

## ภาคผนวก ฉ

เอกสารสอบเทียบเครื่องมือวิเคราะห์ของ บริษัท ยูไนเต็ด  
แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด



## 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	Tisch Environmental,Inc.	27072020	27 Jul 20	26 Jul 22	-
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)	22P800	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2500	21 Jul 21	20 Jul 22	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H771	5 Apr 22	4 Apr 23	-
5	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	21-ACT-326	24 Aug 21	23 Aug 22	-
6	Sound Level Meter	L <sub>Aeq</sub> 24 hr, L <sub>Aeq</sub> 1 hr, L <sub>A90</sub> , L <sub>Adn</sub> , L <sub>Amax</sub>	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	ACL22081	26 Jan 22	25 Jan 23	-
7	Sound Level Meter	L <sub>Aeq</sub> 24 hr, L <sub>Aeq</sub> 1 hr, L <sub>A90</sub> , L <sub>Adn</sub> , L <sub>Amax</sub>		LxT2 0005289					
8	Sound Level Meter	L <sub>Aeq</sub> 24 hr, L <sub>Aeq</sub> 1 hr, L <sub>A90</sub> , L <sub>Adn</sub> , L <sub>Amax</sub>	Larson Davis	LxT2 0005304	Innovative Instrument Co.,Ltd.	22-ACT-249	1 Apr 22	31 Mar 23	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 22P800  
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: 03 March 2022

Calibration Date: 12 March 2022

Reference: 2203-0131WSC

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, Bangkok,  
Phrakhanong, Bangkok 10260

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

### Condition of this result of calibration

1. Reference standards instruments:

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

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

3. Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussamee  
Issue Date: 14 March 2022

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

เอกสารไม่ควบคุม  
B 0282413



Cert.No.: 22P800  
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	High-port side	Low-port side	AP	Error
(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.04	14.04	0.04
16.00	8.00	-8.04	16.04	0.04
18.00	9.00	-9.04	18.04	0.04
20.00	10.00	-10.04	20.04	0.04
22.00	11.00	-11.02	22.02	0.02
24.00	12.00	-12.02	24.02	0.02
26.00	13.00	-13.02	26.02	0.02
28.00	14.00	-14.04	28.04	0.04
30.00	15.00	-15.04	30.04	0.04
32.00	16.00	-16.04	32.04	0.04
34.00	16.98	-17.06	34.04	0.04
35.80	17.98	-18.00	35.98	0.18

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

\* UUC = Unit Under Calibration

\* AP = 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 %.

-o0o-

เอกสารไม่ควบคุม  
a 1099526



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No.: 21P2500  
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.123/2550

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1009 mbar

This certificate may not be reproduced other than in full,  
except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

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

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

Procedure used: 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	DP142	1422505046	MP-0053-21	08 Apr 2022

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussamee  
Issue Date: 22 July 2021

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

เอกสารไม่ควบคุม  
B 0264463



Cert.No.: 21P2500  
Page: 2 of 2

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

Range: 900 hPa to 1030 hPa  
Scale Interval: 1 hPa (The Fifth Estimate)

Applied Pressure (hPa)	950.36	968.61	979.40	990.51	1000.62	1010.72	1020.76	1031.19
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	3.64	1.39	0.60	-0.51	-0.82	-0.72	-0.76	-1.19

Decreasing Pressure	Applied Pressure (hPa)	1031.28	1020.72	1010.67	1000.58	990.42	979.33	968.54	956.29
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0	
Error (hPa)	-1.28	-0.72	-0.67	-0.58	-0.42	0.67	1.46	3.71	

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 %.

-o0o-

เอกสารไม่ควบคุม  
a 1062244



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No.: 22H771  
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE-ANV-003/2548

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022

Reference: 2203-1124WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

### Condition of this result of calibration

1. Reference standards instruments:

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

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

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

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

Calibrated by: Somchai Dumwor  
Issue Date: 08 April 2022

Approved Signatory:

[ ] Chakrit Waewanjus  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawutti

เอกสารไม่ควบคุม  
B 0285423



Cert. No.: 22H771  
Page: 2 of 2

### Result of Calibration:-

Without Adjustment				
Function: Humidity measurement.				
Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	61	1.0	1.8
25.0	80.0	78	-2.0	2.0

### Result of Calibration:-

Without Adjustment				
Function: Temperature measurement.				
Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement	
(°C)	(°C)	(°C)	(±°C)	
20.02	20.0	-0.02	0.72	
29.98	30.0	0.02	0.72	
35.02	35.0	-0.02	0.72	
40.03	40.0	-0.03	0.72	

UUC\*: Unit Under Calibration

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

-00-

เอกสารไม่ควบคุม  
a 1104141

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No.: ACL22081  
Pages: 1 of 8

## Calibration Certificate

Equipment: SOUND LEVEL METER  
Manufacturer: LARSON DAVIS  
Model: LxT2/ Microphone 375B02 / Pre-amplifier PRML x T2B  
Serial No.: 0005286 / 011740 / 056087  
ID No.: -

Condition As Found: GOOD

Customer: UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

Location: -  
Ambient Temperature: ( 23.0 ± 3 ) °C  
Pressure: ( 101.3 ± 3 ) kPa  
Relative Humidity: ( 50.0 ± 20 ) %

Received Date: 18 JANUARY 2022  
Calibration Date: 26 JANUARY 2022  
Date of Issue: 28 JANUARY 2022

Calibrated by: Nathakorn Pisutpaisan

Approved by:

T. Petchurai  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced  
other than in full, except with the prior written approval of the head of Calibration Laboratory.

