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เอกสารสอบเทียบเครื่องมือ

# 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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental, Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	CL-003-65	26 Jul 22	25 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM <sub>2.5</sub> )	Mesa Labs	DeltaCal DC1 160491	Innovative Instrument Co., Ltd.	23-AFM-204	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particular Matter (PM <sub>2.5</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particular Matter (PM <sub>2.5</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	5 Jun 23	5 Jun 24	-
6	High Volume Air Sampler	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-109	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
7	High Volume Air Sampler	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-110	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
8	High Volume Air Sampler	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-111	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
9	High Volume Air Sampler	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-112	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
10	High Volume Air Sample	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-117	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
11	High Volume Air Sample	Total Suspended Particulate (TSP)	Thermo Scientific	HIVOL-CMBBD 2012-05	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
12	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	IP10 4389	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
13	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	IP10 4390	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
14	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	IP10 4393	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
15	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	IP10 4394	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
16	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thermo Scientific	HIVOL-CM CBD 2012-06	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
17	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental	TE-6070DX 1022	Jiranatee Associates Co., Ltd.	Ref. No.3383	26 Jul 22	25 Jul 24	-
18	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	143/23	31 Mar 23	30 Mar 24	-
19	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	178/23	10 Apr 23	9 Apr 24	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	162/23	11 Apr 23	10 Apr 24	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	177/23	10 Apr 23	9 Apr 24	-
22	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	144/23	31 Mar 23	30 Mar 24	-
23	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	E-LOG 305 20070022	Thai Meteorological Department	284/23	15 Aug 23	14 Aug 24	-
24	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11056	Calibration Laboratory Co.Ltd	Q23015867	12 Feb 23	11 Feb 24	-
25	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11057	Calibration Laboratory Co.Ltd	Q23022494	1 Mar 23	28 Feb 24	-

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									
26	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11059	Calibration Laboratory Co.Ltd	Q23019602	22 Feb 23	21 Feb 24	-
27	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14547	Calibration Laboratory Co.Ltd	Q23012458	8 Feb 23	7 Feb 24	-
28	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14463	Calibration Laboratory Co.Ltd	Q23030864	21 Mar 23	20 Mar 24	-
29	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6457	Innovative Instrument Co.,Ltd.	23-ACT-064	12 May 23	11 May 24	-
30	Sound Level Meter	$L_{Aeq}$ 24 hours, $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	23-SLM-227	28 Jun 23	27 Jun 25	-
31	Sound Level Meter	$L_{Aeq}$ 24 hours, $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005293	Innovative Instrument Co.,Ltd.	23-SLM-210	23 Jun 23	22 Jun 25	-
32	Sound Level Meter	$L_{Aeq}$ 24 hours, $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005294	Innovative Instrument Co.,Ltd.	23-SLM-222	28 Jun 23	27 Jun 25	-
33	Sound Level Meter	$L_{Aeq}$ 24 hours, $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005296	Innovative Instrument Co.,Ltd.	23-SLM-209	23 Jun 23	22 Jun 25	-
34	Sound Level Meter	$L_{Aeq}$ 24 hours, $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005305	Innovative Instrument Co.,Ltd.	23-SLM-225	28 Jun 23	27 Jun 25	-

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	IRON	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DUJ / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	25 Apr 24
3	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DUJ / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	25 Apr 24
4	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
5	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0046	technology promotion association (thailand-japan)	24CH40	10 Jan 24	8 Jan 25
6	UV-VIS Spectrophotometer	SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
7	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.



JIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-161-TIS 17025  
CALIBRATION 0367

Jiranatee Associates Co., Ltd  
63/14-15, 67/95-96  
Petchkasem 7/11 Rd. Wattana, Bangkoknoi,  
Bangkok 10600 (Thailand)  
Tel: +6686800812  
Mobile: +66869395453  
Email: jnac-calibration@jiranatee.com  
Web Site: www.jiranatee.com

Flow measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-003-65

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

: Top Load Orifice  
: Tisch Environmental, Inc.  
: TE-5025A  
: 3388  
: UKREFM.063/2560  
: Used item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260  
: 15 Jul 2022  
: 25 Jul 2022  
: 26 Jul 2022

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  $24.8$  °C and  $55.1$  %RH.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Panya Booncharoen  
Calibration Department Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR เอกสารไม่ควบคุม IN WRITING FROM THE LABORATORY



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CL-003-65

### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are  $25$  °C ( $298.15$  K) and  $760$  mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.697	754.265	24.640	23.960	55.399	1.699	1.299	0.643
2	1.000	754.236	24.950	24.350	62.172	3.444	1.849	0.913
3	1.118	754.323	24.730	24.210	41.925	4.582	2.133	1.051
4	1.169	754.212	24.640	24.160	31.045	5.150	2.262	1.116
5	1.416	754.175	24.480	24.210	30.117	7.629	2.754	1.351

Slope (m): 2.04804  
Intercept (b): -0.01939  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.011 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.697	754.265	24.640	23.960	55.399	1.699	0.819	0.647
2	1.000	754.236	24.950	24.350	62.172	3.444	1.167	0.919
3	1.118	754.323	24.730	24.210	41.925	4.582	1.345	1.058
4	1.169	754.212	24.640	24.160	31.045	5.150	1.426	1.123
5	1.416	754.175	24.480	24.210	30.117	7.629	1.735	1.361

Slope (m): 1.28277  
Intercept (b): -0.01223  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.012 m<sup>3</sup>/min

\*\*\*End of Certificate of Calibration\*\*\*



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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No. : 23P1401  
Page : 1 of 2

Equipment : U-Tube Manometer  
Manufacturer: Dwyer  
Model : 1221-36-W/M  
Serial No.: -  
ID No.: UAE EFM.022/2560  
Condition As-Received: Used Item  
Received Date: 26 April 2023  
Calibration Date: 09 May 2023  
Reference: 2304-0703WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar

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, Bangchak, Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0137-22	24 Aug 2023

2. This result of calibration was made on requested at the point specified by customer.  
3. Scale and conversion factor is 1 kPa = 4.0146283 inH<sub>2</sub>O  
4. This instrument was used clean air and oil 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 through:-  
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussaree  
Issue Date : 11 May 2023

Approved Signatory : Attapol P.  
[ ] Phalinee Prabpaijal  
[ ] Sura Suwanasri  
[x] Attapol Panurach

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Cert.No.: 23P1401  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure  
Range : 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval : 0.1 inH<sub>2</sub>O ( The Fifth Estimate )

UUC Indication			
Applied Pressure (inH <sub>2</sub> O)	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)	Error (inH <sub>2</sub> O)
0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98
4.00	2.00	-1.98	3.98
6.00	3.00	-2.98	5.98
8.00	4.00	-3.98	7.98
10.00	5.00	-4.98	9.98
12.00	6.00	-6.00	12.00
14.00	7.00	-7.00	14.00
16.00	8.00	-8.00	16.00
18.00	9.00	-9.00	18.00
20.00	10.00	-10.00	20.00
22.00	11.00	-11.00	22.00
24.00	12.02	-12.00	24.02
26.00	13.02	-13.00	26.02
28.00	14.02	-14.00	28.02
30.00	15.04	-15.00	30.04
32.00	16.04	-16.00	32.04
34.00	17.02	-17.00	34.02
35.80	18.00	-17.96	35.96

The uncertainty of measurement was ± 0.11 inH<sub>2</sub>O

\* 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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a 1160340  
Attapol P.





