

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ



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	YSI	pH100A JC03354	Technology Promotion Association (Thailand-Japan)	22CH60	13 Jan 22	12 Jan 23	-

การปฏิบัติงานตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการท่าเทียบเรือ บริษัท พีทีจี เอ็นเนอยี จำกัด (มหาชน)
ระหว่างเดือนกรกฎาคม-ธันวาคม 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
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ									
1	pH Meter	ความเป็นกรดและด่าง	Hanna Instrument	H2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2202097-001-01	16 Mar 22	15 Mar 23	-
2	Analytical Balance (Readability 0.01 mg)	ของแข็งเจือจางร้อยละ ของแข็งละลายน้ำทั้งหมด	Mettler-Toledo	XSR205DU / C210685394	Mettler-Toledo (Thailand) Ltd.	Tr42058-043-050622- ACC-TH	9 May 22	8 May 23	-
3	Hot Air Oven			UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
4	BOD Incubator	บีโอดี	Arco	UC4-1320 / (LJAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
5	COD Reactor (Heating Block)	ซีโอดี	Hanna	HI89800-02 / H0185001	Technology Promotion Association (Thailand-Japan)	HIT-2209-0184	1 Mar 22	1 Mar 23	-
6	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2202934-001-01	13 May 22	12 May 23	-

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2117-3000-27 FAX. 0-2179-9484



Cert.No.: 22CH60
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC03354
ID No. : UAE.EFM.063/2582(ENV.pH 03/62)
Condition As-Received: Used Item
Received Date : 12 January 2022
Calibration Date : 13 January 2022
Reference : 2201-0350WSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Sol Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.6) °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 Lernagatrakul

Approved by :
Approved Signatory

(/) Malee Butkruea
() Sathip Meangmai
() Warakorn Lernagatrakul

Issue Date : 17 January 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 host of Corporate Services 3: Equipment Calibration and Testing Services

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Cert.No.: 22CH60
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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	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	766820	23 Sep 2023
pH 6.882	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 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 (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00

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Cert.No.: 22CH60
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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: 200729SIA605377	4.008	4.01	144	0.0079	2.00
	6.882	6.98	-28	0.011	2.00
	6.882	6.98	-27	0.0099	2.00
	10.015	10.01	-200	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 200729SIA605377

Dimension of probe;

- Length : 112 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
25.0	25.003	25.1	0.097	0.13	2.00
30.0	30.002	30.1	0.098	0.13	2.00
35.0	35.004	35.0	-0.004	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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National Food Institute of Metrology (Thailand)



Calibration Certificate

Certificate No.: 2202097-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.004/2956
Order No.: 2202097
Operation No.: 2202097-001
Date of Receipt: 11 March 2022
Date of Calibration: 18 March 2022

Calibrated by: Mr. Manan Kamah
Specialist
Approved by:
(Mr. Manan Kamah, Specialist)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 31 March 2022

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

This Certificate is issued in accordance with the provisions of accreditation granted by the Thai Laboratory Accreditation Scheme (TLAS) which has assessed the measurement capability of the laboratory and its traceability to recognized national standards held to the order 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.

TLAS-009 Revision: 00 Date: 14-12-63

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Calibration Report

Certificate No.: 220299-001-01
 Equipment: pH Meter
 Manufacturer: HANNA INSTRUMENTS
 Serial No: HI 2214
 ID No: UAE WAT 0045558
 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 %
 Condition of Equipment: Good

Condition of this Results of Calibration
 1. Calibration Method: In-house method, NIST 422 based on direct measurement by using standard buffer solution and certified reference material (CRM).

