

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

ง-1

คุณภาพอากาศ เสียงและความสั่นสะเทือน

List of Instruments Certification for Air & Noise Quality Analysis

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 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P967	12 Aug 22	11 Aug 23	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 155895	Innovative Instrument Co., Ltd.	22-AFM-117	16 Aug 22	15 Aug 23	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2728	22 Jul 22	21 Jul 23	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1584	27 Jul 22	26 Jul 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920007	UAE Consultant Co., Ltd.	21062022	21 Jun 22	20 Jun 23	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920008	UAE Consultant Co., Ltd.	17052022	17 May 22	16 May 23	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	09012023	9 Jan 23	8 Jan 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co., Ltd.	16012023	16 Jan 23	15 Jan 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co., Ltd.	08042022	8 Apr 22	7 Apr 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co.,Ltd.	22042022	22 Apr 22	21 Apr 23	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-76465-383	UAE Consultant Co.,Ltd.	25042023	25 Apr 23	24 Apr 24	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 43C-65007-345	UAE Consultant Co.,Ltd.	07032023	7 Mar 23	6 Mar 24	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	26042022	26 Apr 22	25 Apr 23	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920018	UAE Consultant Co.,Ltd.	13052022	13 May 22	12 May 23	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920019	UAE Consultant Co.,Ltd.	03042023	3 Apr 23	2 Apr 24	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920020	UAE Consultant Co.,Ltd.	21022023	21 Feb 23	20 Feb 24	-
20	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
21	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	25042022	25 Apr 22	24 Apr 23	-
22	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	25042022	25 Apr 22	24 Apr 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
23	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 93JN1MN9	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
24	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
25	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03A199E15A006C	16 Oct 20	16 Oct 28	-
26	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14106	Calibration Laboratory Co.Ltd	Q22012257	8 Feb 22	7 Feb 23	-
27	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM13368	Calibration Laboratory Co.Ltd	Q23015868	13 Feb 23	12 Feb 24	-
28	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	22-ACT-405	1 Jul 22	30 Jun 23	-
29	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005405	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 24	-
30	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005407	Innovative Instrument Co.,Ltd.	22-ACT-037	21 Jan 22	20 Jan 24	-

RECALIBRATION
DUE DATE:
July 5, 2023

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	July 5, 2022	Rootsmeeter S/N:	438320
Operator:	Jim Tisch	Ta:	297
Calibration Model #:	G25A	Pa:	750.1
		Calibrator S/N:	1901

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation			
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta} \right)}$ (y-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.7353
0.9818	1.0174	1.9902	1.0274
0.9797	1.1339	2.2251	0.9893
0.9785	1.1933	2.3337	0.9881
0.9732	1.4354	2.8146	0.9828
QSTD	m= 1.98897 b= -0.03691 r= 0.99996	QA	m= 1.24546 b= -0.02334 r= 0.99996

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

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeeter 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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3090-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No.: 22P967
Page: 1 of 2

Equipment: U Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.:
ID No.: UAE EFM.178/2561
Condition As-Received: Used Item
Received Date: 03 August 2022
Calibration Date: 12 August 2022
Reference: 2208-0131WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 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-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: Pressure Calibrator
Model: PC106P
Serial No.: 1189
Certificate No.: MP-0113-22
Due Date: 14 Jul 2023
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 Ausarnree
Issue Date: 14 August 2022

Approved Signatory:

() Pradit Praditpaipal
() Sura Suwanmasri
() Atitapol Panurach

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B 0282414



Cert.No.: 22P967
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			
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00
2.00	0.98	-0.94	-0.08
4.00	2.00	-1.98	-0.02
6.00	3.00	-2.98	-0.02
8.00	4.00	-3.98	-0.02
10.00	5.00	-4.98	-0.02
12.00	6.02	-5.96	-0.02
14.00	7.02	-6.96	-0.02
16.00	8.04	-7.98	0.02
18.00	9.04	-8.98	0.02
20.00	10.04	-9.98	0.02
22.00	11.06	-10.98	0.04
24.00	12.06	-12.00	0.06
26.00	13.06	-13.00	0.06
28.00	14.08	-14.02	0.10
30.00	15.08	-15.02	0.10
32.00	16.08	-16.04	0.12
34.00	17.10	-17.04	0.14
36.00	17.90	-17.86	-0.04

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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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 13, SOI 31 NINTAKORN 11 TAMBON BANG KAE, DISTRICT BANG KHAO, BANGKOK 10140 THAILAND
TEL: 06-60-2116-5860-1 FAX: 06-60-2116-7140



Certificate of Calibration

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

Certificate No : 22-AFM-117
Request No : Req-2022-1332

Unit Under Calibration Details
Measurement Item : Air Flow meter
Manufacturer : BCI
Model : Delta Cal DCI
Serial Number : 155895
ID : UAE.EFM.0762560

Location of Calibration : LAB - AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 ± 3 °C
Humidity : $55 \pm 8\%$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 22 July 2022
Calibration Date : 16 August 2022
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High Flow	1850101202	Seroddyne	15 June 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 %.