เอกสารไม่ควบคุม

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

### Continuation of Calibration Certificate

Cert. No.: ACL22081  
Job No.: VC65AC0044  
Pages: 2 of 8

Calibration Procedure: CP-AC-02

### Calibration Method:

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference  
Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration:

1. Reference Standard Instruments:

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

3. This certificate is traceable to the international system of unit maintained at:

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

เอกสารไม่ควบคุม



Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
31.0

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	30.8
C - weight	30.6
Flat	36.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	-0.1	0.1	0.0	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	3.1	3.2	3.2	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0
16000	-0.1	0.0	0.1	±5.0 (-∞)

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.1	0.1	± 1.1
132.0	132.1	0.1	± 1.1
131.0	131.1	0.1	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.1	0.1	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.1	0.1	± 1.1
44.0	44.2	0.2	± 1.1
39.0	39.6	0.6	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22081  
Job No. : VC65AC0044  
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.2	89.4	0.2
		±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22082  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : LARSON DAVIS  
Model : LX2/ Microphone 375B02 / Preamplifier PRML x T2B  
Serial No. : 0005289 / 011732 / 056076  
ID No. : -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 18 JANUARY 2022  
Calibration Date : 26 JANUARY 2022  
Date of Issue : 28 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur



Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
29.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	29.4
C - weight	29.1
Flat	34.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	-0.1	0.2	0.2	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	2.6	2.6	2.6	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	-0.1	0.0	±3.0
8000	0.0	0.1	0.0	±5.0
16000	-0.1	0.1	0.1	±5.0 (-∞)

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.4	0.0	±2.0
Negative half cycle	135.4	135.4	0.0	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Y. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22082  
Job No. : VC65AC0044  
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.2	89.4	0.2
		±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Y. Petch

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEU,  
AMPHOE BANG PHEI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (0660-2110-5800-1 FAX: (0660-2110-7140)



Page: 1/6

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Address :  
Certificate No : 22-ACT-249  
Request No : Req2022-0629

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005504  
ID : UAE.EFM.115/2562  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 329356  
Preamplifier Model : PRMLxT2B  
Preamplifier S/N : 056099  
Instrument Status : Used

Calibration Environment and Details

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

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svanick	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By : JPE  
Mr. Nopadol Luangrat  
Calibration Officer

Approved By : P. Petch  
Mr. Puch Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 1 April 2022

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEU,  
AMPHOE BANG PHEI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (0660-2110-5800-1 FAX: (0660-2110-7140)



Page: 2/6

Certificate No : 22-ACT-249

Request No : Req2022-0629

1. Indication at the calibration check frequency

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

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 25A, SN:58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	24.7	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	24.1	0.10
C	23.5	0.10
Z	27.8	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139			
STD Setting			
125 Hz	0.1	0.1	0.50
1000 Hz	0.0	0.0	0.60
4000 Hz	0.4	0.3	0.60
8000 Hz	-0.2	-0.3	0.70



Certificate No : 22-ACT-249  
Request No : Req-2022-0629

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

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

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	Limit	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.1	0.1		0.2
Z	114.00	114.1	0.1		0.2

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

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

Certificate No : 22-ACT-249  
Request No : Req-2022-0629

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	98.9	-0.1		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1

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

Certificate No : 22-ACT-249  
Request No : Req-2022-0629

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	43.9	44.1	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	REF	Ref	UUC	ERR	Limit	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

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

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

Certificate No : 22-ACT-249  
Request No : Req-2022-0629

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	Limit	Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.9		
Negative one-half cycle	142.7		
Deviant	0.2	0.2	1.5

13. High Level Stability

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

End of Certificate

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

## List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1F0002	Technology Promotion Association (Thailand-Japan)	21CH1607	19 Nov 21	18 Nov 22	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



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

## Certificate of Calibration

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

Calibrated by : Warakorn Lerngagtrakul

Approved by :

(✓) Malee Butkruea  
( ) Sathip Meangmal  
( ) Warakorn Lerngagtrakul

Issue Date : 25 November 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



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

### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	2111201	26 Oct 2022

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

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

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

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

### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	( ±mV )	k
pH Meter S/N.: HA1F0002	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	-0.2	7.02	0.058	2.00
	7.00	0.00	-0.2	7.02	0.058	2.00
	10.00	-177.48	-177.6	10.01	0.058	2.00

เอกสารไม่ควบคุม



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

### Calibration Results

Function : pH Measurement

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

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

### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

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

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

Remark : - UUC\* = Unit Under Calibration

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

-o0o-

เอกสารไม่ควบคุม



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการเหมืองแร่ดินอุตสาหกรรมชนิดดินซีเมนต์ประทานบัตรหมายเลข 28810/15998 (คำขอฯ ที่ 2/2551) และ 28814/16000 (คำขอฯ ที่ 6/2551)