## Certificate of Calibration

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

Certificate No : 23-TPM-460

Request No : Req-2023-1918

Page : 1/2

### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Air Flow meter  
Manufacturer : BGI  
Model : Delta Cal DC1  
Serial Number : 160491  
Resolution : 0.1 °C  
ID Number : UAE.EFM.175/2561  
Range Calibration : 20 °C to 50 °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 : 7 September 2023  
Calibrated Date : 27 September 2023  
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 27 February 2023, Calibration Certificate No. : QR23-0494

**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. Noppadon Luangart  
Technical Manager  
27 September 2023

**Issue Date :**

### Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-460

Request No : Req-2023-1918

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### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
Ta	20.033	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.033	30.2	-0.2	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
Tf	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13
	20.033	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.033	30.0	0.0	0.13
	35.034	35.0	0.0	0.13
	40.040	39.9	+0.1	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13

End of Certificate

Calibrated By :

Mr. Sittichok Jirapokdeesakul



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. : 23P1858  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.ANV.124/2550  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 02 June 2023  
Reference: 2305-0919WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1007 mbar  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

- This instrument was installed in vertical orientation and center of the dial was used as the reference level.
- This result of calibration was made on requested at the point specified by customer.
- This result of calibration instrument was in absolute pressure.
- This instrument was used clean air as pressure media.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 09 June 2023

Approved Signatory : Attapol P.  
[ ] Phalinee Prabpaijal  
[ ] Sura Suwanasri  
[x] Attapol Panurach

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Cert.No.: 23P1858  
Page: 2 of 2

Result of calibration:- Without adjustment									
Function:- Absolute Pressure Measurement									
Range : 960 hPa to 1030 hPa									
Scale Interval : 1 hPa ( The Fifth Estimate )									
Increasing Pressure									
Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.29	1011.64	1021.14	1032.30	
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0	
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.29	-1.64	-1.14	-2.30	
Decreasing Pressure									
Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.35	992.35	981.94	970.49	959.94	
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0	
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06	

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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a 1165506  
Attapol P.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23H1200  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model :  
Serial No.: UAE.ANV.130/2550  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 30 May 2023 to 06 June 2023  
Reference: 2305-0919WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, 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) Hygro-M2 Dew Point Monitor	5112	2380195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024

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 through:-

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

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

☒ J Chakrit Waewwanjua  
☐ J Ponthippa Tarneyakul  
☐ J Viporn Tantiyawutti

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B 0316274



Cert. No.: 23H1200  
Page.: 2 of 2

Result of Calibration:-			
Function:			
Humidity Measurement			
Before Adjustment			
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	1.6
25.0	60.0	63	1.7
25.0	80.0	76	1.9
Error (%R.H.)			
7.9			
3.0			
-4.0			

Result of Calibration:-			
Function:			
Humidity Measurement			
After Adjustment			
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	1.6
25.0	60.0	60	1.7
25.0	80.0	75	1.9
Error (%R.H.)			
3.9			
0.0			
-5.0			

Result of Calibration:-			
Function:			
Temperature Measurement			
Without Adjustment			
Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC\* : Unit Under Calibration

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

-000-

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a 1165295



JIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-161-TIS 17025  
CALIBRATION 0367

Jiranatee Associates Co., Ltd  
63/14-15, 67/95-96  
Petchkasem 7/11 Rd. Wattana, Bangkoknoi,  
Bangkok 10600 (Thailand)  
Tel: +6686800812  
Mobile: +66869395453  
Email: jnac-calibration@jiranatee.com  
Web Site: www.jiranatee.com

Flow measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-003-65

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

: Top Load Orifice  
: Tisch Environmental, Inc.  
: TE-5025A  
: 3388  
: UKREFM.063/2560  
: Used item  
: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260  
: 15 Jul 2022  
: 25 Jul 2022  
: 26 Jul 2022

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  $24.8 \pm 0.8$  °C and  $55.1 \pm 0.1$  %RH.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☐ Mr. Sorawit Thachalad  
☐ Mr. Jitraporn Lertsomphol



Approved signatory:

Mr. Panya Booncharoen  
Calibration Department Manager

Page 1 of 2 Pages

**Calibration procedure:**  
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2-dp, The WH-CL-004 was used as a calibration guideline.

**Traceability:**  
This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via certificate number: G2211501

**Uncertainty of Measurement:**  
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CL-003-65

### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The humid air was used as a medium in the system. The standard conditions are  $25 \pm 0.5$  °C ( $298.15 \pm 0.5$  K) and  $760 \pm 0.1$  mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.697	754.265	24.640	23.960	55.399	1.699	1.299	0.643
2	1.000	754.236	24.950	24.350	62.172	3.444	1.849	0.913
3	1.118	754.323	24.730	24.210	41.925	4.582	2.133	1.051
4	1.169	754.212	24.640	24.160	31.045	5.150	2.262	1.116
5	1.416	754.175	24.480	24.210	30.117	7.629	2.754	1.351

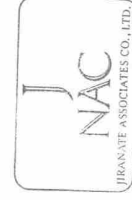
Slope (m): 2.04804  
Intercept (b): -0.01939  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.011 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.697	754.265	24.640	23.960	55.399	1.699	0.819	0.647
2	1.000	754.236	24.950	24.350	62.172	3.444	1.167	0.919
3	1.118	754.323	24.730	24.210	41.925	4.582	1.345	1.058
4	1.169	754.212	24.640	24.160	31.045	5.150	1.426	1.123
5	1.416	754.175	24.480	24.210	30.117	7.629	1.735	1.361

Slope (m): 1.28277  
Intercept (b): -0.01223  
Correlation coefficient (r): 0.99982  
Uncertainty (k=2): 0.012 m<sup>3</sup>/min

\*\*\*End of Certificate of Calibration\*\*\*



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION IS OBTAINED FROM THE LABORATORY

เอกสารไม่ควบคุม

# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2023 Certification No. 143/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0041

WIND SENSOR : 2111DT0041

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

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

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by : Signed

Mr. Watcharapol Subwat

Mechanical Engineer



Sub-Standard **เอกสารไม่ควบคุม**



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 143/23

Page : 2 of 5

31 March, 2023

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



Sub-Standard **เอกสารไม่ควบคุม**



## The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1014.29	1014	0.29
1014.02	1014	0.02
1011.47	1012	-0.53
1011.25	1011	0.25
1011.11	1011	0.11
1011.38	1012	-0.62
1011.71	1012	-0.29
1013.48	1014	-0.52
1013.81	1014	-0.19
1014.02	1014	0.02
1013.73	1013	0.73
1013.32	1013	0.32
1014.92	1015	-0.08
1014.75	1015	-0.25
1014.38	1014	0.38
1014.21	1014	0.21
1013.57	1013	0.57
1013.01	1013	0.01
1011.26	1011	0.26
1011.59	1012	-0.41
Average		

Average

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม

31 March, 2023

Certification No. 143/23

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
760.78	761	-0.22
760.58	761	-0.42
758.66	759	-0.34
758.50	758	0.50
758.39	758	0.39
758.60	759	-0.40
758.84	759	-0.16
760.17	760	0.17
760.42	760	0.42
760.58	761	-0.42
760.36	760	0.36
760.05	760	0.05
761.25	761	0.25
761.12	761	0.12
760.85	761	-0.15
760.72	761	-0.28
760.24	760	0.24
759.82	760	-0.18
758.51	759	-0.49
758.75	759	-0.25
Average		

Average

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



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## The Result of Calibration

31 March, 2023  
Certification No. 143/23  
Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.24	45.4	-0.16
32.16	32.3	-0.14
16.48	16.5	-0.02

Calibrated by :

*Mr. Watchapol Subwat*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue : 10 April, 2023  
Certification No. 178/23  
Page : 1 of 5

Object : WIRELESS ANEMOMETER  
Manufacturer : SCARLET  
Type : WIRELESS RECEIVER : WL-21  
WIND SENSOR : WL-21  
Mfg Code : WIRELESS RECEIVER : 2111DR0052  
WIND SENSOR : 2111DT0052  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563  
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board  
N.I.S.T. Test Reference Number 731/241460  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 1107/30029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION  
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo testo 645 Serial No. 02848057 : Thermoschneider No.918802  
STANDARD BAROMETER : Digital Barometer Vaisala Type PTB320 No. V1320015  
: Digital Barometer Vaisala Type PTB330 No. V1320001

