analysis

รหัส : 2022-006175

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc	G25A 11MX	Tisch Environmental, Inc.	28062022	28 Jun 21	27 Jun 23	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P802	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2722	22 Jul 22	21 Jul 23	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1583	27 Jul 22	26 Jul 23	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co.,Ltd.	07042022	7 Apr 22	6 Apr 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co.,Ltd.	07042022	7 Apr 22	6 Apr 23	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-70971-367	UAE Consultant Co.,Ltd.	19042022	19 Apr 22	18 Apr 23	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-

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รหัส : 2022-006175

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540074	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
14	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
16	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6306	Innovative Instrument Co.,Ltd.	22-ACT-372	8 Jun 22	7 Jun 23	-
18	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 5 minutes, L _{Adn} , L _{A90} L _{Amax} , Annoyance Noise	Larson Davis	LxT2 0006614	Innovative Instrument Co.,Ltd.	22-ACT-104	11 Feb 22	10 Feb 23	-
19	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 5 minutes, L _{Adn} , L _{A90} L _{Amax} , Annoyance Noise	Larson Davis	LxT2 0006615	Innovative Instrument Co.,Ltd.	22-ACT-102	11 Feb 22	10 Feb 23	-
20	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 5 minutes, L _{Adn} , L _{A90} L _{Amax} , Annoyance Noise	Larson Davis	LxT2 0006616	Innovative Instrument Co.,Ltd.	22-ACT-113	15 Feb 22	14 Feb 23	-

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	June 28, 2021	Rootsmeter 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
m=		2.04215	m=		1.27876
b=		-0.04258	b=		-0.02680
r=		1.00000	r=		1.00000

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

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmer 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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No.: 22P802
Page: 1 of 2

Equipment:	U-Tube Manometer	This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.
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) %	81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Atmospheric Pressure:	1010 mbar	

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 inH ₂ O				
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 Aussarree
Issue Date: 14 March 2022

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

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Cert.No.: 22P802
Page: 2 of 2

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		ΔP (inH ₂ O)	Error (inH ₂ O)
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)		
0.00	0.00	0.00	0.00
2.00	1.00	-0.92	-0.08
4.00	2.00	-1.92	-0.08
6.00	3.00	-2.92	-0.08
8.00	4.02	-3.92	-0.06
10.00	5.02	-4.94	-0.04
12.00	6.04	-5.94	-0.02
14.00	7.04	-6.94	-0.02
16.00	8.06	-7.94	0.00
18.00	9.06	-8.94	0.00
20.00	10.08	-9.96	0.04
22.00	11.08	-10.96	0.04
24.00	12.10	-11.96	0.06
26.00	13.10	-12.96	0.06
28.00	14.10	-13.98	0.08
30.00	15.10	-14.98	0.08
32.00	16.12	-15.98	0.10
34.00	17.12	-16.98	0.10
35.50	17.98	-17.86	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No.: 22P2722
Page: 1 of 2

Equipment:	Aneroid Barometer	This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.
Manufacturer:	Bango	
Model:	-	
Serial No.:	-	
ID No.:	UAE.ANV.013/2547	
Condition As-Received:	Used Item	
Received Date:	20 July 2022	
Calibration Date:	22 July 2022	
Reference:	2207-0584WSC	Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
Ambient Temperature:	(23 ± 2) °C	
Relative Humidity:	(50 ± 15) %	81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Atmospheric Pressure:	1010 mbar	

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	DP1142	1422505046	MP-0076-22	02 May 2023
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. Scale and conversion factor is 1 kPa = 7.50062 mmHg				
5. This result of calibration instrument was in absolute pressure.				
6. This instrument was used clean air as pressure media.				
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 Aussarree
Issue Date: 25 July 2022

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

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Cert.No.: 22P2722
Page: 2 of 2

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

Range: 720 mmHg to 780 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	718.46	729.33	739.85	750.22	760.90	772.01	785.89
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.54	0.67	0.15	-0.22	-0.90	-2.01	-5.89

Decreasing Pressure

Applied Pressure (mmHg)	785.90	771.99	760.85	750.17	739.90	729.57	718.62
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-5.90	-1.99	-0.85	-0.17	0.10	0.43	1.38