2. Reference Standards: Certified Reference Material

Instrument	Serial No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2150017	Fluke	SC1-011-001-01	24 June 2022
2.2 Digital Thermometer	2110007	Fluke	CC 640199-01	30 October 2022
2.3 Thermocouple Meter	200101574-585	ACUPRE	CR21-7347	15 November 2022

Calibrated Reference Material	Lot No.	Manufacturer	Serial No.	Expiry Date
2.4 pH buffer 4.00 (Primary pH buffer Solution)	780011	CPAchem	PH01-L16	21 November 2022
2.5 pH buffer 6.86 (Primary pH buffer Solution)	780011	CPAchem	PH01-L16	21 November 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780011	CPAchem	PH01-L16	21 November 2022
2.7 pH buffer 7.00 (Universal pH buffer Solution)	775047	CPAchem	PH01-L16	8 November 2022

3. This calibration is traceable to the International System of Units (SI) Unit:

2.1 instrument No. 2.1	through	NIST 150-150-17025 Laboratory Accreditation of Calibration No. 0010
2.2 instrument No. 2.2	through	NIST 150-150-17025 Laboratory Accreditation of Calibration No. 0010
2.3 instrument No. 2.3	through	NIST 150-150-17025 Laboratory Accreditation of Calibration No. 0010
2.4 Certified Reference Material No. 2.4 to 2.7	through	Primary measurement method: Handheld using calibrated thermometer, thermometer and hand-drawn The Standard Solution preparation and certified by CPAchem Ltd is according to ISO 17025 and ISO/IEC 17025

4. This certificate is valid only for the equipment calibrated.

5. The result of calibration was found accurate as shown on data and page of calibration only.

F-C5-012 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 220299-001-01
 Equipment: pH Meter
 Manufacturer: HANNA INSTRUMENTS
 Serial No: HI 2214
 ID No: UAE WAT 0045558
 Date of Calibration: 16 March 2022 Page 3 of 5

Calibration Results:
 1. Calibration of pH Meter: 0 Manual Temperature Compensation at 25 °C

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (1)
		mV	pH		
6	414.117	414	6.80	0.04	2.00
2	296.111	295.7	7.01	0.04	2.00
4	177.492	177.4	6.90	0.04	2.00
8	85.119	85.2	6.90	0.04	2.00
7	-10.01	0.1	7.00	0.04	2.00
9	66.102	-49.1	6.90	0.04	2.00
10	-177.453	-177.3	10.00	0.04	2.00
11	-295.917	-295.9	12.00	0.04	2.00
14	-414.119	-414	14.00	0.04	2.00

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

Equipment	pH Electrode	Type	Connected Electrode
Manufacturer	ATE TLE 9 TD, FCD	Model	LF42C
Serial No.	1143072	ID No	N/A

Performance of Electrode system: (Three Point Calibration at pH 4, 7 and 10)

Certified Value @ 25 °C (pH)	Average Indicator Reading		Slope Slope (%)	Uncertainty (± pH)	Coverage Factor (1)
	pH	mV			
4.005	4.01	190.5	98.3	0.0021	2.00
6.805	6.81	12.5	99.3	0.0024	2.00
10.010	10.01	-177.5	99.3	0.0020	2.00
8.965	8.96	0.2	99.3	0.0012	2.00

F-C5-012 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 220299-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: HI-2211
 Serial No: 0816545 ID No: UAE WAT 0045558
 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: 45 ± 4 %

Condition of this Results of Calibration:

- Calibration Method:
 - In-house method, NIST 422 based on comparison with standard thermometer.
 - The Calibration is determined by the NIST 422 with a known temperature from a standard resistance thermometer.
 - The temperature scale is used at the laboratory in the International Temperature scale of 1990 (ITS 90).

2. Reference Standards (Instrument)

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HAND-HELD THERMOMETER	1501	2116104	PSLT 005164	24 Jun 22	THIR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: Low Temperature Bath (ISOCAL 40; Model: Europa-6 Plus Basic S/N: 5415592)

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

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

5. The result of calibration was found accurate as shown on data and page of calibration only.

6. Condition of Calibration item: Good

7. Result of Calibration: ☒ Within specification ☐ After adjustment

F-C5-012 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 220299-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: HI-2211
 Serial No: 0816545 ID No: UAE WAT 0045558
 Manufacturer: HANNA INSTRUMENTS
 Date of Calibration: 16 March 2022 Page 5 of 5

Calibration point: 15.0 °C and 15.0 °C

Calibration result:

- The probe was immersed in 15.0 °C bath for a minimum depth of 100 mm.
- Disposition of probe: 15.0 °C bath.
- Disposition of probe: Diameter: 3.5 mm Length: 150 mm.
- Shield material: Stainless Steel