บริษัท ปูนซีเมนต์นครหลวง จำกัด (มหาชน) ระหว่างเดือนมกราคม-มิถุนายน พ.ศ. 2565

### Certificate of Instrument for Environment Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Instrument for Air Quality Analysis.									
1	Analytical Balance (Readability 0.1 mg)	ปริมาณฝุ่นละอองแขวนลอยทั้งหมด (TSP), ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM10)	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2200704-001-01	24 Nov 21	23 Nov 22	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2102572-001-01	26 Apr 21	25 Apr 22	-
Instrument for Water Quality Analysis.									
1	pH Meter	ความเป็นกรด-ด่าง (pH at 25 °C)	Mettler-Toledo	Seven Easy S20 / 123052512	National Food Institute, Ministry of Industry, Thailand	2101930-001-01	17 Mar 21	16 Mar 22	-
2	pH Meter		Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2102015-001-01	17 Mar 21	16 Mar 22	-
3	Turbidity Meter	ความขุ่น (Turbidity)	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	21CH1017	17 Aug 21	16 Aug 22	-
4	Analytical Balance (Readability 0.01 mg)	ปริมาณสารแขวนลอยทั้งหมด (Total Suspended Solids)	Mettler-Toledo	XSR205DU / C009071872	Calibration Laboratory Mettler-Toledo (Thailand) Limited	2102573-001-01	26 Apr 21	25 Apr 22	-
5	Hot Air Oven	ปริมาณมวลสารทั้งหมดที่ละลายได้ (Total Dissolved Solids)	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	21TM813	21 Apr 21	20 Apr 22	-
6	UV-VIS Spectrophotometer	ซัลเฟต (Sulfate; SO4)	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
7	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP21-008	25 Jan 22	24 Jan 23	-
8	Atomic Absorption Spectrometer (AAS)	ปริมาณเหล็กทั้งหมด (Total Iron; สารหนู (Arsenic; As) แคดเมียม (Cadmium; Cd) ตะกั่ว (Lead; Pb)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 335/64	4 Feb 22	3 Feb 23	-

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

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 3382  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong Contact: Suwit Chotnok  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number:

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S Asset Number: UAE.AIR.019/2550  
Serial No.: 1128312528 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (206)

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

### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CP/W02/20  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity span of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %

As Found Calibration Date: 07-Apr-2022 Calibrator:   
As Left Calibration Date: N/A  
Issue Date: 08-Apr-2022 Approved Signatory:   
☒ Kassakorn Tassanachaisakul  
☐ Santi Jitriyom  
☐ Surachet Sukkate

เอกสารไม่ควบคุม

## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A



The "d" in the graph represents the readability of the range interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0002 g	N/A

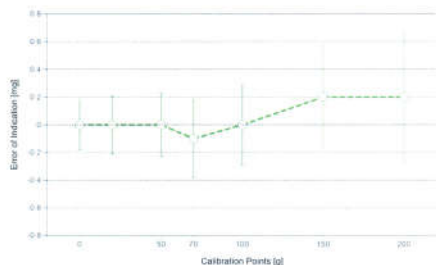


The "d" in the graph represents the readability of the range interval in which the test was performed.

เอกสารไม่ควบคุม

## Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg	2



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

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

### Test Equipment

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

#### Weight Set 1: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022  
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

#### Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021  
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

เอกสารไม่ควบคุม

## Remarks

Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filler pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

### End of Accredited Section

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

เอกสารไม่ควบคุม

## Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-5} / K$

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

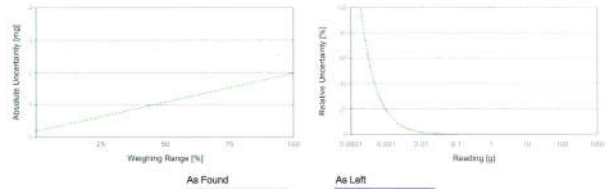
### Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found	As Left
0.0220 g	0.19 mg	N/A
0.2200 g	0.19 mg	N/A
2.2000 g	0.21 mg	N/A
22.0000 g	0.37 mg	N/A
220.0000 g	2.0 mg	N/A



เอกสารไม่ควบคุม

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Laksale Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 6382  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong Contact: Suwit Chotnolk  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number:

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S/FACT Asset Number: UAE.AIR.0162555  
Serial No.: B108115858 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (208)

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

### Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
Mettler Toledo Work Instruction: CIP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

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

	Temperature	Humidity
As Found	Start: 22.8 °C End: 22.1 °C	Start: 56.0 % End: 51.9 %
As Left	Start: 22.3 °C End: 22.4 °C	Start: 46.2 % End: 55.8 %

As Found Calibration Date: 07-Apr-2022  
As Left Calibration Date: 07-Apr-2022  
Issue Date: 08-Apr-2022

Calibrator:   
Approved Signatory:

☒ Kasakorn Teisanacharakul  
☐ Santi Jitinyom  
☐ Surachet Sukkate

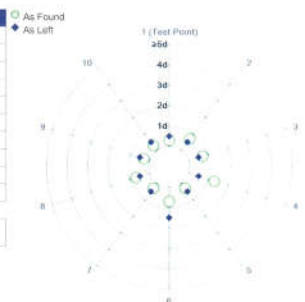
เอกสารไม่ควบคุม

## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g
Standard Deviation	0.00007 g	0.00007 g

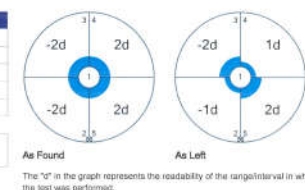


The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0005 g	100.0000 g
2	100.0003 g	99.9999 g
3	100.0003 g	99.9998 g
4	100.0007 g	100.0001 g
5	100.0007 g	100.0002 g
Maximum Deviation	0.0002 g	0.0002 g



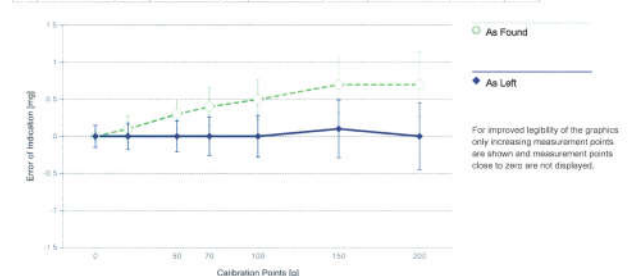
The "d" in the graph represents the readability of the range/interval in which the test was performed.