The uncertainty of measurement was ± 0.24 mmHg

* 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.: 22H1583
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.016/2547

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0586WSC

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

This certificate may not be reproduced other than in full, except with the prior written approval of the head of 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	10240757	TH-0125-21	13 Dec 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 Durmwor
Issue Date: 03 August 2022

Approved Signatory:

[✓] Chakrit Waewanjua
[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

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Cert. No.: 22H1583
Page: 2 of 2

Result of Calibration:-

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	63	3.0	1.8
25.0	80.0	78	-2.0	2.0

Result of Calibration:-

Function: Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)
20.00	20.0	0.00	0.72
30.01	30.0	-0.01	0.72
35.04	35.0	-0.04	0.72
39.98	40.0	0.02	0.72

UUC* : Unit Under Calibration

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

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Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

Equipment: Gas Analyzer (NO₂) Model: 42i
Manufacturer: Thermo Scientific Serial Number: CM08130002

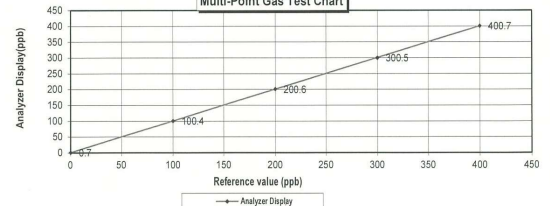
Standard Gas Concentration

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.:	CCI59599			
Expiration Date:	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.70	0.70	0.70
Level 2 20.00%	100.4	0.40	0.40	0.40
Level 3 40.00%	200.6	0.60	0.30	0.30
Level 4 60.00%	300.5	0.50	0.17	0.17
Level 5 80.00%	400.7	0.70	0.17	0.17
Remark: Measuring Range	500.0 ppb	Average Difference (%)		0.35
: Acceptable Limit $\pm 5\%$				

Multi-Point Gas Test Chart



Calculate by

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21/4/22

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Signature: [Signature]
8 Apr 2022

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MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

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

Standard Gas Concentration

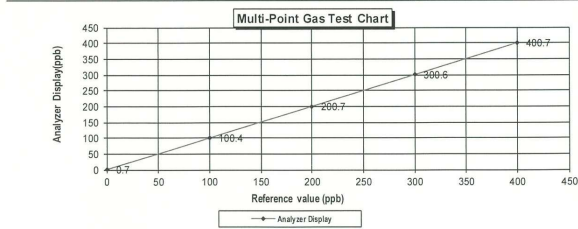
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

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	0.7	0.70	0.70	0.70
Level 2	20.00%	100.4	0.40	0.40	0.40
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	300.6	0.60	0.20	0.20
Level 5	80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.36	
Acceptable Limit	± 5%				



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8, 1, Apr, 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 19, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-70971-367

Standard Gas Concentration

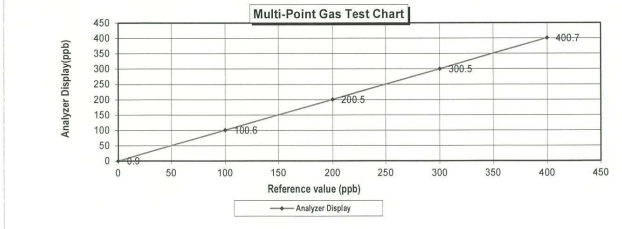
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

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	0.9	0.90	0.90	0.90
Level 2	20.00%	100.6	0.60	0.60	0.60
Level 3	40.00%	200.5	0.50	0.25	0.25
Level 4	60.00%	300.5	0.50	0.17	0.17
Level 5	80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.42	
Acceptable Limit	± 5%				



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21, Apr, 2022



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 660
Gas Code: CO, NO, NO₂, 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/P-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	45.98 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	44.68 PPM	G1	+/- 1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D686525	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 23, 2020
GMIS	401423838102	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	14080119	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 Multi-point 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



CERT 3082.01

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 : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906876