Calibrated by : *Mr. Watchapol Subwat*  
Mr. Watchapol Subwat  
Mechanical Engineer  
Signed : *Mr. Wisod Promsat*  
Mr. Wisod Promsat  
for the Chief  
Sub-Standard Instrument



เอกสารไม่ควบคุม



## The Result of Calibration

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



## The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H <sub>2</sub> O	Vacuum inches H <sub>2</sub> O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม

10 April, 2023

Certification No. 178/23

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1013.17	1013	0.17
1013.43	1014	-0.57
1014.15	1014	0.16
1014.22	1014	0.22
1009.63	1009	0.63
1009.71	1010	-0.29
1009.95	1010	-0.05
1010.31	1010	0.31
1010.72	1011	-0.28
1010.80	1011	-0.20
1011.47	1011	0.47
1011.21	1011	0.21
1011.33	1011	0.33
1011.59	1012	-0.41
1011.89	1012	-0.11
1012.40	1012	0.40
1008.64	1009	-0.36
1008.80	1009	-0.20
1009.25	1009	0.25
1009.45	1009	0.45
Average		0.06

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

10 April, 2023

Certification No. 178/23

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
759.94	760	-0.06
760.13	760	0.13
760.67	761	-0.33
760.73	761	-0.27
757.28	757	0.28
757.34	757	0.34
757.52	758	-0.48
757.79	758	-0.21
758.10	758	0.10
758.16	758	0.16
758.66	759	-0.34
758.47	758	0.47
758.56	758	0.56
758.75	759	-0.25
758.98	759	-0.02
759.36	759	0.36
756.54	757	-0.46
756.66	757	-0.34
757.00	757	0.00
757.15	757	0.15
Average		0.03



Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

เอกสารไม่ควบคุม



## The Result of Calibration

10 April, 2023

Certification No. 178/23

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.15	45.3	-0.15
31.05	31.1	-0.05
15.32	15.5	-0.18

Calibrated by :

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

## Calibration Certificate



Issued by : Calibration &amp; Test Section : Meteorological Instruments Bureau

Date of Issue 11 April, 2023 Certification No. 162/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0058

WIND SENSOR : 2111DT0058

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.7 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 1107/30029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

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

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V14320001

Calibrated by :

Signed :

Mr. Watcharapol Subwat

Mr. Visood Promsat

Mechanical Engineer



เอกสาร ใจควบคุม



## The Result of Calibration

Certification No. 162/23

Page : 2 of 5

11 April, 2023

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	6.9	0.14
9.02	-	-	9.0	0.02
11.02	-	-	11.0	0.02
13.01	-	-	13.0	0.01
15.01	-	-	14.9	0.11
17.02	-	-	17.0	0.02
20.02	-	-	20.0	0.02

Wind Aloft Plotting Board.

US.DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสาร ใจควบคุม



## The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 3 of 5

Standard Barometer Pressure (mbar)	Tested Barometer Pressure (mbar)	Correction (mbar)
1010.39	1010	0.39
1011.13	1011	0.13
1011.31	1011	0.31
1011.57	1011	0.57
1008.42	1009	-0.58
1008.86	1009	-0.14
1008.99	1009	-0.01
1009.36	1009	0.36
1009.94	1010	-0.06
1010.36	1010	0.36
1009.53	1010	-0.47
1009.85	1010	-0.15
1010.06	1010	0.06
1010.23	1010	0.23
1009.06	1009	0.06
1009.21	1009	0.21
1009.71	1010	-0.29
1010.32	1010	0.32
1011.21	1011	0.21
1011.50	1011	0.50
Average		0.18

Average

Calibrated by :

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 4 of 5

Standard Barometer Pressure (mmHg)	Tested Barometer Pressure (mmHg)	Correction (mmHg)
757.85	758	-0.15
758.41	758	0.41
758.54	758	0.54
758.74	759	-0.26
756.38	756	0.38
756.71	756	0.71
756.80	757	-0.20
757.08	757	0.08
757.52	757	0.52
757.83	758	-0.17
757.21	757	0.21
757.45	758	-0.55
757.61	758	-0.39
757.73	758	-0.27
756.86	757	-0.14
756.97	757	-0.03
757.34	757	0.34
757.80	758	-0.20
758.47	759	-0.53
758.69	759	-0.31
Average		0.00

Average

Calibrated by :

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 April, 2023 Certification No. 177/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2112DR0065

WIND SENSOR : 2112DT0065

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K3320001

Calibrated by :  Signed : 

Mr. Watcharapol Subwat

Mechanical Engineer

Mr. Pissol Pomsut



เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 162/23

Page : 5 of 5

11 April, 2023

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45.1	0.02
31.24	31.3	-0.06
15.82	15.9	-0.08

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

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



## The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by : 

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

10 April, 2023

Certification No. 177/23

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1013.17	1013	0.17
1013.43	1014	-0.57
1014.15	1014	0.15
1014.22	1014	0.22
1009.63	1010	-0.37
1009.71	1010	-0.29
1009.95	1010	-0.05
1010.31	1010	0.31
1010.72	1011	-0.28
1010.80	1011	-0.20
1011.47	1011	0.47
1011.21	1011	0.21
1011.33	1011	0.33
1011.59	1011	0.59
1011.89	1012	-0.11
1012.40	1012	0.40
1008.64	1009	-0.36
1008.80	1009	-0.20
1009.25	1009	0.25
1009.45	1010	-0.55

Average

Calibrated by :



Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
759.94	760	-0.06
760.13	760	0.13
760.67	761	-0.33
760.73	761	-0.27
757.28	757	0.28
757.34	757	0.34
757.52	758	-0.48
757.79	758	-0.21
758.10	758	0.10
758.16	758	0.16
758.66	759	-0.34
758.47	759	-0.53
758.56	759	-0.44
758.75	759	-0.25
758.98	759	-0.02
759.36	759	0.36
756.54	756	0.54
756.66	757	-0.34
757.00	757	0.00
757.15	757	0.15
Average		0.06



Calibrated by : *Watchapol*  
Mr. Watchapol Subwat  
Mechanical Engineer

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.15	45.2	-0.05
31.05	31.0	0.05
15.32	15.4	-0.08



Calibrated by : *Watchapol*  
Mr. Watchapol Subwat  
Mechanical Engineer

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# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2023 Certification No. 144/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2205DR0105

WIND SENSOR : 2205DT0105

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

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

STANDARD THERMOMETER

: Testo, testo 645 Serial No. 02848057 : Thermoschneider No.918805

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB330 No. K4320015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by : Signed :

Mr. Watcharapol Subwat

Mr. Pisoot Promsut

Mechanical Engineer

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# THAI METEOROLOGICAL DEPARTMENT

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



## The Result of Calibration

Certification No. 144/23

Page : 2 of 5

31 March, 2023

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.

US. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 144/23

31 March, 2023

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1014.29	1014	0.29
1014.02	1014	0.02
1011.47	1012	-0.53
1011.25	1011	0.25
1011.11	1011	0.11
1011.38	1011	0.38
1011.71	1012	-0.29
1013.48	1013	0.48
1013.81	1014	-0.19
1014.02	1014	0.02
1013.73	1014	-0.27
1013.32	1013	0.32
1014.92	1015	-0.08
1014.75	1015	-0.25
1014.38	1014	0.38
1014.21	1014	0.21
1013.57	1014	-0.43
1013.01	1013	0.01
1011.26	1011	0.26
1011.59	1012	-0.41
Average		0.04

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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## The Result of Calibration

Certification No. 144/23

31 March, 2023

Page : 4 of 5

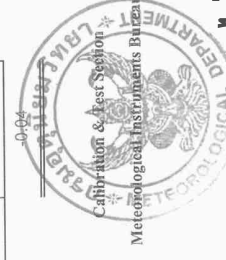
Standard Barometer Pressure	Tested Barometer Pressure	Correction
760.78	761	-0.22
760.58	761	-0.42
758.66	759	-0.34
758.50	759	-0.50
758.39	758	0.39
758.60	759	-0.40
758.84	759	-0.16
760.17	760	0.17
760.42	760	0.42
760.58	760	0.58
760.36	760	0.36
760.05	760	0.05
761.25	761	0.25
761.12	761	0.12
760.85	761	-0.15
760.72	761	-0.28
760.24	760	0.24
759.82	760	-0.18
758.51	759	-0.49
758.75	759	-0.25
Average		0.04

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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### The Result of Calibration

31 March, 2023  
Certification No. 144/23  
Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.24	45.0	0.24
32.16	32.0	0.16
16.48	16.4	0.08

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue : 15 August, 2023  
Certification No. 284/23  
Page : 1 of 2

Object : Wind speed and wind direction  
Manufacturer : LSI  
Type : Data Logger E-LOG 305 wind speed and wind direction DNA 821  
Serial No. : Data Logger 20070022 wind speed and wind direction 20040186  
ID No. : No.16  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.5 hPa

#### NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563  
: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023  
N.I.S.T. Test Reference Number 731/241460  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer  
Signed :   
Mr. Pisood Promsut



# THAI METEOROLOGICAL DEPARTMENT

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



## The Result of Calibration

Certification No. 284/23

15 August, 2023

Page : 2 of 2

Standard	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Vacuum
Ultrasonic Anemometer	inches	inches	hPa	m/sec
1.00	-	-	-	0.00
3.02	-	-	-	0.12
5.00	-	-	-	0.50
7.04	-	-	-	0.14
9.02	-	-	-	0.42
11.01	-	-	-	0.01
13.01	-	-	-	0.41
15.01	-	-	-	0.01
17.02	-	-	-	0.42
20.02	-	-	-	0.12

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

Calibrated by : *Wattana*

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladprao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11056/UM11056  
CLID. NO. : 252000389  
JOB CONTROL NO. : 230211015867

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. Q23015867

F3-011-04/01-12

page 1 of 4



เอกสารไม่ควบคุม

@cccalibration



# CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
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# CALIBRATION LABORATORY CO., LTD.

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



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11056/UM11056  
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 16063-21 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 :

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

#### TRACEABILITY :

- 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.
- 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.
- 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. Q23015867

F3-011-04/01-12

page 2 of 4

เอกสารไม่ควบคุม



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#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point ( g )	( frequency )	Mode	STD Reading ( g )	DUC Reading ( g )	Correction ( g )	Uncertainty $\pm$ ( % of rdg. )
0.3	50 Hz	peak	0.300	0.304	-0.004	1.9
0.4	50 Hz		0.400	0.406	-0.006	1.9
0.5	50 Hz		0.500	0.507	-0.007	1.3
0.6	50 Hz		0.600	0.609	-0.009	1.3
0.7	50 Hz	peak	0.700	0.711	-0.011	1.3
0.3	100 Hz		0.300	0.302	-0.002	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		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.708	-0.008	1.3

##### 2. VELOCITY RESULT

Test point ( mm/s )	( frequency )	Mode	STD Reading ( mm/s )	DUC Reading ( mm/s )	Correction ( mm/s )	Uncertainty $\pm$ ( % of rdg. )
3	50 Hz	peak	3.000	3.041	-0.041	1.8
4	50 Hz		4.000	4.055	-0.055	1.8
5	50 Hz		5.000	5.071	-0.071	1.8
6	50 Hz		6.000	6.083	-0.083	1.8
7	50 Hz	peak	7.000	7.091	-0.091	1.8
3	100 Hz		3.000	3.037	-0.037	1.8
4	100 Hz		4.000	4.043	-0.043	1.8
5	100 Hz		5.000	5.059	-0.059	1.8
6	100 Hz		6.000	6.067	-0.067	1.8
7	100 Hz		7.000	7.079	-0.079	1.8

Certificate No. Q23015867

F3-011-04/01-12

page 3 of 4

เอกสารไม่ควบคุม



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# CALIBRATION LABORATORY CO., LTD.

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



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DIMENSIONAL MEASUREMENT  
ACDM-2814



CLC  
Accredited  
ISO/IEC 17025



# CALIBRATION LABORATORY CO., LTD.

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DIMENSIONAL MEASUREMENT  
ACDM-2814

## CALIBRATION DATA

### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty $\pm$ (% 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	1.2
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	0.060	0.000	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. Q23015867

F3-011-04/01-12

page 4 of 4



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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11057/UM11057  
CLID. NO. : 252000248  
JOB CONTROL NO. : 230228022494

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

DATE OF RECEIVED : 28 February 2023

DATE OF ISSUED : 02 March 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 Yoisoontorn  
Authorized Signatory  
02 March 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. Q23022494

F3-011-04/01-12

page 1 of 4



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# CALIBRATION LABORATORY CO., LTD.

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

CLC  
Accredited  
ISO/IEC 17025



ANAB  
ASQ Mutual Accreditation Board  
ACCREDITED  
CALIBRATION AND  
DIMENSIONAL MEASUREMENT  
ACDM 2814

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11057/UM11057  
DATE OF CALIBRATION : 01 March 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 16063-21 as calibration guideline.  
The calibration was performed by using Digital Multimeter, Universal Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N. 29320.
- Universal Counter, HP Model 5315A S/N. 2448A13042.
- Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

#### TRACEABILITY :

- 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.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0075/22, Due Date 27 July 2023.
- 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. Q23022494

F3-011-04/01-12

page 2 of 4

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# CALIBRATION LABORATORY CO., LTD.

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

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ANAB  
ASQ Mutual Accreditation Board  
ACCREDITED  
DIMENSIONAL MEASUREMENT  
ACDM 2814

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	0.304	-0.004	1.9
0.4	50 Hz		0.400	0.405	-0.005	1.9
0.5	50 Hz		0.500	0.507	-0.007	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	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.508	-0.008	1.3
0.6	100 Hz		0.600	0.609	-0.009	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	3.031	-0.031	1.8
4	50 Hz		4.000	4.043	-0.043	1.8
5	50 Hz		5.000	5.055	-0.055	1.8
6	50 Hz		6.000	6.067	-0.067	1.8
7	50 Hz	peak	7.000	7.073	-0.073	1.8
3	100 Hz		3.000	3.038	-0.038	1.8
4	100 Hz		4.000	4.043	-0.043	1.8
5	100 Hz		5.000	5.058	-0.058	1.8
6	100 Hz		6.000	6.067	-0.067	1.8
7	100 Hz		7.000	7.079	-0.079	1.8

Certificate No. Q23022494

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ANAB National Accreditation Board  
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DIMENSIONAL MEASUREMENT  
ACDM-2814



# CALIBRATION LABORATORY CO., LTD.

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



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DIMENSIONAL MEASUREMENT  
ACDM-2814

## CALIBRATION DATA

### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty $\pm$ (% 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	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	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	0.060	0.000	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. Q23022494

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11059/UM11059  
CLID. NO. : 252000388  
JOB CONTROL NO. : 230221019602

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

DATE OF RECEIVED : 21 February 2023

DATE OF ISSUED : 24 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 Yotsontorn  
Authorized Signatory  
24 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. Q23019602

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



2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
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# CALIBRATION LABORATORY Co., LTD.