LUIC Reading (°C)	Standard Temperature (°C)	Corrected Value (°C)	Uncertainty (°C)
15.0	15.001	0.0	0.009
25.0	25.002	0.0	0.009
30.0	30.002	0.0	0.009

Note: LUIC = 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-C5-012 Revision: 00 Date: 14-12-61

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Mettler-Toledo (Thailand) Ltd.
645M - 645's Lane 1st Fl., Bangna-Tra Sub-District
Bangna District, Bangkok 10260
+66 2723 0367
MT-TH-Support@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 350 Udon Suk 41, Sukhumvit Rd., Bang Chak
City: Pore Phrasong Contact: Sures Chottrak
Zip / Postal: 10260
State / Province: Bangkok
Order Number:

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XSR2050DU Asset Number: UAE-WAQ-010265
Serial No.: C21065394 Terminal Model: SRAT
Building: N/A Terminal Serial No.: C21065394
Floor: 7 Terminal Asset No.: N/A
Room: Balance Room

Range	Max. Capacity	Readability (g)
1	81 g	0.0001 g
2	220 g	0.0001 g

Procedure

Calibration Guidelines: EURAMET up-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPM000270
This calibration certificate contains measurement results 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 of the weighing instrument was adjusted before calibration with a test weight.
In accordance with EURAMET up-18 (11/2015), the test weights were selected to reflect the intended use of the weighing device or to accommodate manufacturer calibration standards.

As Found	Temperature	Humidity
Start 22.4 °C	End 22.4 °C	Start 47.5 %
		End 46.2 %

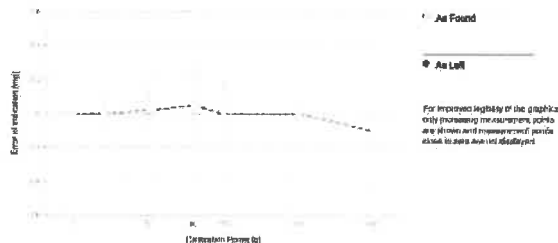
As Found Calibration Date: 05-May-2022 Calibration:
As Left Calibration Date: N/A
Issue Date: 05-May-2022 Approved Signatory:
Technical Manager / Head of Calibration Center

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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	0.020 mg	2
2	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
3	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
4	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
5	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
6	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
7	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
8	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
9	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
10	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2
11	0.0001 g	0.0001 g	0.0000 g	0.023 mg	2

The calibration uncertainty was reduced by the EMC (Calibration and Measurement Capability) value because the laboratory's uncertainty was smaller than the EMC value.



The uncertainty stated in the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k = 2, which can be larger than 2 according to EURAMET up-18. The value of the measurement results within the adjusted 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: W334 Date of Issue: 17-Nov-2020
Certificate Number: 170240 Calibration Due Date: 16-May-2022
Thermo Hygrometer
Equipment No: W161 Date of Issue: 14-Jun-2021
Certificate Number: 2101229 Calibration Due Date: 27-Jun-2022

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Measurement Results

Repeatability

Test Load: 70 g	As Found	As Left	As Found
1	70.00005 g	N/A	As Left
2	70.00006 g	N/A	As Left
3	70.00004 g	N/A	As Left
4	70.00005 g	N/A	As Left
5	70.00007 g	N/A	As Left
6	70.00007 g	N/A	As Left
7	70.00005 g	N/A	As Left
8	70.00006 g	N/A	As Left
9	70.00005 g	N/A	As Left
10	70.00006 g	N/A	As Left
Standard Deviation	0.000008 g	N/A	

The 'As Found' in the graph represents the repeatability of the measurement results under the test conditions.
The results of the graph are based upon the standard value of the reference weight.

Eccentricity

Test Load: 100 g	As Found	As Left	As Found
1	100.00000 g	N/A	As Found
2	100.00000 g	N/A	As Found
3	100.00000 g	N/A	As Found
4	100.00000 g	N/A	As Found
5	100.00000 g	N/A	As Found
Maximum Deviation	0.0000 g	N/A	



The 'As Found' in the graph represents the repeatability of the measurement results under the test conditions.
The results of the graph are based upon the standard value of the reference weight.