เอกสารไม่ควบคุม

## Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.38 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



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

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

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

เอกสารไม่ควบคุม



### Test Equipment

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

#### Weight Set 1: OIML E2

Weight Set No.: WS80 Date of Issue: 23-Feb-2022  
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

#### Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021  
Certificate Number: 21H1226 Calibration Due Date: 01-Jun-2022

### Remarks

FACT adjustment functionality activated  
Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filter pan: 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

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

เอกสารไม่ควบคุม

### Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $2.5 \cdot 10^{-6} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

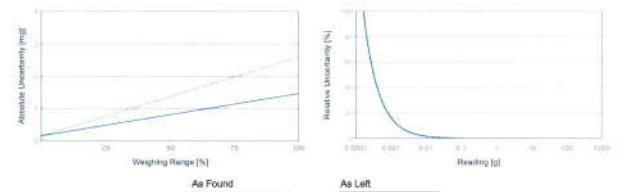
#### Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$	$U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$

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

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

Net Indication	As Found	As Left
0.0220 g	0.16 mg, 0.73%	0.16 mg, 0.73%
0.2200 g	0.16 mg, 0.074%	0.16 mg, 0.073%
2.2000 g	0.16 mg, 0.0084%	0.17 mg, 0.0079%
22.0000 g	0.40 mg, 0.0018%	0.29 mg, 0.0013%
220.0000 g	2.6 mg, 0.0012%	1.5 mg, 0.00068%



เอกสารไม่ควบคุม

## Calibration Certificate

Certificate No.: 2203527-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter  
Manufacturer: METTLER TOLEDO  
Model: Seven Compact S220  
Serial No.: C113432421  
ID No.: UAE-WAT.009/2564  
Order No.: 2203527  
Operation No.: 2203527-001  
Date of Receipt: 30 June 2022  
Date of Calibration: 5 July 2022

Calibrated by: Mr. Worapob Sooktong, Scientist  
Approved by: (Mr. Pheraphat Tuanjit), Manager, Division of Calibration Laboratory  
Date of Issue: 5 July 2022  
Responsible for the Technical Management Team

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

## Calibration Report

Certificate No.: 2203527-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: METTLER TOLEDO  
Model: Seven Compact S220  
Serial No.: C113432421  
Type: Bench top  
ID No.: UAE-WAT.009/2564

Date of Calibration: 5 July 2022  
Location: Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 23.5 ± 1.5 ) °C, Relative Humidity: ( 53 ± 5 ) %  
Condition of Equipment: Good Condition

#### Condition of this Results of Calibration

1. Calibration Method: In house method: W-CO-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

#### 2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	22E1958	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC-440599-01	30 October 2022
2.3 Thermo-Hygro Meter	NFLBTH00518	PONPE	QR22-0351	18 February 2023
Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	805203	CPAchem	PH216.LS	21 April 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	805204	CPAchem	PH217.LS	21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	805205	CPAchem	PH220.LS	21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	805206	CPAchem	PH107.LS	21 April 2023

3. This certification is traceable to The International System of Unit (SI Unit)  
3.1 Instruments No.2.1 through NSC-TIS-17025 Laboratory Accreditation of Calibration No.0075  
3.2 Instruments No.2.2 through NSC-TIS-17025 Laboratory Accreditation of Calibration No.0061  
3.3 Instruments No.2.3 through NSC-TIS-17025 Laboratory Accreditation of Calibration No.0292  
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025  
3.5 Certified Reference Material No.2.7 traceable to BIM RefN H-27 LoN 04.06.2021; BIM RefN H-28 LoN 28.05.2021; BIM RefN H-27 LoN 04.06.2021; BIM RefN H-28 LoN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

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

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**Type:** Bench top  
**ID No.:** UAE.WAT.009/2564

**Date of Calibration:** 5 July 2022 Page 3 of 5

**Calibration Results:**  
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	454.117	414	0.00	0.58	2.00
2	295.811	286	2.00	0.58	2.00
4	177.482	177	4.00	0.58	2.00
6	59.159	59	6.00	0.58	2.00
7	-0.801	0	7.00	0.58	2.00
8	-58.159	-59	8.00	0.58	2.00
10	-177.482	-177	10.00	0.58	2.00
12	-295.812	-286	12.00	0.58	2.00
14	-454.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

**Equipment:** pH Electrode  
**Type:** Combined Electrode  
**Manufacturer:** METTLER TOLEDO  
**Model:** InLab Expert Pro-ISM  
**Serial No.:** 2210418  
**ID No.:** N/A

**Performance of Electrode system** (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.010	182	-	0.0071	2.00
9.885	9.850	14	100.0	0.0075	2.00
10.008	10.010	-169	97.9	0.0093	2.00
9.985	9.990	6	-	0.0087	2.00

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

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO

**Date of Calibration:** 5 July 2022 Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C

**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : - S/N : -
- Dimension of probe : Diameter 9 mm., Length 120 mm.,
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.038	- 0.1	0.12
25.1	25.038	- 0.1	0.12
35.2	35.024	- 0.2	0.12