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM11059/UM11059  
DATE OF CALIBRATION : 22 February 2023

#### ENVIRONMENT CONDITIONS :

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

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

#### 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, 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. Q23019602

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#### 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	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.503	-0.003	1.3
0.6	50 Hz		0.600	0.603	-0.003	1.3
0.7	50 Hz		0.700	0.703	-0.003	1.3
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.9
0.5	100 Hz		0.500	0.503	-0.003	1.3
0.6	100 Hz		0.600	0.604	-0.004	1.3
0.7	100 Hz		0.700	0.704	-0.004	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	3.021	-0.021	1.8
4	50 Hz		4.000	4.033	-0.033	1.8
5	50 Hz		5.000	5.055	-0.055	1.8
6	50 Hz		6.000	6.061	-0.061	1.8
7	50 Hz		7.000	7.078	-0.078	1.8
3	100 Hz	peak	3.000	3.039	-0.039	1.8
4	100 Hz		4.000	4.045	-0.045	1.8
5	100 Hz		5.000	5.055	-0.055	1.8
6	100 Hz		6.000	6.068	-0.068	1.8
7	100 Hz		7.000	7.079	-0.079	1.8

Certificate No. Q23019602

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# CALIBRATION LABORATORY CO., LTD.

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



## CALIBRATION DATA

### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading ( mm )	DUC Reading ( mm )	Correction ( mm )	Uncertainty $\pm$ ( % 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	0.061	-0.001	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	1.3
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. Q23019602

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UMI14547/UMI14547  
CLID. NO. : 252000390  
JOB CONTROL NO. : 230207012458

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

DATE OF RECEIVED : 07 February 2023

DATE OF ISSUED : 10 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 Yotsontorn

Authorized Signatory

10 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. Q23012458

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14547/UM14547  
DATE OF CALIBRATION : 08 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 16063-21 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. Q23012458

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CONDITION OF CALIBRATION ITEM : GOOD  
MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point (g)	( frequency )	Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty $\pm$ (% of rdg.)
0.3	50 Hz	peak	0.300	0.298	+0.002	1.9
0.4	50 Hz		0.400	0.401	-0.001	1.9
0.5	50 Hz		0.500	0.501	-0.001	1.3
0.6	50 Hz		0.600	0.600	0.000	1.3
0.7	50 Hz	peak	0.700	0.703	-0.003	1.3
0.3	100 Hz		0.300	0.296	+0.004	1.9
0.4	100 Hz		0.400	0.394	+0.006	1.9
0.5	100 Hz		0.500	0.497	+0.003	1.3
0.6	100 Hz		0.600	0.596	+0.004	1.3
0.7	100 Hz		0.700	0.699	+0.001	1.3

##### 2. VELOCITY RESULT

Test point (mm/s)	( frequency )	Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty $\pm$ (% of rdg.)
3	50 Hz	peak	3.000	3.003	-0.003	1.8
4	50 Hz		4.000	4.004	-0.004	1.8
5	50 Hz		5.000	5.005	-0.005	1.8
6	50 Hz		6.000	6.006	-0.006	1.8
7	50 Hz	peak	7.000	6.999	+0.001	1.8
3	100 Hz		3.000	3.003	-0.003	1.8
4	100 Hz		4.000	3.996	+0.004	1.8
5	100 Hz		5.000	4.997	+0.003	1.8
6	100 Hz		6.000	5.998	+0.002	1.8
7	100 Hz		7.000	6.999	+0.001	1.8

Certificate No. Q23012458

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



# CALIBRATION LABORATORY CO., LTD.

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

## CALIBRATION DATA

### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading ( mm )	DUC Reading ( mm )	Correction ( mm )	Uncertainty $\pm$ ( % of rdg. )
( mm )	( frequency )					
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.041	-0.001	1.7
*0.05	50 Hz		0.050	0.051	-0.001	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz	peak	0.070	0.072	-0.002	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	1.3
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. Q23012458

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14463/UM14463  
CLID. NO. : 252000348  
JOB CONTROL NO. : 230320030864

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

DATE OF RECEIVED : 20 March 2023

DATE OF ISSUED : 23 March 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

23 March 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. Q23030864

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Tel. 02-578-0353-4 Fax. 02-578-2872 WWW.CALLABORATORY.COM Email:sale@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14463/UM14463  
DATE OF CALIBRATION : 21 March 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 16063-21 as calibration guideline.  
The calibration was performed by using Digital Multimeter, Universal 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. Universal Counter, HP Model 5315A S/N. 2448A13042.
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. 07-0075/22, Due Date 27 July 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. Q23030864

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# CALIBRATION LABORATORY CO., LTD.

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Tel. 02-578-0353-4 Fax. 02-578-2872 WWW.CALLABORATORY.COM Email:sale@cal-laboratory.com



#### CONDITION OF CALIBRATION ITEM : GOOD

#### MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point (g)	(frequency)	Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty $\pm$ (% of rdg.)
0.3	50 Hz	peak	0.300	0.307	-0.007	1.9
0.4	50 Hz		0.400	0.411	-0.011	1.9
0.5	50 Hz		0.500	0.514	-0.014	1.3
0.6	50 Hz		0.600	0.617	-0.017	1.3
0.7	50 Hz	peak	0.700	0.719	-0.019	1.3
0.3	100 Hz		0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.398	+0.002	1.9
0.5	100 Hz		0.500	0.496	+0.004	1.3
0.6	100 Hz		0.600	0.593	+0.007	1.3
0.7	100 Hz		0.700	0.691	+0.009	1.3

##### 2. VELOCITY RESULT

Test point (mm/s)	(frequency)	Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty $\pm$ (% of rdg.)
3	50 Hz	peak	3.000	3.047	-0.047	1.8
4	50 Hz		4.000	4.053	-0.053	1.8
5	50 Hz		5.000	5.067	-0.067	1.8
6	50 Hz		6.000	6.075	-0.075	1.8
7	50 Hz	peak	7.000	7.087	-0.087	1.8
3	100 Hz		3.000	3.053	-0.053	1.8
4	100 Hz		4.000	4.068	-0.068	1.8
5	100 Hz		5.000	5.077	-0.077	1.8
6	100 Hz		6.000	6.083	-0.083	1.8
7	100 Hz		7.000	7.091	-0.091	1.8

Certificate No. Q23030864

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# CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax. 02-578-2872 www.ccl-lab.com Email: sale@ccl-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	0.051	-0.001	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	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	0.051	-0.001	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.072	-0.002	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. Q23030864

F3-011-04/01-12

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



## Certificate of Calibration

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

**Certificate No** : 23-ACT-064  
**Request No** : Req-2023-0975

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : LARSON DAVIS  
Model : CAL150  
Serial Number : 6457  
ID : UAE.EFM.055/2564

Class : 2  
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 : 9 May 2023  
Calibration Date : 12 May 2023  
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	31 January 2024

**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** : 12 May 2023

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-709/2023

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Certificate No : 23-ACT-064  
Request No : Req-2023-0975

Sound pressure level		Calibration Results : Without Adjustment			
		Without Adjustment (dB)		Adjustment (dB)	
Calibration Range (dB)		Measured	Error	Measured	Error
94 dB / 1000 Hz		93.91	-0.09	-	-
114 dB / 1000 Hz		113.97	-0.03	-	-

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Acceptance limit Class 2 ( ± % )
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)	
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Acceptance limit Class 2 ( ± % )
	Measured (%)	Error (%)	Measured (%)	Error (%)	
94 dB / 1000 Hz	0.13	-	-	-	0.40
114 dB / 1000 Hz	0.29	-	-	-	0.40

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

Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-227  
Address 81 Soi Udonsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2023-1416  
10560

