TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Cert.No.: 24CH623

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenCompact S220
Serial No. :	B614308589
ID No. :	-
Condition As-Received:	Used Item
Received Date :	29 May 2024
Calibration Date :	30 May 2024
Reference :	2405-0974WN-17
Submitted by :	WATER INDEX & CONSULTANT CO.,LTD. 229/8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd., Bang-aor, Bangphlat, Bangkok 10700
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

( ) Unnopphol Harachai
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 31 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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 Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor *k*
	pH	mV	mV	pH		
pH Meter	4.000	177.48	177.6	4.000	0.058	2.00
S/N.: B614308589	7.000	0.00	0.2	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.004	156.7	0.0055	2.09
S/N.: 6195824	6.986	6.988	-17.4	0.0084	2.00
	9.997	10.008	-193.6	0.0075	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 6195824

Dimension of probe

- Length : 120 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 *k*
22.0	22.001	22.2	0.199	0.13	2.00
25.0	25.002	25.2	0.198	0.13	2.00
28.0	28.004	28.2	0.196	0.13	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 %.

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT24-5225
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Refrigerator
Manufacturer : S-Cool
Model : SSM163T
Serial No. : 144201410
Identification No. : N/A
Calibration Place : Customer Laboratory

Order No. : 1996/24
Received date : Jun 08, 2024
Calibration date : Jun 08, 2024
Environment Condition :
Temperature : (25+/-10) °C
Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT23-7160	Nov 24, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY INCTECH METROLOGICAL CENTER CO.,LTD. IMC

Calibrated by : Mr.Yuttakorn Jamneansri

Approved by :

Issue date : Jun 19, 2024

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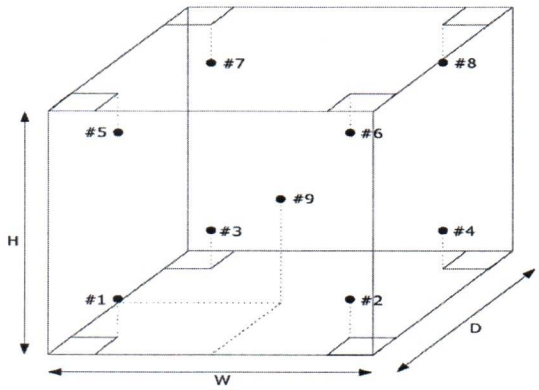
Function : Temperature measurement
Calibration point : 3 °C
Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
3	3.511	3.270	3.330	3.361	3.227	3.341	3.490	3.429	3.273	0.33

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
3.0	3.0	0.24	0.44	0.62



Front view

#1 Lower Left Front
#2 Lower Right Front
#3 Lower Left Rear
#4 Lower Right Rear
#5 Upper Left Front
#6 Upper Right Front
#7 Upper Left Rear
#8 Upper Right Rear
#9 Geometric Center

UUC* = Unit under calibration
Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.
Overall Variation = Difference of temperature value between the maximum and minimum any time.
Stability = One half of the maximum difference of measured temperatures at any one probe.

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Certificate of Calibration

Certificate No. : MT24-5221
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Digital with Probe (TYPE K)
Manufacturer : CHY
Model : 502A
Serial No. : 56000360
Identification No. : N/A
Calibration Place : Temperature Laboratory (IMC)

Order No. : 1996/24
Received date : Jun 09, 2024
Calibration date : Jun 09, 2024
Environment Condition :
Temperature : (23+/-3) °C
Humidity : (50+/-15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-001* According to comparison with Standard Digital Thermometer with 2 PRT.
The calibration methods based on ITS-90.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
Standard Digital Thermometer with 2 PRT	1586A/5609/5609	41130006/00543/03713	TE24-0006	Jan 14, 2025

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY INCTECH METROLOGICAL CENTER CO.,LTD. IMC

Calibrated by : Miss Jarunee Tubsay

Approved by : [redacted]

Issue date : Jun 19, 2024

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Result : Without Adjustment
Function : Temperature measurement
Sensor Type : Thermocouple type K
Diameter : - mm **Resolution** : 0.1 °C
Calibration point : 0, 3, 20 °C

Channel : T1

Immersion depth (mm)	Calibration point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
140	0	-0.220	0.0	-0.220	0.24
140	3	2.761	3.0	-0.239	0.24
140	20	19.706	19.8	-0.094	0.24
140	0	-0.220	0.0	-0.220	0.24