Standard Gas Concentration

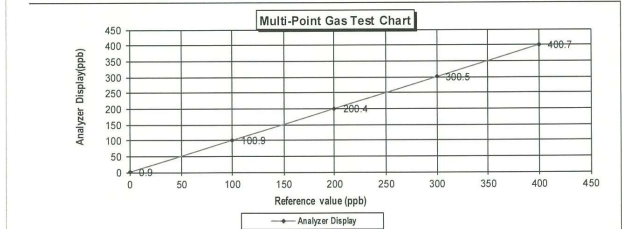
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

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	0.9	0.90	0.90	0.90
Level 2	20.00%	100.9	0.90	0.89	0.89
Level 3	40.00%	200.4	0.40	0.20	0.20
Level 4	60.00%	300.5	0.50	0.17	0.17
Level 5	80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.47	
Acceptable Limit	± 5%				



Calculate by

Signature
3, 5, 18

Approve by

Signature
4, May, 2022

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

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

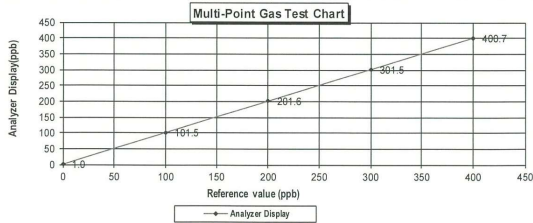
Dilutor Detail

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	1.00	1.00	1.00
Level 2	20.00%	100.0	101.5	1.01	1.01
Level 3	40.00%	200.0	201.6	1.00	1.00
Level 4	60.00%	300.0	301.5	1.00	1.00
Level 5	80.00%	400.0	400.7	1.00	1.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit $\pm 5\%$



Calculate by

Chirach Y.
27/5/22

Approve by

Chirach Y.
4/6/22

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778113

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

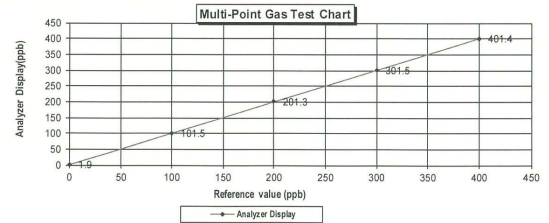
Dilutor Detail

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	1.90	1.90	1.90
Level 2	20.00%	100.0	101.5	1.01	1.01
Level 3	40.00%	200.0	201.3	1.00	1.00
Level 4	60.00%	300.0	301.5	1.00	1.00
Level 5	80.00%	400.0	401.4	1.00	1.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit $\pm 5\%$



Calculate by

Chirach Y.
27/5/22

Approve by

Chirach Y.
4/6/22

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 660
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/P-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	45.98 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	44.68 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 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	12388	D186025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 23, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
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

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 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



CERT 3082.01
เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540074

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

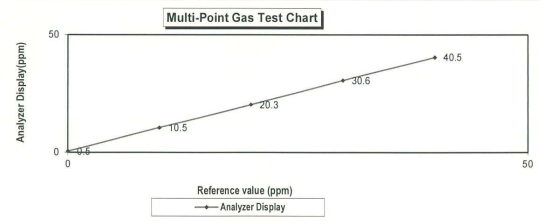
Dilutor Detail

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	10.5	4.8	4.8
Level 3	40.00%	20.0	20.3	1.5	1.5
Level 4	60.00%	30.0	30.6	2.0	2.0
Level 5	80.00%	40.0	40.5	1.2	1.2

Remark : Measuring Range 50.0 ppm
:Acceptable Limit $\pm 5\%$



Calculate by

Chirach Y.
26/4/22

Approve by

Chirach Y.
27/4/22

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

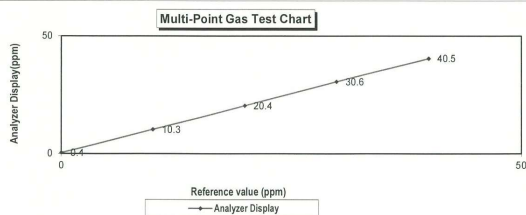
Equipment : Gas Analyzer (CO) **Model** : APMA-370
Manufacturer : Horiba **Serial Number** : YN43AG7T