Calibration By :

Mr. Supachon Luangtong
Service Calibration Engineer

Approved By :

Mr. Pichit Mahayom
Calibration Engineer Supervisor

Issue Date : 16 August 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-AFM-02 Rev.00 Issue date 01/07/19

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Certificate No : 22-APM-117
Request No : Req-2022-1332

Result of Calibration :

Flow Setting (LPM)	STD Flow Reading (LPM)	UUC Flow Reading (LPM)	Correction Flow (LPM)	Uncertainty (LPM)
14.5	14.50	14.53	-0.03	0.21
15.0	15.00	15.01	-0.01	0.22
15.8	15.80	15.80	0.00	0.23
16.6	16.60	16.57	0.03	0.24
18.3	18.30	18.27	0.03	0.27

Note
STD : Standard
UUC : Unit Under Calibration
Calibration media : Air
* Indicates non accredited

End of Certificate

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Certificate of Calibration

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

Certificate No : 22-TPM-347
Request No : Req-2022-1332
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DCI
Serial Number : 155895
Resolution : 0.1 °C
ID Number : UAE.EFM.076/2560
Range Calibration : 20 °C to 45 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 22 July 2022
Calibrated Date : 16 August 2022

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN:
08000057, ID: 02-TPM Which was calibrated on 10 March 2022, Calibration Certificate No. : QR22-0578

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By :

Mr. Paet Mahavorn

Calibration Engineer Supervisor

Issue Date :

16 August 2022

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10240 THAILAND
TEL: 6660-2116-5869-1 FAX: 6660-2116-7140

Certificate No : 22-TPM-347
Request No : Req-2022-1312
Page : 3/2

Calibration Note
UUC Adjustment : No Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
T _a	20.003	19.9	+0.1	0.14
	25.004	24.9	+0.1	0.14
	30.000	29.9	+0.1	0.14
	35.004	34.9	+0.1	0.14
	40.000	40.0	0.0	0.14
	45.003	45.1	-0.1	0.14
T _T	20.003	20.0	0.0	0.14
	25.004	25.0	0.0	0.14
	30.000	30.0	0.0	0.14
	35.004	35.0	0.0	0.14
	40.000	39.9	+0.1	0.14
	45.003	44.8	+0.2	0.14

End of Certificate

Calibrated By :
Mr. [Redacted] [Redacted]

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-206-TPM-01 Rev.01 Issue date 13.02.20

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3006-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 22P2728
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE-ANV.1522550
Condition As-Received : Used Item
Received Date : 20 July 2022
Calibration Date : 22 July 2022

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

Reference: 2207-0584WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

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

1) Standard Barometer

Model
DP142

Serial No.
1422505046

Certificate No.
MP-0076-22

Due Date
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.This result of calibration instrument was in absolute pressure.

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Ausarree
Issue Date : 25 July 2022

Approved Signatory :

Phallinot Pratsapal

J Jura Suwannasri

Atitap Panurach

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Cert.No.: 22P2728
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		Decreasing Pressure	
Applied Pressure (hPa)	956.27	1031.19	1020.73
UUC* Indication (hPa)	956.0	1030.0	1020.0
Error (hPa)	3.73	-1.19	-0.73
		969.56	969.92
		976.89	979.13
		980.0	980.0
		990.0	990.0
		1000.0	1000.0
		1010.0	1010.0
		1020.0	1020.0
		1030.0	1030.0
		956.54	956.64
		960.0	960.0
		970.0	970.0
		980.0	980.0
		990.0	990.0
		1000.0	1000.0
		1010.0	1010.0
		1020.0	1020.0
		1030.0	1030.0

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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TECHNOLOGY PROMOTION ASSOCIATION (THAIAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3008-24 FAX. 0-2719-9484



ACCREDITED
CALIBRATION ISO9

Certificate of Calibration

Certificate No. : 22H1594
Page : 1 of 2

Equipment :

Dial Thermo-Hygrometer

Manufacturer:

Barigo

Model :

-

Serial No.:

-

ID No.:

UAE.ANV.129/2550

Condition As-Received:

Used Item

Received Date:

20 July 2022

Calibration Date:

22 July 2022
to 27 July 2022

Reference:

2207-0566WSC

Ambient Temperature:

(25 ± 3) °C

Relative Humidity:

(50 ± 20) %

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 Dumwar
Issue Date : 03 August 2022

Approved Signatory :

☒ Chakrit Waewanjua

☐ Porntippa Tameyakul

☐ Viporn Tantiyawutti

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Cert. No.: 22H1584
Page.: 2 of 2

Result of Calibration:-

Function:

Humidity measurement			Without Adjustment	
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	59	-1.0	1.8
25.0	80.0	76	-4.0	2.0

Result of Calibration:-

Function:

Temperature measurement		Without Adjustment
Standard Temperature (°C)	UUC* Reading (°C)	
20.00	21.0	
30.01	30.0	
35.04	35.0	
39.98	39.5	

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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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : June 21, 2022

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1182920007

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Dilutor Detail
Nitric Oxide (NO)	45.35	PPM	
Methane (CH ₄)	-	PPM	
Carbon Monoxide (CO)	1007	PPM	
Cylinder No. :	CC159599		Manufacturer :
Expiration Date :	Jul 30, 2022		Model :
			Serial Number :
			Thermo Scientific
			1461
			1180540071

