

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

- 5-1 เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในขบวนและสถานีรถไฟฟ้า
- 5-2 เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำทิ้ง



ภาคผนวกที่ 5-1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในขบวนและสถานีรถไฟฟ้า



Certificate of Calibration

Customer

Name : TNP ENVIRONMENT CO.,LTD
Address : 332/173 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110

Certificate No : 23-DPM-119

Request No : Req-2023-0894

Unit Under Calibration Details

Measurement Item : Bioaerosol Sampler Resolution : 0.001 inch H₂O
Manufacturer : Aquaria
Model : Microflow α
Serial Number : M3732
ID : -

Calibration Environment and Details

Temperature : 23 °C \pm 3 °C
Humidity : 55 %RH \pm 15 %RH
Received Date : 24 April 2023
Calibrated Date : 11 May 2023
Calibration By : Mr. Noppadon Luangart
Location of Calibration : LAB 4 Air Velocity
Calibration Procedure : In-house method CP-DPM-02 by Comparison With Standard Differential Pressure Transducer

Reference Standard	Model	Serial Number	Due Calibration
Digital Pressure Calibrator	ADT672-05-DP20-MBAR	273160C0023	4 July 2023
Thermo Hygrometer	SD700	Q597547	24 August 2023

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

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

Calibration By :



Service Calibration Engineer

Approved By :



Calibration Engineer Supervisor

Issue Date :

11 May 2023

Certificate No : 23-DPM-119

Request No : Req-2023-0894

Calibration Results : Without Adjustment

Flow Rate Accuracy

Flow Rate (L/min)	ΔP SETRA (inch H ₂ O)	Mean STD Reading (inch H ₂ O)	Error (inch H ₂ O)		Uncertainty (±) (inch H ₂ O)
30	0.014	0.014	0.0%	0.0000	0.0012
60	0.050	0.050	0.0%	0.0000	0.0012
90	0.118	0.119	0.1%	0.0085	0.0012
100	0.138	0.138	0.0%	0.0000	0.0012
120	0.206	0.205	-0.1%	0.0049	0.0012

Note :

Mean : The average standard of 4 values on each Point

inch H₂O = 249.0889 Pascal

ΔP = Differential Pressure

End of Certificate

CERTIFICATE OF CALIBRATION

Certificate No.: WD-01072022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Davis
: Wind direction sensor: Davis

Model/Type : Data logger: Vantage PRO2
: Wind direction sensor: -

Serial Number : Data logger: BF210628045
: Wind direction sensor: -

ID No : Data logger: TNP-F-W02
: Wind direction sensor: TNP-F-W02

Customer : TNP Environment Co., Ltd.
: 332/173 Vision Smart Life Village, Bangrak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Environmental Condition:

The measurement was carried out in an ambient temperature of (23 ± 3) °C, and relative humidity of (40 ± 10) %.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21086014, Certificate No.: KWS64/0025.

Measurement Date : Jul 14, 2022.
Issued Date : Jul 18, 2022.

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....

Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No.: WD-01072022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Davis
: Wind direction sensor: Davis

Model/Type : Data logger: Vantage PRO2
: Wind direction sensor: -

Serial Number : Data logger: BF210628045
: Wind direction sensor: -

ID No : Data logger: TNP-F-W02
: Wind direction sensor: TNP-F-W02

Customer : TNP Environment Co., Ltd.
: 332/173 Vision Smart Life Village, Bangrak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

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Issued Date : Jul 18, 2022.

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....



Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No.: WD-01072022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Davis
: Wind direction sensor: Davis

Model/Type : Data logger: Vantage PRO2
: Wind direction sensor: -

Serial Number : Data logger: BF210628045
: Wind direction sensor: -

ID No : Data logger: TNP-F-W02
: Wind direction sensor: TNP-F-W02

Customer : TNP Environment Co., Ltd.
: 332/173 Vision Smart Life Village, Bangrak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

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The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21086014, Certificate No.: KWS64/0025.