Result : Without Adjustment
Function : Temperature measurement
Sensor Type : Thermocouple type K
Diameter : - mm **Resolution** : 0.1 °C
Calibration point : 0, 380 °C

Channel : T2

Immersion depth (mm)	Calibration point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
140	0	-0.220	0.0	-0.220	0.24
140	380	380.096	382.0	-1.904	0.93
140	0	-0.220	0.0	-0.220	0.24

UUC* = Unit under calibration

-oOo-

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Certificate of Calibration

Certificate No. : MT24-5222
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Digital with Probe (TYPE RTD)
Manufacturer : CHY
Model : 804U
Serial No. : 090034
Identification No. : N/A
Calibration Place : Temperature Laboratory (IMC)

Order No. : 1996/24
Received date : Jun 09, 2024
Calibration date : Jun 18, 2024
Environment Condition :
Temperature : (23+/-3) °C
Humidity : (50+/-15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-001* According to comparison with Standard Digital Thermometer with 2 PRT.
The calibration methods based on ITS-90.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
Standard Digital Thermometer with 2 PRT	1586A/5609/5609	41130006/00543/03713	TE24-0006	Jan 14, 2025

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY INCTECH METROLOGICAL CENTER CO.,LTD. IMC

Calibrated by : Miss Jarunee Tubsay

Approved by :

Issue date : Jun 19, 2024

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ISO/IEC 17025

Result : Without Adjustment
Function : Temperature measurement
Sensor Type : Resistance Temperature Detector PT100
Diameter : - mm **Resolution** : 0.1 °C
Calibration point : 70, 104, 150, 180 °C

Channel : T1

Immersion depth (mm)	Calibration point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
140	70	69.927	69.8	0.127	0.07
140	104	103.964	103.8	0.164	0.08
140	150	149.945	149.8	0.145	0.08
140	180	179.934	179.8	0.134	0.08
140	70	69.927	69.8	0.127	0.07

UUC* = Unit under calibration

-oOo-

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Calibration Cert. # 3884.01
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Certificate of Calibration

Certificate No. : MT24-5223
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Digital Thermo Hygrometer
Manufacturer : Digicon
Model : TH-02A
Serial No. : 1718B0744383
Identification No. : N/A
Calibration Place : Temperature & Humidity Laboratory (IMC)

Order No. : 1996/24
Received date : Jun 09, 2024
Calibration date : Jun 10, 2024
Environment Condition :
Temperature : (23+/-3) °C
Humidity : (50+/-15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-007* According to comparison with Standard Temperature & Humidity into Environmental Stability Chamber.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
Standard Digital Hygrometer	One-TH	0x0000158D000E121E	SG-H-00748/66	Dec 07, 2024
Standard Digital Thermometer with Probe	UM RTD	2002Z A21 0181A	MT23-4665	Jul 14, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY IMC INCTECH METROLOGICAL CENTER CO.,LTD.

Calibrated by : Miss Jarunee Tubsay

Approved by :

Issue date : Jun 19, 2024

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Result : Without adjustment
Function : Temperature measurement
Calibration point : 20, 25, 30 °C
Resolution : 0.1 °C
Standard Humidity reading : 50.30 %RH

Test point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
20	20.06	19.8	0.26	0.36
25	25.02	24.7	0.32	0.36
30	29.95	29.7	0.25	0.36

Result : Without adjustment
Function : Humidity measurement
Calibration point : 40, 50, 60 %RH
Resolution : 1 %RH
Standard Temperature reading : 25.08 °C

Test point (%RH)	Standard reading (%RH)	UUC* reading (%RH)	UUC* correction (%RH)	Uncertainty of measurement (+/- %RH)
40	40.26	39	1.26	2.3
50	50.23	49	1.23	2.3
60	60.38	59	1.38	2.3

UUC* = Unit under calibration

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Certificate of Calibration

Certificate No. : MT24-5224
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Digital Thermo Hygrometer
Manufacturer : Digicon
Model : TH-02A
Serial No. : 1718B0744392
Identification No. : N/A
Calibration Place : Temperature & Humidity Laboratory (IMC)

Order No. : 1996/24
Received date : Jun 09, 2024
Calibration date : Jun 10, 2024
Environment Condition :
Temperature : (23+/-3) °C
Humidity : (50+/-15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-007* According to comparison with Standard Temperature & Humidity into Environmental Stability Chamber.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
Standard Digital Hygrometer	One-TH	0x0000158D000E121E	SG-H-00748/66	Dec 07, 2024
Standard Digital Thermometer with Probe	UM RTD	2002Z A21 0181A	MT23-4665	Jul 14, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY IMC INCTECH METROLOGICAL CENTER CO.,LTD.

