

ภาคผนวก จ
เอกสารสอบเทียบเครื่องมือ

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์
เอ็นจิเนียริง คอนซัลแตนท์ จำกัด


รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำผิวดิน									
1	UV-VIS Spectrophotometer	Nitrate-Nitrogen (NO3-N) Ammonia-Nitrogen (NH3-N)	Agilent Technologies	Cary60 / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
2	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
3	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP23-008	6 Jan 23	5 Jan 24	-
4	Distillation Unit (Kjeldahl Method)	Ammonia-Nitrogen (NH3-N)	FOSS TECATOR	KT8100 / 91889052	Sithiporn Associates Co.,Ltd.	17 Feb 18	25 May 23	23 May 24	-
5	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24230059	16 Mar 23	14 Mar 24	-
6	Incubator	Total Coliform Bacteria (TCB)	ARCO	UR-1320	Technology Promotion Association (THAILAND-JAPAN)	23TM372	11 Apr 23	9 Apr 24	-
7	Incubator		ARCO	UR-1320	Technology Promotion Association (THAILAND-JAPAN)	23TM375	12 May 23	10 May 24	-
8	Water Bath		Memmert	WNE 14 / I414.1410	Technology Promotion Association (THAILAND-JAPAN)	23TM377	12 Apr 23	10 Apr 24	-
9	Water Bath	Analytical Balance	Memmert	WNE 14 / L414.1407	Technology Promotion Association (THAILAND-JAPAN)	23TM374	11 Apr 23	9 Apr 24	-
10	Analytical Balance		Mettler-Toledo	AB204-S / Fact / 1129361010	National food institute ministry of Industry	2303074-001-01	26 May 23	24 May 24	-

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

DQEServices

DQEServices Co.,Ltd.
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ISO 17025:2017
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064


ID No. : UAE.WAS.006/2552


Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Rittidach)

Approved by :

(Ms. Chonthicha Sangern)

Technical ManagerQuality Manager

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


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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.


Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 4 of 5


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.865	0.0024	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

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


DQE Services

REPORT OF CALIBRATION

Certificate No. : SP24-008Page 5 of 5

Wavelength Accuracy :


CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	241.1	0.44	0.18	2.00
279.40	278.9	0.50	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.8	0.42	0.18	2.00
361.26	360.8	0.46	0.18	2.00
418.48	418.2	0.28	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.1	0.10	0.18	2.00
460.06	459.6	0.46	0.18	2.00
536.90	536.4	0.50	0.18	2.00
637.94	637.6	0.34	0.18	2.00
440.74	440.1	0.64	0.18	2.00
472.22	472.0	0.22	0.18	2.00
513.70	513.5	0.20	0.18	2.00
528.72	528.2	0.52	0.18	2.00
574.60	574.3	0.30	0.18	2.00
585.48	585.0	0.48	0.20	2.00
684.63	684.2	0.43	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.8	0.36	0.18	2.00
879.70	879.2	0.50	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The mean expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k,
which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates not TISI accredited

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DQE Services

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 4 January 2024

Calibration Date : 4 January 2024

Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by : (Mr.Tanawat Rittidach)Approved by : (Ms. Chonthicha Sangngern)Quality Manager


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

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

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REPORT OF CALIBRATION

Certificate No. : SP24-001Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min


Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP24-001Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

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

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

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

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



CAL-EM-C24-09: 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	24.5 µS/cm	0.500 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1403 µS/cm	10.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.5 mS/cm	2.80 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	24.8 µS/cm	0.200 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.8 mS/cm	2.50 mS/cm	2.00	0.67 mS/cm

The End of Certificate

บริษัท เทคโนโลยี จำกัด
D2S Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certidto-thailand

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เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022

เลขที่ใบงาน: KSPR2304472

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: Lab 955

หมายเลขเครื่อง: 16300356

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
16 Mar 2023	16 Mar 2023	
ปกติ	ปกติ	
ไม่ปกติ	ไม่ปกติ	
General		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
Spectrophotometer		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)
pH Meter and Conductivity Meter		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันละออง Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)
Turbidimeter		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไมล์ใน 3.0)
Automatic titrator		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. เข็มฉวัด Piston Burettes
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ

ข้อเสนอแนะ: Electrode วัดอุณหภูมิได้ 25.1°C โดย Control Waterbath ที่ 25.0 ± 0.1°C

Mr. Atachai Ngamchanat

Service Engineer

เอกสารไม่ควบคุม

CAL-FM-R31-03: 20 Jul 2022

บริษัท เทคโนโลยี จำกัด
D2S Technology Limited
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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



Cert. No.: 23TM372
Page: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.006/2553
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrahanang,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee

Approved by :
() Pormthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 24 April 2023

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

A 0053361



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-3
Procedure Used :-

Cert. No.: 23TM372
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD). 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	34972A	MY59003411	22LM165	26 Nov 2023

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

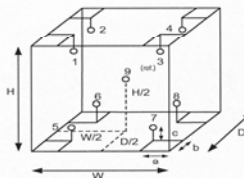
3. This certification is traceable to the International System of Unit.

Result of Calibration :- () Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	44	41
AC Supply (Volt)	221	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 = 0.89 m³

Position	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

เอกสารไม่ควบคุม

a 1158257



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : Z304-0156OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available


Cert. No.: 23TM372
Page : 3 of 3


Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.9	0.40	0.72	0.97	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.236	20.278	19.949	19.981	20.313	20.369	19.887	19.828	19.755	0.59



Average* : The average of 30 values in each position.
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity .
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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 เอกสารไม่ควบคุม
 a 1151821




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

Cert. No.: 23TM375
Page : 1 of 3


Certificate of Calibration


Equipment : BOD Incubator
 Manufacturer : ARCO
 Model : UR-1320
 Serial No. : -
 ID No. : UAE.WAO.018/2551
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Location : Lab Floor 2
 Received Order : 11 April 2023
 Calibration Date : 12 April 2023
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Krisda Malee

Approved by : 
 Approved Signatory
 (/) Pornthippa Tameyakul
 (/) Malee Butkruea
 (/) Suwit Imjai

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95 %
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 เอกสารไม่ควบคุม
 A 0053360



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : Z304-0156OC-2
Procedure Used :-
Calibration were 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 34972A MY59003411 22LM165 26 Nov 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available


Cert. No.: 23TM375
Page : 2 of 3


Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.48	0.42	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.040	20.170	20.263	20.093	19.749	19.704	19.920	20.191	20.020	0.66

Average* : The average of 30 values in each position.
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity .
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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 เอกสารไม่ควบคุม
 a 1158259



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : Z304-0156OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available


Cert. No.: 23TM375
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.48	0.42	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.040	20.170	20.263	20.093	19.749	19.704	19.920	20.191	20.020	0.66

Average* : The average of 30 values in each position.
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity .
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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 a 1158258



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM377
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1410
ID No. : UAE.MIC.007/2558
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hlahib
Approved by :
() Pornthipha Tameyakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-4
Procedure Used :-

Cert. No.: 23TM377
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

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	34972A	MY49001451	23LM27	25 Feb 2024

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

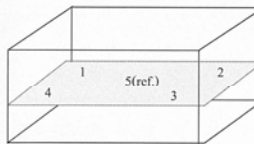
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	65	220
Finished of Calibration	30	70	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM377
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.494	44.459	44.477	44.507	44.498	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.13	0.056	2

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

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.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

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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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



Cert. No.: 23TM374
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1407
ID No. : UAE.MIC.006/2558
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 11 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Pornthipha Tameyakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-3
Procedure Used :-

Cert. No.: 23TM374
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

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	34972A	MY59003411	22LM165	26 Nov 2023

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

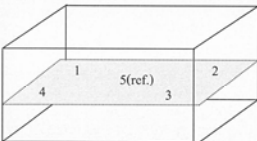
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	26	55	220
Finished of Calibration	25	56	221



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

Valu.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM374
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.508	44.466	44.456	44.478	44.483	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.065	0.031	2

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

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.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-o0o-

Valu.



Certificate of Calibration

Equipment: Autoclave
Model: CL-40L
Serial No. (or ID.): 810010
Manufacturer: ALP
Condition: In Condition

Certificate No.: C11230106
Issued Date: 11 June 2023
Job No.: KSPR2308770
Page: 1 of 4

Customer: United Analyst and Engineering Consultant Company Limited.
3 Soi Udumsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand.

Environment Condition: Temperature: 22 °C ± 0.8 °C
Humidity: 58 %RH ± 4.0 %RH
Voltage: 229 VAC ± 1.3 VAC

Calibration Place: United Analyst and Engineering Consultant Company Limited. (301 Room)
3 Soi Udumsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand.

Calibration By: Mr. Amornthep Phumtho

Calibration Date: 09 June 2023

The Method used: In house method, CAL-WI-18, base on BS 2646 : Part 5

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality reborn Co., Ltd.
Certificate No. QR23-0086

(Mr. Amornthep Phumtho)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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DKSH Technology Limited
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2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7300 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

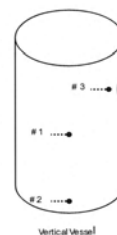
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CAL-FM-C11-15: 12 Sep 2022



Certificate No.: C11230106

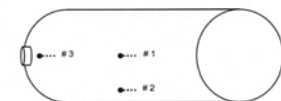
Page: 2 of 4



Vertical Vessel



Position of Standard
1: Center of Chamber
2: Temperature Sensor of UUC
3: Exhaust port



Horizontal Vessel



Standard Installation Locations

Standard Locations (#1): Geometric center of the chamber
Standard Locations (#2): Distance from temperature sensor of UUC 2 (cm.)
Standard Locations (#3): Distance from the wall 5 (cm.)