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)		Difference Error		Percent Error		[% Error]	
Level 1	Zero	0.0	1.2	1.20	1.20	1.20	1.20	1.20	1.20
Level 2	20.00%	100.0	101.3	1.30	1.30	1.28	1.28	1.28	1.28
Level 3	40.00%	200.0	201.3	1.30	1.30	0.65	0.65	0.65	0.65
Level 4	60.00%	300.0	301.4	1.40	1.40	0.46	0.46	0.46	0.46
Level 5	80.00%	400.0	401.1	1.10	1.10	0.27	0.27	0.27	0.27
Remark : Measuring Range		500.0 ppb		Average Difference (%)		0.77		0.77	
				Acceptable Limit ± 5%					

Multi-Point Gas Test Chart



Calculate by

21 June 2022

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

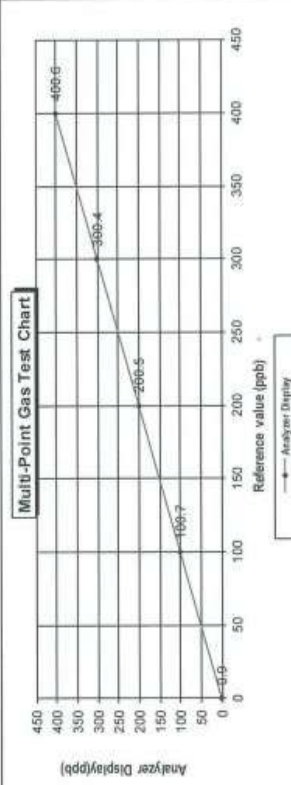
Test Date : May 17, 2022

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1182920008

Standard Gas Concentration			Dilutor Detail	
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	PPM		
Cylinder No. :	CC159599			
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	0.90	0.90	0.90
Level 2 20.00%	100.7	0.70	0.70	0.70
Level 3 40.00%	200.5	0.50	0.25	0.25
Level 4 60.00%	300.4	0.40	0.13	0.13
Level 5 80.00%	400.6	0.60	0.15	0.15
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.43
Acceptable Limit \pm 5%				



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MULTI-POINT GAS TEST REPORT

Test Date : Jan 9, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8	PPM		
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.8	0.80	0.79	0.79
Level 3 40.00%	201.2	1.20	0.60	0.60
Level 4 60.00%	300.7	0.70	0.23	0.23
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.32
Acceptable Limit \pm 5%				



Calculate by

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MULTI-POINT GAS TEST REPORT

Test Date : Jan 16, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050150

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH ₄)	-	PPM	1180540071
Carbon Monoxide (CO)	984.8	PPM	
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.50	0.50	0.50
Level 3	40.00%	200.0	0.60	0.30	0.30
Level 4	60.00%	300.0	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00
Average Difference (%)					0.21

Remark : Measuring Range 500.0 ppb
Acceptable Limit ± 5%

Multi-Point Gas Test Chart



Calculate by

16 Jan 2023

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NO₂, SO₂, BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
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-12/031, 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	Assay Dates
NO _x	45.00 PPM	45.98 PPM	G1	08/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	08/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	08/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	08/14/2021, 06/21/2021
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	20081120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%
PRM	12386	DB5025	9.01 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GMS	401423638102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.				

Triad Data Available Upon Request

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



เอกสารไม่ควบคุม
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

MULTI-POINT GAS TEST REPORT

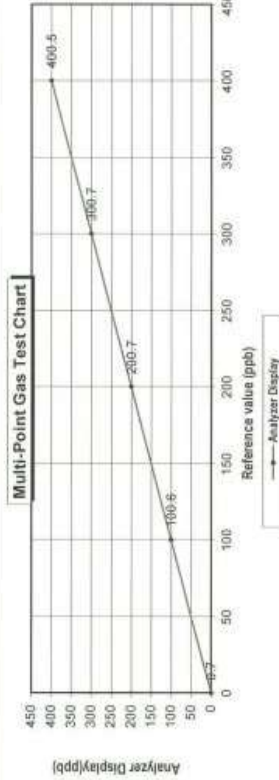
Test Date : Apr 8, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1182920014

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
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	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.7	0.35	0.35
Level 4 60.00%	300.0	300.7	0.23	0.23
Level 5 80.00%	400.0	400.5	0.12	0.12
Remark : Measuring Range 500.0 ppb Acceptable Limit \pm 5%				
Average Difference (%)				



Calculate by

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MULTI-POINT GAS TEST REPORT

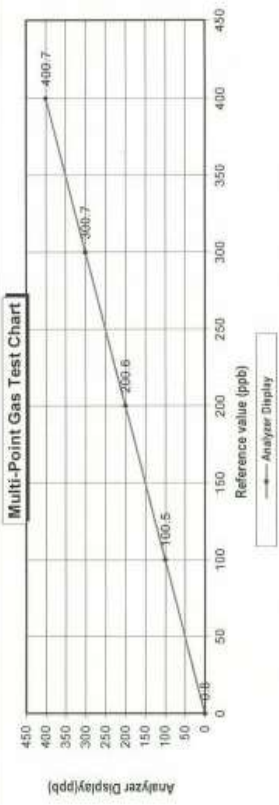
Test Date : Apr 22, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1182920015