Calibrated by : Miss Jarunee Tubsay

Approved by : [redacted]

Issue date : Jun 19, 2024

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Result : Without adjustment
Function : Temperature measurement
Calibration point : 20, 25, 30 °C
Resolution : 0.1 °C
Standard Humidity reading : 50.30 %RH

Test point (°C)	Standard reading (°C)	UUC* reading (°C)	UUC* correction (°C)	Uncertainty of measurement (+/- °C)
20	20.06	21.6	-1.54	0.36
25	25.02	25.2	-0.18	0.36
30	29.95	28.4	1.55	0.36

Result : Without adjustment
Function : Humidity measurement
Calibration point : 50, 60, 70 %RH
Resolution : 1 %RH
Standard Temperature reading : 25.08 °C

Test point (%RH)	Standard reading (%RH)	UUC* reading (%RH)	UUC* correction (%RH)	Uncertainty of measurement (+/- %RH)
50	50.23	51	-0.77	2.3
60	60.38	61	-0.62	2.3
70	70.22	71	-0.78	2.3

UUC* = Unit under calibration

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Certificate of Calibration

Certificate No. : MT24-5225
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Refrigerator
Manufacturer : S-Cool
Model : SSM163T
Serial No. : 144201410
Identification No. : N/A
Calibration Place : Customer Laboratory

Order No. : 1996/24
Received date : Jun 08, 2024
Calibration date : Jun 08, 2024
Environment Condition :
Temperature : (25+/-10) °C
Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT23-7160	Nov 24, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY INCTECH METROLOGICAL CENTER CO.,LTD. IMC

Calibrated by : Mr.Yuttakorn Jamneansri

Approved by :

Issue date : Jun 19, 2024

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Calibration Cert. # 3884.01
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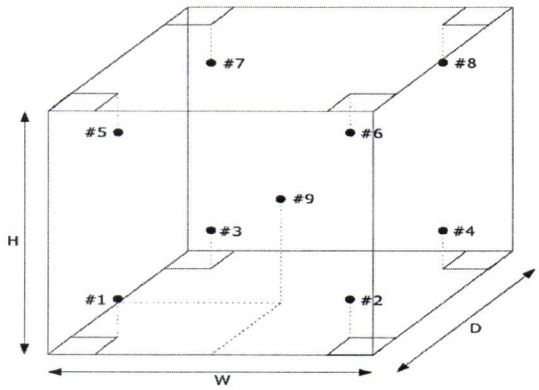
Function : Temperature measurement
Calibration point : 3 °C
Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
3	3.511	3.270	3.330	3.361	3.227	3.341	3.490	3.429	3.273	0.33

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
3.0	3.0	0.24	0.44	0.62



Front view

#1 Lower Left Front
#2 Lower Right Front
#3 Lower Left Rear
#4 Lower Right Rear
#5 Upper Left Front
#6 Upper Right Front
#7 Upper Left Rear
#8 Upper Right Rear
#9 Geometric Center

UUC* = Unit under calibration
Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.
Overall Variation = Difference of temperature value between the maximum and minimum any time.
Stability = One half of the maximum difference of measured temperatures at any one probe.

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT24-5226
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Refrigerator
Manufacturer : Accuplus
Model : i250
Serial No. : 1250402-0110-0303
Identification No. : N/A
Calibration Place : Customer Laboratory

Order No. : 1996/24
Received date : Jun 08, 2024
Calibration date : Jun 08, 2024
Environment Condition :
Temperature : (25+/-10) °C
Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT23-7160	Nov 24, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY · INCTECH METROLOGICAL CENTER CO.,LTD. · IMC

Calibrated by : Mr.Yuttakorn Jamneansri

Approved by : [redacted]

Issue date : Jun 19, 2024

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

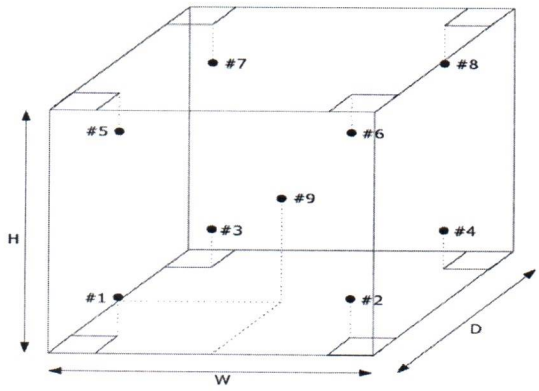
Inctech Metrological Center Co.Ltd.
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,
Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com

ilac-MRA
ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

Function : Temperature measurement
Calibration point : 20 °C
Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
20	20.138	20.061	20.009	20.069	20.079	20.111	20.017	20.044	20.142	0.31