Standard Gas Concentration **Dilutor Detail**
Sulphur Dioxide (SO₂) 44.75 PPM **Manufacturer** : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM **Model** : 146i
Methane (CH₄) - PPM **Serial Number** : 1180540071
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

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	10.3	0.3	2.9
Level 3 40.00%	20.0	20.4	0.4	2.0
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.5	0.5	1.2
Remark : Measuring Range	50.0 ppm	Average Difference (%)		1.69

Remark : Measuring Range 50.0 ppm
Acceptable Limit $\pm 5\%$



Calculate by

Signature Y.
26.4.22

Approve by

Signature N.
27. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

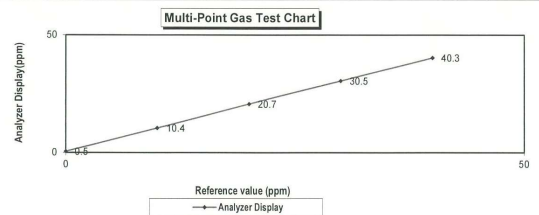
Equipment : Gas Analyzer (CO) **Model** : APMA-370
Manufacturer : Horiba **Serial Number** : YRLHTB7G

Standard Gas Concentration **Dilutor Detail**
Sulphur Dioxide (SO₂) 44.75 PPM **Manufacturer** : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM **Model** : 146i
Methane (CH₄) - PPM **Serial Number** : 1180540071
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

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	10.4	0.4	3.8
Level 3 40.00%	20.0	20.7	0.7	3.4
Level 4 60.00%	30.0	30.5	0.5	1.6
Level 5 80.00%	40.0	40.3	0.3	0.7
Remark : Measuring Range	50.0 ppm	Average Difference (%)		2.02

Remark : Measuring Range 50.0 ppm
Acceptable Limit $\pm 5\%$



Calculate by

Signature Y.
26.4.22

Approve by

Signature N.
27. Apr. 2022

Page 1 of 1

เอกสารไม่ควบคุม



Airgas Specialty Gases
Airgas USA, LLC
690 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 **Reference Number:** 122-402135167-1
Cylinder Number: EB0143262 **Cylinder Volume:** 144.4 CF
Laboratory: 124 - Durham (SAP) - NC **Cylinder Pressure:** 2015 PSIG
PGVP Number: B22021 **Valve Outlet:** 660
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/P-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	45.98 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12388	D1846255	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 23, 2020
GMS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.1\%$	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

The SRM, PRM or RSM noted above is only in reference to the GMS 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 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



CERT 3082.01
เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTANAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)9-2116-5860-1 FAX: (66)9-2116-7140



Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 22-ACT-372
Request No : Req-2022-0840

Unit Under Calibration Details

Measurement item : Acoustic Calibrator **Class** : 2
Manufacturer : LASON DAVIS **Range** : 94, 114 dB / 1000 Hz
Model : CAL150 **Instrument Status** : Used
Serial Number : 6306
ID : UAE.EFM.048/2563

Calibration Environment and Details

Temperature : (23 \pm 2 $^{\circ}$ C)
Humidity : (50 \pm 20 %RH)
Barometric Pressure : (1013 \pm 10.0 hPa)
Received Date : 10 May 2022
Calibration Date : 8 June 2022
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	EEL	31 May 2023
THD Multimeter	2015	1047765	NIMT	2 February 2023

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 : 8 June 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
File: IEC-17025 Rev.00 Issued on: 07/07/19

Certificate No : 22-ACT-372

Request No : Req-2022-0840

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.02	0.02	-	-	0.11	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.11	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.05	-	-	-	0.40	3.0
114 dB / 1000 Hz	0.21	-	-	-	0.40	3.0

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 Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม 07/19

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-104

Request No : Req-2022-0232

Unit Under Calibration Details

Measurement item : Sound Level Meter
Microphone Class : 2
Manufacturer : LARSON DAVIS
Microphone Model : 375A04
Model : LXT2
Microphone S/N : 329353
Serial Number : 0006614
Preamplifier Model : PRMLX2TC
ID : UAE.EFM.045/2564
Preamplifier S/N : 071534
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 : 
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 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104