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Remarks

FAC™ adjustment functionality activated
Equipment condition: Good
Calibration status: Insufficient
Next calibration according to customer's procedure
Calibration date not decided 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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Equipment : Hot Air Oven
 Condition As-Received :
 Reference : 2210-0575QC-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM1490
 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	0.051	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.567	104.426	104.012	103.928	104.370
140.0	138.189	139.189	138.808	139.550	140.268	139.822	138.293	139.385	140.369
180.0	177.930	179.267	178.643	179.753	181.011	180.093	178.496	179.743	181.278

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

Temperature stability : One-half of the greatest maximum difference of measured temperatures at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation UUC* : Unit Under Calibration

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

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

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กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM1490

Equipment : Hot Air Oven

Model : UF55

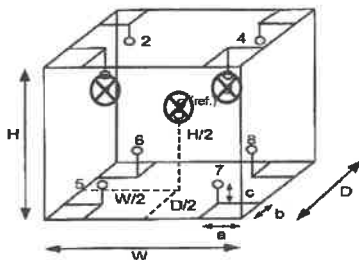
Serial No. : B216.1666

ID No. : UAE.WAO.027/2559

Manufacturer : Memmert

Calibration Point : 180.0 °C

Unit Under Calibration Setting : 180.0°C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่....1,3,9.....

หมายเหตุ เก็บใบแนบ.....
 \\uae.net\app\Waoapp_LAB\Lab-09\INSTRUMENT\01-22\A-Certificate\กำหนดจุดห้ามใช้งาน\เอกสารไม่ควบคุม\22TM1490.doc
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กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM1490

Equipment : Hot Air Oven

Model : UF55

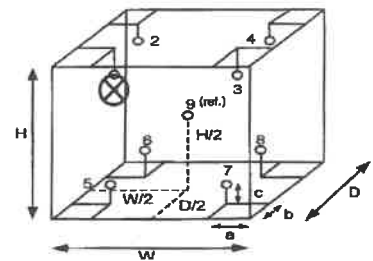
Serial No. : B216.1666

ID No. : UAE.WAO.027/2559

Manufacturer : Memmert

Calibration Point : 140.0 °C

Unit Under Calibration Setting : 140.0°C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่....1.....

หมายเหตุ เก็บใบแนบ.....