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
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	0.8	0.80	0.80
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	200.6	0.30	0.30
Level 4 60.00%	300.0	300.7	0.23	0.23
Level 5 80.00%	400.0	400.7	0.17	0.17
Remark : Measuring Range 500.0 ppb Acceptable Limit \pm 5%				
Average Difference (%)				



Calculate by

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MULTI-POINT GAS TEST REPORT

Test Date : Apr 25, 2023

Equipment:	Gas Analyzer (SO ₂)	Model:	43C
Manufacturer:	Thermo Environmental Instruments	Serial Number:	43C-76465-383

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	Manufacturer :	ppm
Nitric Oxide (NO)	45.94	Model :	ppm
Methane (CH ₄)	-	Serial Number :	ppm
		Thermo SCIE	1180540071
		1461	

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	ppm	Manufacturer :
Nitric Oxide (NO)	45.94	ppm	Model :
Methane (CH ₄)	-	ppm	Serial Number :
			Thermo SCIENTIFIC
			1461
			1180540071

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.00	0.00	0.00
Level 3	40.00%	200.0	1.50	1.48	1.48
Level 4	60.00%	300.0	1.70	0.84	0.84
Level 5	80.00%	400.0	1.30	0.43	0.43
Demand - Measuring Range		400.0	0.00	0.00	0.00
Demand - Measuring Range		500.0 ppb	Average	Difference (%)	0.55

Remark : Measuring Range 500.0 ppb
:Acceptable Limit + 5%



Calculate by

25, APR, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment :	Gas Analyzer (SO ₂)	Model :	43C
Manufacturer :	Thermo Environmental Instruments		Serial Number : 43C-65007-345

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	Manufacturer :	PPM
Nitric Oxide (NO)	45.94	Model :	PPM
Methane (CH ₄)	-	Serial Number :	PPM
			Thermo SCI 1461 1180540071

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	Manufacturer :	ppm
Nitric Oxide (NO)	45.94	Model :	ppm
Methane (CH ₄)	-	Serial Number :	ppm

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	102.2	2.15	2.15
Level 3	40.00%	200.0	201.7	0.84	0.84
Level 4	60.00%	300.0	301.5	0.50	0.50
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)	0.00	0.70

Remark : Measuring Range 500.0 ppb
:Acceptable Limit + 5%



Calculus: 100

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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
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NOX, SO2, BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Valve Pressure: 2015 PSIG
Valve Outlet: 580
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-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a local 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 150 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	06/14/2021
Balance				
ANALYTICAL RESULTS				
Total Relative Uncertainty				
+/- 1.4% NIST Traceable				
+/- 1.4% NIST Traceable				
+/- 1.0% NIST Traceable				
+/- 0.7% NIST Traceable				

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	20061120	CC709068	Feb 02, 2025
PRM	12386	D85026	Feb 20, 2020
GMS	40142383102	CC505581	Feb 18, 2023
NTRM	16011043	CC473277	Jun 17, 2022
NTRM	14060119	CC434277	Nov 15, 2025
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.			
ANALYTICAL EQUIPMENT			
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 #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



CERT 3082.01
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The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

lease



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsiluk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10280
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Apr 26, 2022

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo SCIENTIFIC
Model : 48i
Serial Number : CM081-40004

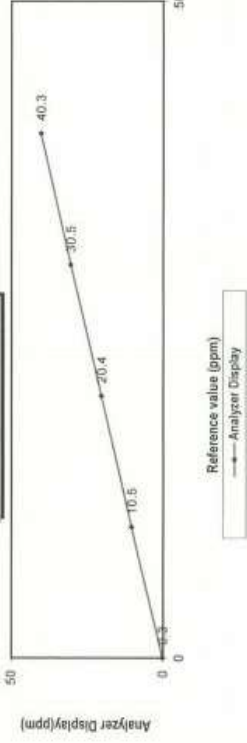
Standard Gas Concentration

Standard Gas Concentration	PPM	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.75	Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	Model : 146i
Methane (CH ₄)	-	Serial Number : 1180540071
Carbon Monoxide (CO)	1007	
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	0.3	0.3	0.3
Level 2 20.00%	10.0	10.5	0.5	4.8
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	40.3	0.3	0.7
Remark : Measuring Range				
Acceptable Limit ± 5%				
Average Difference (%)				
1.88				

Multi-Point Gas Test Chart



Calculate by

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MULTI-POINT GAS TEST REPORT

Test Date : May 13, 2022

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific

Model : 481
Serial Number : 1182920018

Standard Gas Concentration

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

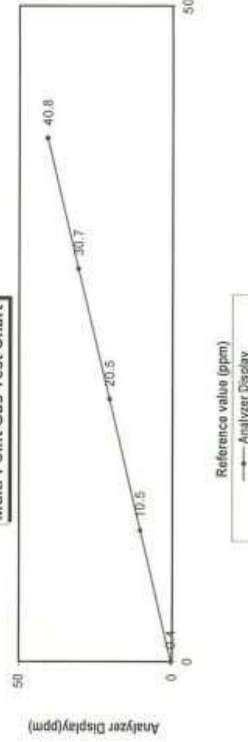
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	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	4.8	4.8
Level 3	40.00%	20.0	20.5	2.4	2.4
Level 4	60.00%	30.0	30.7	2.3	2.3
Level 5	80.00%	40.0	40.8	2.0	2.0
Remark : Measuring Range : 50.0 ppm					2.37
: Acceptable Limit $\pm 5\%$					
Average Difference (%)					2.37