**Note**

- UUC\* : Unit Under Calibration

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

\*\*\*\*\* End \*\*\*\*\*

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

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** Seven Compact S220  
**Serial No.:** C113432421  
**ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO

**Date of Calibration:** 5 July 2022 Page 4 of 5

**Location:** Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 25 °C ± 1 °C  
Relative Humidity 48 % ± 3 %

**Condition of this results of Calibration:**

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.  
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.  
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 650057-01	10-Dec-22	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (TSOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
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.
6. Condition of Calibrated item : Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

เอกสารไม่ควบคุม

## Calibration Certificate

**Certificate No.:** 2202097-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260

**Equipment:** pH Meter

**Manufacturer:** HANNA INSTRUMENTS

**Model:** HI 2211

**Serial No.:** 08165345

**ID No.:** UAE.WAT.004/2556

**Order No.:** 2202097

**Operation No.:** 2202097-001

**Date of Receipt:** 11 March 2022

**Date of Calibration:** 16 March 2022

**Calibrated by** Mr.Manas Somsak  
Specialist

**Approved by** (Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

**Date of Issue:** 21 March 2022

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 220297-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH : 0.1 mV  
Manufacturer: HANNA INSTRUMENTS Model: HI 2211  
Serial No.: 08165345 Type: Bench top  
ID No.: UAE.WAT.0042556

Date of Calibration: 16 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 23.0 ± 1.5 ) °C Relative Humidity: ( 45.5 ± 5 ) %  
Condition of Equipment: Good Condition  
Condition of this Results of Calibration

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SC-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	asa JSL BTH 005/58	PONPE	GR21-2787	15 November 2022

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.005 (Primary pH buffer Solution)	780012	CPAchem	PH216.L5	21 November 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	780013	CPAchem	PH217.L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780015	CPAchem	PH220.L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776840	CPAchem	PH107.L5	8 November 2022

3. This certification is traceable to The International System of Unit (SI Unit)

- 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
- 3.2 Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No. 2.7 traceable to BHM RefN HI-7 Loth 30.04.2020; BHM RefN HI-8 Loth 28.05.2020; BHM RefN HI-9 Loth 30.04.2020; BHM RefN HI-10 Loth 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 220297-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH : 0.1 mV  
Manufacturer: HANNA INSTRUMENTS Model: HI 2211  
Serial No.: 08165345 Type: Bench top  
ID No.: UAE.WAT.0042556

Date of Calibration: 16 March 2022 Page 3 of 5

Calibration Results: ( Manual Temperature Compensation at 25 °C )

1. Calibration of pH Meter

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.117	414	0.90	0.58	2.00
2	295.811	295.7	2.00	0.063	2.00
4	177.462	177.4	4.00	0.063	2.00
6	59.159	59.2	6.00	0.063	2.00
7	-0.001	0.1	7.00	0.063	2.00
8	-59.155	-59.1	8.00	0.063	2.00
10	-177.463	-177.3	10.00	0.063	2.00
12	-295.812	-295.6	12.00	0.063	2.00
14	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )

Equipment: pH Electrode Type: Combined Electrode  
Manufacturer: METTLER TOLEDO Model: LE420  
Serial No.: 1142602 ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value (25 °C pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	180.5	99.3	0.0071	2.00
6.866	6.87	12.5	-	0.0074	2.00
10.018	10.01	-171.5	99.1	0.0090	2.00
6.883	6.86	5.2	-	0.0092	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 220297-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: HI 2211  
Serial No.: 08165345 ID No.: UAE.WAT.0042556  
Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 16 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: Ambient Temperature ( 23.0 ± 1.0 ) °C  
Relative Humidity ( 50 ± 4 ) %

Condition of this results of Calibration:

- 1. Calibration Method : In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0651164	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : Low Temperature Bath (SDCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).

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.

6. Condition of Calibrated item : Good

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 220297-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: HI 2211  
Serial No.: 08165345 ID No.: UAE.WAT.0042556  
Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 16 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : N/A S/N : N/A
- Dimension of probe : Diameter 3.5 mm, Length 100 mm.
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.001	0.0	0.099
25.0	25.002	0.0	0.099
35.0	35.002	0.0	0.099

\* UUC\* : Unit Under Calibration

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

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม





## Certificate of Calibration

Cert.No.: 21CH1017  
Page.: 1 of 2

Equipment : Turbidity Meter  
Manufacturer : Oakton  
Model : T100IR  
Serial No. : 1120501017  
ID. No. : UAE.WAT.056/2563  
Condition As-Received : Used Item  
Received Date : 09 August 2021  
Calibration Date : 17 August 2021  
Reference : 2108-0201WSC-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 Sirithean

Approved by :   
Approved Signatory

( ) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagtrakul

Issue Date : 23 August 2021

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

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration and Testing Equipment Services.

เอกสารไม่ควบคุม  
A 0007434



Cert.No.: 21CH1017  
Page.: 2 of 2

### Condition of this calibration result

1. 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-Hygrograph	1103328	130EC010	21H1462	27 June 2022
2) Electronic Balance	1126143764	140RC004	20MM595	27 Sep 2021

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000343342	99.5%
2) Hydrazinium Sulfate	HIMEDIA	0000332928	99.2%

3. 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	0.0062	2.00
20	20.2	0.39	2.00
100	101	0.72	2.00
400	403	1.5	2.09
800	803	2.1	2.13

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 %.