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2  
Manufacturer : LARSON DAVIS Microphone Model : 375B02  
Model : LX72 Microphone S/N : 011740  
Serial Number : 0005286 Preamplifier Model : PRMLxT2B  
ID : UAE.EFM.102/2562 Preamplifier S/N : 056087  
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 : 26 June 2023  
Calibrated Date : 28 June 2023  
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	S/N.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Svanek	Svan401	131	12 October 2023	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. Paet Matthavorn  
Calibration Engineer Supervisor

Issue Date : 28 June 2023





Certificate No : 23-SLM-227  
Request No : Req-2023-1416

12. Overload indication			
UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)	(± dB)	
Positive one-half cycle	145.2		
Negative one-half cycle	145.2		
Deviated	0.0	0.2	1.5

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

End of Certificate

Certificate of Calibration

**Customer**  
Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 23-SLM-210  
Request No : Req-2023-1387

**Unit Under Calibration Details**  
Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005393  
ID : UAE.EFM.108/2562  
Resolution : 0.1 dB  
Calibration Environment and Details  
Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 21 June 2023  
Calibrated Date : 23 June 2023  
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  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone SN : 346386  
Preamplifier Model : PRMLxT2B  
Preamplifier SN : 056084  
Instrument Status : Used

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Tracebility
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Svanek	Svan401	131	12 October 2023	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. Paei Mathavorn  
Calibration Engineer Supervisor

Issue Date : 23 June 2023

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		After Adjust		Acceptance Limit (± dB)
	Level (dB)		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114 dB	114.54		114.5	-0.04	114.5	-0.04	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN: AC-300001087

2. Self-generated noise, Microphone installed

UUC Setting	Measured		UNCERTAINTY (± dB)
	Level (dB)		
FAST / 37-139			
UUC Weighting			
A	24.1		0.1

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

UUC Setting	Measured		UNCERTAINTY (± dB)
	Level (dB)		
FAST / 37-139			
UUC Weighting			
A	23.5		0.1
C	23.0		0.1
Z	27.5		0.1

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C	Z (dB)			
FAST / 37-139						
STD Setting						
125 Hz	0.0	0.1	0.1		0.6	2.0
1000 Hz	0.0	0.0	0.0		0.6	1.0
4000 Hz	0.0	0.0	0.1		0.6	3.0
8000 Hz	-0.6	-0.6	-0.5		0.7	5.0

Certificate No : 23-SLM-210  
Request No : Req-2023-1387

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

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

6. Frequency and time weightings at 1kHz

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











Certificate No : 23-SLM-209  
Request No : Req-2023-1386

1. Indication at the calibration check frequency

UUC Setting	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
	Nominal Level (dB)	UUC (dB)	ERR (dB)	ERR (dB)		
FAST / A / 37-139 Calibrator Setting						
1000 Hz 114 dB	114.54	114.6	+0.06	-0.04	0.2	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Self-generated noise, Microphone installed

UUC Setting	UNCERTAINTY	
	Measured (dB)	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting		
A	29.9	0.1

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

UUC Setting	UNCERTAINTY	
	Measured (dB)	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting		
A	29.7	0.1
C	29.0	0.1
Z	33.4	0.1

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
	Weighting Response curve					
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.1	0.1		0.6	2.0
1000 Hz	0.0	0.0	0.0		0.6	1.0
4000 Hz	1.0	1.0	1.0		0.6	3.0
8000 Hz	2.0	1.9	2.0		0.7	5.0

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
FAST / 37-139		Weighting Response curve				
STD Setting		A (dB)	C (dB)	Z (dB)		
63 Hz		-0.2	-0.1	-0.1		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	-0.1		1.5
1000 Hz		0.0	0.0	-0.1	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		-0.1	-0.1	0.0		5
16000 Hz		-0.1	-0.1	-0.1		+5, -1NF.

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	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	0.2	0.1
Leq	114.00	114.0	0.0		0.1









Certificate No : 23-SLM-225  
 Request No : Req-2023-1413

#### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	UUC (dB)		
STD Setting			
Positive one-half cycle	144.9		
Negative one-half cycle	144.8		
Deviated	0.1	0.2	1.5

#### 13. High Level Stability

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

End of Certificate

## Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

### Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.  
 Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

**Note:** While non-current production AA instrument and or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services>

### Introduction

#### Customer Information

- 1 Customers should provide all necessary operating supplies upon request of the engineer.
- 2 A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 3 Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- 4 If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

## Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery.
- A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our *Support Home page* at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections:
- Join the Agilent Community at <https://community.agilent.com/welcome>

## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
  - Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. **(Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)**
  - Only select those pages that relate to the system or module being serviced.
  - Complete empty fields with the relevant information.
  - Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
  - Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
  - Complete the Preventive Maintenance service in the order of the tasks listed.
  - Complete the Service Review section together with the customer.
  - Complete the fields for page numbers at the foot of each selected page
  - Complete the total number of pages field in the Service Completion section
  - Ask the customer to sign the Service Completion section including the customer's and your signature.
- This information is subject to change without notice.

## Instrument Maintenance

### System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	Instrument System Site and Location	UNITED ANALYST AND ENGINEERING CONSULTANT / 2nd Lab Fl
-------------------------------	-------------------------------------	--

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8432 A	17 0316 0001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

## Preparation, Safe operation and Initial performance checks

## Preventive Maintenance Procedures

### FLAME SYSTEM section

☐ Section not applicable

#### Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the **SVD Power Supply diagnostic**
- ☒ For Dual Beam instruments - Confirm RBC frequency using the **SVD RBC frequency diagnostic**.

#### Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
  - ☒ Monochromator drive
  - ☒ Slit drive
  - ☒ Lamp selector
  - ☐ ABA N/A

#### Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform **Mono Wavelength Correction**.
- ☒ Use SVD and perform **Slit Calibration**.
- ☒ Use SVD and perform **Grating Squareness Diagnostic**.
- ☒ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☒ Use SVD and perform **Wavelength Repeatability**.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

## Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel
- ☒ Check and clean the igniter electrode

## Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the **SVD interlock monitoring diagnostic**.

## Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

## FURNACE SYSTEM section

☒ Section not applicable

### Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the **SVD Power Supply diagnostic**.

### Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:

- ☐ Monochromator drive
- ☐ Slit drive
- ☐ Lamp selector

### Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform **Mono Wavelength Correction**.
- ☐ Use SVD and perform **Slit Calibration**.
- ☐ Use SVD and perform **Grating Squareness Diagnostic**.
- ☐ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☐ Use SVD and perform **Wavelength Repeatability**.

- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

### Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

### Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

### PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

### Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

### Sample preparation system (SPS 4) accessory

☒ *Section NOT Applicable*

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes..
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

**NOTE: The autosampler requires no extra lubrication throughout its lifetime.**

For further details refer to the SPS 4 service manual G8410-90050.

### Sample preparation system (SPS 3) accessory

☒ *Section NOT Applicable*

- ☐ Check the x-axis and z-axis timing belts – Replace if there is are any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

### Vapor generation accessory VGA (hydride generator)

☒ *Section NOT Applicable*

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

### UltraAA lamp accessory (external)

☒ *Section NOT Applicable*

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

### Restore System

- ☒ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

### Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

## Signature Page

### Service Review

- ☒ Attach available reports/printsouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.