Multi-Point Gas Test Chart



Calculate by

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MULTI-POINT GAS TEST REPORT

Test Date : Feb 21, 2023

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific

Model : 481
Serial Number : 1182920020

Standard Gas Concentration

Sulphur Dioxide (SO₂) : 44.68
Nitric Oxide (NO) : 45.94
Methane (CH₄) : -
Carbon Monoxide (CO) : 984.8
Cylinder No. : E80143262
Expiration Date : Jun 20, 2024

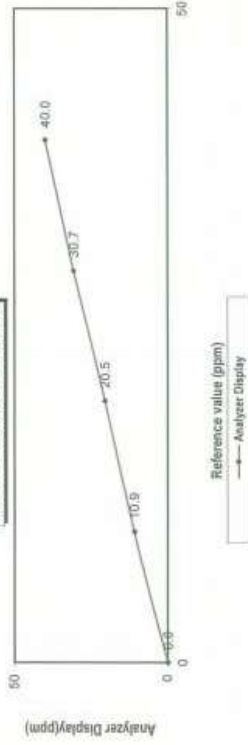
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range : 50.0 ppm					2.60
: Acceptable Limit $\pm 5\%$					
Average Difference (%)					2.60

Multi-Point Gas Test Chart



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MULTI-POINT GAS TEST REPORT

Test Date : Apr 3, 2023

Equipment :	Gas Analyzer (CO)	Model :	481
Manufacturer :	Thermo Scientific	Serial Number :	1182920019

Standard Gas Concentration		Diluter Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	1461
Methane (CH ₄)	-	PPM	1180540071
Carbon Monoxide (CO)	984.8	PPM	
Cylinder No. :	EB0143262		
Expiration Date :	Jun 20, 2024		

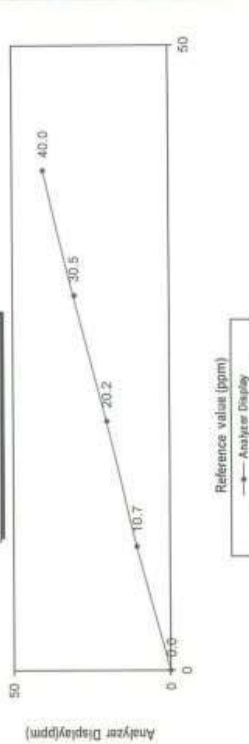
Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	10.0	10.7	0.7	6.5	6.5
Level 3	20.0	20.2	0.2	1.0	1.0
Level 4	30.0	30.5	0.5	1.6	1.6
Level 5	40.0	40.0	0.0	0.0	0.0
Average Difference (%)		1.83			

Remark : Measuring Range 50.0 ppm

Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



Calculate by

3 04/04/2023

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04/04/2023

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NO₂, SO₂, BALN

Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 560
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-12/031, 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	Assay Dates
NO _x	45.00 PPM	45.98 PPM	G1	08/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	08/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	08/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	08/14/2021, 06/21/2021
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	20081120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	Feb 02, 2025
PRM	12386	DB5025	9.01 PPM NITROGEN DIOXIDE/AIR	Feb 20, 2025
GMS	401423638102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	Feb 16, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	Nov 15, 2025

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Nicolet 6700 AHR0801333 CO	FTIR
Nicolet 6700 AHR0801333 NO	FTIR
Nicolet 6700 AHR0801333 NO ₂	FTIR
Nicolet 6700 AHR0801333 SO ₂	FTIR

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



CERT 3092.01
เอกสารไม่ควบคุม

The analytical test results reported on this certificate relate only to the cylinder number(s) identified above. This concludes the test report.

Approved for Release

MULTI-POINT GAS TEST REPORT

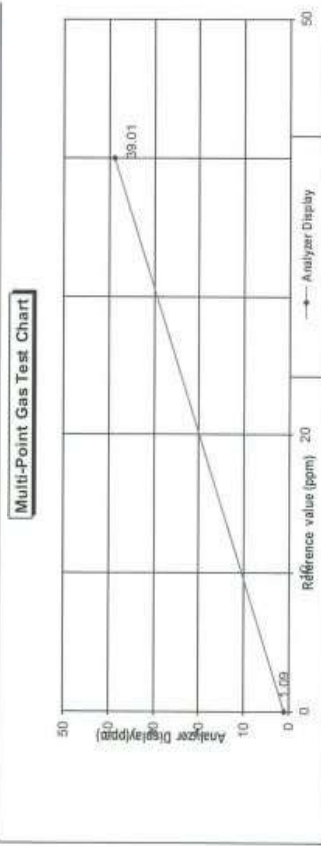
Test Date : Apr 25, 2022

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

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

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1 Zero	0.00	1.09	1.09	1.09
Level 2 80.00%	40.00	-0.99	-2.54	2.54
Remark : Measuring Range 50.00 ppm		Average Difference (%)		
		Acceptable Limit $\pm 5\%$		