Position of Std	#1	#2	#3
Channel of Logger	4	5	6

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

บริษัท ดิกซ์ เทคโนโลยี จำกัด
DKSH Technology Limited
2533 หมู่ 9 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7300 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

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CAL-FM-C11-15: 12 Sep 2022

Calibration Results:
Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 115.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	115.34	0.34	0.35
#2	115.43	0.43	0.35
#3	115.43	0.43	0.35

Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty (± °C)*
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating Mpa	#1 (°C)	#2 (°C)	#3 (°C)	
115	115	115.0	0.08	115.34	115.43	115.43	0.35

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure Mpa	Measured Stability (± °C)
115.0	0.08	0.15

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 121.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	121.34	0.34	0.35
#2	121.40	0.40	0.35
#3	121.26	0.26	0.35

Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty (± °C)*
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating Mpa	#1 (°C)	#2 (°C)	#3 (°C)	
121	121	121.0	0.12	121.34	121.40	121.26	0.35

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure Mpa	Measured Stability (± °C)
121.0	0.12	0.07

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

The End of Certificate

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

CERTIFICATE OF CALIBRATION

Certificate No. : CL-008-66

Page 1 of 2 Pages

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

: Top-Load Orifice
: TISCH
: TE-5028A
: 2926
: -
: Used item

: Integrated Research Center Company Limited.
122 Moo 2, Thatoom, Srirachaphote, Prachinburi 25140,
Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 20 Mar 2023
: 24 Apr 2023
: 24 Apr 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 24.4 °C and 51.3%RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Roots
Meter) Model G65/IMC/W2-4b. The W-CL-004
was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the
measurement to recognized the national
standards, and to realization of the international
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: G2211901

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

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (238.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.705	758.329	24.44	23.77	50.462	1.122	1.059	0.659
2	1.001	758.356	24.29	23.90	36.610	2.376	1.542	0.954
3	1.117	758.415	24.01	23.47	31.484	3.004	1.734	1.074
4	1.166	758.484	23.86	23.34	29.640	3.290	1.815	1.124
5	1.418	758.544	23.98	23.51	18.777	5.030	2.245	1.387

Slope (m): 1.62707

Intercept (b): -0.01273

Correlation coefficient (r): 0.99981

Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.705	758.329	24.44	23.77	50.462	1.122	0.664	0.659
2	1.001	758.356	24.29	23.90	36.610	2.376	0.965	0.954
3	1.117	758.415	24.01	23.47	31.484	3.004	1.085	1.073
4	1.166	758.484	23.86	23.34	29.640	3.290	1.135	1.122
5	1.418	758.544	23.98	23.51	18.777	5.030	1.404	1.385

Slope (m): 1.01912

Intercept (b): -0.00799

Correlation coefficient (r): 0.99981

Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☐ Mr. Sorajit Thachalad
☒ Miss Jittrapon Lertsomphol



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager



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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom, A.Srirachaphote, Prachinburi 25140

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : ACO
Model : 6236
Serial No. : 192014
Microphone : 7052NR No.73303
Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 13 Jan. 2023

Date of Calibration : 13 Feb. 2023

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FM.BLMTC.002 Rev.4

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Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust			
114.00	113.9	114.0	0.0	1.0	0.30
					N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.7	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	13.1	0.10	N/A
C-Weight	18.0	0.10	N/A
Flat	21.9	0.10	N/A

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0				
End	94.0	0.0	0.3	0.10	0.1

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat	
125	0.1	0.1	0.0	1.5
1 000	-0.6	-0.6	-0.5	1.0
8 000	-2.3	-2.5	-2.1	5.0

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat	
63	0.1	0.0	-0.1	2.0
125	0.0	0.0	-0.1	1.5
250	0.0	0.0	0.0	1.5
500	0.0	0.0	0.0	1.5
1 000	0.0	0.0	0.0	1.0
2 000	-0.1	0.0	-0.1	2.0
4 000	-0.4	-0.4	-0.1	3.0
8 000	-0.6	-0.6	-0.2	5.0

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
34	34.0	0.0	1.1	0.30	0.3
33	33.0	0.0	1.1	0.30	0.3
32	32.1	0.1	1.1	0.30	0.3
31	31.1	0.1	1.1	0.30	0.3
30	30.2	0.2	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 13 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
133.0	133.0	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : *Wittawat Supanich*
(Mr. Wittawat Supanich)

Approved by : *Prasert Khuyap*
(Mr. Prasert Khuyap)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 13 Feb. 2023

Date of Issue : 13 Feb. 2023

Ref : 2011266011300149010

End of Certificate

9 / 9

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FMBL.MTC.002 Rev.4

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Request No. 21-66/0219

MTC No. EEL. BP. 144/0166

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.3	0.3	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3
20-90	25	25.2	0.2	1.1	0.30	0.3
20-80	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.2	-0.8	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13 Feb. 2023

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FMBL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 141/0166

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2 T.Thatoom, A.Srimahaphote, Prachinburi 25140
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.
Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 00433730
Microphone : UC-52 No.144953
Preamplifier : NH-24 No.33780
Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa
Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 13 Jan. 2023

Date of Calibration : 7 Feb. 2023

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 7 Feb. 2023

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	-0.1	0.0	0.0	1.5	0.45	0.6
1 000	0.1	0.1	0.1	1.0	0.45	0.6
8 000	-2.5	-2.5	-2.6	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.1	0.1	2.0	0.20	0.6
125	0.0	0.1	0.1	1.5	0.20	0.6
250	0.0	0.1	0.1	1.5	0.20	0.6
500	0.0	0.1	0.1	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.2	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 7 Feb. 2023

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value(dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.97	114.1	114.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
17.0	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	12.4	0.10	N/A
C-Weight	17.7	0.10	N/A
Flat	23.1	0.10	N/A

Date of Calibration : 7 Feb. 2023

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5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0				
End	94.0	0.0	0.3	0.10	0.1

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 7 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 141/0166

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
128	128.1	0.1	1.1	0.30	0.3
127	127.1	0.1	1.1	0.30	0.3
126	126.1	0.1	1.1	0.30	0.3
125	125.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3

Date of Calibration : 7 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 141/0166

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
80-130	85	85.0	0.0	1.1	0.30	0.3
70-120	75	75.0	0.0	1.1	0.30	0.3
60-110	65	65.0	0.0	1.1	0.30	0.3
50-100	55	54.9	-0.1	1.1	0.30	0.3
40-90	45	44.9	-0.1	1.1	0.30	0.3
30-80	35	35.0	0.0	1.1	0.30	0.3
20-70	25	24.9	-0.1	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.1	0.1	±1.0	0.20	0.3
	2	99.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -5.0	0.20	0.3
SEL	200	110.0	0.0	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	81.0	0.0	+1.5; -5.0	0.20	0.3

Date of Calibration : 7 Feb. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0219

MTC No. EEL. BP. 141/0166

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	43.9	-0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
24	23.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
80-130	94.0	94.0	0.0	1.1	0.30	0.3
70-120	94.0	94.0	0.0	1.1	0.30	0.3
60-110	94.0	94.0	0.0	1.1	0.30	0.3
50-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 7 Feb. 2023

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Request No. 21-66/0219

MTC No. EEL. BP. 141/0166

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.6	136.6	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

Wittawat Supanich
(Mr. Wittawat Supanich)

Approved by :

Prasit Kiatyap
(Mr. Prasit Kiatyap)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 7 Feb. 2023

Date of Issue : 9 Feb. 2023

Ref : 2011266011300149007

End of Certificate

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Certificate of Calibration

Equipment: Balance
Model: BSA224S-CW
Serial No. (or ID.): 34490341
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01233749
Issued Date: 03 November 2023
Job No.: WO-00008313
Page: 1 of 2

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 23 °C ± 0.5 °C
Humidity 61 %RH ± 4.3 %RH

Calibration Place: Double A (1991) Public Company Limited.
(Water Laboratory IP1 (Balance Room))
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung

Calibration Date: 02 November 2023

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222418

Signature

(Mr. Piypat Saidoung)
Person in charge

Signature

(Mr. Rungrod Jenkitrakulchai)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Delivering Growth - in Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022

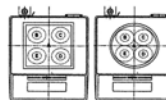
Certificate No.: C01233749

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 100 (g)

Reference Points (g)				
A	B	C	D	E
-	-0.0001	0.0000	0.0001	-0.0001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

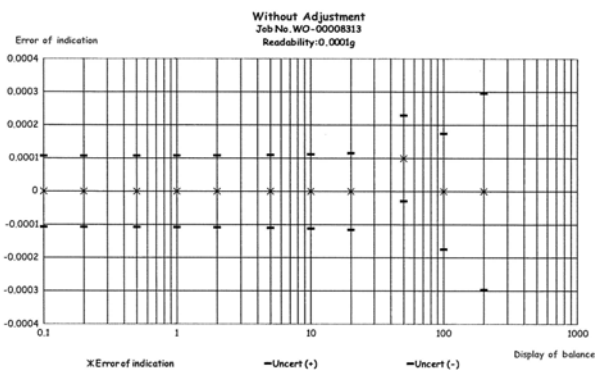
Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.1	0.10000	0.1000	0.0000	0.00011	2.04
0.2	0.20000	0.2000	0.0000	0.00011	2.04
0.5	0.50000	0.5000	0.0000	0.00011	2.04
1	1.00000	1.0000	0.0000	0.00011	2.04
2	2.00001	2.0000	0.0000	0.00011	2.04
5	4.99999	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	19.99998	20.0000	0.0000	0.00012	2.03
50	49.99994	50.0000	0.0001	0.00013	2.02
100	99.99997	100.0000	0.0000	0.00017	2.01
200	199.99993	199.9999	0.0000	0.00030	2.00

The End of Certificate

DKSH Technology Limited
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ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00008313

ชนิดเครื่องมือ: Balance

รุ่น: BSA224S-CW

หมายเลขเครื่อง: 34490341

ตรวจสอบ (วัน)		รายการตรวจสอบ	ตรวจสอบ (ครั้ง)		หมายเหตุ
02 Nov 2023			02 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระดกกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดกระดองระดับน้ำ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตรวจสอบถังของไม่เกิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและบน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติมอื่น ๆ :

Mr. Piypat Saidoung
Service Engineer

DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Certificate of Calibration

Certificate No.: C06230521 Page 2 of 3

Equipment: SPECTROPHOTOMETER
Model: DR3900
Serial No. (or ID.): 2008400
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230521
Issued Date: 03 November 2023
Job No.: WO-00008310
Page: 1 of 3

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 25.9 °C ± 0.2 °C
Humidity 65.0 %RH ± 2.7 %RH

Calibration Place: Double A (1991) Public Company Limited, (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr.Piyapat Saidoung
Calibration Date: 31 October 2023
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.
The standard for Wavelength Certificate No. 105931 and 111584
The standard for Photometric Certificate No. 105940
The standard for Stray light Certificate No. 101040

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.40	418	0.40	0.59	
459.30	459	0.30	0.59	
638.00	638	0.00	0.59	
585.56	586	-0.44	0.59	
747.61	748	-0.39	0.59	
807.04	807	0.04	0.59	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5890	0.588	0.0010	0.0045
	0.7604	0.759	0.0014	0.0045
440 nm	1.0241	1.024	0.0001	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5782	0.577	0.0012	0.0045
465 nm	0.7430	0.740	0.0030	0.0045
	1.0016	1.001	0.0006	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5283	0.529	-0.0007	0.0045
	0.6854	0.685	0.0004	0.0045
	0.9509	0.951	-0.0001	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5457	0.544	0.0017	0.0045
	0.6944	0.692	0.0024	0.0045
635 nm	0.9965	0.995	0.0015	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5837	0.581	0.0027	0.0045
635 nm	0.7223	0.718	0.0043	0.0045
	1.0935	1.089	0.0045	0.0045
	0.0000	0.000	0.0000	0.0045
635 nm	0.5675	0.565	0.0025	0.0045
	0.6900	0.686	0.0040	0.0045
	1.0862	1.083	0.0032	0.0045

เพื่อความสะดวกแก่ผู้รับใช้
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CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230521 Page 3 of 3

Calibration Results: Without Adjustment

Stray light *	Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
	391.94 +/- 0.11 nm	392	4.2	1.377

* Calibration Marked * Not TISI Accredited * in this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: SPECTROPHOTOMETER		รุ่น: DR3900	หมายเลขเครื่อง: 2008400	
ตรวจสอบ (รับ)		31 Oct 2023	ตรวจสอบ (ส่ง)	
รายการตรวจเช็ค		31 Oct 2023		หมายเหตุ
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Spectrophotometer				
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	807nm=807.0nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องจัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>
pH Meter and Conductivity Meter				
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระบบสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันเปื้อน Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>
Turbidimeter				
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระบบการส่องสว่างของแสง (>= 2.5 ไม่นับ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>
Automatic titrator				
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาวะ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>

เพิ่มเติมข้อแนะนำ :

Mr.Piyapat Saidoung
Service Engineer

เพื่อความสะดวกแก่ผู้รับใช้
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CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Certificate No.: C06230520 Page 2 of 3

Equipment: SPECTROPHOTOMETER
Model: DR3900
Serial No. (or ID.): 1918120
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230520
Issued Date: 03 November 2023
Job No.: WO-00008310
Page: 1 of 3

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 25.9 °C ± 0.2 °C
Humidity 65.0 %RH ± 2.7 %RH

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr.Piyapat Saidoung
Calibration Date: 31 October 2023
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.
The standard for Wavelength Certificate No. 105931 and 111584
The standard for Photometric Certificate No. 105940
The standard for Stray light Certificate No. 101040

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) 95% provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.
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CAL-FM-C06-15: 12 Sep 2023

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.40	418	0.40	0.59	
459.30	459	0.30	0.59	
638.00	638	0.00	0.59	
585.56	586	-0.44	0.59	
747.61	748	-0.39	0.59	
807.04	807	0.04	0.59	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5890	0.588	0.0010	0.0045
	0.7604	0.758	0.0024	0.0045
440 nm	1.0241	1.024	0.0001	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5782	0.577	0.0012	0.0045
465 nm	0.7430	0.740	0.0030	0.0045
	1.0016	1.001	0.0006	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5283	0.529	-0.0007	0.0045
	0.6854	0.685	0.0004	0.0045
	0.9509	0.952	-0.0011	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5457	0.544	0.0017	0.0045
	0.6944	0.692	0.0024	0.0045
635 nm	0.9965	0.995	0.0015	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5837	0.581	0.0027	0.0045
807 nm	0.7223	0.719	0.0033	0.0045
	1.0935	1.090	0.0035	0.0045
	0.0000	0.000	0.0000	0.0045
870 nm	0.5675	0.565	0.0025	0.0045
	0.6900	0.687	0.0030	0.0045
	1.0862	1.084	0.0022	0.0045

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CAL-FM-C06-15: 12 Sep 2023



Certificate No.: C06230520 Page 3 of 3



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00008310

Calibration Results: Without Adjustment

Stray light *	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
Standard: cut-off			
391.94 +/- 0.11 nm	392	3.5	1.456

* Calibration Marked * Not TISI Accredited * in this Certificate have been included for completeness.

The End of Certificate

ชนิดเครื่องมือ: SPECTROPHOTOMETER		รุ่น: DR3900	หมายเลขเครื่อง: 1918120	
ตรวจสอบ (รับ)		ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2023		31 Oct 2023		
ปกติ	ไม่ปกติ			
		ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ซอสใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Spectrophotometer				
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	807nm=807.2nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. ซอรั่วหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>
pH Meter and Conductivity Meter				
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>
Turbidimeter				
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นับ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>
Automatic titrator				
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและระบบโปรแกรม	<input type="checkbox"/>	<input type="checkbox"/>

เพิ่มเติมข้อแนะนำ :

Mr.Piyapat Saidoung
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
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CAL-FM-C06-15: 12 Sep 2023

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CAL-FM-R31-03: 20 Jul 2022



Certificate No.: C07230542 Page 2 of 3

Certificate of Calibration

Equipment: pH METER
Model: SevenEasy
Serial No. (or ID.): 1232025225
Manufacturer: Mettler Toledo
Electrode Serial No.: 1220653
Condition: In Condition

Certificate No.: C07230542
Issued Date: 3 November 2023
Job No.: WO-00008310
Page: 1 of 3
Model: 405-60-T-PA-S8/120 pH Brand: Mettler Toledo

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 26.5 °C ± 0.2 °C
Humidity 66.5 %RH ± 2.2 %RH

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
Calibration Date: 1 November 2023
The Method used: In house method, CAL-WI-58, base on ASTM E 70-07
Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 873613, 873615, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

(Mr. Piypat Saidoung)

Person in charge

(Mr. Nitinun Srihawan)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C07-13: 12 Sep 2022

Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(mV)	Error (mV) (pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	236	-0.64	3.00	0.58	2.00
177.48	177	-0.48	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-119	-0.68	9.00	0.58	2.00
-177.48	-178	-0.52	10.00	0.58	2.00
-236.64	-237	-0.36	11.00	0.58	2.00
-295.8	-296	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	13.99	0.58	2.00

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CAL-FM-C07-13: 12 Sep 2022



Certificate No.: C07230542 Page 3 of 3



Electrode Test Results*

The three-point calibration using three standard buffer solutions; pH 4.008, pH 6.986 and pH 9.997

-During calibration, display of pH meter reading: pH 4.00, pH 7.00 and pH 10.01

The practical slope of the pH electrode; 57.91 (mV/pH), 97.88%

The zero point of the pH electrode; 7.10 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.00	-0.008	0.0072	2.00
6.986	7.00	0.014	0.010	2.00
9.997	10.01	0.013	0.014	2.00

* Calibration Marked * Not TISI Accredited * in this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: pH METER

รุ่น: SevenEasy

หมายเลขเครื่อง: 1232025225

ตรวจสอบ (วัน)	รายการตรวจเช็ค	ตรวจสอบ (ตั้ง)		หมายเหตุ
		ปกติ	ไม่ปกติ	
01 Nov 2023				
ปกติ	ไม่ปกติ			
	General			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/> 6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 7. ตัวหน่วงเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
	pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 12. อินดิเคเตอร์ (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 13. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 15. ขาตั้งอินดิเคเตอร์ (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
	Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/> 16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 17. ระดับการล้นสีของแสง (>= 2.5 ไม่นาที 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
	Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/> 18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> 20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติมข้อแนะนำ:

Mr. Piypat Saidoung
Service Engineer

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CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Certificate No.: C15231038

Page: 2 of 2

Equipment: Digital Thermometer with Probe
 Model: SevenEasy
 Serial No.: 1232025225
 Manufacturer: Mettler Toledo
 Condition: In Condition

Certificate No.: C15231038
 Issued Date: 03 November 2023
 Job No.: WO-00008310
 ID No.: -
 Page: 1 of 2

Customer: Integrated Research Center Co.,Ltd.
 122 Moo 2, Tambol Thatoom,
 Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 30 °C ± 10 °C
 Humidity: 55 %RH ± 25 %RH
 Voltage: 220 VAC ± 10 %

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
 1 Moo 2, Thatoom, Srimahaphot,
 Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
 Calibration Date: 31 October 2023
 The Method used: In house method, CAL-WI-69, by comparison with standard thermometer
 Traceability: This certificate is traceable to the International System of Unit maintained by Quality Reborn Co.,Ltd. (QR) Certificate No. QR22-2916

(Mr. Piypat Saidoung)
 Person in charge

(Mr. Pramote Ramrong)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C15-14: 06 Dec 2022

Calibration Results:

Without Adjustment

Sensor Type: RTD

Channel: Correction

Diameter (mm): 15

Length (mm): 120

Immersion (mm): 110

Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
25.0	24.994	25.0	-0.006	0.20

The End of Certificate

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CAL-FM-C15-14: 06 Dec 2022

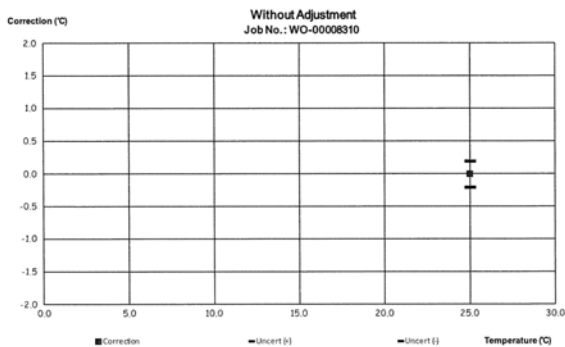
ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Digital Thermometer with Probe

รุ่น: SevenEasy

หมายเลขเครื่อง: 1232025225



ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)	หมายเหตุ
31-Oct-2023		31-Oct-2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
	General		
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. Adapter / Power supply 220 / 110 VAC	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> 6. Battery	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. สภาพพื้นเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. สภาพ Sensor (In / Ex)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ขอแนะนำ :

Mr. Piypat Saidoung
 Service Engineer

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Certificate of Calibration

Certificate No.: C07230543 Page 2 of 3

Equipment: pH METER
Model: SevenGo S2
Serial No. (or ID.): B633886757
Manufacturer: Mettler Toledo
Electrode Serial No.: 2351365
Condition: In Condition

Certificate No.: C07230543
Issued Date: 3 November 2023
Job No.: WO-00008310
Page: 1 of 3
Model: InLabExpertGo-ISM Brand: Mettler Toledo

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 26.5 °C ± 0.2 °C
Humidity 66.5 %RH ± 2.2 %RH

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
Calibration Date: 31 October 2023
The Method used: In house method, CAL-WI-58, base on ASTM E 70-07
Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 873613, 873615, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

(Mr. Piypat Saidoung)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C07-13: 12 Sep 2022

Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(mV)	Error (mV)		
414.12	414	-0.12	0.02	0.58	2.00
354.96	355	0.04	1.02	0.58	2.00
295.8	295	-0.80	2.02	0.58	2.00
236.64	236	-0.64	3.02	0.58	2.00
177.48	177	-0.48	4.01	0.58	2.00
118.32	118	-0.32	5.01	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	8.99	0.58	2.00
-177.48	-177	0.48	9.99	0.58	2.00
-236.64	-236	0.64	10.98	0.58	2.00
-295.8	-295	0.80	11.98	0.58	2.00
-354.96	-355	-0.04	12.98	0.58	2.00
-414.12	-414	0.12	13.98	0.58	2.00

บริษัท เทคโนโลยี เคเอสเอช จำกัด
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CAL-FM-C07-13: 12 Sep 2022



Certificate No.: C07230543 Page 3 of 3



Electrode Test Results*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.986 and pH 9.997
-During calibration, display of pH meter reading: pH 4.01 , pH 7.00 and pH 10.01
The practical slope of the pH electrode; 57.84 (mV/pH), 97.77%
The zero point of the pH electrode; 7.08 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.01	0.002	0.0072	2.00
6.986	7.00	0.014	0.011	2.00
9.997	10.01	0.013	0.014	2.00

* Calibration Marked * Not TISI Accredited * In this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: pH METER รุ่น: SevenGo S2 หมายเลขเครื่อง: B633886757

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2023			31 Oct 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ซองใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Spectrophotometer					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ซองวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
pH Meter and Conductivity Meter					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อินดิเคเตอร์ (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาจับอินดิเคเตอร์ (Stand)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Turbidimeter					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นาที 3.0)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Automatic titrator					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. สภาพ Piston Burettes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

เพิ่มเติมข้อมูล:

Mr.Piypat Saidoung
Service Engineer

บริษัท เทคโนโลยี เคเอสเอช จำกัด
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CAL-FM-C07-13: 12 Sep 2022

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CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Certificate No.: C15231039

Page: 2 of 2

Equipment: Digital Thermometer with Probe
 Model: Seven2Go S2
 Serial No.: B633886757
 Manufacturer: Mettler Toledo
 Condition: In Condition

Certificate No.: C15231039
 Issued Date: 03 November 2023
 Job No.: WO-00008310
 ID No.: -
 Page: 1 of 2

Customer: Integrated Research Center Co.,Ltd.
 122 Moo 2, Tambol Thatoom,
 Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 30 °C ± 10 °C
 Humidity: 55 %RH ± 25 %RH
 Voltage: 220 VAC ± 10 %

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
 1 Moo 2, Thatoom, Srimahaphot,
 Prachinburi 25140 Thailand.

Calibration By: Mr. Piypat Saidoung
 Calibration Date: 31 October 2023
 The Method used: In house method, CAL-WI-69, by comparison with standard thermometer
 Traceability: This certificate is traceable to the International System of Unit maintained by Quality Reborn Co.,Ltd. (QR) Certificate No. QR22-2916

(Mr. Piypat Saidoung)
 Person in charge

(Mr. Pramote Ramrong)
 Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

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CAL-FM-C15-14: 06 Dec 2022

Calibration Results:

Without Adjustment

Sensor Type: RTD			Channel: Correction	
Diameter (mm) 15		Length (mm): 120	Immersion (mm): 110	
Calibrate Point.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
25.0	24.996	25.1	-0.104	0.20

The End of Certificate

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 DKSH Technology Limited
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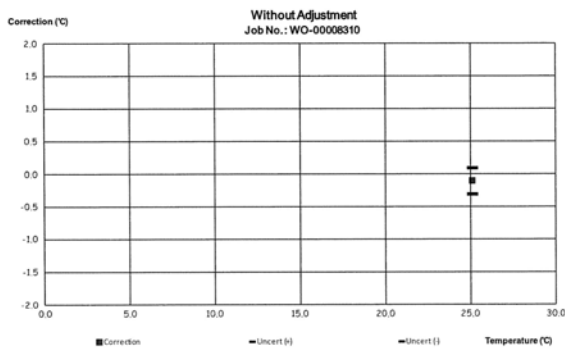
CAL-FM-C15-14: 06 Dec 2022

ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Digital Thermometer with Probe
 หมายเลขเครื่อง: B633886757

รุ่น: Seven2Go S2



ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
31-Oct-2023	31-Oct-2023	
ปกติ	ไม่ปกติ	
General		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Main Switch
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การทำงาน Selector Key
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การแสดงผล Display
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Battery
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพผิวเครื่อง
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Sensor (In / Ex)

ขอแนะนำ :

Mr. Piypat Saidoung
 Service Engineer

บริษัท ดิกซ์ เทคโนโลยี จำกัด
 DKSH Technology Limited
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Certificate of Calibration

Certificate No.: C31232274

Page: 2 of 4

Equipment: Hot Air Oven
Model: UF110
Serial No.(or ID): B417.1014
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31232274
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 4
Ventilation Valve: Closed

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 1.0 °C
Humidity: 54 %RH ± 5.1 %RH
Voltage: 230 VAC ± 3.2 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 01 November 2023
The Method used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230001

(Mr. Suphanimit Khamnonphoem)
Person in charge

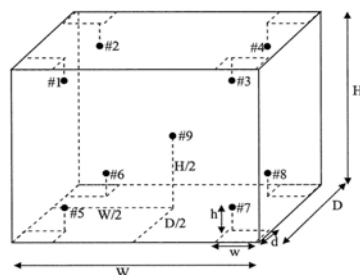
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C31-10: 12 Sep 2022



Standard Installation Locations

Volume (Calibration Zone)= 50 (Liters)

Inside chamber: W = 56 (cm) D = 40 (cm) H = 48 (cm)

Standard Locations (#1, #2, #3, #4): w = 6 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 6 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

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CAL-FM-C31-10: 12 Sep 2022

Certificate No.: C31232274

Page: 3 of 4

Calibration Results:
Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
180.0 180.0 181.69 180.65 181.55 180.91 179.79 179.96 179.14 179.90 180.11

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.57	0.57	0.39
#2	104.23	0.23	0.39
#3	104.52	0.52	0.39
#4	104.30	0.30	0.39
#5	103.71	-0.29	0.39
#6	103.85	-0.15	0.39
#7	103.47	-0.53	0.39
#8	103.85	-0.15	0.39
#9	103.90	-0.10	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.57	104.23	104.52	104.30	103.71	103.85	103.47	103.85	103.90	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.70	0.07	1.20

Note: * Maximum uncertainty of the each position

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CAL-FM-C31-10: 12 Sep 2022

Certificate No.: C31232274

Page: 4 of 4

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	181.34	1.34	0.51
#2	180.32	0.32	0.50
#3	181.19	1.19	0.50
#4	180.56	0.56	0.50
#5	179.41	-0.59	0.50
#6	179.63	-0.37	0.50
#7	178.79	-1.21	0.50
#8	179.57	-0.43	0.50
#9	179.77	-0.23	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180.0	180.0	180.0	181.34	180.32	181.19	180.56	179.41	179.63	178.79	179.57	179.77	0.51

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.66	0.12	2.75

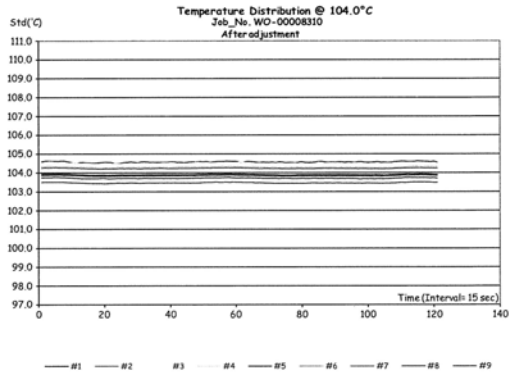
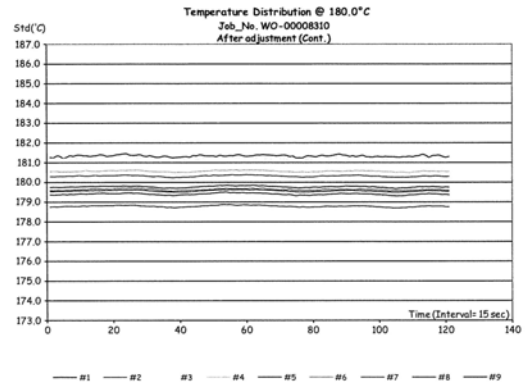
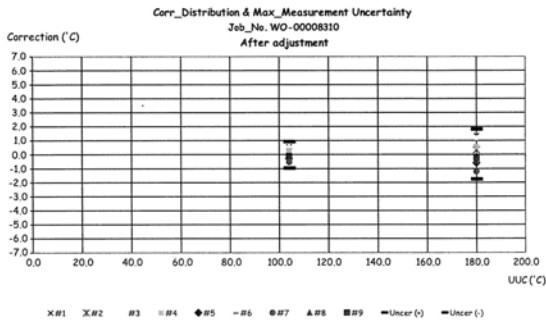
Note: * Maximum uncertainty of the each position

The End of Certificate

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CAL-FM-C31-10: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Hot Air Oven
หมายเลขเครื่อง: B417.1014

รุ่น: UF110

ตรวจสอบ (วัน)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)	หมายเหตุ
01 Nov 2023		01 Nov 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> 10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input type="checkbox"/>	<input type="checkbox"/> 11. การทำงานของระบบทำความชื้น	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/> 12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ข้อแนะนำ:

Mr. Suphanimit Khamnonphoem
Service Engineer



Certificate of Calibration

Equipment: Oven
Model: ED 115
Serial No.(or ID): 2019000012946
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31232273
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 4
Ventilation Valve: Closed

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.9 °C
Humidity: 54 %RH ± 5.1 %RH
Voltage: 230 VAC ± 3.2 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 01 November 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230001

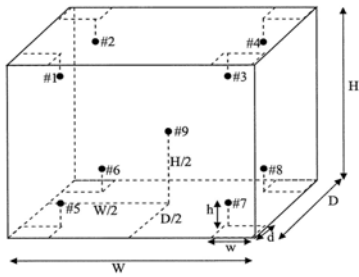
(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

**Standard Installation Locations**

Volume (Calibration Zone) = 62 (Liters)

Inside chamber: W = 60 (cm) D = 40 (cm) H = 53 (cm)

Standard Locations (#1, #2, #3, #4): w = 6 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 6 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Calibration Results:**Before adjustment**

Setting: 104 Indicating: 104 #1: 103.37 #2: 103.16 #3: 103.45 #4: 103.03 #5: 101.07 #6: 100.53 #7: 100.78 #8: 100.26 #9: 100.33

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	105.80	1.80	0.79
#2	105.65	1.65	0.80
#3	105.85	1.85	0.79
#4	105.45	1.45	0.80
#5	104.19	0.19	0.80
#6	103.85	-0.15	0.80
#7	104.09	0.09	0.81
#8	103.91	-0.09	0.82
#9	104.03	0.03	0.82

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104	104	104	105.80	105.65	105.85	105.45	104.19	103.85	104.09	103.91	104.03	0.82

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	1.94	0.17	2.19

Note: * Maximum uncertainty of the each position

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CAL-FM-C31-10: 12 Sep 2022

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 177 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	180.97	3.97	0.83
#2	180.96	3.96	0.84
#3	180.99	3.99	0.84
#4	180.63	3.63	0.84
#5	180.12	3.12	0.85
#6	179.31	2.31	0.85
#7	179.84	2.84	0.87
#8	179.41	2.41	0.86
#9	178.94	1.94	0.86

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180	177	177	180.97	180.96	180.99	180.63	180.12	179.31	179.84	179.41	178.94	0.87

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
177	2.20	0.25	2.34

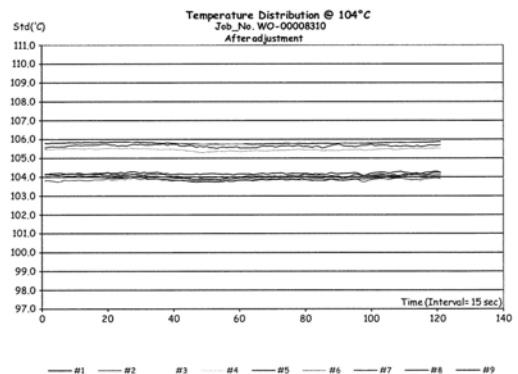
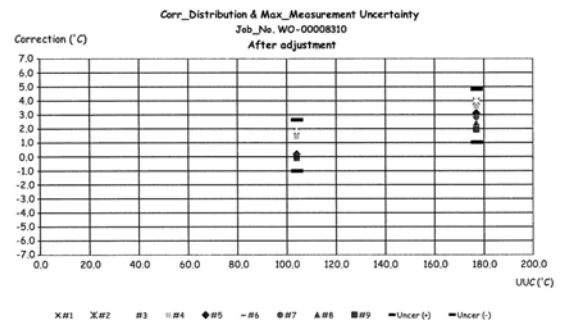
Note: * Maximum uncertainty of the each position

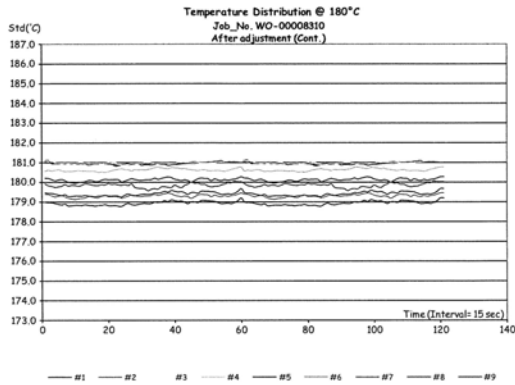
The End of Certificate

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ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Oven

รุ่น: ED 115

หมายเลขเครื่อง: 2019000012946

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
01 Nov 2023			01 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ:

Mr. Suphanimit Khamnonphoom
Service Engineer

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 หมู่ 9 ตำบลบางจาก เขตภาษีเจริญ กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate No.: C31232272

Page: 2 of 4



Certificate of Calibration

Equipment: Oven
Model: ED 115
Serial No.(or ID): 950360
Manufacturer: Binder
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31232272
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 4
Ventilation Valve: Closed

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 1.0 °C
Humidity: 54 %RH ± 5.1 %RH
Voltage: 230 VAC ± 3.2 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoom
Calibration Date: 01 November 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230001

(Mr. Suphanimit Khamnonphoom)
Person in charge

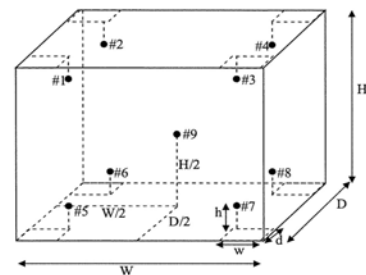
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 หมู่ 9 ตำบลบางจาก เขตภาษีเจริญ กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Standard Installation Locations

Volume (Calibration Zone)= 22 (Liters)

Inside chamber: W = 60 (cm) D = 40 (cm) H = 48 (cm)

Standard Locations (#1, #2, #3, #4): w = 10 (cm) d = 10 (cm) h = 10 (cm)

Standard Locations (#5, #6, #7, #8): w = 10 (cm) d = 10 (cm) h = 10 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
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2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
104 104 105.17 105.35 105.61 105.33 104.22 104.75 104.49 104.66 105.10

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	103.97	-0.03	0.70
#2	104.11	0.11	0.71
#3	104.29	0.29	0.71
#4	104.06	0.06	0.71
#5	103.01	-0.99	0.71
#6	103.43	-0.57	0.77
#7	103.22	-0.78	0.72
#8	103.48	-0.52	0.77
#9	103.88	-0.12	0.73

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104	104	104	103.97	104.11	104.29	104.06	103.01	103.43	103.22	103.48	103.88	0.77

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	1.04	0.30	1.53

Note: * Maximum uncertainty of the each position

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 181 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	179.71	-1.29	0.72
#2	180.55	-0.45	0.72
#3	180.27	-0.73	0.71
#4	180.36	-0.64	0.71
#5	179.16	-1.84	0.71
#6	179.74	-1.26	0.77
#7	179.26	-1.74	0.72
#8	180.47	-0.53	0.76
#9	180.05	-0.95	0.74

Temperature Distribution

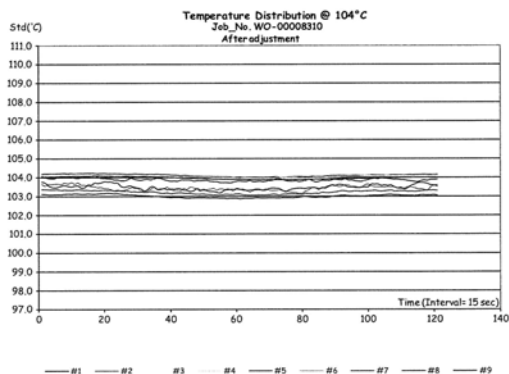
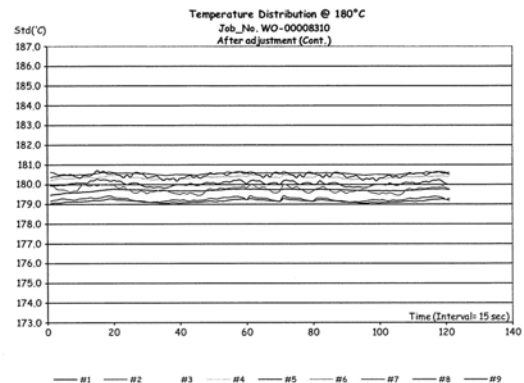
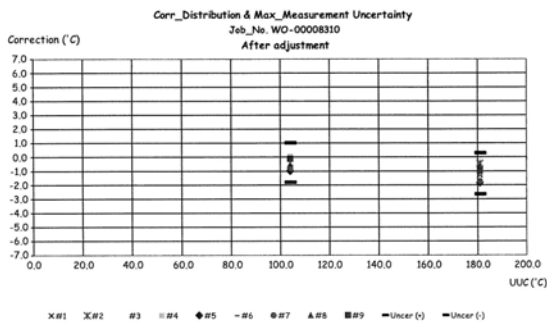
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180	181	181	179.71	180.55	180.27	180.36	179.16	179.74	179.26	180.47	180.05	0.77

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
181	1.09	0.28	1.68

Note: * Maximum uncertainty of the each position

The End of Certificate





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-0008310

ชนิดเครื่องมือ: Oven
หมายเลขเครื่อง: 950360

รุ่น: ED 115

ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		01 Nov 2023	01 Nov 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตู้เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ข้อเสนอแนะ:

Mr. Suphanimit Khamnonphoom
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ 9 ตำบลบางจาก อำเภอบางพลี จังหวัดสมุทรปราการ 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
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Certificate of Calibration

Equipment: Liquid Bath
Model: WNB22/MAC5A
Serial No. (or ID.): L518.0690
Manufacturer: Memmert/SHIMAX
Condition: In Condition
Forced Circulation: None
Certificate No.: C13230363
Issued Date: 09 November 2023
Job No.: WO-0008310
Page: 1 of 3
Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand
Environment Condition: Temperature: 25 °C ± 0.5 °C
Humidity: 54 %RH ± 4.8 %RH
Voltage: 230 VAC ± 3.4 VAC
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.
Calibration By: Mr. Suphanimit Khamnonphoom
Calibration Date: 02 November 2023
The Method used: In house method, CAL-WI-17, base on ASTM E715-80
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230001

(Mr. Suphanimit Khamnonphoom)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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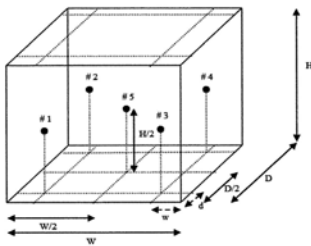
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CAL-FM-C13-13: 12 Sep 2022



Certificate No.: C13230363

Page: 2 of 3



Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 36 (cm) D = 32 (cm) H = 24 (cm) Volume = 28 (Liters)

Standard Locations #1: w = 5 (cm) d = 5 (cm)

Standard Locations #2: w = 5 (cm) d = 5 (cm)

Standard Locations #3: w = 5 (cm) d = 5 (cm)

Standard Locations #4: w = 5 (cm) d = 5 (cm)

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	301	302	303	304	305

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the bath.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

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CAL-FM-C13-13: 12 Sep 2022



Certificate No.: C13230363

Page: 3 of 3

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	84.99	-0.01	0.33
#2	85.09	0.09	0.38
#3	84.91	-0.09	0.37
#4	84.84	-0.16	0.37
#5	84.88	-0.12	0.37

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
85.0	85.0	85.0	84.99	85.09	84.91	84.84	84.88	0.38

Bath Characterization

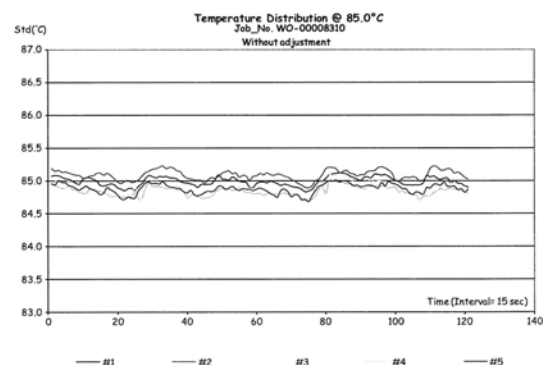
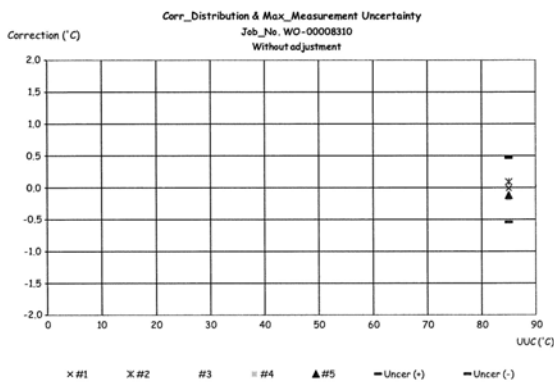
Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
85.0	0.35	0.17	0.54

Note: * Maximum uncertainty of the each position

The End of Certificate

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CAL-FM-C13-13: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Liquid Bath

รุ่น: WNB22/MAC5A

หมายเลขเครื่อง: L518.0690

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
02 Nov 2023			02 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน Circulator	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever door open / close	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ท่อระบายน้ำทิ้ง (DRAIN)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ:

Mr. Suphanimit Khamnonphoom
Service Engineer

DKSH Technology Limited
2533 หมู่ 2 ตำบลท่าช้าง อำเภอเมือง จังหวัดสุพรรณบุรี 19200
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Certificate of Calibration

Certificate No.: C13230362

Page: 2 of 3

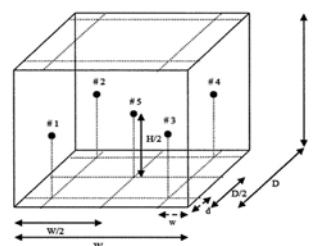
Equipment: Liquid Bath
Model: WNB22/TCN4L
Serial No. (or ID.): L508.0973
Manufacturer: Memmert/Autronics
Condition: In Condition
Forced Circulation: None

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 25 °C ± 1.1 °C
Humidity: 55 %RH ± 5.2 %RH
Voltage: 230 VAC ± 3.3 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoom
Calibration Date: 31 October 2023
The Method used: In house method, CAL-WI-17, base on ASTM E715-80
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230001



Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 36 (cm) D = 32 (cm) H = 24 (cm) Volume = 28 (Liters)

Standard Locations #1: w = 5 (cm) d = 5 (cm)

Standard Locations #2: w = 5 (cm) d = 5 (cm)

Standard Locations #3: w = 5 (cm) d = 5 (cm)

Standard Locations #4: w = 5 (cm) d = 5 (cm)

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	301	302	303	304	305

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the bath.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.(Mr. Suphanimit Khamnonphoom)
Person in charge(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

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CAL-FM-C13-13: 12 Sep 2022

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CAL-FM-C13-13: 12 Sep 2022



Certificate No.: C13230362

Page: 3 of 3

Calibration Results:**Before adjustment**

Setting: Indicating: #1: #2: #3: #4: #5:
85 85 85.55 85.69 85.53 85.55 85.49

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	84.62	-0.38	1.4
#2	84.76	-0.24	1.3
#3	84.60	-0.40	1.3
#4	84.62	-0.38	1.4
#5	84.56	-0.44	1.3

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
85	85	85	84.62	84.76	84.60	84.62	84.56	1.4

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
85	0.32	0.63	1.39

Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH Technology Limited
2533 หมู่ 2 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C13-13: 12 Sep 2022

**ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ**

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Liquid Bath

รุ่น: WNB22/TCN4L

หมายเลขเครื่อง: L508.0973

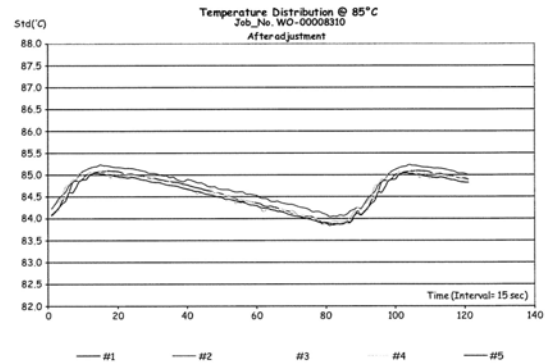
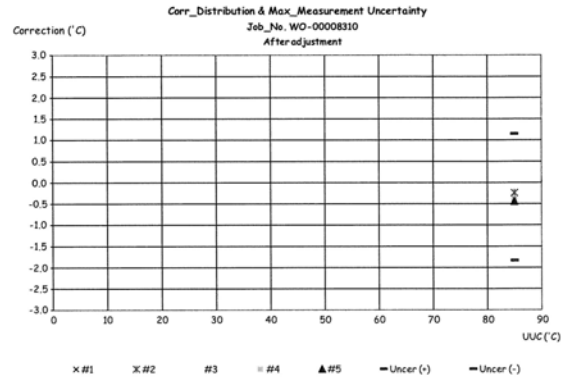
ตรวจสอบ (วัน)	รายการตรวจสอบ		ตรวจสอบ (ครั้ง)	หมายเหตุ	
31 Oct 2023			31 Oct 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
	General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน Circulator	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ท่อระบายน้ำทิ้ง (DRAIN)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. สภาพตู้เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ลงนาม: _____

Mr. Suphanimit Khamnonphom
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ 2 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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**Certificate of Calibration**

Equipment: Cooled Incubator
Model: ESCC
Serial No.(or ID): 03021
Manufacturer: OmRon
Condition: In Condition
Shelves(pc.): 9

Certificate No.: C31232275
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 3
Ventilation Valve: None

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.4 °C
Humidity: 52 %RH ± 5.3 %RH
Voltage: 231 VAC ± 3.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphote,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphom
Calibration Date: 30 October 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230001

_____ (Mr. Suphanimit Khamnonphom)
Person in charge

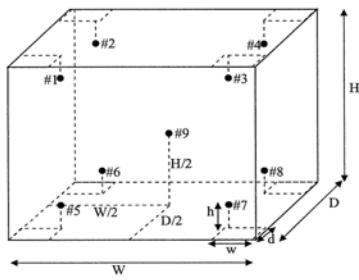
_____ (Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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DKSH Technology Limited
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CAL-FM-C31-10: 12 Sep 2022



Standard Installation Locations

Volume (Calibration Zone) = 422 (Liters)

Inside chamber: W = 110 (cm) D = 60 (cm) H = 160 (cm)

Standard Locations (#1, #2, #3, #4): w = 11 (cm) d = 6 (cm) h = 30 (cm)

Standard Locations (#5, #6, #7, #8): w = 11 (cm) d = 6 (cm) h = 30 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 หมู่ 5 ตำบลบางจาก เขตภาษีเจริญ กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phra Prathung, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 21 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	20.39	-0.61	0.63
#2	20.32	-0.68	0.64
#3	20.39	-0.61	0.65
#4	20.34	-0.66	0.64
#5	20.00	-1.00	0.73
#6	20.05	-0.95	0.68
#7	20.08	-0.92	0.67
#8	20.10	-0.90	0.66
#9	20.07	-0.93	0.71

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20	20	21	20.39	20.32	20.39	20.34	20.00	20.05	20.08	20.10	20.07	0.73

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
21	0.51	0.34	0.86

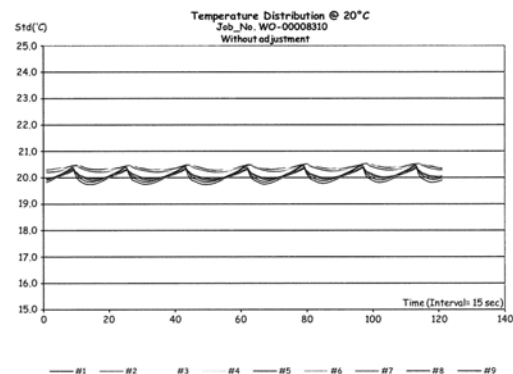
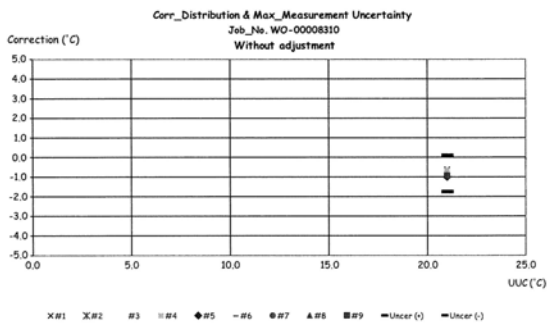
Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 หมู่ 5 ตำบลบางจาก เขตภาษีเจริญ กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phra Prathung, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-0008310

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: E5CC

หมายเลขเครื่อง: 03021

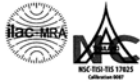
ตรวจสอบ (วัน)	รายการตรวจเช็ค	ตรวจสอบ (ตั้ง)	หมายเหตุ
30 Oct 2023		30 Oct 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
	General		
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> 6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> 11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/> 12. สภาพตู้เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ชื่อเจ้าหน้าที่:

Mr. Suphanimit Khamnonphom
Service Engineer

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 หมู่ 5 ตำบลบางจาก เขตภาษีเจริญ กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phra Prathung, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Certificate No.: C31232276

Page: 2 of 4

Equipment: Cooled Incubator
Model: i250
Serial No.(or ID): 0213-0004
Manufacturer: Accuplus
Condition: In Condition
Shelves(pc.): 4

Certificate No.: C31232276
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 4
Ventilation Valve: None

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.5 °C
Humidity: 52 %RH ± 5.3 %RH
Voltage: 231 VAC ± 3.6 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2023
The Method used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230001

(Mr. Suphanimit Khamnonphoem)
Person in charge

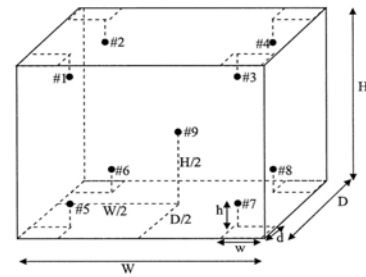
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C31-10: 12 Sep 2022



Standard Installation Locations

Volume (Calibration Zone) = 114 (Liters)

Inside chamber: W = 50 (cm) D = 48 (cm) H = 106 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 20 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 11 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

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CAL-FM-C31-10: 12 Sep 2022

Certificate No.: C31232276

Page: 3 of 4

Calibration Results:
Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.07	0.07	0.31
#2	20.09	0.09	0.37
#3	20.11	0.11	0.33
#4	19.91	-0.09	0.47
#5	19.99	-0.01	0.29
#6	19.97	-0.03	0.29
#7	20.02	0.02	0.34
#8	19.84	-0.16	0.30
#9	19.90	-0.10	0.35

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
20.0	20.0	20.0	20.07	20.09	20.11	19.91	19.99	19.97	20.02	19.84	19.90	0.47

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.25	0.37	0.84

Note: * Maximum uncertainty of the each position

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CAL-FM-C31-10: 12 Sep 2022

Certificate No.: C31232276

Page: 4 of 4

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 29.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	28.75	-0.25	0.30
#2	28.77	-0.23	0.33
#3	28.60	-0.40	0.29
#4	28.64	-0.36	0.38
#5	28.71	-0.29	0.28
#6	28.71	-0.29	0.28
#7	28.81	-0.19	0.31
#8	28.62	-0.38	0.30
#9	28.64	-0.36	0.34

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
29.0	29.0	29.0	28.75	28.77	28.60	28.64	28.71	28.71	28.81	28.62	28.64	0.38

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
29.0	0.22	0.28	0.70

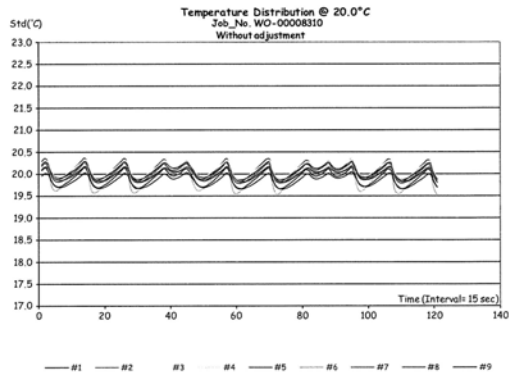
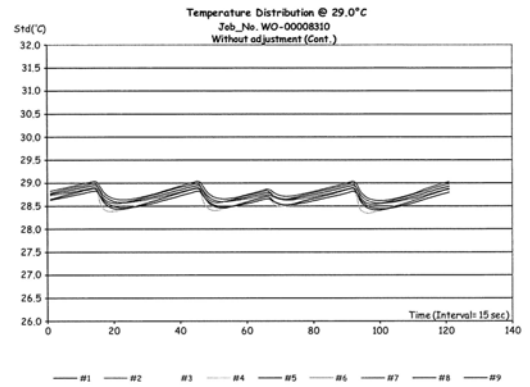
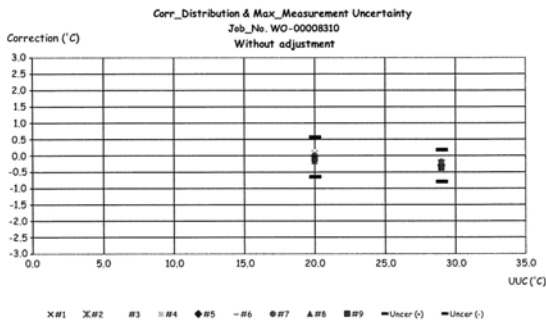
Note: * Maximum uncertainty of the each position

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CAL-FM-C31-10: 12 Sep 2022

The End of Certificate



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

Certificate of Calibration

ชนิดเครื่องมือ: Cooled Incubator รุ่น: I250
หมายเลขเครื่อง: 0213-0004 เลขที่ใบงาน: WO-00008310

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
31 Oct 2023			31 Oct 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ : _____

Mr. Suphanimit Khamnonphoem
Service Engineer

Equipment: COD Reactor
Model: DRB200
Serial No. (or ID.): 19070C0337
Manufacturer: Hach
Condition: In Condition
Covers: Open (Max) Locations heating Block: Left and Right

Certificate No.: C17230188
Issued Date: 09 November 2023
Job No.: WO-00008310
Page: 1 of 5

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.7 °C
Humidity: 52 %RH ± 4.8 %RH
Voltage: 231 VAC ± 2.5 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

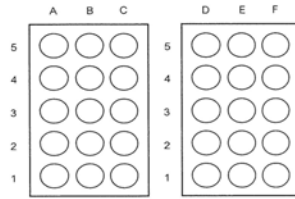
Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2023

The Method used: In house method, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230001

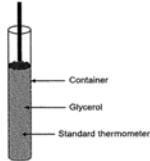
(Mr. Suphanimit Khamnonphoem)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.



Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Calibration Results: Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Left	150	150
Right	150	150

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	149.09	-0.91	0.65
A2	149.43	-0.57	0.66
A3	151.24	1.24	0.65
A4	149.63	-0.37	0.65
A5	150.71	0.71	0.65
B1	150.14	0.14	0.65
B2	150.06	0.06	0.65
B3	150.35	0.35	0.65
B4	149.97	-0.03	0.66
B5	150.01	0.01	0.66
C1	150.08	0.08	0.65
C2	150.23	0.23	0.69
C3	151.13	1.13	0.65
C4	150.61	0.61	0.65
C5	149.47	-0.53	0.66
D1	150.36	0.36	0.65
D2	150.87	0.87	0.65
D3	151.24	1.24	0.65
D4	150.73	0.73	0.65
D5	151.10	1.10	0.65
E1	148.88	-1.12	0.65
E2	153.51	3.51	0.65
E3	149.55	-0.45	0.65
E4	147.55	-2.45	0.65
E5	148.94	-1.06	0.65
F1	149.97	-0.03	0.65
F2	151.10	1.10	0.65
F3	150.87	0.87	0.66
F4	150.55	0.55	0.65
F5	150.24	0.24	0.65

Characterization of the unit under calibration:

Locations heating Block	Desired (°C)	Unit Under Calibration (°C)		Measured Temperature (°C)
		Setting	Reading	Stability (± °C)
Left	150	150	150	0.14
Right	150	150	150	0.09

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: COD Reactor

รุ่น: DRB200

หมายเลขเครื่อง: 19070C0337

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพหัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ:

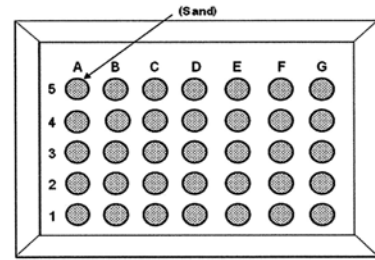
Mr. Suphanimit Khamnonphoom
Service Engineer

Certificate of Calibration

Certificate No.: C29230040

Page: 2 of 3

Fig. 1.: Top view



Location of standard

Equipment: Block Digestion Unit
Model: SC2100-35V240
Serial No. (or ID.): 2021CEP296
Manufacturer: Environmental Express
Condition: In Condition

Certificate No.: C29230040
Issued Date: 16 November 2023
Job No.: WO-00008310
Page: 1 of 3
Digestion Block: 18 holes.

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 26 °C ± 0.7 °C
Humidity: 54 %RH ± 5.3 %RH
Voltage: 230 VAC ± 3.5 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 31 October 2023

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL) Certificate No.: TC22/0080

(Mr. Suphanimit Khamnonphoem)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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CAL-FM-C29-07: 20 Jul 2022

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

Calibration Results:

Before adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	104.0	104.0	104.0	98.4	-5.6	1.4
A3				99.0	-5.0	1.4
A5				99.1	-4.9	1.4
B2				98.5	-5.5	1.4
B4				98.6	-5.4	1.4
C1				99.0	-5.0	1.4
C3				98.3	-5.7	1.4
C5				98.4	-5.6	1.4
D2				99.4	-4.6	1.4
D4				99.0	-5.0	1.4
E1				99.4	-4.6	1.4
E3				98.5	-5.5	1.4
E5				98.3	-5.7	1.4
F2				99.6	-4.4	1.4
F4				99.0	-5.0	1.4
G1				99.3	-4.7	1.4
G3				98.3	-5.7	1.4
G5				98.6	-5.4	1.4

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CAL-FM-C29-07: 20 Jul 2022

Certificate No.: C29230040

Page: 3 of 3

Calibration Results:

After adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	95.0	95.0	95.0	94.5	-0.5	1.4
A3				95.2	0.2	1.4
A5				94.8	-0.2	1.4
B2				95.3	0.3	1.4
B4				95.0	0.0	1.4
C1				95.3	0.3	1.4
C3				95.0	0.0	1.4
C5				94.6	-0.4	1.4
D2				95.2	0.2	1.4
D4				95.0	0.0	1.4
E1				95.4	0.4	1.4
E3				95.0	0.0	1.4
E5				94.5	-0.5	1.4
F2				94.4	-0.6	1.4
F4				95.2	0.2	1.4
G1				95.1	0.1	1.4
G3				95.5	0.5	1.4
G5				95.0	0.0	1.4

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	104.0	104.0	104.0	103.8	-0.2	1.4
A3				104.2	0.2	1.4
A5				104.3	0.3	1.4
B2				103.9	-0.1	1.4
B4				103.9	-0.1	1.4
C1				104.2	0.2	1.4
C3				103.5	-0.5	1.4
C5				103.7	-0.3	1.4
D2				104.4	0.4	1.4
D4				104.0	0.0	1.4
E1				104.5	0.5	1.4
E3				103.8	-0.2	1.4
E5				103.2	-0.8	1.4
F2				104.6	0.6	1.4
F4				104.1	0.1	1.4
G1				104.3	0.3	1.4
G3				103.6	-0.4	1.4
G5				103.8	-0.2	1.4

The End of Certificate

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ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่อง: Block Digestion Unit รุ่น: SC2100-35V240
หมายเลขเครื่อง: 2021CEP296

ตรวจสอบ (วัน)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)	หมายเหตุ
31 Oct 2023		31 Oct 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
	General		
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การแสดง Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> 6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/> ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>

ข้อเสนอแนะ:

Mr. Suphanimit Khamnonphoem
Service Engineer

DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Certificate of Calibration

Certificate No.: C29230041

Page: 2 of 3

Equipment: Block Digestion Unit
Model: KT 20s-BS
Serial No. (or ID.): GER5720190108
Manufacturer: Gerhardt
Condition: In Condition
Certificate No.: C29230041
Issued Date: 16 November 2023
Job No.: WO-00008310
Page: 1 of 3
Digestion Block: 20 holes.

Customer: Integrated Research Center Co.,Ltd.
 122 Moo 2, Tambol Thatoom,
 Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 26 °C ± 0.7 °C
 Humidity: 54 %RH ± 4.7 %RH
 Voltage: 230 VAC ± 3.5 VAC

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
 1 Moo 2, Thatoom, Srimahaphot,
 Prachinburi 25140 Thailand.

Calibration By: Mr. Suphanimit Khamnonphoem
Calibration Date: 01 November 2023
The Method used: In house method, base on by comparison with standard
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL) Certificate No.: TC22/0080

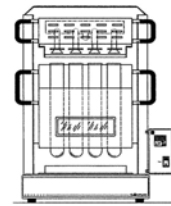
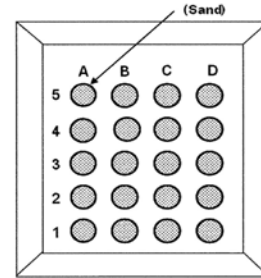


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.
Measured Temperature: The average reading of working standard at any positions or location.

(Mr. Suphanimit Khamnonphoem)
 Person in charge

(Mr. Udon Srichana)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
 The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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Certificate No.: C29230041

Page: 3 of 3

Calibration Results: Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	380	380	380	380.8	0.8	1.5
A2				381.1	1.1	1.5
A3				380.9	0.9	1.5
A4				381.1	1.1	1.5
A5				381.2	1.2	1.5
B1				380.0	0.0	1.5
B2				380.6	0.6	1.5
B3				380.1	0.1	1.5
B4				380.4	0.4	1.5
B5				380.8	0.8	1.5
C1				379.3	-0.7	1.5
C2				379.4	-0.6	1.5
C3				379.8	-0.2	1.5
C4				380.0	0.0	1.5
C5				379.9	-0.1	1.5
D1				376.7	-3.3	1.5
D2				376.9	-3.1	1.5
D3				377.9	-2.1	1.5
D4				378.6	-1.4	1.5
D5				377.5	-2.5	1.5

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: Block Digestion Unit รุ่น: KT 20s-BS
 หมายเลขเครื่อง: GER5720190108

ตรวจสอบ (วัน)		รายการตรวจสอบเช็ค	ตรวจสอบ (สิ่ง)		หมายเหตุ
01 Nov 2023			01 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ:

Mr. Suphanimit Khamnonphoem
 Service Engineer

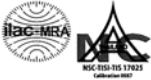
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 DKSH Technology Limited
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CAL-FM-C29-07: 20 Jul 2022

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Certificate of Calibration

Equipment: Standard Weight
 Model: 1 g
 Serial No. (or ID.): Weight 001
 Manufacturer: LS
 Condition: In condition

Certificate No.: C02232073
 Issued Date: 7 November 2023
 Job No.: WO-00009104
 Page: 1 of 2
 Class: -

Customer: Integrated Research Center Co.,Ltd.
 122 Moo 2, Tambol Thatoom,
 Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
 Relative Humidity 50 %RH ± 10 %RH
 Atmospheric Pressure 980-1030 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
 2533 Sukhumvit Road, Bangchak,
 Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Palchet Saefong
 Calibration Date: 07 November 2023
 The Method used: In house method, CAL-WI-48, base on OIML R111-1
 Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02231914.

Palchet

(Mr. Palchet Saefong)
 Person in charge

Rungrod

(Mr. Rungrod Jenkitrakulchai)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
 The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
 These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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 Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C02-12: 12 Sep 2022

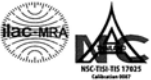
Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty (\pm mg)	MPE Class (\pm mg)
1 g	None	1 g + 0.043 mg	0.030	0.10 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

Certificate No.: C02232073 Page 2 of 2



Certificate of Calibration

Equipment: Standard Weight
 Model: 100 g
 Serial No. (or ID.): Weight 002
 Manufacturer: LS
 Condition: In condition

Certificate No.: C02232074
 Issued Date: 7 November 2023
 Job No.: WO-00009104
 Page: 1 of 2
 Class: -

Customer: Integrated Research Center Co.,Ltd.
 122 Moo 2, Tambol Thatoom,
 Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
 Relative Humidity 50 %RH ± 10 %RH
 Atmospheric Pressure 980-1030 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
 2533 Sukhumvit Road, Bangchak,
 Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Palchet Saefong
 Calibration Date: 07 November 2023
 The Method used: In house method, CAL-WI-48, base on OIML R111-1
 Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02231914.

Palchet

(Mr. Palchet Saefong)
 Person in charge

Rungrod

(Mr. Rungrod Jenkitrakulchai)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
 The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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CAL-FM-C02-12: 12 Sep 2022

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty (\pm mg)	MPE Class (\pm mg)
100 g	None	100 g - 0.06 mg	0.16	0.5 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

Certificate No.: C02232074 Page 2 of 2

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CAL-FM-C02-12: 12 Sep 2022



Certificate of Calibration

Equipment: Standard Weight
Model: 200 g
Serial No. (or ID.): Weight 003
Manufacturer: LS
Condition: In condition

Certificate No.: C02232075
Issued Date: 7 November 2023
Job No.: WO-00009104
Page: 1 of 2
Class: -

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
Relative Humidity 50 %RH ± 10 %RH
Atmospheric Pressure 980-1030 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Palchet Saefong
Calibration Date: 07 November 2023
The Method used: In house method, CAL-WI-48, base on OIML R111-1
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02231914.

Palchet

(Mr. Palchet Saefong)
Person in charge

Rungrod

(Mr. Rungrod Jenkitrakulchai)
Authorized signatory

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The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
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CAL-FM-C02-12: 12 Sep 2022

Calibration Results:

Certificate No.: C02232075 Page 2 of 2

Nominal Value	Marking	Conventional Mass	Uncertainty (± mg)	MPE Class (± mg)
200 g	None	200 g - 0.36 mg	0.30	1.0 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

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CAL-FM-C02-12: 12 Sep 2022



Certificate of Calibration

Certificate No.: C17230199 Page: 2 of 4

Equipment: COD Reactor
Model: DRB 200
Serial No. (or ID.): 19050C0191
Manufacturer: Hach
Condition: In Condition
Covers: Open (Max) Locations heating Block: Left and Right

Certificate No.: C17230199
Issued Date: 21 November 2023
Job No.: WO-00010182
Page: 1 of 4

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature: 23 °C ± 5.0 °C
Humidity: 50 %RH ± 15.0 %RH
Voltage: 230 VAC ± 11.0 VAC

Calibration Place: Temperature Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Bovon Jannantha
Calibration Date: 20 November 2023
The Method used: In house method, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230015

Bovon

(Mr. Bovon Jannantha)
Person in charge

Udon

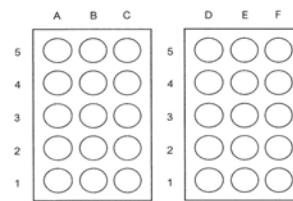
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
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CAL-FM-C17-08: 20 Jul 2022



Location of standard

Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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CAL-FM-C17-08: 20 Jul 2022

Calibration Results:

Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Left	150	150
Right	150	150

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	148.65	-1.35	0.68
A2	151.14	1.14	0.67
A3	151.18	1.18	0.66
A4	148.99	-1.01	0.69
A5	149.00	-1.00	0.68
B1	151.08	1.08	0.68
B2	150.79	0.79	0.69
B3	151.35	1.35	0.66
B4	149.39	-0.61	0.69
B5	149.77	-0.23	0.68
C1	151.06	1.06	0.69
C2	151.21	1.21	0.69
C3	150.16	0.16	0.67
C4	149.48	-0.52	0.68
C5	148.75	-1.25	0.67
D1	150.34	0.34	0.67
D2	150.48	0.48	0.68
D3	149.47	-0.53	0.67
D4	148.70	-1.30	0.69
D5	149.29	-0.71	0.67
E1	150.64	0.64	0.66
E2	148.93	-1.07	0.69
E3	151.31	1.31	0.67
E4	149.17	-0.83	0.65
E5	148.46	-1.54	0.68
F1	149.08	-0.92	0.65
F2	149.23	-0.77	0.65
F3	148.69	-1.31	0.65
F4	148.23	-1.77	0.65
F5	149.71	-0.29	0.65

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Characterization of the unit under calibration:

Locations heating Block	Desired (°C)	Unit Under Calibration (°C)		Measured Temperature (°C)
		Setting	Reading	Stability (± °C)
Left	150	150	150	0.22
Right	150	150	150	0.22

The End of Certificate

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ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00010182

ชนิดเครื่องมือ: COD Reactor

รุ่น: DRB 200

หมายเลขเครื่อง: 19050C0191

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
20 Nov 2023			20 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ:

Mr. Bovon Jannantha
Service Engineer

Certificate of Calibration

Equipment:	TURBIDIMETER	Certificate No.:	C08230180
Model:	2100Q	Issued Date:	03 November 2023
Serial No. (or ID.):	14090C035505	Job No.:	WO-00008310
Manufacturer:	HACH	Page:	1 of 2
Condition:	In Condition		

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 26 °C ± 0.3 °C
Humidity 63 %RH ± 3 %RH

Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piyapat Saidoung
Calibration Date: 01 November 2023
The Method used: In house method, CAL-WI-23, base on Hach Manufacturer Method 8195
Traceability: This certificate is traceable to Primary standard Fromazin and StabCal accepted by United States Environmental Protection Agency (EPA) through Hach Company
Certificate No. A2005 , A3004 , A3012 , A3004

ปิยพัฏฐ์
(Mr. Piyapat Saidoung)
Person in charge

นิตินันท์
(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
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CAL-FM-C08-08: 20 Jul 2022

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ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00008310

ชนิดเครื่องมือ: TURBIDIMETER

รุ่น: 2100Q

หมายเลขเครื่อง: 14090C035505

Calibration Results:
Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.20	-0.120	0.0	0.070
20.50	23.0	-2.50	0.1	1.0
103.0	109	-6.0	0.6	7.0
824.0	917	-93.0	0.8	45

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.07	0.010	0.0	0.070
20.50	20.5	0.00	0.1	1.0
103.0	104	-1.0	0.5	7.0
824.0	823	1.0	0.7	45

The End of Certificate

ตรวจสอบ (วัน)		รายการตรวจสอบ	ตรวจสอบ (ตั้ง)		หมายเหตุ
01 Nov 2023			01 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
รายการตรวจสอบ					
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาป้องกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	16. ค่าความทึบที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.58/0.03 NTU
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (> 2.5 ไมล์ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เซ็นเซอร์แนบมา :

Mr.Piyapat Saidoung
Service Engineer