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND JAPAN)
 CORPORATE SERVICES EQUIPMENT CALIBRATION AND TESTING SERVICES
 311/1 TATTAJARN ROAD, SU-20, SU-21, SU-22, SU-23, SU-24, SU-25, SU-26, SU-27, SU-28, SU-29, SU-30, SU-31, SU-32, SU-33, SU-34, SU-35, SU-36, SU-37, SU-38, SU-39, SU-40, SU-41, SU-42, SU-43, SU-44, SU-45, SU-46, SU-47, SU-48, SU-49, SU-50, SU-51, SU-52, SU-53, SU-54, SU-55, SU-56, SU-57, SU-58, SU-59, SU-60, SU-61, SU-62, SU-63, SU-64, SU-65, SU-66, SU-67, SU-68, SU-69, SU-70, SU-71, SU-72, SU-73, SU-74, SU-75, SU-76, SU-77, SU-78, SU-79, SU-80, SU-81, SU-82, SU-83, SU-84, SU-85, SU-86, SU-87, SU-88, SU-89, SU-90, SU-91, SU-92, SU-93, SU-94, SU-95, SU-96, SU-97, SU-98, SU-99, SU-100, SU-101, SU-102, SU-103, SU-104, SU-105, SU-106, SU-107, SU-108, SU-109, SU-110, SU-111, SU-112, SU-113, SU-114, SU-115, SU-116, SU-117, SU-118, SU-119, SU-120, SU-121, SU-122, SU-123, SU-124, SU-125, SU-126, SU-127, SU-128, SU-129, SU-130, SU-131, SU-132, SU-133, SU-134, SU-135, SU-136, SU-137, SU-138, SU-139, SU-140, SU-141, SU-142, SU-143, SU-144, SU-145, SU-146, SU-147, SU-148, SU-149, SU-150, SU-151, SU-152, SU-153, SU-154, SU-155, SU-156, SU-157, SU-158, SU-159, SU-160, SU-161, SU-162, SU-163, SU-164, SU-165, SU-166, SU-167, SU-168, SU-169, SU-170, SU-171, SU-172, SU-173, SU-174, SU-175, SU-176, SU-177, SU-178, SU-179, SU-180, SU-181, SU-182, SU-183, SU-184, SU-185, SU-186, SU-187, SU-188, SU-189, SU-190, SU-191, SU-192, SU-193, SU-194, SU-195, SU-196, SU-197, SU-198, SU-199, SU-200, SU-201, SU-202, SU-203, SU-204, SU-205, SU-206, SU-207, SU-208, SU-209, SU-210, SU-211, SU-212, SU-213, SU-214, SU-215, SU-216, SU-217, SU-218, SU-219, SU-220, SU-221, SU-222, SU-223, SU-224, SU-225, SU-226, SU-227, SU-228, SU-229, SU-230, SU-231, SU-232, SU-233, SU-234, SU-235, SU-236, SU-237, SU-238, SU-239, SU-240, SU-241, SU-242, SU-243, SU-244, SU-245, SU-246, SU-247, SU-248, SU-249, SU-250, SU-251, SU-252, SU-253, SU-254, SU-255, SU-256, SU-257, SU-258, SU-259, SU-260, SU-261, SU-262, SU-263, SU-264, SU-265, SU-266, SU-267, SU-268, SU-269, SU-270, SU-271, SU-272, SU-273, SU-274, SU-275, SU-276, 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SU-902, SU-903, SU-904, SU-905, SU-906, SU-907, SU-908, SU-909, SU-910, SU-911, SU-912, SU-913, SU-914, SU-915, SU-916, SU-917, SU-918, SU-919, SU-920, SU-921, SU-922, SU-923, SU-924, SU-925, SU-926, SU-927, SU-928, SU-929, SU-930, SU-931, SU-932, SU-933, SU-934, SU-935, SU-936, SU-937, SU-938, SU-939, SU-940, SU-941, SU-942, SU-943, SU-944, SU-945, SU-946, SU-947, SU-948, SU-949, SU-950, SU-951, SU-952, SU-953, SU-954, SU-955, SU-956, SU-957, SU-958, SU-959, SU-960, SU-961, SU-962, SU-963, SU-964, SU-965, SU-966, SU-967, SU-968, SU-969, SU-970, SU-971, SU-972, SU-973, SU-974, SU-975, SU-976, SU-977, SU-978, SU-979, SU-980, SU-981, SU-982, SU-983, SU-984, SU-985, SU-986, SU-987, SU-988, SU-989, SU-990, SU-991, SU-992, SU-993, SU-994, SU-995, SU-996, SU-997, SU-998, SU-999, SU-1000, SU-1001, SU-1002, SU-1003, SU-1004, SU-1005, SU-1006, SU-1007, SU-1008, SU-1009, SU-1010, SU-1011, SU-1012, SU-1013, SU-1014, SU-1015, SU-1016, SU-1017, SU-1018, SU-1019, SU-1020, SU-1021, SU-1022, SU-1023, SU-1024, SU-1025, SU-1026, SU-1027, SU-1028, SU-1029, SU-1030, SU-1031, SU-1032, SU-1033, SU-1034, SU-1035, SU-1036, SU-1037, SU-1038, SU-1039, SU-1040, SU-1041, SU-1042, SU-1043, SU-1044, SU-1045, SU-1046, SU-1047, SU-1048, SU-1049, SU-1050, SU-1051, SU-1052, SU-1053, SU-1054, SU-1055, SU-1056, SU-1057, SU-1058, SU-1059, SU-1060, SU-1061, SU-1062, SU-1063, SU-1064, SU-1065, SU-1066, SU-1067, SU-1068, SU-1069, SU-1070, SU-1071, SU-1072, SU-1073, SU-1074, SU-1075, SU-1076, SU-1077, SU-1078, SU-1079, SU-1080, SU-1081, SU-1082, SU-1083, SU-1084, SU-1085, SU-1086, SU-1087, SU-1088, SU-1089, SU-1090, SU-1091, SU-1092, SU-1093, SU-1094, SU-1095, SU-1096, SU-1097, SU-1098, SU-1099, SU-1100, SU-1101, SU-1102, SU-1103, SU-1104, SU-1105, SU-1106, SU-1107, SU-1108, SU-1109, SU-1110, SU-1111, SU-1112, SU-1113, SU-1114, SU-1115, SU-1116, SU-1117, SU-1118, SU-1119, SU-1120, SU-1121, SU-1122, SU-1123, SU-1124, SU-1125, SU-1126, SU-1127, SU-1128, SU-1129, SU-1130, SU-1131, SU-1132, SU-1133, SU-1134, SU-1135, SU-1136, SU-1137, SU-1138, SU-1139, SU-1140, SU-1141, SU-1142, SU-1143, SU-1144, SU-1145, SU-1146, SU-1147, SU-1148, SU-1149, SU-1150, SU-1151, SU-1152, SU-1153, SU-1154, SU-1155, SU-1156, SU-1157, SU-1158, SU-1159, SU-1160, SU-1161, SU-1162, SU-1163, SU-1164, SU-1165, SU-1166, SU-1167, SU-1168, SU-1169, SU-1170, SU-1171, SU-1172, SU-1173, SU-1174, SU-1175, SU-1176, SU-1177, SU-1178, SU-1179, SU-1180, SU-1181, SU-1182, SU-1183, SU-1184, SU-1185, SU-1186, SU-1187, SU-1188, SU-1189, SU-1190, SU-1191, SU-1192, SU-1193, SU-1194, SU-1195, SU-1196, SU-1197, SU-1198, SU-1199, SU-1200, SU-1201, SU-1202, SU-1203, SU-1204, SU-1205, SU-1206, SU-1207, SU-1208, SU-1209, SU-1210, SU-1211, SU-1212, SU-1213, SU-1214, SU-1215, SU-1216, SU-1217, SU-1218, SU-1219, SU-1220, SU-1221, SU-1222, SU-1223, SU-1224, SU-1225, SU-1226, SU-1227, SU-1228, SU-1229, SU-1230, SU-1231, SU-1232, SU-1233, SU-1234, SU-1235, SU-1236, SU-1237, SU-1238, SU-1239, SU-1240, SU-1241, SU-1242, SU-1243, SU-1244, SU-1245, 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SU-1357, SU-1358, SU-1359, SU-1360, SU-1361, SU-1362, SU-1363, SU-1364, SU-1365, SU-1366, SU-1367, SU-1368, SU-1369, SU-1370, SU-1371, SU-1372, SU-1373, SU-1374, SU-1375, SU-1376, SU-1377, SU-1378, SU-1379, SU-1380, SU-1381, SU-1382, SU-1383, SU-1384, SU-1385, SU-1386, SU-1387, SU-1388, SU-1389, SU-1390, SU-1391, SU-1392, SU-1393, SU-1394, SU-1395, SU-1396, SU-1397, SU-1398, SU-1399, SU-1400, SU-1401, SU-1402, SU-1403, SU-1404, SU-1405, SU-1406, SU-1407, SU-1408, SU-1409, SU-1410, SU-1411, SU-1412, SU-1413, SU-1414, SU-1415, SU-1416, SU-1417, SU-1418, SU-1419, SU-1420, SU-1421, SU-1422, SU-1423, SU-1424, SU-1425, SU-1426, SU-1427, SU-1428, SU-1429, SU-1430, SU-1431, SU-1432, SU-1433, SU-1434, SU-1435, SU-1436, SU-1437, SU-1438, SU-1439, SU-1440, SU-1441, SU-1442, SU-1443, SU-1444, SU-1445, SU-1446, SU-1447, SU-1448, SU-1449, SU-1450, SU-1451, SU-1452, SU-1453, SU-1454, SU-1455, SU-1456, SU-1457, SU-1458, SU-1459, SU-1460, SU-1461, SU-1462, SU-1463, SU-1464, SU-1465, SU-1466, SU-1467, SU-1468, SU-1469, SU-1470, SU-1471, SU-1472, SU-1473, SU-1474, SU-1475, SU-1476, SU-1477, SU-1478, SU-1479, SU-1480, SU-1481, SU-1482, SU-14