### Test Results

#### Test Description

<b>Flame optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	44 %
<b>Flame performance test with 5 ppm copper sample</b>		
Air / acetylene, mixing paddle removed	Abs value > 0.5	0.7401 A
Air / acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.5 % RSD
<b>Deuterium furnace optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	N/A
<b>Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)</b>		
Precision %RSD	≤ 4.0%	N/A
Abs value	≥ 0.15	N/A
<b>Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)</b>		
Precision %RSD	≤ 4.0%	N/A
Abs value	≥ 0.10	N/A
MSR%	≥ 70 %	N/A

## AA consumable and parts list table

Part Description	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu 5ppm solution	6610030100	PM supplied	Common
Test Solution - Blank solution	5190-7001	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	99100093400	PM supplied	Flame
Organic Kit	99100093500	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	consumable	Flame
Tubing-Capillary Std Neb	9910024800	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	consumable	Flame
Glass impact beads (5, pk)	9910025700	consumable	Flame
Teflon impact beads (5, pk): (organics only)	9910053300	consumable	Flame
Burner cleaning strip (100, pk)	9910053900	consumable	Flame
Window UV silica - round (right side)	2010082600	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	PM supplied	Common
Pad adhesive window (rectangular)	4910012700	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	PM supplied	Common
Shroud (D2)	6310003100	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	PM supplied	Furnace
Zeeman shroud	6310003600	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PM supplied	Furnace

\* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Completion

Service request number 6006371115  
Agilent signature Worawit T.  
Total number of pages in this document 13

Date service completed 24 January 2024  
Customer signature David A.

SVD Results Report



Report ID: 1  
Diagnostic Start Time: 1/24/2024 9:41:24 AM  
Diagnostic End Time: 1/24/2024 10:10:55 AM  
Customer: Service Engineer: Worawit T.  
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: MY13160001  
Instrument Model: Varian AA140/240/280  
Flame Instrument: True  
Furnace Instrument: True  
Zeeman Present: False  
Internal Zeeman: False  
Internal UltraAA: False  
Optics Type: Double Beam  
D2 BG Correction Fitted: True  
Boot Block Version: 1.09  
Turret Type: Automatic  
Number Of Lamps: 4  
Mono Type: Automatic  
Gasbox Type: Y Gas Box  
Auto Burner Adjuster: False  
Mains Frequency: 50  
Firmware Version: 2.11  
Photomultiplier Type: Normal(900nm)  
PWB Version: 45

EEPROM Data:

Instrument Run Hours: 62609.832  
Zero Wavelength Offset: 30.148  
Mono Correction: 0.765  
Flame Hours: 29802.416  
D2 Run Hours: 49136.000  
D2 Serial Number: not set !  
D2 Install Date: 1/1/1970  
D2 Original Intensity: 1.000  
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0  
Datapoint Count: 20  
Upper Limit: 51.00  
Lower Limit: 49.00  
Average Frequency: 50.00  
Highest Measured Frequency: 50.00  
Lowest Measured Frequency: 50.00

Result: Passed

Power Supply:

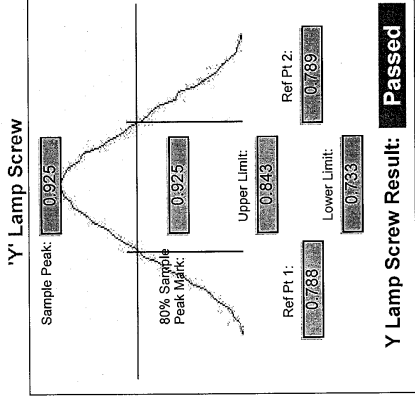
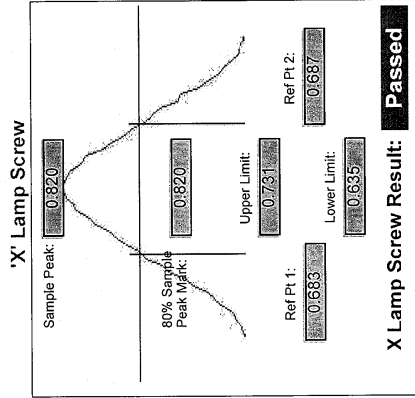
Averaging Period: 30.0  
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.19	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.05	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper  
Lamp Socket Used: 3  
Peak Selected: 324.80  
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper  
Lamp Turret Position: 3  
Lamp Current(mA): 4.00  
Slit Width(nm): 0.5  
1st Order Wavelength(nm): 324.80  
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper  
Peak Used(nm): 324.750  
Connected to Socket: 3  
Lamp Current(mA): 4  
Slit Width(nm): 0.2  
Slit Height: Normal

Lamp Alignment: **Performed**

Lower Limit(nm) 324.768      324.888 Upper Limit(nm)  
(Approach from Zero Order)      (Approach from end)  
Sample 1: 324.828      Sample 2: 324.828  
Sample 3: 324.828      Sample 4: 324.823  
Sample 5: 324.823      Sample 6: 324.823  
Sample 7: 324.823      Sample 8: 324.823  
Sample 9: 324.823      Sample 10: 324.823

Mean: 324.825      Standard Deviation: 0.002

Result: **Passed**

**Mechanical**

Wavelength Drive: **Passed**

Slit Drive: **Passed**

Turret Drive: **Passed**

Auto Burner Adjuster Drive: **Untested**

**Miscellaneous**

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	<b>Passed</b>
S1	156	165	191	<b>Passed</b>
S2	271	296	332	<b>Passed</b>
S3	474	507	579	<b>Passed</b>
S4	825	918	1008	<b>Passed</b>
S5	1435	1528	1754	<b>Passed</b>
S6	2498	2769	3053	<b>Passed</b>
S7	4347	4752	5313	<b>Passed</b>

Interlocks:

Burner Fitted: **Working**      Flame Detect: **Working**  
N2O Burner Fitted: **Untested**      GCU Active: **Working**  
Flame Shield Closed: **Working**      Oxidant Pressure: **Working**  
Gas Control Fitted: **Untested**      Oxidant Changeover: **Untested**  
Pressure Release Bung Fitted: **Working**      Ignition: **Working**  
Liquid Trap Fitted: **Working**

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected  
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/CL  
Lamp 3: 14 - Copper (Cu)  
Lamp 4: Uncoded Lamp/Not Connected  
Lamp 5: Not Supported  
Lamp 6: IINot Supported  
Lamp 7: Not Supported  
Lamp 8: Not Supported

Result: Passed

GTA Temperature Monitoring:

Not Performed

Notes:

PM 24 Jan 2024

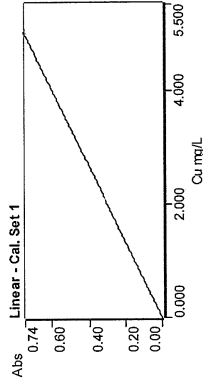
Signatures:

David- 24/1/24 Date  
Worawit T. 24/1/24 Date

Analyst  
Date Started 1/24/2024 11:39 AM GMT: 1/24/2024 4:39 AM  
Worksheet Cu 5 PPM Sense check  
Comment  
Methods Cu  
Computer name DESKTOP-RJUIFRS  
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc mg/L	%RSD	Mean Abs
CAL ZERO	0.000	55.0	0.0003
Readings			
	0.0002	0.0002	0.0004
			1/24/2024
STANDARD 1			
	5.000	1.7	0.7419
Readings			
	0.7274	0.7515	0.7468
			1/24/2024



Curve Fit = Linear  
Characteristic Conc = 0.028 mg/L  
r = 1.0000  
Calculated Conc = 0.000 5.000  
Residuals = 0.000 0.000

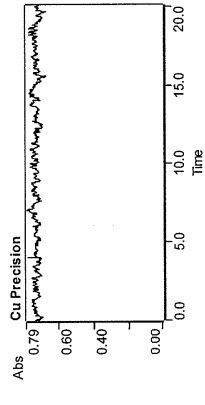
Abs = 0.14833 x C + 0.00023

Sample 001	4.988	0.7	0.7401
Readings			
	0.7454	0.7399	0.7349
			1/24/2024

Analyst 1/24/2024 11:47 AM GMT: 1/24/2024 4:47 AM  
Date Started  
Worksheet Cu 5 FFW Precision  
Comment  
Methods Cu  
Computer name DESKTOP-R9UJFSS  
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
Cu Precision	0.723	0.5	0.7232
Readings			
0.7221	0.7195	0.7226	0.7283
0.7201	0.7213	0.7266	0.7174