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20.0	0.14	0.31	0.32



#1 Lower Left Front
#2 Lower Right Front
#3 Lower Left Rear
#4 Lower Right Rear
#5 Upper Left Front
#6 Upper Right Front
#7 Upper Left Rear
#8 Upper Right Rear
#9 Geometric Center

Front view

UUC* = Unit under calibration
Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.
Overall Variation = Difference of temperature value between the maximum and minimum any time.
Stability = One half of the maximum difference of measured temperatures at any one probe.

-oOo-

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ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT24-5228
Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd
Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor.Bangphlat, Bangkok 10700

Description : Hot Air Oven
Manufacturer : Memmert
Model : SM400
Serial No. : B4921010
Identification No. : ID146E94
Calibration Place : Customer Laboratory

Order No. : 1996/24
Received date : Jun 08, 2024
Calibration date : Jun 08, 2024

Environment Condition :
Temperature : (25+/-10) °C
Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT23-7160	Nov 24, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of not less than 95%

CALIBRATION LABORATORY INCTECH METROLOGICAL CENTER CO.,LTD. IMC

Calibrated by : Mr.Yuttakorn Jamneansri

Approved by : [redacted]

Issue date : Jun 19, 2024

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ilac-MRA ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

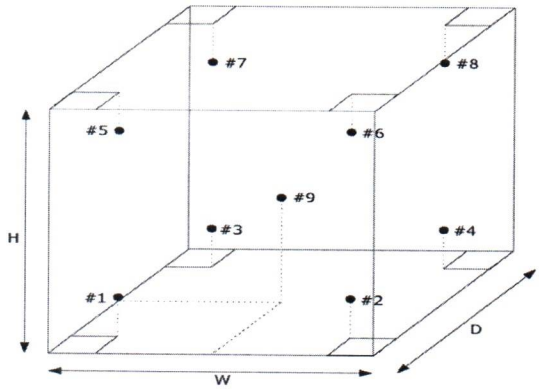
Certificate No. : MT24-5228
Page : 2 of 2

Function : Temperature measurement
Calibration point : 104, 110, 120, 150, 180 °C

Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
104	104.175	104.224	103.956	104.185	104.243	104.140	104.068	104.171	104.067	0.44
110	110.832	110.937	110.067	110.453	110.972	110.781	110.341	110.449	110.344	0.44
120	121.239	121.250	120.379	120.782	121.266	121.173	120.674	120.790	120.697	0.44
150	150.361	150.542	150.202	150.653	150.606	150.267	150.571	150.686	150.608	0.44
180	180.976	181.108	179.941	180.036	181.157	180.869	180.019	180.086	180.033	0.44

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
104.0	104.0	0.20	0.53	0.60
110.0	110.0	0.13	0.70	1.1
120.0	120.0	0.10	0.75	1.1
150.0	150.0	0.13	0.45	0.72
178.0	180.0	0.11	1.3	1.4



Front view

#1 Lower Left Front
#2 Lower Right Front
#3 Lower Left Rear
#4 Lower Right Rear
#5 Upper Left Front
#6 Upper Right Front
#7 Upper Left Rear
#8 Upper Right Rear
#9 Geometric Center

UUC* = Unit under calibration
Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.
Overall Variation = Difference of temperature value between the maximum and minimum any time.
Stability = One half of the maximum difference of measured temperatures at any one probe.

-oOo-

CALIBRATION REPORT

Cert. Number
BTC-T-07/66

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

B.T.METROLOGY CO.,LTD.
17/166 Soi Prachachun 14 (PEA Village)
Tungsonghong Laksi, Bangkok 10210

Approved Signatory

P.P.

P.Prasitimate

Customer : Water Index & Consultant Co., Ltd

Address : 229/7-8 Soi Charan Sanit Wong 95/1,Charan Sanit Wong Rd., Bang-aor. Bangphlat, Bangkok 10700

Date of Received : 25 August 2023

Instrument – Description : **COD REACTOR**
Id. Number : **134E02**
Manufacturer : **Lovibond**
Model Number : **BT125SC**
Serial Number : **0980/2426**

Calibration Procedure : Indicate temperature of Unit Under Test (UUC) was compared to temperature Obtained from reference standards at calibration point.