Calculate by

Approve by

25.1.04.15

25.1. Apr. 2022

MULTI-POINT GAS TEST REPORT

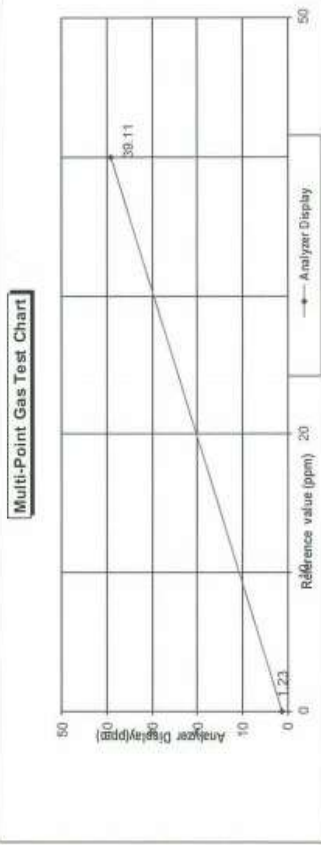
Test Date : Apr 25, 2022

Equipment : Hydrocarbon Analyzer
Manufacturer : HORIBA
Model : APHA-370
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

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	-0.89	-2.28	2.28
Remark : Measuring Range 50.00 ppm		Average Difference (%)		
		Acceptable Limit $\pm 5\%$		



Calculate by

Approve by

25.1.04.15

25.1. Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : 93N1MN9

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

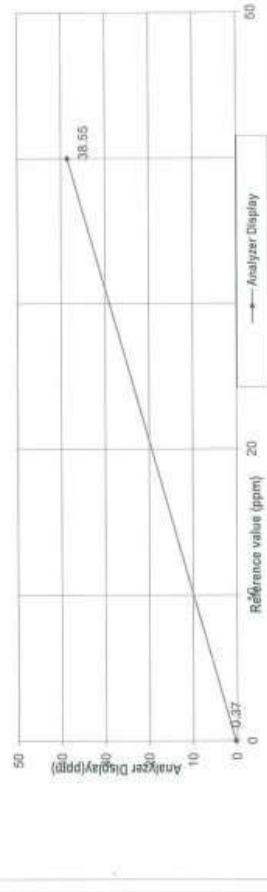
Dilutor Detail
Manufacturer : PPM
Model : PPM
Serial Number : PPM

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	0.37	0.37	0.37	0.37
Level 2 80.00%	40.00	-1.45	-3.76	3.76
Average Difference (%)				2.07

Remark : Measuring Range 50.00 ppm
: Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

15 Feb 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : KWWW1R96

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

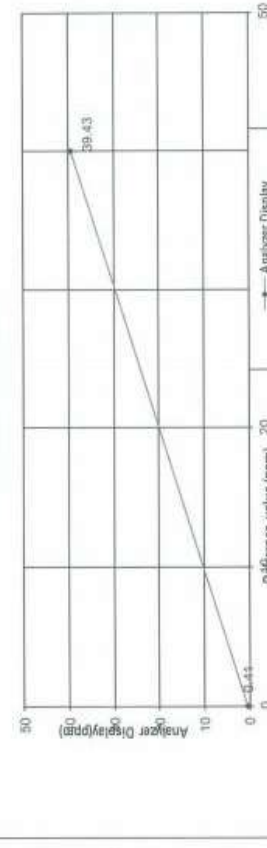
Dilutor Detail
Manufacturer : PPM
Model : PPM
Serial Number : PPM

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.00	0.41	0.41	0.41	0.41
Level 2 80.00%	40.00	-0.57	-1.45	1.45
Average Difference (%)				0.93

Remark : Measuring Range 50.00 ppm
: Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

15 Feb 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03A190E15A006C
Cylinder Number: CC143232
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12020
Gas Code: CH4, PPN, BALA

Reference Number: 160-401908379-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 590
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-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical uncertainty. All concentrations are on a purity basis. All concentrations are stated below with a confidence level of 95%. There are no known biases unless otherwise noted.

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

DO NOT USE THIS CYLINDER FOR 100 ppm, 1% or 1% methane standards

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
NITRM	02010405	K010090	4976 PPM PROPANE/NITROGEN	+/- 0.5%	Dec 02, 2021
NITRM	170608	CC160290	0.997 % METHANE/NITROGEN	+/- 0.4%	/Aug 22, 2023
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle				
MKS FTIR - CH4 - 000928781	FTIR				
Nicolet 6700 APWT100391 C3H8	FTIR				
Last Multipoint Calibration					
	Oct 14, 2020				
	Sep 18, 2020				

Triad Data Available Upon Request

NOTES: NET WEIGHTS: 4.885kg
GROSS WEIGHTS: 27.365kg
PO#: 5220003825



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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.
210-11, 14, 55 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladprao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2072 www.ccl-lab.com E-mail: sales@ccl-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14106/UM14106
CLID. NO. : 252100074
JOB CONTROL NO. : 220207012257

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 07 February 2022

DATE OF ISSUED : 10 February 2022

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

Calibrated By :

Suwit Phuanbusabong
Calibration Engineer

Approved By :

Mongkol Yotsoontorn
Authorized Signatory
10 February 2022



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

Certificate No. Q22012257

F3-011-04/01-12

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CALIBRATION LABORATORY Co., LTD.