เอกสารไม่ควบคุม



สถาบันพัฒนาผลิตภัณฑ์อาหาร  
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Certificate

Certificate No.: 2402283-002-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR205DU  
Serial No.: C210685394  
ID No.: UAE.WAO.010/2565  
Order No.: 2402283  
Operation No.: 2402283-002  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong  
Scientist  
Approved by ( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



เอกสารไม่ควบคุม

2008 ซอยอุทิศ 35 ถนนสุขุมวิท แขวงบางซื่อ เขตบางซื่อ กรุงเทพมหานคร  
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545



**kfi**  
national food institute  
ministry of industry

อุตสาหกรรมพัฒนาอุตสาหกรรม  
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร

Foundation for Industrial Development National  
Food Industrial Laboratory Service Center

# Calibration Report

2008 ซอยอรุณนิมิตร 35 ถนนอรุณนิมิตร แขวงบางยี่สิบ เขตบางพลี กรุงเทพมหานคร  
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand  
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545



## Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.0001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

## Calibration Certificate

Certificate No.: 2402283-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment:

Electronic Balance

Manufacturer:

METTLER TOLEDO

Model:

XSR205DU

Serial No.:

C009071872

ID No.:

UAE.WAO.012/2563

Order No.:

2402283

Operation No.:

2402283-001

Date of Receipt:

2 April 2024

Date of Calibration:

2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong

Scientist

Approved by

( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

Date of Issue:

9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.00001 g / 0.0001 g

**ID No.:** UAE.WAO.012/2563

**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

**Environment Condition:** Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

**Place of Calibration:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

**Reference Standard**

**Model**

**Serial No.**

**Calibrated By**

**Certificate No.**

**Due Date**

**Instrument**

**Model**

**Serial No.**

**Calibrated By**

**Certificate No.**

**Due Date**

**Quality Reborn**

**QR24-0343**

**9 February 2025**

**Thermo-Hygro Meter**

**608-H1**

**NFLBTH 016/23**

**Quality Reborn**

**QR24-0343**

**9 February 2025**

**3. This certification is traceable to SI UNIT**

**4. This certificate was certified only for the instrument we calibrated.**

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

**Calibration Results:**

**1. Repeatability of Reading:**

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.00001 g / 0.0001 g

**ID No.:** UAE.WAO.012/2563

**Capacity:** 220 g

**Date of Calibration:** 2 April 2024

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Model:** XS205DU

**Serial No.:** C059071872

**Capacity:** 220 g

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.00001 g / 0.0001 g

**ID No.:** UAE.WAO.012/2563

**Date of Calibration:** 2 April 2024

Page 4 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 81 - 200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 81 - 200 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	0.00028	2.00

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

2008 อาคารศูนย์บริการ 36 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10700, Thailand  
2008 501 36, Auen Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand  
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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. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TME589  
Page : 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven

**Manufacturer :** Memmert

**Model :** UF 55

**Serial No. :** B212.0411

**ID No. :** UAE.WAO.005/2556

**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Lab Floor 2

**Received Order :** 01 April 2024

**Calibration Date :** 01 - 02 April 2024

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Krisda Malee

**Approved by :** Approved Signatory

( ) Ponpan Palim

(✓) Suwit Imjai

( ) Kunchit Promprat

**Issue Date :** 5 April 2024

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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A 0065065



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Cert. No.: 24TM589  
Page : 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

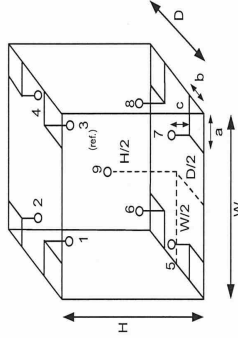
**Result of Calibration :-**

( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	26
REL Humid. ( % )	47	48
AC Supply ( Volt )	221	220



**Probe Installation Details :**

Dimension of Chamber :	
a =	5.0 cm
b =	5.0 cm
c =	5.0 cm
D =	0.50 m
W =	0.80 m
H =	0.75 m
Capacity =	0.30 m <sup>3</sup>

Ref. Std. ID No. : @ Calibration Point		
Position :	( 120 to 180 ) °C	( 104 ) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Cert. No.: 24TM589  
Page : 3 of 3  
Result of Calibration :-  
( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
104.0	104.0	104.0	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.531	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

**Average\* :** The average of 30 values in each position.

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\* :** Unit Under Calibration

**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .

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

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a 1209739

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a 1209738



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000, 29 FAX. 0-2719-9484



NSC7181-TS17025  
CALIBRATION 0008

Cert.No.: 24CH40  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA9M0046  
ID No. : UAE.EFM.001/2563(EFM.pH.01/63)  
Condition As-Received: Used Item  
Received Date : 09 January 2024  
Calibration Date : 10 January 2024  
Reference : 2401-0219WSC-3  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

(✓) Saithip Meangmai  
( ) Warakorn Lemgagrakul  
( ) Ponpan Paipim

Issue Date : 15 January 2024

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Cert.No.: 24CH40  
Page.: 2 of 3

### Condition of this calibration result

1. Reference Standard Instrument : -  
Instrument Serial No. ID No. Cert. No. Due Date  
1) Document Process Calibrator 54030049 130RC116 23E2802 27 Aug 2024  
2) Ref. Standard Thermometer 4982054 110RC044 23I908 26 July 2024  
This certification is traceable to the International System of Unit maintained through:-  
- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

### Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	( ±mV )	k
pH Meter S/N.: HA9M0046	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.0	10.01	0.058	2.00



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Cert.No.: 24CH40  
Page.: 3 of 3

#### Calibration Results

#### Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	171.9	0.0079	2.00
	6.986	6.99	-2.2	0.0093	2.00
	6.986	6.99	-3.6	0.0093	2.00
	9.997	10.01	-171.0	0.011	2.07

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

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

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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Sathip

a 1197724

DQE Services Co., Ltd.

**DQE Services**

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2024, Email : dqeservicesinfo@gmail.com



## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 4 January 2024

Calibration Date : 4 January 2024

Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

(Mr. Tanawut Rittdach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangern)

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

DQE Services

DQE Services Co.,Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

ISO 9001

ISO 17025

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.743	0.0000 0.0039	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.862	0.0000 0.0054	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.289	0.0000 0.0029	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.641	0.0000 0.0020	0.0050 0.0055	2.00 2.00

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ISO 9001

ISO 17025

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

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FM-708-02 R01 1/11/2021



## Certificate of Calibration

**Equipment :** Turbidity Meter  
**Manufacturer :** Oakton  
**Model :** T100IR  
**Serial No. :** 1120501017  
**ID. No. :** UAE.WAT.056/2563  
**Condition As-Received:** Used Item  
**Received Date :** 13 September 2023  
**Calibration Date :** 14 September 2023  
**Reference :** 2309-0458DSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 20) %  
**Calibration Procedure :** In - house method : CP-CH11  
based on direct measurement by  
using Formazin standard solution

**Calibrated by :** Walalak Sirthean

**Approved by :**   
Approved Signatory

( ) Saithip Meangmai  
(x) Warakorn Lengagrakul  
( ) Ponpan Paipim

**Issue Date :** 15 September 2023

The Uncertainties are for a confidence probability of approximately 95%.

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### Condition of this calibration result

- Reference Standard Instruments :  
This certification is traceable to the International System of unit (SI unit) through:-  
- Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygograph	1103328	130EC010	23C1361	13 June 2024
2) Electronic Balance	1124013382	140RC006	23MM18	20 Feb 2024

- Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

### Calibration result

Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU  
Turbidity Meter Serial Number : 1120501017

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
0	0.00	0.0067	2.00
20	20.3	0.39	2.00
100	101	0.76	2.00
400	401	1.5	2.05
800	800	2.1	2.23

**Remark**  
- UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

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

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