Measurement Method : The thermocouples shall be placed with in the chamber in accordance with the appendix A and the temp. readings of the thermocouples could be found in the appendix A.

Cal. Inform. : Cal. (✔) Only ( ) Adjusted

Location of Calibration : At Customer Location

Environmental Conditions :
Temperature is 27 ± 3°C Relative Humidity is 60 ± 10 % Rh

Comments

The temperature scale in use is the International Temperature Scale of 1990 (ITS-90).
The Uncertainties of report based on a standard uncertainty Multiplied by a coverage factor k=2,
Providing level of confidence approximately 95%
All Tests pass standard tolerance.

Tractability Information

Reference Standards Description	**Serial Number**	**Certificate Number**	**Cal. Date**	**Due Date.**
STD Thermometer with Probe, PRT	1912	22-65/0709	7-9/September/2022	7-9/September/2023
Equipment Description	**Serial Number**	**Certificate Number**	**Cal. Date**	**Dule Date.**
Data logger With Probe (RTD : 01-10)	MY49020096	BTC-T-001-66	1/February/2023	1/February/2024
	Maker: Agilent	**Model:** 34972A	**Make in USA**	

This certification is traceable to SI Unit through the reference standard laboratory of In-house B.T.Metrology Calibration Lab. The used to perform this calibration is Traceable to National Institute of Metrology (Thailand), NIMT through Reference Standard Laboratory of Thailand Institute of Scientific and Technological Research (TISTR), No. Calibration 0260.(Laboratories was Accreditation by TISI According to ITS ISO / IEC 17025

Calibrated By:

Date of Calibration : 2 September 2023

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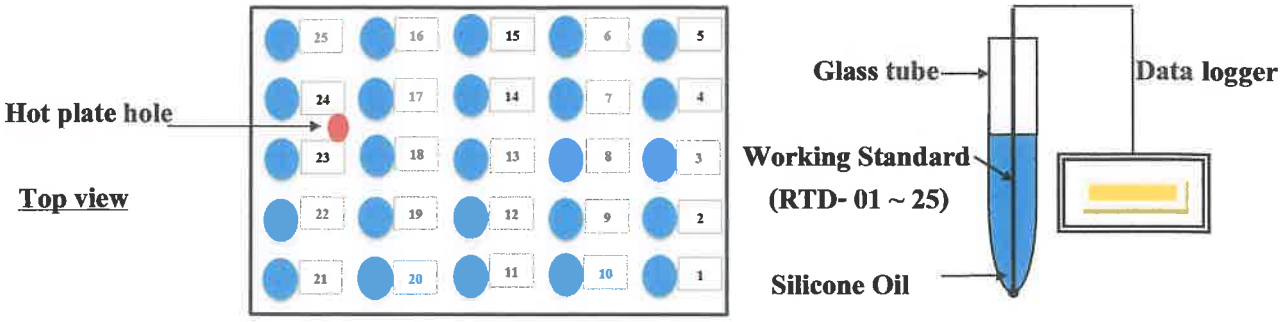
CALIBRATION REPORT

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

Appendix A.



Calibrated By:

Date of Calibration : 2 September 2023

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CALIBRATION REPORT

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

Hole No. (Position)	Max (°C)	Min (°C)	Mid-Range (°C)	Difference (°C)	Uncertainty of measurement (± °C)
1	149.1	149.1	149.1	0.0	0.5
2	149.2	149.2	149.2	0.0	
3	150.8	150.7	150.8	0.1	
4	149.8	149.7	149.8	0.0	
5	149.2	149.2	149.2	0.0	
6	149.3	149.3	149.3	0.0	
7	150.8	150.8	150.8	0.0	
8	150.4	150.4	150.4	0.0	
9	150.8	150.8	150.8	0.0	
10	149.6	149.6	149.6	0.0	
11	149.1	149.1	149.1	0.0	
12	150.6	150.6	150.6	0.0	
13	151.0	151.0	151.0	0.0	
14	151.0	151.0	151.0	0.0	
15	149.2	149.2	149.2	0.0	
16	149.3	149.3	149.3	0.0	
17	149.6	149.6	149.6	0.0	
18	150.2	150.1	150.2	0.0	
19	150.3	150.3	150.3	0.0	
20	149.5	149.5	149.5	0.0	
21	149.7	149.7	149.7	0.0	
22	149.4	149.4	149.4	0.0	
23	149.7	149.7	149.7	0.0	
24	150.0	150.0	150.0	0.0	
25	149.3	149.2	149.3	0.0	
Hot plate hole	150.3	149.6	150.0	0.6	