Cert. No.: 22TM90

BOD Incubator

Ayco

Model: UCA-1380

S/N: B9RCA5013201

ID No.: UAE WAO 01512561

3 Mar 2022
3 Mar 2022



Equipment: BOD Incubator

Condition As-Received: Used Item

Reference: 2202-0446OC-1

Procedure Used:-

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement

method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

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	MY44035217	21LM30	23 Dec 2022

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

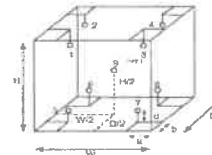
3. This certification is traceable to the International System of Unit

Result of Calibration:- (°) Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL Humid (%)	66	75
AC Supply (Volt)	220	220



Probe Installation Details:

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber:

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.88 m³

Position	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

11/03/2022



Equipment: BOD Incubator
Condition As-Received: Used Item
Reference: 2202-0446OC-1
Result of Calibration:- (°) Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Not Available

Cert. No.: 22TM90
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
20.3	19.5	19.4	0.30	0.56	1.0	0.65	2

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.
Note: The reported uncertainty of measurement was included stability and excluded uniformity.
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

11/03/2022

Hanna Instruments (Thailand) Ltd.
410/67-68 Soi Patchadagard 25, Patchadagard Rd., Samsen-Loke, Huaykwang Bangkok 10310 Tel: 0-2544-4109 Fax: 0-2544-4108
Certificate No.: 1017-2269-0000
Page: 1 of 3

CERTIFICATE OF CALIBRATION

Equipment: CO2 Test Tube Holder
Meter Model: HHS39804-02 Serial No.: H9185001
Manufacturer: Hanna Instruments
Made in: Romania
Condition As-Received: Used Product
Reference: RL220234
Customer name: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomrak 41, Sukhumvit Rd., Bangkok, Phrakhanong, Bangkok 10260

Received date: 21 February 2022
Calibrate date: 1 March 2022
Issue date: 2 March 2022
Ambient Temperature: (25 ± 2) °C
Relative Humidity: (50 ± 15) % RH
Calibrated Location: Hanna Instruments (Thailand) Ltd.


Calibrated by:
Mr. Pichai Petibong
Calibration Engineer

Approved by:
Mr. Anan Suwanchaisakul
Authorized Signatory

This certificate was certified only for the instrument we calibrated.
This result of calibration was found accurate on date and place of calibration only.

** This certificate may not be reproduced other than in full, except with the prior written approval of the head of Hanna Instrument (Thailand)

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Certificate No.: HIT-2209-0184
 Page: 2 of 3

Condition of this result of calibration

Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	141935005	03250060101	217167	Technology Promotion Association (Thailand-Japan)

Reference / Procedure:




This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No: 141.

This temperature scale used was based on ITS-90


All data shown below were as-received values without adjustment.

SITE CALIBRATION

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

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Certificate No.: HIT-2209-0184
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Result of Calibration:

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	- (°C)	150.6 (°C)	1.3 (°C)	±0.39 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	150.2	150.4	150.4	150.3	150.2
	6	7	8	9	10
	150.4	150.9	151.1	151.1	150.6
	11	12	13	14	15
	150.4	151.0	151.5	151.3	150.5
	16	17	18	19	20
	150.3	150.8	151.2	151.2	150.5
	21	22	23	24	25
	150.2	150.3	150.5	150.4	150.3

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%.