2110-11,14,35 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-lab.com E-mail: sale@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14106/UM14106
DATE OF CALIBRATION : 08 February 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Universal Counter, Hewlett Packard Model 5315A S/N. 2448A13042.
3. Portable Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0073/21, Due Date 14 May 2022.
3. The measurements are traceable to International System of Units (SI), through The Modal Shop, Inc. Certificate No. 2649.01, Due Date 10 November 2022.

UNCERTAINTY :

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

Certificate No. Q22012257

F3-011-04/01-12

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CALIBRATION LABORATORY Co., LTD.

2110-11,14,35 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-lab.com E-mail: sale@cal-lab.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty \pm (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.9
0.5	50 Hz		0.500	0.506	-0.006	1.3
0.6	50 Hz		0.600	0.608	-0.008	1.3
0.7	50 Hz	peak	0.700	0.709	-0.009	1.3
0.3	100 Hz		0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.506	-0.006	1.3
0.6	100 Hz	peak	0.600	0.608	-0.008	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty \pm (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.034	-0.034	1.8
4	50 Hz		4.000	4.063	-0.063	1.8
5	50 Hz		5.000	5.071	-0.071	1.8
6	50 Hz		6.000	6.079	-0.079	1.8
7	50 Hz	peak	7.000	7.088	-0.088	1.8
3	100 Hz		3.000	3.037	-0.037	1.8
4	100 Hz		4.000	4.065	-0.065	1.8
5	100 Hz		5.000	5.075	-0.075	1.8
6	100 Hz	peak	6.000	6.083	-0.083	1.8
7	100 Hz		7.000	7.090	-0.090	1.8

Certificate No. Q22012257

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CALIBRATION LABORATORY CO., LTD.

2710-11, 14, 95 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-lab.com E-mail: sales@cal-lab.com



CALIBRATION DATA

*3. DISPLACEMENT RESULT

Test point (mm)	(frequency)	Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty \pm (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.1
0.04	50 Hz		0.040	0.040	0.000	1.7
0.05	50 Hz		0.050	0.050	0.000	1.5
0.06	50 Hz		0.060	0.060	0.000	1.3
0.07	50 Hz	peak	0.070	0.071	-0.001	1.2
0.03	100 Hz		0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.5
0.07	100 Hz		0.070	0.071	-0.001	1.2

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

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

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

End of Certificate

Certificate No. Q22012257

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CALIBRATION LABORATORY CO., LTD.

2710-11, 14, 95 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-lab.com E-mail: sales@cal-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13368/UM13368
CLID. NO. : 251900391
JOB CONTROL NO. : 230211015868

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

81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 14 February 2023

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

Calibrated By :

Suwit Phuanbusabong

Calibration Engineer

Approved By :

Mongkol Yotsoontorn

Authorized Signatory

14 February 2023

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

Certificate No. Q23015868

F3-011-04/01-12

page 1 of 4





CALIBRATION LABORATORY Co., LTD.

2/10-11/14, 55 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladprao, Bangkok 10230
Tel. 02-578-0354-4 Fax: 02-578-2672 www.cal-laboratory.com Email: sales@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13368/UM13368
DATE OF CALIBRATION : 13 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-31 as calibration guideline.

The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0001/22, Due Date 22 February 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23015668

F3-011-04/01-12

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calibration



CALIBRATION LABORATORY Co., LTD.

2/10-11/14, 55 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladprao, Bangkok 10230
Tel. 02-578-0354-4 Fax: 02-578-2672 www.cal-laboratory.com Email: sales@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty \pm (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.9
0.5	50 Hz		0.500	0.506	-0.006	1.3
0.6	50 Hz		0.600	0.608	-0.008	1.3
0.7	50 Hz	peak	0.700	0.710	-0.010	1.3
0.3	100 Hz		0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.609	-0.009	1.3
0.7	100 Hz		0.700	0.710	-0.010	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty \pm (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.022	-0.022	1.8
4	50 Hz		4.000	4.033	-0.033	1.8
5	50 Hz		5.000	5.043	-0.043	1.8
6	50 Hz		6.000	6.051	-0.051	1.8
7	50 Hz	peak	7.000	7.067	-0.067	1.8
3	100 Hz		3.000	3.023	-0.023	1.8
4	100 Hz		4.000	4.031	-0.031	1.8
5	100 Hz		5.000	5.043	-0.043	1.8
6	100 Hz		6.000	6.051	-0.051	1.8
7	100 Hz		7.000	7.063	-0.063	1.8

Certificate No. Q23015668

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calibration



CALIBRATION LABORATORY CO., LTD.
210-11, 14, 35 Soi Pansat Manut 28 Yaek 4, Pansat Manut Rd., Latphrao, Bangkok 10230
Tel. 02-574-0354-4 Fax: 02-574-2672 Email: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty ± (% of rdg.)
(mm)	(frequency)					
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.060	0.000	1.3
*0.07	50 Hz	peak	0.070	0.071	-0.001	1.4
0.03	100 Hz		0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

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

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

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

End of Certificate

Certificate No. Q23015868
F3-011-04-01-12

page 4 of 4

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
3139 MOO 13, SOI SUNTAKORN 11, TAMBON BANG KAE, KAE
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0690-2116-5800-1 FAX: 0690-2116-7140