Calibrated By:

Date of Calibration : 2 September 2023

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CALIBRATION REPORT

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

UUC		Average Measured Temperature * (°C)	Measured Temperature		Measured Variation		
Setting (°C)	Reading (°C)		Max (°C)	Min (°C)	Stability (±°C)	Uniformity (°C)	Overall (°C)
150.0	149.1-151.0	149.9	151.0	149.1	0.3	1.9	1.9

Note : - Reference Standards are measurement in tube silicone oil at 240 value record after temperature stability.
- Level high of silicone oil is equal heater plate of UUC.

... end of certificate ...

Calibrated By:

Date of Calibration : 2 September 2023

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Calibration Certificate ID
TH2004-028-101123-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Limited
846/4 - 846/5 Lasalle Road
Bangna Tai, Bangna, Bangkok 10260
THAILAND
www.mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	WATER INDEX & CONSULTANT CO., LTD.		
Address:	229/7-8 Soi Charansanitwong 95/1, Charansanitwong Rd., Bang-aor		
City:	Bangphlat	**Contact:**	Nungruthai Sairat
Zip / Postal:	10700		
State / Province:	Bangkok		
Order Number:	0 3 3 2 9 0 7 7 8 2		

Weighing Device

Manufacturer:	Mettler Toledo	**Instrument Type:**	Weighing Instrument
Model:	MS204TS/00	**Asset Number:**	300EI7
Serial No.:	B724237367	**Terminal Model:**	N/A
Building:	Office	**Terminal Serial No.:**	N/A
Floor:	2	**Terminal Asset No.:**	N/A
Room:	Laboratory		

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/W002/20

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: 26.5 °C	End: 26.1 °C	Start: 55.1 %	End: 54.1 %

As Found Calibration Date:	11-Oct-2023	**Calibrator:**	
As Left Calibration Date:	N/A		
Issue Date:	12-Oct-2023	**Approved Signatory:**	

Technical Manager / Head of Calibration Center

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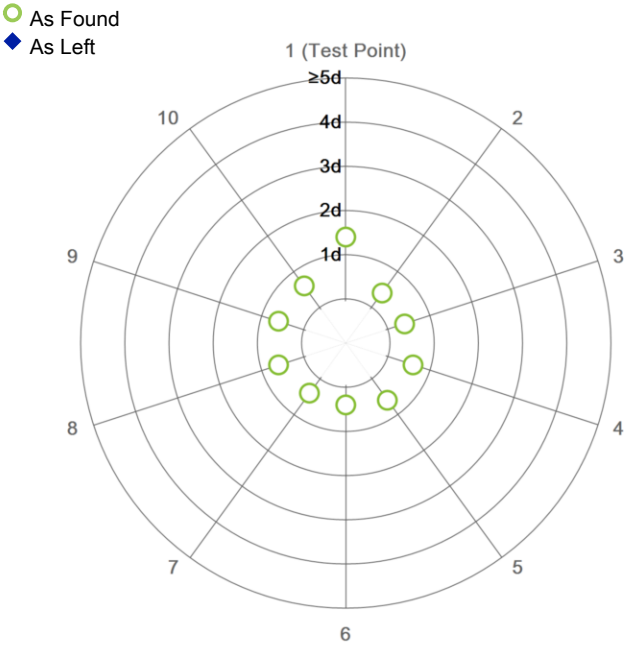
Measurement Results

Repeatability

Test Load: 100 g

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

Standard Deviation	0.00007 g	N/A



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

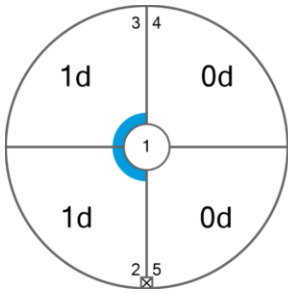
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0001 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A