Request No : Req-2022-0232

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / 37-139	(dB)	113.85	114.0	+0.15	113.9	0.05	0.3
Calibrator Setting	(dB)	113.85	114.0	+0.15	113.9	0.05	0.3
1000 Hz 114.00 dB		113.85	114.0	+0.15	113.9	0.05	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	(dB)	(± dB)
A	28.7	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	28.6	0.10
C	28.8	0.10
Z	34.7	0.10

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
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	0.7	0.7	0.7	0.60	3.0
8000 Hz	1.0	0.9	0.8	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 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104

Request No : Req-2022-0232

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

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	0.0	0.0	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	0.1	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	0.0	0.0	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

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

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
37-139 / A	REF (dB)	UUC (dB)	ERR (dB)		
UUC Time Responce	(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

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7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
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 Limit
FAST / A / 37-139	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
140.00	140	140.0	0.0	0.3	1.1
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

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9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	44.1	43.7	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.9	-0.1		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		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	99.7	-0.3		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit
FAST / C / 95-142	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.7	-0.70	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

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12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.7		
Negative one-half cycle	142.6		
Deviated	0.1	0.2	1.5

13. High Level Stability

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

End of Certificate

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

เอกสารไม่ควบคุม

12. Overload indication

13. High Level Stability

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Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-113
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0330
10260

Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class :	2
Manufacturer :	LARSON DAVIS	Microphone Model :	375A04
Model :	LxT2	Microphone S/N :	329351
Serial Number :	0006616	Preamplifier Model :	PRMLxT2C
ID :	UAE.EFM.047/2564	Preamplifier S/N :	073798
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 ± 20 hPa
Received Date	: 14 February 2022
Calibrated Date	: 15 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	GRS
Multi-frequency 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 : *rne*
Mr. Noppadon Luangart
Calibration Officer

Approved By : _____
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 15 February 2022

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approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

For the SLM of record date

Certificate No	:	22-ACT-113
Request No	:	Req-2022-0330

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	Level	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	114.1	+0.25	113.8	-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 (dB)	UNCERTAINTY (\pm dB)
FAST / 37-139		
UUC Weighting		
A	28.6	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)
FAST / 37-139		
UUC Weighting		
A	28.4	0.10
C	27.8	0.10
Z	32.4	0.10

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

Table 1. Absolute signal test of frequency weighting (without windscreen)					
UIC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	A	C	Z		
	(dB)	(dB)	(dB)		
FAST / 37-139					
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	0.3	0.3	0.4	0.60	3.0
8000 Hz	-0.1	-0.1	0.0	0.70	5.0

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เอกสารไม่ควบคุม

Certificate No : 22-ACT-113
Request No : Req-2022-0330

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

UDC Setting	Deviation from various Frequency			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)		
63 Hz	-0.2	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	-0.1		1.5
250 Hz	-0.1	-0.1	-0.1		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	Acceptance Limit
		UUC	ERR		
FAST / 37-139	REF	(dB)	(dB)	(\pm dB)	(\pm dB)
UUC Weighting					
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 (\pm dB)	Acceptance Limit (\pm dB)
37-39 / A	REF	UUC	ERR		
UUC Time Response	(dB)				
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leg	114.00	114.0	0.0		0.1

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Certificate No : 22-ACT-113
Request No : Req-2022-0330

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	Limit
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		
STD dB	(dB)	(dB)	(dB)	(± dB)	Limit
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	68.9	-0.1		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	58.9	-0.1		1.1
54.00	54	53.9	-0.1		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	38.5	0.5		1.1

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Certificate No : 22-ACT-113
Request No : Req-2022-0330

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)	(± dB)	Limit
37-139	43.6	43.7	0.1	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		
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	Limit
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.6	-0.4		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		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	109.0	0.0		+1.0, -2.5
	0.25	100.0	99.8	-0.2		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)	(± dB)	Limit
Complete cycle	137.4	136.7	-0.70	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

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Certificate No : 22-ACT-113
Request No : Req-2022-0330

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	Limit
Positive one-half cycle	141.9		
Negative one-half cycle	141.9		
Deviated	0.0	0.2	1.5

13. High Level Stability

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

End of Certificate

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