-000-

เอกสารไม่ควบคุม  
A 1065933



Cert.No.: 22MM210  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : XSR205  
Serial No. : C009071872  
ID No. : UAE.WAO.012/2563  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phakhanong,  
Bangkok 10260

Location : Balance Room

Received order : 26 April 2022  
Calibration Date : 26 April 2022  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %

Calibrated by : Kunchit Promprat

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 29 April 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม  
A 0007434



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2204-0542OC-1

Cert.No.: 22MM210  
Page: 2 of 3

### Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

### Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	-	70RC138	MM-0009-21	3 Feb 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

Range capacity :	0 g to 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

### Before Adjustment :

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
80	80.00004	-0.00004	0.15	2.00
200	199.9999	+0.0001	0.35	2.00

### After Adjustment :

1. Determination of the standard deviation of weighing machine ( n = 10 )

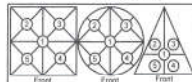
Applied Weight ( g )	Standard Deviation of Reading ( g )
80	0.000008
200	0.00005

เอกสารไม่ควบคุม  
A 1065933



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2204-0542OC-1  
Result of calibration

Cert.No.: 22MM210  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)  
0.0002

## 2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0002	-0.0001	0.0000	-0.0002	-0.0002

## 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
0.1	0.10001	-0.00001	0.017	2.11
1	1.00002	-0.00002	0.019	2.05
5	5.00003	-0.00003	0.026	2.00
20	20.00008	-0.00008	0.049	2.00
50	50.00010	-0.00010	0.080	2.00
80	80.00014	-0.00014	0.15	2.00
100	100.0001	-0.0001	0.21	2.00
150	150.0001	-0.0001	0.29	2.00
200	200.0001	-0.0001	0.35	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 %.

-o0o-

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3009-27 FAX. 0-2719-9484



Cert. No.: 22TM304  
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  
Location : Lab Floor 2  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3 (Equipment Calibration and Testing Services).

เอกสารไม่ควบคุม

A 0040245



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2204-0015OC-1  
Procedure Used :-

Cert.No.: 22TM304  
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

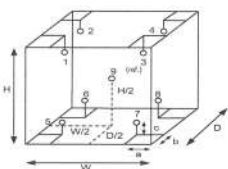
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	221	224

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

เอกสารไม่ควบคุม

a 1104316



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2204-0015OC-1  
Result of Calibration :- (°) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM304  
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.040	0.57	0.80	0.42	2
120.0	120.0	120.0	0.11	0.82	1.1	1.1	2
180.0	180.0	180.0	0.12	1.4	2.0	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.403	104.220	104.517	104.474	103.778	103.859	104.292	104.357	104.319
120.0	120.183	119.878	120.238	120.355	119.476	119.455	120.046	120.173	120.199
180.0	180.502	179.929	180.655	180.797	179.012	179.044	180.043	180.305	180.340

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 %.

-o0o-

เอกสารไม่ควบคุม

a 1104315





## CERTIFICATE OF CALIBRATION

Certificate No. : SP21-015 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 315

Equipment : Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 29 May 2021

Calibration Date : 29 May 2021

Issue Date : 30 May 2021

Condition of Instrument : Used

Calibrated by : ธนวิทย์ Approved by : ชลิษา  
(Mr.Tanawut Rittidach) (Miss Chonitha Sangerng)  
Technical Manager 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.

FM-510-02 R03 11/03/201

เอกสารไม่ควบคุม



## REPORT OF CALIBRATION

Certificate No. : SP21-015 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C  
Relative humidity  $50 \pm 15$  %RH

Calibration method : In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	11/7/2021
Absorbance Standard set	25757	80105	11/7/2021
Wavelength Standard set	25806	80103	11/7/2021
Wavelength Standard set	25758	80104	11/7/2021

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 : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

FM-510-02 R03 11/03/201

เอกสารไม่ควบคุม



## REPORT OF CALIBRATION

Certificate No. : SP21-015 Page 3 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.19	2.00
279.45	279.5	-0.05	0.19	2.00
287.81	287.9	-0.09	0.19	2.00
334.06	333.8	0.26	0.19	2.00
360.93	360.5	0.43	0.19	2.00
418.59	418.2	0.39	0.19	2.00
445.94	445.6	0.34	0.19	2.00
453.66	453.3	0.36	0.19	2.00
460.02	459.8	0.22	0.19	2.00
536.59	536.7	-0.11	0.19	2.00
637.98	638.4	-0.42	0.19	2.00
431.38	430.9	0.48	0.19	2.00
472.50	472.5	0.00	0.19	2.00
513.47	513.4	0.07	0.19	2.00
528.88	529.2	-0.32	0.19	2.00
573.17	573.5	-0.33	0.19	2.00
585.35	584.8	0.55	0.20	2.00
684.40	684.9	-0.50	0.19	2.00
740.72	740.4	0.32	0.19	2.00
748.55	749.0	-0.45	0.19	2.00
807.03	807.1	-0.07	0.19	2.00
879.28	879.4	-0.12	0.19	2.00