As Found

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

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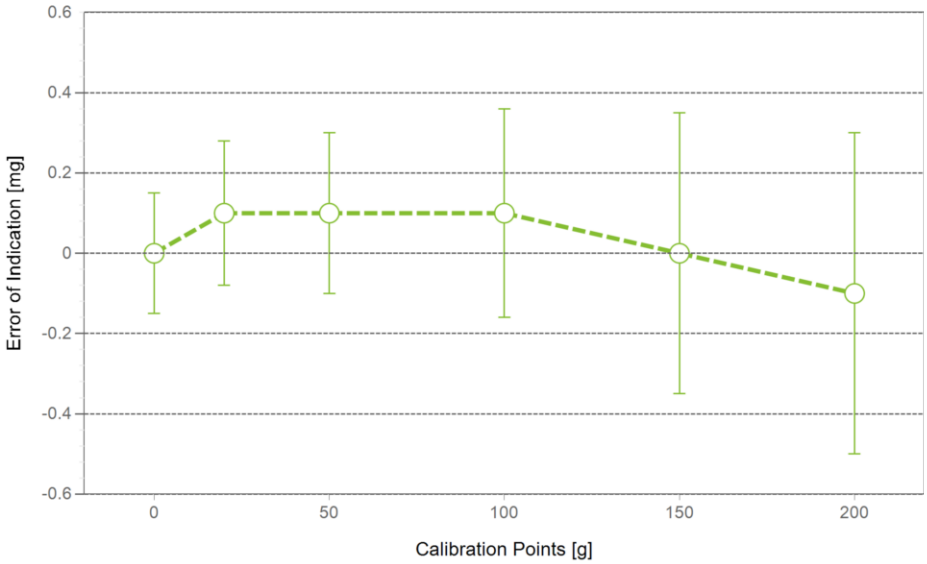
Error of Indication

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	0.0500 g	0.0500 g	0.0000 g	0.16 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.16 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.16 mg	2
6	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
7	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.20 mg	2
9	99.9999 g	100.0000 g	0.0001 g	0.26 mg	2
10	149.9999 g	149.9999 g	0.0000 g	0.35 mg	2
11	200.0000 g	199.9999 g	-0.0001 g	0.40 mg	2



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and 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. The results of this calibration certificate relate only to the calibrated item.

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.:	WS54	Date of Issue:	15-Jun-2022
Certificate Number:	179958	Calibration Due Date:	14-Dec-2023

Thermo Hygrometer

Equipment No.:	IN306	Date of Issue:	10-Jan-2023
Certificate Number:	23H4	Calibration Due Date:	03-Jan-2024

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Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

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

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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: $1.5 \cdot 10^{-6}$ / K

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

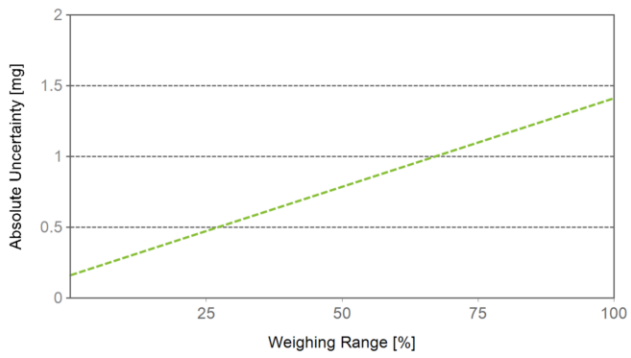
Linearization of Uncertainty Equation

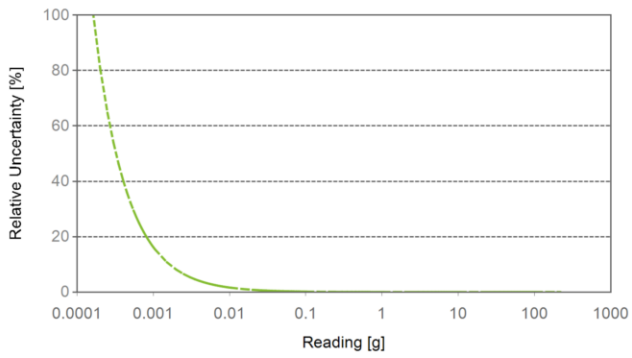
Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	U_1 = 0.16 mg + 0.00569 mg/g · R	N/A

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	0.16 mg	0.73%	N/A	N/A
0.2200 g	0.16 mg	0.073%	N/A	N/A
2.2000 g	0.17 mg	0.0078%	N/A	N/A
22.0000 g	0.29 mg	0.0013%	N/A	N/A
220.0000 g	1.4 mg	0.00064%	N/A	N/A





As Found As Left

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METTLER TOLEDO Service

GWP® Certificate

As Found

The weighing device does not meet the given process requirements.

As Left

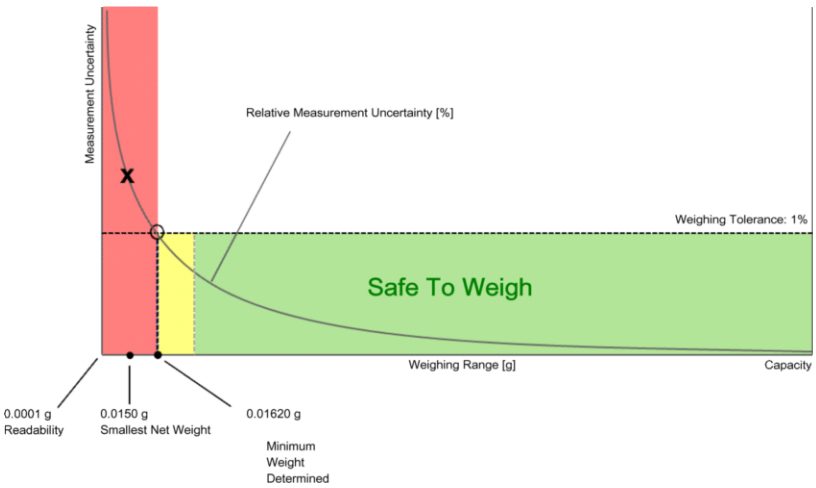
The weighing device does not meet the given process requirements.

Tests Performed: ☑ As Found ☐ As Left ☑ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: **1%** | Smallest Net Weight: **0.0150 g** | Safety Factor: **2**

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

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Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	**1**	**2**	**3**	**5**	**10**
0.1%	0.16286 g	0.32759 g	0.49423 g	0.83335 g	1.71694 g
0.2%	0.08120 g	0.16286 g	0.24499 g	0.41067 g	0.83335 g
0.5%	0.03242 g	0.06492 g	0.09749 g	0.16286 g	0.32759 g
1%	0.01620 g	0.03242 g	0.04866 g	0.08120 g	0.16286 g
2%	0.00810 g	0.01620 g	0.02431 g	0.04054 g	0.08120 g
5%	0.00324 g	0.00648 g	0.00972 g	0.01620 g	0.03242 g

Fail: The determined minimum weight does not meet the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	**1**	**2**	**3**	**5**	**10**
0.1%	0.16286 g	0.32759 g	0.49423 g	0.83335 g	1.71694 g
0.2%	0.08120 g	0.16286 g	0.24499 g	0.41067 g	0.83335 g
0.5%	0.03242 g	0.06492 g	0.09749 g	0.16286 g	0.32759 g
1%	0.01620 g	0.03242 g	0.04866 g	0.08120 g	0.16286 g
2%	0.00810 g	0.01620 g	0.02431 g	0.04054 g	0.08120 g
5%	0.00324 g	0.00648 g	0.00972 g	0.01620 g	0.03242 g

Fail: The determined minimum weight does not meet the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

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Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	⚠	✓	✓

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

		As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0.00007 g*	N/A	0.00007 g*	N/A
0.2%	N/A		N/A		N/A
0.5%	N/A		N/A		N/A
1%	0.00008 g		✓		⚠
2%	0.00015 g		✓		✓
5%	0.00038 g		✓		✓

*The calculated standard deviation value is below the rounding error of the balance. The 0.41*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

		As Found		As Left	
Tolerance	Control Limit	Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

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METTLER TOLEDO Service

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.0000 g	0.0001 g	0.0100 g	0.0200 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.0000 g	0.0001 g	0.0100 g	0.0200 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
149.9999 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

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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. 0-2717-3000-29 FAX. 0-2719-9484

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NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenDirect SD20
Serial No. :	C238831431
ID No. :	-
Condition As-Received:	Used Item
Received Date :	12 December 2023
Calibration Date :	13 December 2023
Reference :	2312-0250WN-1
Submitted by :	WATER INDEX & CONSULTANT CO.,LTD. 229/8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd., Bang-aor,Bangphlat, Bangkok 10700
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 :

Approved by :

Approved Signatory

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

Issue Date : 20 December 2023

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.

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Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	2188080	130RC044	23I1216	10 Oct 2024

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

- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor *k*
	pH	mV	mV	pH		
pH Meter S/N.: C238831431	4.000	177.48	177.5	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.009	187.6	0.0051	2.05
S/N.: 2256471	6.986	7.006	12.6	0.0084	2.00
	9.997	9.990	-161.5	0.0077	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 2256471

Dimension of probe;

- Length : 120 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 *k*
22.0	22.003	22.2	0.197	0.13	2.00
25.0	25.002	25.2	0.198	0.13	2.00
28.0	28.003	28.2	0.197	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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