Page 1 of 2

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-405

Request No : Req-2022-1080

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Manufacturer : SVANTEK

Model : SV 35A

Serial Number : 73246

ID : UAE.EFM.104/2561

Class : 1

Range : 94, 114 dB / 1000 Hz

Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ± 10.0 hPa)

Received Date : 15 June 2022

Calibration Date : 1 July 2022

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CIP-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. Noppaon Luangart
Service Calibration Engineer

Approved By :

Mr. Paet Mahavorn
Calibration Engineer Supervisor

Issue Date :

1 July 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.

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เอกสารควบคุม

Certificate No : 22-ACT-405
Request No : Req-2022-1080
Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.80	-0.20	-	-	0.12	0.25
114 dB / 1000 Hz	113.77	-0.23	-	-	0.11	0.25

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)					
Calibration Range (Hz)	Without Adjustment		Adjustment		Acceptance limit Class 1 (± %)
	Measured (%)		Measured (%)		
94 dB / 1000 Hz	0.09		-		2.5
114 dB / 1000 Hz	0.31		-		2.5

Note :
- Acceptance limits was IEC 60942:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name :
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 22-ACT-101
Request No : Req-2022-0231

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LXT2
Serial Number : 0005405
ID : UAE EFM.041/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone SN : 329560
Preamplifier Model : PRMLxT2C
Preamplifier SN : 073800
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

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	185273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000214	14 June 2022	TSI
Audio Generator	Svaniek	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. Noppadol Luangart
Calibration Officer

Approved By :
Mr. Patti Mathavorn
Calibration Engineer Supervisor

Issue Date : 11 February 2022

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Certificate No : 22-ACT-101
Request No : Req-2022-0231

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 (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting								
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 (\pm dB)
FAST / 37-139		
UUC Weighting		
A	27.3	0.10

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

UUC Setting	Measured	UNCERTAINTY (\pm dB)
FAST / 37-139		
UUC Weighting		
A	27.6	0.10
C	27.3	0.10
Z	31.2	0.10

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

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

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PIN-708-SLM-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-101
Request No : Req-2022-0231

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 (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting						
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	0.2	1.0
2000 Hz		0.0	0.0	0.0		2.0
4000 Hz		0.0	0.0	0.0		3.0
8000 Hz		0.0	0.0	0.0		5
16000 Hz		-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

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

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

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PIN-708-SLM-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-101
Request No : Req-2022-0231

7. Long Term Stability

UUC Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139		UUC (dB)	(\pm dB)	(\pm dB)
STD Setting				
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 (dB)	UUC (dB)	ERR (dB)	(\pm dB)	(\pm dB)
STD 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	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	74.0	0.0		1.1
69.00		69	69.0	0.0		1.1
64.00		64	64.1	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		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

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FM-508-SL24-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-101
Request No : Req-2022-0231

9. Level linearity including the level range control

UUC Setting		STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A		REF (dB)	UUC (dB)	ERR (dB)	(\pm dB)
UUC Range					
37-139		43.9	43.6	-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 (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(\pm dB)
UUC Time Response						
Fast		200	135.0	134.9	-0.1	1
		2	118.0	117.6	-0.4	+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
		200	129.0	129.0	0.0	1
		2	109.0	109.0	0.0	+1.0, -2.5
SEL		0.25	100.0	100.0	0.0	+1.5, -5.0

11. Peak C Sound level

UUC Setting		Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 95-142		REF (dB)	UUC (dB)	ERR (dB)	(\pm dB)
STD Setting					
Complete cycle		137.4	136.7	-0.70	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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FM-508-SL24-01 Rev.0 Issue date 01/07/21

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Certificate No : 22-ACT-101
Request No : Req-2023-0231

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting	141.8		
Positive one-half cycle	141.9		
Negative one-half cycle	-0.1	0.2	1.5

13. High Level Stability

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

End of Certificate

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sakhuwiri Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 22-ACT-037
Request No : Req-2023-0096

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005407
ID : UAE EFM 043.2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329358
Preamplifier Model : PPM1.xT2C
Preamplifier S/N : 073802
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 Annotele

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000334	14 June 2022	TSE
Audio Generator	Scantek	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. Paeat Madharm

Calibration Officer

Approved By :

Mr. Paeat Madharm

Calibration Engineer Supervisor

Issue Date :

21 January 2022

Certificate No : 22-ACT-037
Request No : Req-2022-0096

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139 Calibrator Setting 1000 Hz 114.00 dB	Level 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 (\pm dB)
FAST / 37-139		
UUC Weighting	(dB)	
A	29.0	0.10

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

UUC Setting	Measured	UNCERTAINTY (\pm dB)
FAST / 37-139		
UUC Weighting	(dB)	
A	28.8	0.10
C	28.1	0.10
Z	32.8	0.10

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

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

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Certificate No : 22-ACT-037
Request No : Req-2022-0096

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

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

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139	REF				
UUC Weighting	(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 (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
37-139 / A	REF				
UUC Time Response	(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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เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

12. Overload Indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting			
Positive one-half cycle	142.9		
Negative one-half cycle	142.9		
Deviated	0.0	0.2	1.5

13. High Level Stability

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

End of Certificate