FM-510-02 R03 11/03/201

เอกสารไม่ควบคุม



## REPORT OF CALIBRATION

Certificate No. : SP21-015 Page 4 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	0.0000	0.0000	0.0042	2.00
	0.5791	0.5767	0.0024	0.0042	2.00
	1.0488	1.0444	0.0044	0.0042	2.00
	2.1914	2.1841	0.0073	0.0092	2.00
440	0.0000	0.0001	-0.0001	0.0042	2.00
	0.5618	0.5609	0.0009	0.0042	2.00
	1.0260	1.0244	0.0016	0.0042	2.00
	2.1259	2.1192	0.0067	0.0091	2.00
465	0.0000	0.0000	0.0000	0.0042	2.00
	0.5240	0.5212	0.0028	0.0042	2.00
	0.9639	0.9632	0.0007	0.0042	2.00
	1.9788	1.9717	0.0071	0.0091	2.00
546.1	0.0000	-0.0001	0.0001	0.0042	2.00
	0.5194	0.5184	0.0010	0.0042	2.00
	0.9991	0.9991	0.0000	0.0042	2.00
	1.9970	1.9911	0.0059	0.0093	2.00
590	0.0000	0.0000	0.0000	0.0042	2.00
	0.5523	0.5517	0.0006	0.0042	2.00
	1.0810	1.0802	0.0008	0.0042	2.00
	2.0369	2.0293	0.0076	0.0092	2.00
635	0.0000	-0.0001	0.0001	0.0042	2.00
	0.5596	0.5593	0.0003	0.0042	2.00
	1.0513	1.0505	0.0008	0.0042	2.00
	1.9268	1.9217	0.0051	0.0092	2.00


FM-510-02 R03 11/03/201

เอกสารไม่ควบคุม





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



## REPORT OF CALIBRATION

Certificate No. : SP21-015
Page 5 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7498	0.0001 0.7438	-0.0001 0.0060	0.0075 0.0075	2.00 2.00
257	0.0000 0.8712	0.0000 0.8647	0.0000 0.0065	0.0075 0.0075	2.00 2.00
313	0.0000 0.2920	0.0000 0.2900	0.0000 0.0020	0.0075 0.0075	2.00 2.00
350	0.0000 0.6459	0.0000 0.6428	0.0000 0.0031	0.0075 0.0075	2.00 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%


- End of Certificate -

FM-510-02 R03 11/03/201

เอกสารไม่ควบคุม



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



## CERTIFICATE OF CALIBRATION

Certificate No. : SP21-008
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 315

Equipment : Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064


ID No. : UAE.WS.006/2552


Received Date : 25 January 2564

Calibration Date : 25 January 2564

Issue Date : 26 January 2564

Condition of Instrument : Used


Calibrated by :   
(Mr. Tanawut Ritidach)  
Technical Manager

Approved by :   
(Miss Chonthicha Sangniam)  
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.

FM-510-02 R03 11/03/2019

เอกสารไม่ควบคุม



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



## REPORT OF CALIBRATION

Certificate No. : SP21-008
Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C  
Relative humidity  $50 \pm 15$  %RH

Calibration method : In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	7/11/2021
Absorbance Standard set	25757	80105	7/11/2021
Wavelength Standard set	25806	80103	7/11/2021
Wavelength Standard set	25758	80104	7/11/2021

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 : 4.0 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.

FM-510-02 R03 11/03/2019

เอกสารไม่ควบคุม



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



## REPORT OF CALIBRATION

Certificate No. SP21-008
Page 3 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.19	2.00
279.40	278.6	0.80	0.19	2.00
288.70	287.6	1.10	0.19	2.00
334.22	333.6	0.62	0.19	2.00
361.26	360.6	0.66	0.19	2.00
418.48	418.0	0.48	0.19	2.00
446.70	445.8	0.90	0.19	2.00
453.20	452.8	0.40	0.19	2.00
460.06	459.6	0.46	0.19	2.00
536.90	536.2	0.70	0.19	2.00
637.94	637.4	0.54	0.19	2.00
440.74	440.2	0.54	0.19	2.00
472.22	471.8	0.42	0.19	2.00
513.70	513.0	0.70	0.19	2.00
528.72	528.2	0.52	0.19	2.00
574.60	574.0	0.60	0.19	2.00
585.48	584.8	0.68	0.19	2.00
684.63	684.0	0.63	0.19	2.00
740.27	739.8	0.47	0.19	2.00
748.28	747.8	0.48	0.19	2.00
807.16	806.6	0.56	0.19	2.00
879.70	879.0	0.70	0.19	2.00

FM-510-02 R03 11/03/2019

เอกสารไม่ควบคุม

## REPORT OF CALIBRATION

Certificate No. : SP21-008

Page 4 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	0.0042	2.00
	0.5791	0.577	0.0021	0.0042	2.00
	1.0488	1.045	0.0038	0.0042	2.00
	2.1914	2.183	0.0084	0.0092	2.00
440	0.0000	0.000	0.0000	0.0042	2.00
	0.5618	0.560	0.0018	0.0042	2.00
	1.0260	1.025	0.0010	0.0042	2.00
	2.1259	2.122	0.0039	0.0091	2.00
465	0.0000	0.000	0.0000	0.0042	2.00
	0.5240	0.522	0.0020	0.0042	2.00
	0.9639	0.965	-0.0011	0.0042	2.00
	1.9788	1.978	0.0008	0.0092	2.00
546.1	0.0000	0.000	0.0000	0.0042	2.00
	0.5194	0.519	0.0004	0.0042	2.00
	0.9991	1.001	-0.0019	0.0042	2.00
	1.9970	1.998	-0.0010	0.0092	2.00
590	0.0000	0.000	0.0000	0.0042	2.00
	0.5523	0.553	-0.0007	0.0042	2.00
	1.0810	1.082	-0.0010	0.0042	2.00
	2.0369	2.035	0.0019	0.0092	2.00
635	0.0000	0.000	0.0000	0.0042	2.00
	0.5596	0.561	-0.0014	0.0042	2.00
	1.0513	1.052	-0.0007	0.0042	2.00
	1.9268	1.925	0.0018	0.0092	2.00