** End of certificate **

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Calibration Certificate

Certificate No.: 2202934-001-01

Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Order No.: 2202934

Operation No.: 2202934-001

Date of Receipt: 13 May 2022

Date of Calibration: 13 May 2022

Calibrated by Mr. Manis Somsak Specialist




Date of Issue: 25 May 2022

Approved by 
(Mr. Phrasaphat Yuenjit)
Manager, Division of Calibration Laboratory
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-C5-009 Revision 01 Date: 20-04-65

Calibration Report

Certificate No.: 2202934-001-01

Equipment: Electronic Balance

Model: XSR204

Serial No.: C117635043

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g

ID No.: UAE.WAS.012/2564

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Date of Calibration: 13 May 2022

Environment Conditions: Ambient Temperature: 22.3 ± 0.1 °C Relative Humidity: 47 ± 3 %

Place of Calibration: Reference room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

- Calibration Method: NIST Method (WMA-001) In-house Method based on NIST Lab 14 - 2018
- Reference Standard:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight, Class E2	1mg to 200g	BMS567572	TCS	PC20041375	23 April 2021
- Instrument:

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hydro Meter	PCNPE 490	1974TH 010716	Quality Room	Q022-0310	18 February 2021
- This certification is traceable to SI UNIT
- This certificate was certified only for the instrument was calibrated.
- The result of calibration was found accurate as shown on date and block of calibration only.




Calibration Results:

1. Repeatability of Reading:


Normal Value (g)	Standard Deviation of Reading (g)
100	0.000033
200	0.000031

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan. The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.000	50.000	50.000	50.000	50.000	50.000	0.000



F-C5-012 Revision 01 Date: 20-04-65

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เอกสารไม่ควบคุม

Calibration Report

Certificate No.:	2202934-001-01		
Equipment:	Electronic Balance	Manufacturer:	METTLER TOLEDO
	Model: N1204	Resolution:	0.0001 g
	Serial No.: C1763543	ID No.:	4AE WAS 0124564
	Capacity: 220 g		

Date of Calibration: 13 Nov 2022

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Calibration Results: (Continued)

Calibration Range: 0 - 200g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Normal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
μ	σ	\bar{x}	δ	$\pm u$	k
0.0000	0.00000	0.0000	0.0000	0.0000005	2.00
0.31	0.01002	0.0100	0.0000	0.0000005	2.00
0.02	0.00000	0.0000	0.0000	0.0000005	2.00
0.03	0.00000	0.0000	0.0000	0.0000005	2.00
0.1	0.00000	0.0000	0.0000	0.0000005	2.00
0.2	0.00000	0.0000	0.0000	0.0000005	2.00
0.5	0.00000	0.0000	0.0000	0.0000005	2.00
1	0.00000	0.0000	0.0000	0.0000005	2.00
2	0.00000	0.0000	0.0000	0.0000005	2.00
3	0.00000	0.0000	0.0000	0.0000005	2.00
5	0.00000	0.0000	0.0000	0.0000005	2.00
10	0.00000	0.0000	0.0000	0.0000005	2.00
20	0.00000	0.0000	0.0000	0.0000005	2.00
50	0.00000	0.0000	0.0000	0.0000005	2.00
100	0.00000	0.0000	0.0000	0.0000005	2.00

F-35:012 Revision: 01 Date: 10-04-65

Calibration Report

Certificate No.:	2202934-001-01		
Equipment:	Electronic Balance	Manufacturer: METTLER TOLEDO	
	Model: XSR204	Resolution: 0.0001 g	
	Serial No.: C117435047	ID No.: UAE-WAS-012/2364	
	Capacity: 220 g		

Date of Calibration: 11 May 2023

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Calibration Results: (Continued)

Calibration Range: 0 - 200g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	k
50	50.80094	50.5001	-0.0001	0.00013	2.00
55	55.80026	55.5001	-0.0001	0.00013	2.00
60	60.80025	60.5001	-0.0001	0.00012	2.00
65	65.80012	65.5002	-0.0001	0.00012	2.00
70	70.80008	70.5002	-0.0001	0.00013	2.00
75	75.80018	75.5001	-0.0001	0.00013	2.00
80	80.80008	80.5002	-0.0001	0.00014	2.00
85	85.80011	85.5002	-0.0001	0.00014	2.00
90	90.80012	90.5002	-0.0001	0.00015	2.00
100	100.80008	100.0003	-0.0001	0.00016	2.00
120	120.80001	120.0003	-0.0001	0.00018	2.00
150	150.80001	150.0004	-0.0001	0.00021	2.00
200	200.80015	200.0006	-0.0001	0.00028	2.00

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

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

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