Measurement Date : Jul 14, 2022.
Issued Date : Jul 18, 2022.

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....

Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No.: WD-01072022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Davis
: Wind direction sensor: Davis

Model/Type : Data logger: Vantage PRO2
: Wind direction sensor: -

Serial Number : Data logger: BF210628045
: Wind direction sensor: -

ID No : Data logger: TNP-F-W02
: Wind direction sensor: TNP-F-W02

Customer : TNP Environment Co., Ltd.
: 332/173 Vision Smart Life Village, Bangrak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21086014, Certificate No.: KWS64/0025.

Measurement Date : Jul 14, 2022.
Issued Date : Jul 18, 2022.

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....

Calibration Department Manager

ภาคผนวกที่ 5-2

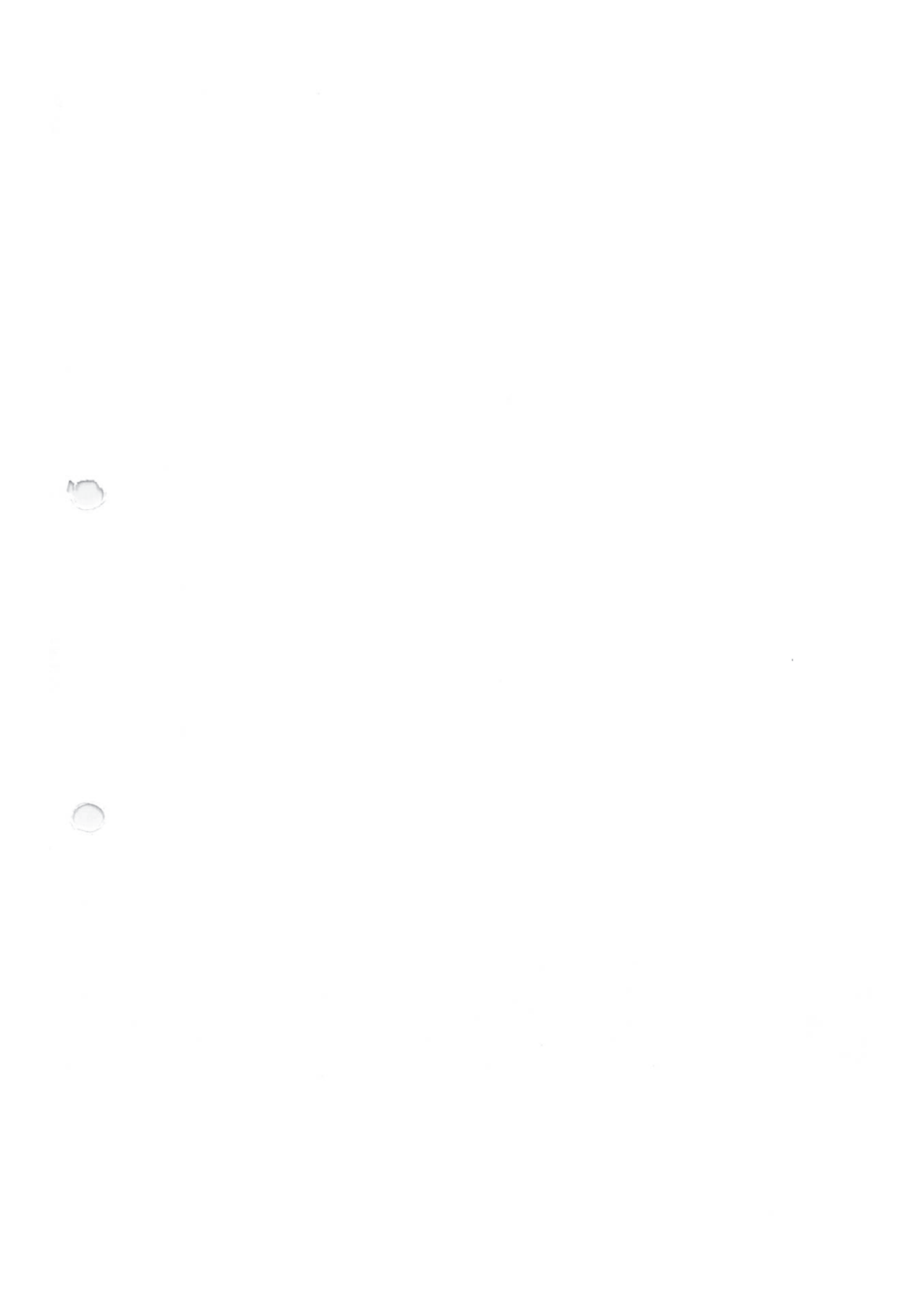
เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำทิ้ง



๕1

ใบรับรองการสอบเทียบ “เทอร์โมมิเตอร์”

(Calibration Certificate of Liquid in Glass Thermometer)





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



Certificate of Calibration

Certificate No. : 23T793

Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 926

Serial No.: 5609260110250914

ID No.: EQL-058

Condition As-Received: Used Item

Received Date: 07 April 2023

Calibration Date: 18 April 2023
to 08 May 2023

Reference: 2304-0179DN

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkokhuan, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :


<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Black Stack Thermometer	1560	8C454	22I616	23 May 2023
2) PRT Scanner Module	2562	A01303	22I616	23 May 2023
3) Industrial Platinum Resistance Thermometer	5627	739433	22I616	23 May 2023
4) Industrial Platinum Resistance Thermometer	5627	739434	22I616	23 May 2023

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : 
Issue Date : 12 May 2023

Approved Signatory : 

B 0313441



Cert. No.: 23T793

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement

This equipment was connected with Thermocouple Type T

ID No. EQL-058

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
150	3.0045	2.9	-0.1045	0.24
150	20.0060	19.9	-0.1060	0.24
150	35.0057	34.8	-0.2057	0.24
150	103.0046	102.6	-0.4046	0.37
150	104.0025	103.6	-0.4025	0.37
150	120.0046	119.7	-0.3046	0.42
150	140.0018	139.7	-0.3018	0.47
150	150.0083	149.7	-0.3083	0.49
150	170.0054	169.5	-0.5054	0.55
150	180.0026	178.9	-1.1026	0.58

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement

This equipment was connected with Thermocouple Type T

ID No. EQL-058 Water Proof

Dimension of probe : Diameter 6 mm., Length 111 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
100	41.5080	41.3	-0.2080	0.24
100	45.0040	44.8	-0.2040	0.24
100	50.0045	49.8	-0.2045	0.24
100	83.0082	82.7	-0.3082	0.31
100	92.0024	91.7	-0.3024	0.33
100	95.0054	94.7	-0.3054	0.34
100	150.0076	149.4	-0.6076	0.49

UUC* : Unit Under Calibration

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

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



Certificate of Calibration

Certificate No. : 23T475

Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 926

Serial No.: 33824123/004

ID No.: EQL-138

Condition As-Received: Used Item

Received Date: 09 March 2023

Calibration Date: 20 March 2023
to 22 March 2023

Reference: 2303-0314DN

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Digital Thermometer	1529	A7A609	2211274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571970	2211274	17 Oct 2023
3) Industrial Platinum Resistance Thermometer	5627	824304	2211274	17 Oct 2023

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 Metrology Thailand (NIMT)

Calibrated by : 
Issue Date : 23 March 2023

Approved Signatory : 

B 0310381



Cert. No.: 23T475

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement

This equipment was connected with Thermocouple Type T ID No. EQL-138

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
150	2.9962	2.6	-0.3962	0.24
150	35.0051	34.8	-0.2051	0.24
150	36.0061	35.8	-0.2061	0.24
150	36.9974	36.8	-0.1974	0.24
150	41.5051	41.4	-0.1051	0.24
150	43.9973	43.9	-0.0973	0.24
150	55.0047	55.0	-0.0047	0.25
150	169.9960	170.4	0.4040	0.55

UUC* : Unit Under Calibration

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

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QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com





CERTIFICATE No : 22T8762
REFERENCE No : 66179-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : ---
SERIAL No : 8925
No : EQL-103
RESOLUTION : 0.1 °C
TYPE : TOTAL IMMERSION
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

ALIBRATED BY : 
CALIBRATION DATE : 18-Aug-22
APPROVED BY : 
ISSUED DATE : 18-Aug-22
RECEIVED DATE : 11-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.



CERTIFICATE No : 22T8762

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : ---
ID No : EQL-103
RESOLUTION : 0.1 °C
RECEIVED DATE : 11-Aug-22
AMBIENT TEMPERATURE : 23 °C ± 3 °C
SERIAL NUMBER : 8925
TYPE : TOTAL IMMERSION
CALIBRATION DATE : 18-Aug-22
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1529	A22167	21T12439	09-Dec-22
2) SPRT PROBE	5612	587312	21T12439	09-Dec-22
3) PRECISION BATH	7320	A21105	21T12433	16-Dec-22
4) PRECISION BATH	CTR-40	A68155	21T12434	10-Dec-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
20.0214	20.0	140	0.0214	N/A	0.079
25.0309	25.0	160	0.0309	N/A	0.079
41.5541	41.5	225	0.0541	N/A	0.079
44.5416	44.5	235	0.0416	N/A	0.079
45.0409	45.0	240	0.0409	N/A	0.079
50.0520	50.0	260	0.0520	N/A	0.084

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 APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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



Certificate of Calibration

Certificate No. : 22H2197

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: EQL-064

Condition As-Received: Used Item

Received Date: 17 October 2022

Calibration Date: 25 October 2022
to 28 October 2022

Reference: 2210-0461DN

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: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

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 :


<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Chilled-Mirror Hygrometer	Dew Master	41292	19848	03 Nov 2022
2) Handheld Thermometer With Sensor	1523	3240076	22I249	02 Mar 2023

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 : 
Issue Date : 01 November 2022

Approved Signatory : 

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Cert. No.: 22H2197
Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	30.1	29.0	-1.1	1.5
25.0	40.1	39.0	-1.1	1.5
25.0	50.1	50.0	-0.1	1.7
25.0	60.0	61.0	1.0	1.7
25.0	75.2	76.5	1.3	1.7

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
15.013	15.0	-0.013	0.72
20.023	20.0	-0.023	0.72
25.019	25.0	-0.019	0.72
30.009	30.0	-0.009	0.72

UUC* : Unit Under Calibration

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

-o0o-

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com


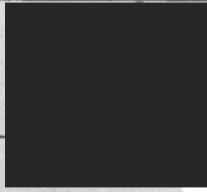


CERTIFICATE No : 22T8761
REFERENCE No : 66179-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : G13004
SERIAL No : N/A
Lot No : EQL-111
RESOLUTION : 1 °C
TYPE : TOTAL IMMERSION
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

LIBRATED BY : 
CALIBRATION DATE : 18-Aug-22
APPROVED BY : 
ISSUED DATE : 18-Aug-22
RECEIVED DATE : 11-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.



QUALITY CALIBRATION CO.,LTD.

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CERTIFICATE No : 22T8761

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : G13004
ID No : EQL-111
RESOLUTION : 1 °C
RECEIVED DATE : 11-Aug-22
AMBIENT TEMPERATURE : 23 °C ± 3 °C
SERIAL NUMBER : N/A
TYPE : TOTAL IMMERSION
CALIBRATION DATE : 18-Aug-22
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1529	A22167	21T12439	09-Dec-22
2) SPRT PROBE	5612	587312	21T12439	09-Dec-22
3) PRECISION BATH	7320	A21105	21T12433	16-Dec-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
115.0063	115.0	110	0.0063	N/A	0.15
121.0191	121.0	120	0.0191	N/A	0.15

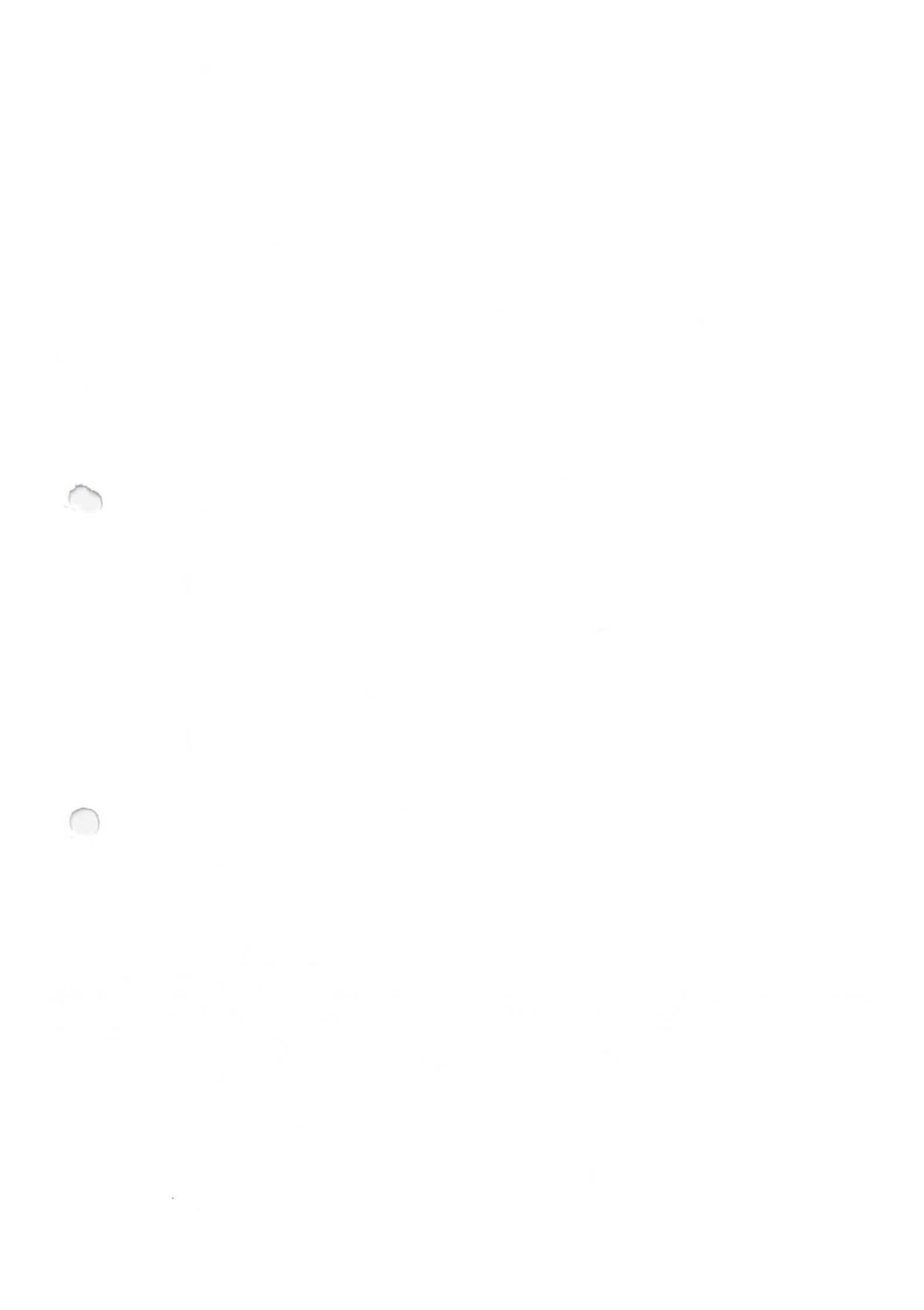
UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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ใบรับรองการสอบเทียบ “เครื่องวัดความนำไฟฟ้า”
(Calibration Certificate of Conductivity Meter)





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.: 23CH92
Page.: 1 of 3

Certificate of Calibration

Equipment :	Conductivity Meter
Manufacturer :	TOA
Model :	CM-41X
Serial No. :	842572
ID No. :	EQL-211
Condition As-Received:	Used Item
Received Date :	19 January 2023
Calibration Date :	20 January 2023
Reference :	2301-0614DN-1
Submitted by :	TEST TECH CO.,LTD. (HEAD Office) 30, 32 Rama II Soi 63, Rama II Rd., Samaedam, Bangkhunthian, Bangkok 10150
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure:	In -house method : - CP-CH6 by direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer
Calibrated by :	Warakorn Lerngagtrakul
Approved by :	<div style="background-color: black; width: 100px; height: 20px; margin-bottom: 5px;"></div> Approved Signatory
(/) Malee Butkruea	
() Saithip Meangmai	
() Warakorn Lerngagtrakul	
Issue Date :	24 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 23CH92

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	2211140	12 Sep 2023
2) Ref. Std. Thermometer	4982054	110RC044	2211306	27 Oct 2023

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
147.0 μ S/cm	CPA Chem	823327	20 June 2023
1.413 mS/cm	CPA Chem	823328	20 June 2023
12.880 mS/cm	CPA Chem	823329	20 June 2023

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}$ C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 147.0, 1413.0, 12880 μ S/cm

Conductivity Electrode Serial No.: 806F0005

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
147.0 μ S/cm	150.3 μ S/cm	147.0 μ S/cm	0.99 μ S/cm	2.00
1.413 mS/cm	1.428 mS/cm	1.413 mS/cm	0.0092 mS/cm	2.00
12.880 mS/cm	12.71 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark

- UUC* = Unit Under Calibration

- 147.0 μ S/cm Adjustment Cell constant = $98.5m^{-1}$

- 1.413 mS/cm Adjustment Cell constant = $99.5m^{-1}$

- 12.880 mS/cm Adjustment Cell constant = $101.8m^{-1}$



Cert.No.: 23CH92

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : CT-58101B
- Serial No. : 806F-0005

Dimension of probe;

- Length : 114 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor <i>k</i>
25.0	25.003	25.0	-0.003	0.13	2.00

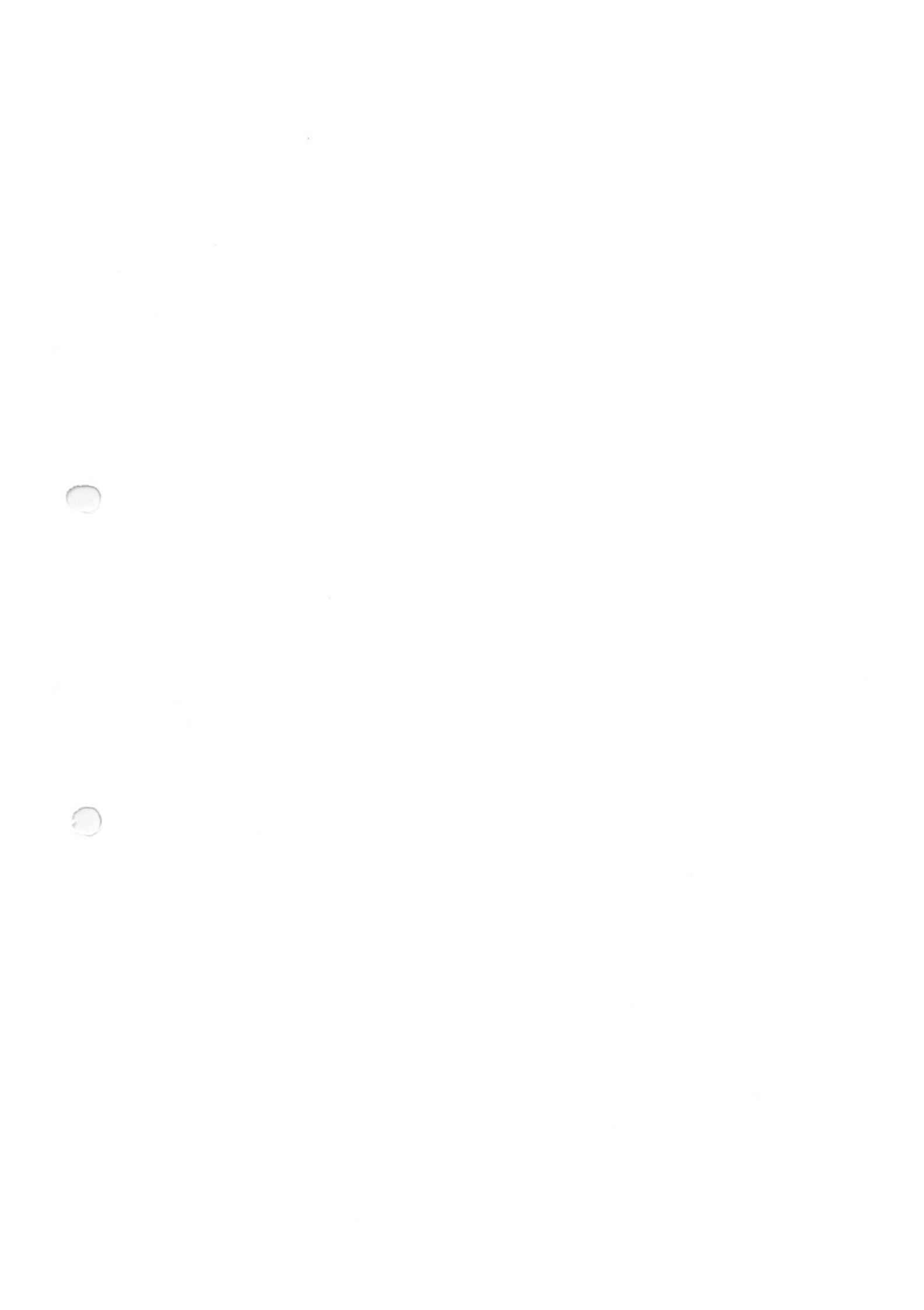
Remark : - UUC* = Unit Under Calibration

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

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ใบรับรองการสอบเทียบ “ตุ้มน้ำหนักมาตรฐาน”
(Calibration Certificate of Standard Weights)





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



Certificate of Calibration

Certificate No. : 23M259

Page : 1 of 2

Equipment : Standard Weight

Manufacturer: LS

Model : -

Serial No.: -

ID No.: EQL-121

Condition As-Received: Used Item

Received Date: 02 February 2023

Calibration Date: 07 February 2023

Reference: 2302-0080DN

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1008.9 mbar

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chaowalit Rittirak
Issue Date : 08 February 2023

Approved Signatory :

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Cert No.: 23M259

Page: 2 of 2

Result of calibration

Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement (\pm)	Maximum Permissible error (\pm)
50 g	50.00015 g	0.10 mg	0.30 mg

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

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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23M260

Page : 1 of 2

Equipment : Standard Weight

Manufacturer: -

Model : -

Serial No.: -

ID No.: EQL-258

Condition As-Received: Used Item

Received Date: 02 February 2023

Calibration Date: 07 February 2023

Reference: 2302-0080DN

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1012 mbar

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.6 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chaowalit Rittirak
Issue Date : 08 February 2023

Approved Signatory : _____

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Cert No.: 23M260

Page: 2 of 2

Result of calibration

Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement (\pm)	Maximum Permissible error (\pm)
2 kg	2.0000034 kg	3.0 mg	10 mg

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

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