PM-510-02 R03 11/03/2019

เอกสารไม่ควบคุม

## REPORT OF CALIBRATION

Certificate No. : SP21-008

Page 5 of 5

### Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0076	2.00
	0.7498	0.745	0.0048	0.0076	2.00
257	0.0000	0.000	0.0000	0.0076	2.00
	0.8712	0.864	0.0072	0.0076	2.00
313	0.0000	0.000	0.0000	0.0076	2.00
	0.2920	0.290	0.0020	0.0076	2.00
350	0.0000	0.000	0.0000	0.0076	2.00
	0.6459	0.632	0.0139	0.0076	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%

- End of Certificate -

PM-510-02 R03 11/03/2019

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

### CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"  
Model AA240FS, Serial No. MY13160001  
2. Working standard solution "Inorganic Ventures"  
Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610  
SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer  
(WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"  
Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,  
Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297  
CALIBRATION RANGE : 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr,  
0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l  
at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 332.0 nm.Ni,  
0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn  
AMBIENT CONDITIONS : Temperature 22 °C. Relative humidity 60 %

The Atomic Absorption Spectrophotometer set has been calibrated against  
Reference Material traceable to National Institute of Standards and Technology ( NIST ) by The Analytical  
Chemistry Laboratory. The results are attached herewith.

Calibrated by   
( Mr. Danai Srithongkum )

Approved by   
( Mrs. Thippaya Junvee Fortune )  
Director of Analytical Chemistry Laboratory  
Ref. 2025265020400522001  
Calibration Date : 3 February 2022

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

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

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : numpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtic@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8592  
Fax. (66) 0 2279 8594  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

1 / 5

MTC. ACL. No. 486 / 65

### CALIBRATION DATA

#### 1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	-0.0004	0.0002	0.0007	0.0002	-0.0016	-0.0001	-0.0004	-0.0001
	0.0002	-0.0005	0.0010	0.0007	0.0000	-0.0003	0.0007	-0.0014
	-0.0002	0.0001	0.0008	0.0000	-0.0001	-0.0003	-0.0012	-0.0006
	0.0000	-0.0007	0.0007	0.0000	-0.0005	-0.0004	-0.0012	-0.0012
	0.0001	0.0004	0.0013	0.0014	-0.0001	-0.0001	0.0003	-0.0008
	0.0000	-0.0004	0.0003	-0.0012	-0.0005	-0.0007	-0.0004	-0.0008
	0.0000	-0.0009	0.0009	-0.0002	-0.0010	-0.0008	0.0007	-0.0003
	-0.0004	-0.0003	0.0015	0.0010	-0.0005	-0.0003	-0.0002	-0.0004
	0.0004	0.0008	0.0014	-0.0004	-0.0014	-0.0005	-0.0006	-0.0003
	-0.0006	-0.0013	0.0012	-0.0006	-0.0006	-0.0006	-0.0007	-0.0007
	0.0005	-0.0003	0.0014	-0.0004	-0.0008	-0.0003	-0.0006	-0.0011
	-0.0007	-0.0014	0.0004	-0.0001	-0.0001	0.0000	0.0000	-0.0003
	0.0008	0.0004	0.0005	-0.0006	-0.0008	0.0000	-0.0005	-0.0009
	0.0011	0.0002	0.0005	0.0017	-0.0016	-0.0008	0.0004	-0.0005
	0.0002	0.0010	0.0014	-0.0002	-0.0010	-0.0010	0.0002	-0.0001
	0.0001	-0.0011	0.0011	-0.0003	-0.0011	-0.0003	-0.0008	-0.0012
	0.0000	-0.0015	0.0009	-0.0010	-0.0011	-0.0013	0.0000	-0.0004
	0.0015	-0.0012	0.0005	0.0002	-0.0017	-0.0001	0.0005	-0.0002
	0.0006	0.0014	0.0010	0.0002	-0.0003	0.0001	-0.0006	-0.0010
	0.0001	0.0003	0.0003	-0.0001	-0.0004	-0.0002	-0.0001	-0.0001
Average Absorbance	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	-0.001
Standard Deviation	0.0005	0.0008	0.0004	0.0007	0.0005	0.0004	0.0005	0.0004

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : numpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtic@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8592  
Fax. (66) 0 2279 8594  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม





Request No. 25-65 / 0398

2 / 5

MTC. ACL. No. 486 / 65

## 2. Precision

Element	Conc. (mg/L)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0943	0.095	0.0005	0.49	
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0669	0.066	0.011	1.70	
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0959	0.0959	0.0972	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8594  
Fax. (66) 0 2279 8592  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

3 / 5

MTC. ACL. No. 486 / 65

## 3. Trueness

## 3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

## 3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

## 3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cu	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8594  
Fax. (66) 0 2279 8592  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

4 / 5

MTC. ACL. No. 486 / 65

## 3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

## 3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

## 3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8594  
Fax. (66) 0 2279 8592  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

5 / 5

MTC. ACL. No. 486 / 65

## 3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

## 3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)  
which gives a level of confidence of approximately 95%

Calibrated by Danai Srithongkum  
(Mr. Danai Srithongkum)

Approved by (Mrs. Thippaya Junvee Fortune)  
Director of Analytical Chemistry Laboratory  
Calibration date : 3 February 2022

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpag@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2279 8594  
Fax. (66) 0 2279 8592  
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม