

เอกสารแนบ 6

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD
214 Bangwack Rd. Bangpak Bangkok 10160
Tel: 0-2865-647-8 Fax: 0-2865-6649 <http://www.mit.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2006-146-0001

Date Issued : 15-Jun-20

Customer : SPECIAL LAB ENVIRONMENT CONSULTANT CO., LTD.
47/91 Moo 3, Tha-Ka, Pak Kret, Nonthaburi 11120

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UN36

Serial No. : B120.0284

ID No./Tag No. : -

Date Received : 12-Jun-20

Date Calibrated : 15-Jun-20

Calibrated by : Mr. Surat Annarb

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

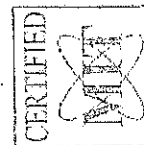
Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Technical Manager, Miracle International Technology Company Limited.

Approved by :

(Mr. Surasak Somsan)
Technical Manager



Page 1 of 2

Certificate No. : AD2006-146-0001

Environment : Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability (°C)	Measured Uniformity (°C)	Overall Variation (°C)
104	104.0	104.0	0.18	0.42	0.92
150	150.0	150.0	0.35	0.45	1.11
180	180.0	180.0	0.44	0.47	0.88

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	STD Uncertainty (°C)
104	104.32	104.12	103.80	104.33	103.98	103.93	104.01	104.42	104.13	0.95
150	149.93	149.62	149.49	149.80	149.63	149.41	149.48	149.91	149.71	1.0
180	179.45	179.35	179.45	179.18	179.42	179.44	179.32	179.32	179.35	1.1

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Measurement Standards Used & Traceability :

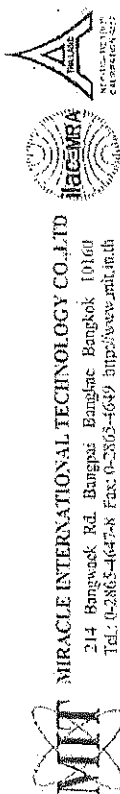
The International System of Units (SI) through

MIT Certificate No. L2002-197 for Digital Thermometer with Probe (Agilent) Module 2 (08) TC Serial No. MY44000197.
Due 26-Sep-20

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is method temperature stability.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

Page 2 of 2



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD.
214 Bangwaek Rd. Bangnai Bangkok 10160
Tel: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.co.th>

CALIBRATION CERTIFICATE

Certificate No. : AD2006-146-0001

Date Issued : 15-Jun-20

Customer : SPECIAL LAB ENVIRONMENT CONSULTANT CO., LTD.
47/91 Moo 3, Tha-It, Pak Kret, Nonthaburi 11120

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UN30

Serial No. : B120.0284

ID No./Tag No. : -

Date Received : 12-Jun-20

Date Calibrated : 13-Jun-20

Calibrated by : Mr. Surat Aumarb

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

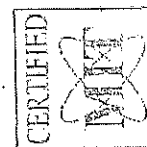
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

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Approved by :

()
Technical Manager

Page 1 of 2



Certificate No. : AD2006-146-0001

Environment : Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

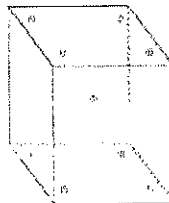
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability (°C)	Measured Uniformity (°C)	Overall Variation (°C)
104	104.0	104.0	0.18	0.42	0.92
150	150.0	150.0	0.35	0.45	1.11
180	180.0	180.0	0.44	0.47	0.88

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	STD Uncertainty (°C)
104	104.32	104.12	103.80	104.33	103.98	103.93	104.01	104.42	104.13	0.95
150	149.93	149.62	149.49	149.80	149.63	149.41	149.48	149.91	149.71	1.0
180	179.45	179.35	179.45	179.18	179.42	179.44	179.32	179.52	179.35	1.1

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 6



Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L2002-197 for Digital Thermometer with Probe (Agilent) Module 2 (08) TC Serial No. NY14000197.
Due 26-Sep-20

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

Page 2 of 2



Calibratech Co., Ltd.

7/101 Moo 3 Subphanchan 3 Road, Songpho-4, Pakkret, Nonthaburi 11120
Tel: 02-02686211 Fax: 02-02686212 E-mail: calibratech.co.ltd@gmail.com

Page : 1 of 2

Certificate No. : 63-400218-3

Submitted by :

Special Lab Envi and Consultant Co., Ltd.

47/91 Moo 3 Tambon Thim-in, Pakkret, Nonthaburi 11120

Equipment :

Air Chamber (Incubator)

Manufacturer : Leishong

Range : N/A °C

Serial No. : 0914053-01

Model : FKU 1800

Resolution : 0.1 °C

UD No. : N/A

Environment :

On site calibration was carried out at the Laboratory.

Special Lab Envi and Consultant Co., Ltd.

Ambient Temperature : (27.4 to 28.0) °C

Relative Humidity : (45 to 55) %

Line Voltage : (226.0 to 226.5) V

Date of Received :

04 May 2020

Date of Calibration :

04 May 2020

Date of Issue :

04 May 2020

Calibrated by :

Wongchai Masti

Calibration Method :

CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

This certification is traceable to the International System of Units

Reference Standard Instruments :

Standard Digital Thermometer with Thermocouple probe

Cert. No.

63-400107-1

Traceability

National Institute of Metrology Thailand (NIMTT)

Due Date

29 Aug 2020

ID No

400022 & 400023

Approved by :

Supervisor

Signature

The Uncertainties are for a confidence probability of approximately 95%

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Calibratech Co., Ltd.

7/101 Moo 3 Subphanchan 3 Road, Songpho-4, Pakkret, Nonthaburi 11120
Tel: 02-02686211 Fax: 02-02686212 E-mail: calibratech.co.ltd@gmail.com

Page : 2 of 2

Certificate No. : 63-400218-3

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function :

Temperature measurement

This instrument was subject to verification at position 0 (closed)

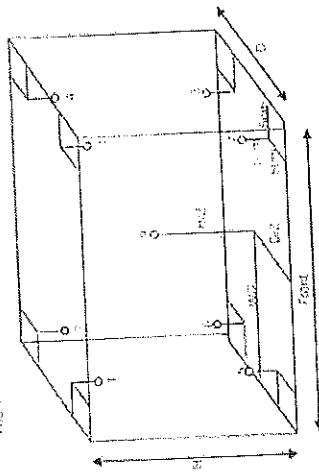
Inside of Chamber

W : 0.55 m

D : 0.03 m

H : 0.50 m

Capacity : 0.20 m³



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) at Sensor No.							Uncertainty (°C)
			1	2	3	4	5	6	7	
20.0	20.0	20.0	19.8	20.0	20.0	20.0	19.9	20.2	20.1	0.27

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.5	0.5	1.3

Remark: The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown in date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2,

providing a level of confidence of approximately 95%.

-0.00-



Calibrattech Co., Ltd.

710-52 715-751 (002)
CALIBRATION UNIT

Calibrattech Co., Ltd.

710-52 715-751 (002)
CALIBRATION UNIT

Certificate No. : 63-400281-1

Page : 1 of 2

Submitted by : Special Lab Eval and Consultant Co., Ltd.

47/91 Moo 3, Tambon Thar-ut, Pakkret, Nonthaburi 11120

Equipment :

Temperature Indicator

Manufacturer : Thermo Scientific

Model : TEMP 10K

Resolution : 0.1 °C

Range : -250 °C to 1372 °C

Serial No. : 4009188

ID No. : SL-28

Environment :

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received :

20 May 2020

Date of Calibration :

04 June 2020

Date of Issue :

04 June 2020

Calibrated by :

Benjard Masri

Calibration Method :

This instrument was calibrated by In-house method comparison technique CAL-M4005

by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments :

This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No. : 17031620

Cert. No. : 17031620

Due Date : 04 Mar 2022

Facility : National Institute of Metrology (Thailand NIMT)

2. Standard Digital Thermometer

ID No. : 17031620

Cert. No. : 17031620

Due Date : 07 May 2021

Facility : National Institute of Metrology (Thailand NIMT)

Certificate No. : 63-400281-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function :

Temperature measurement with Thermocouple probe Type K

Model : Type K

Sheath Material : Teflon

Diameter : 2 mm

Length : 1500 mm

Serial No. : N/A

ID No. : SL-39

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	100.02	99.8	-0.2	0.35
150	150.05	149.8	-0.2	0.35
200	200.08	199.8	-0.2	0.35
250	250.10	249.8	-0.2	0.35

Model : AD-1218-250

Sheath Material : Stainless

Diameter : 3.5 mm

Length : 250 mm

Serial No. : N/A

ID No. : SL-40

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	100.02	99.8	-0.2	0.35
150	150.05	149.8	-0.2	0.35
200	200.08	199.8	-0.2	0.35
250	250.10	249.8	-0.2	0.35

Remark

UUC : Unit Under Calibration

This result of calibration was issued accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2,

providing a level of confidence of approximately 95%.

Approved by :

(Sorachai Pannadong)

Laboratory Manager

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

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CAL-40031-01

CAL-40031-03

CAL

Calibratech Co., Ltd.

7/100 Moo 3, Sukhachaban 1 Rd., Bangchuek, Pakkret, Nonthaburi 11120
Tel: 02-844-6211 Fax: 02-844-6146 e-mail: cal@caltech.co.th, caltech@caltech.co.th



NSG-TS-0187-2014
CALIBRATION ID: 62

Page : 1 of 2

Certificate No. : 62-400577-1

Submitted by : Special Lab Servi and Consultant Co., Ltd.
47/91 Moo 3, Tambon Thua-Ni, Pakkret, Nonthaburi 11120

Equipment : Digital Thermometer with TC probe

Temperature Indicator
Manufacturer : Thermo Scientific
Range : -250 °C to 1572 °C
Model : TEMP 10K
Resolution : 0.1 °C
ID No. : SL-38

Environment :
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Calibration : 07 December 2019
Date of Issue : 09 December 2019
Calibrated by : Chotrip Sanchulsi

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M41003
by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

This certification is traceable to the International System of Units.

Reference Standard Instruments :

1. Platinum Resistance Thermometer (PRT)			
ID No.	Cert. No.	Due Date	Traceability
400016	TT-0058-19	07 May 2021	National Institute of Metrology, Thailand (NIMT)
2. Standard Digital Thermometer			
ID No.	Cert. No.	Due Date	Traceability
000013	19E134	09 Jun 2021	National Institute of Metrology, Thailand (NIMT)
000014	19E134	09 Jun 2021	National Institute of Metrology, Thailand (NIMT)

Approved by :
(Signature Promthong J)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co., Ltd

Calibratech Co., Ltd.

7/100 Moo 3, Sukhachaban 1 Rd., Bangchuek, Pakkret, Nonthaburi 11120
Tel: 02-844-6211 Fax: 02-844-6146 e-mail: cal@caltech.co.th, caltech@caltech.co.th

Page : 2 of 2

Certificate No. : 62-400577-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Model : Type K
Diameter : 2 mm.
Serial No. : N/A
Sheath Material : Teflon
Length : 1500 mm.
ID No. : SL-39

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	150.0005	150.1	-0.1	0.58

Temperature measurement

Model : AD-1218-230
Diameter : 3.5 mm.
Serial No. : N/A
Sheath Material : Stainless
Length : 230 mm.
ID No. : SL-40

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	380.0036	379.2	0.8	1.5

Remark

UUC : Unit Under Calibration

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

Signature



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.

CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-23979 Fax: +66 2615-2350-1
Email: bkk@becthai.com Website: www.becthai.com

Certificate No.: CAL-20-293

Page: 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material:

Material	Model	Serial No.	Cert. No.	Due date
Hologram Glass Filter	RM-100	12705	81255	16 Jan 22
Neutral Density Filter	RD-100	12706	81257	16 Jan 22

2. Traceability: This calibration is traceable to the International System of Unit maintained at

The Metro Science Ltd Accredited Calibration Laboratory No. 0452

3. Method of calibration:

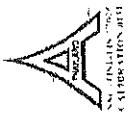
The calibration procedure was carried out according to the Guide by GUM CAL no based on ASTM E275-08 (2014) and
ASTM E275-08 (2014)

4. Result of calibration:

() without adjustment () after adjustment

5. Equipment Specifications:

Spectral Bandwidth	3 nm
Data Interval	1 nm
Scan Speed	N/A



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-23979 Fax: +66 2615-2350-1
Email: bkk@becthai.com Website: www.becthai.com

Page: 3 of 3

Certificate No.: CAL-20-293

CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material (nm)	Nominal Value (nm)	UUC Reading (nm)	Error (nm)	Uncertainty of Measurement ($\pm$ nm)
418.80	418	418	-0.46	0.46
437.80	437	437	-0.29	0.29
537.80	537	537	-0.29	0.29

Photometric Calibration for Visible

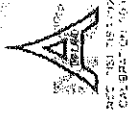
Wavelength (nm)	Certified Values of Reference Material (A)	UUC Reading (A)	Error (A)	Uncertainty of Measurement ($\pm$ A)
420.0	Zero	0.000	0.000	0.000
	0.4717	0.575	0.043	0.043
	0.2813	0.236	0.0019	0.0019
	1.0723	1.077	0.004	0.004
440.0	Zero	0.000	0.000	0.000
	0.5011	0.500	-0.001	0.001
	0.2103	0.216	0.006	0.006
	1.0423	1.046	0.004	0.004
460.0	Zero	0.000	0.000	0.000
	0.5116	0.515	0.004	0.004
	0.2003	0.203	0.003	0.003
	1.0003	1.000	0.000	0.000
480.0 (540.0)	Zero	0.000	0.000	0.000
	0.5003	0.500	-0.000	0.000
	0.2003	0.200	-0.000	0.000
	1.0003	1.000	-0.000	0.000
500.0	Zero	0.000	0.000	0.000
	0.5003	0.500	-0.000	0.000
	0.2003	0.200	-0.000	0.000
	1.0003	1.000	-0.000	0.000
520.0	Zero	0.000	0.000	0.000
	0.5003	0.500	-0.000	0.000
	0.2003	0.200	-0.000	0.000
	1.0003	1.000	-0.000	0.000
540.0	Zero	0.000	0.000	0.000
	0.5003	0.500	-0.000	0.000
	0.2003	0.200	-0.000	0.000
	1.0003	1.000	-0.000	0.000

Remark: Equipment used measured against the primary standard spectral used to 2015 the Spectrometer used for

Note:

UUC: Unit Under Calibration

- End of Report -

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Page: 101

Function : mV Measurement

Submitted by :
Special Lab. Development Co., Ltd.
4739 Moo 3, Thanabul Thai-it Pakkoi Nonthaburi 1120

Equipment :	Air Chamber (Refrigerator)
Manufacturer :	Frosty
Model :	CC-289C
Range :	N/A °C
Resolution :	0.1 °C
Serial No. :	2081207616
ID No. :	N/A
Environment :	On site calibration was carried out at the Laboratory.
	Special Lab Envs and Consultant Co., Ltd.
Ambient Temperature :	(30.0 to 31.3) °C
Relative Humidity :	(50 to 55) %
Line Voltage :	(226.0 to 226.8) V

Date of Calibration : 03 May 2020

Calibrated by: David M. Jones

Calibration Method : CAL-M40M4, TLAS (i-20)

Reference Standard Instruments : This verification is according to the International System of Units

Q.No	Q.No	Due Date	Topic/Title
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63-40104-7 29 Aug 1950

National Institute of Metrology Thailand (NIMT)

1057-1062

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