

ภาคผนวกที่ 10

ผลการเปรียบเทียบอุปกรณ์และเครื่องมือตรวจวัด

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S K SALES AND SERVICE CO.,LTD.

194/56, 194/57 Thakham Rd. Samae Dam

Bang Khun Thian Bangkok 10150

Tel. : 02-417-2144 Fax : 02-417-2155



## Certificate of Calibration

Reference No. : C04561/2401-015 Certificate No. : L2401-1669  
Customer : STS GREEN CO.,LTD. Page 1 of 2  
: 3/23 Moo 5, Phaholyothin-Lamlukka Rd.,  
: T.Lat Sawai, A.Lamlukka, Pathumthani, 12150  
Equipment : pH Meter  
Manufacturer : HORIBA  
Model : D-51  
Serial No. : S005100  
ID No. : PHM-No.7  
Received Date : 29 January 2024  
Calibrated Date : 31 January 2024  
Issued Date : 4 February 2024

Environment	Start Calibration	Stop Calibration
Ambient Temperature ( °C )	21.0	20.8
Relative Humidity (% RH)	46	45

Place of Calibration : Chemical Calibration Laboratory

Calibrated by : Miss Sutida Prasansak

### Calibration Method

In-house method : WI-28 based on direct measurement by using certified reference material (CRM)

### Condition of this result of calibration

1. Reference standard material

pH Solution	Lot No.	Exp Date
1) pH Buffer Solution 4.0	904723	10 June 2025
2) pH Buffer Solution 7.0	904725	10 June 2024
3) pH Buffer Solution 10.0	904724	10 June 2024

2. This result of calibration was found accurate as shown on date and place of calibration for this item only

3. This certificate can be traceable to International System of Unit :

- Through C.P.A.Chem LTD.

Approved by :

☒ Mr.Suphachai Saksri

☐ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

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

Calibration Result

Calibration by using standard buffer solution

Performing 3 Point calibration standard curve using buffer : 4,7,10

STD Buffer Solution (pH)	UUC Reading		UUC Error	Uncertainty (± pH)	Coverage factor k
	Before Adjust	After Adjust			
4.008	4.10	3.95	-0.058	0.017	2.32
6.985	6.95	6.95	-0.035	0.017	2.05
10.010	10.12	10.13	0.120	0.020	2.65

Resolution: 0.01 for pH Function

STD = Standard

UUC = Unit Under Calibration

\*\* End of Calibration Report \*\*  




S K SALES AND SERVICE CO.,LTD.  
194/56, 194/57 Thakham Rd. Samae Dam  
Bang Khun Thian Bangkok 10150  
Tel. : 02-417-2144 Fax : 02-417-2155



## Certificate of Calibration

Reference No. : C04561/2401-015  
Customer : STS GREEN CO.,LTD.  
: 3/23 Moo 5, Phaholyothin-Lamlukka Rd.,  
: T.Lat Sawai, A.Lamlukka, Pathumthani, 12150  
Equipment : Digital Thermometer  
Manufacturer : HORIBA  
Model : D-51  
Serial No. : S005100  
ID No. : PHM-No.07  
Received Date : 29 January 2024  
Calibrated Date : 31 January 2024  
Issued Date : 4 February 2024

Certificate No. : L2401-1670

Page 1 of 2

Environment	Minimum Value	Maximum Value
Ambient Temperature ( °C )	24.7	25.3
Relative Humidity ( % RH)	50	51

Place Of Calibration : Temperature Calibration Room  
Calibrated by : Mr. Natthapong Koetphon

### Calibration Method

In-house method :SK-WI-01 by comparison technique with temperature standard

### Condition of this result of calibration

#### 1. Reference standard instrument

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Temperature indicator with PRT probe	282/AM1730	2502100200037	PSL-T 0522/66	26 February 2024

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by :

☒ Mr.Suphachai Saksri

☐ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

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



Result of Calibration

This Instrument was Connected with Thermister Probe

Stem Diameter : 16 mm

Immersion Depth : 100 mm

Resolution : 0.1 ( $^{\circ}\text{C}$ )

Sheath material : Plastic

Without Adjustment

STD Reading ( $^{\circ}\text{C}$ )	UUC Reading ( $^{\circ}\text{C}$ )	UUC Error ( $^{\circ}\text{C}$ )	Measurement Uncertainty ( $\pm$ $^{\circ}\text{C}$ )
0.012	0.5	0.488	0.16
20.016	19.8	-0.216	0.16
25.010	24.8	-0.210	0.16
30.014	29.8	-0.214	0.16
45.009	44.8	-0.209	0.16

STD= Standard

UUC= Unit Under Calibration

\*\* End of Calibration Report \*\*

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 23T7161

REFERENCE No : 69975-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : HOT AIR OVEN

**MANUFACTURER** : MEMMERT

**MODEL** : UFE500

**SERIAL No** : G509.0605

**ID No** : HOA 02

**CONDITION AS RECEIVED** : USED ITEM

**SUBMITTED BY** : STS GREEN CO., LTD.  
3/23 MOO 5, TAMBOL LAT SAWAI, AMPHUR LAM LUK KA,  
PATHUM THANI 12150

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 24-Jul-23

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 31-Jul-23

**RECEIVED DATE** : 24-Jul-23





CERTIFICATE No : 23T7161

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE500  
ID No : HOA 02  
RECEIVED DATE : 24-Jul-23  
AMBIENT TEMPERATURE : 33 °C ± 1 °C

S/N : G509.0605  
CALIBRATION DATE : 24-Jul-23  
RELATIVE HUMIDITY : 56 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

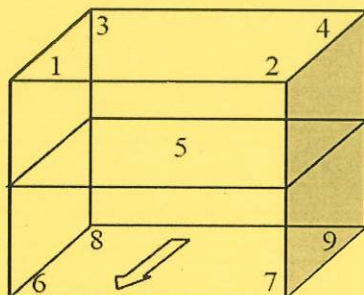
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	22T7509	10-Aug-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0
Overall Line Voltage (V) variation : 2
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm; Vent =0%

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.12	1.05	1.27
180.0	180.0	0.39	2.07	2.48

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.17	103.85	103.80	103.73	103.83	104.20	104.76	104.00	104.04	0.75
180.0	180.0	180.08	179.40	179.59	179.34	179.55	180.43	181.17	180.02	180.09	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT





# ISOCAL TECHNOLOGY CO.,LTD.

## Industrial Instrument Calibration Center

170/405 Moo 3 Serithai Rd., Kannayao Kannayao Bangkok 10230

Tel. 0-2906-3040-1 Fax. 0-2919-9948



## Certificate of Calibration

Certificate Number : 23-06-202/2TO

Page : 1 of 3

Customer : STS Green Co.,Ltd.

3/23 Moo 5, Lat Sawai

Lum Luk Ka , Patum Thani 12150

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Equipment Name : Water Bath  
Model : -  
Serial No. : L715.0065  
ID No. : WAB02  
Manufacture : Memmert  
Environment : Ambient Temperature 25.7 °C  
: Relative Humidity 48 %  
Location of Calibration : Lab Room  
Date of Received : 23-Jun-2023  
Date of Calibration : 23-Jun-2023  
Date of Issued : 27-Jun-2023  
Condition as received : Normal  
Calibration Method : Calibration Procedure Number WI-10A-71

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

This certificate is issued in accordance with ISO/IEC 17025:2017 and the conditions of accreditation granted by the Accreditation Body which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory, The result relate only to the item calibrated.

This certificate shall not be reproduced other than in full except without the prior written approval of the Head of Calibration Laboratory of Isocal Technology Co.,Ltd.

Calibrated by : Miss. Watchara Inchaidee  
Technicial

Approved by :   
( Mr. Narong Phetjaroon )





# ISOCAL TECHNOLOGY CO.,LTD.

## Calibration Report

Certificate Number : 23-06-202/2TO

Page : 2 of 3

### Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Data Acquisition/Switch Unit	MY41028589	NIMT	22-12-145/15TI	15-Dec-23

#### Definitions :-

\* NIMT - National Institute of Metrology, Thailand



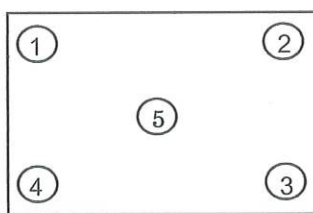
# ISOCAL TECHNOLOGY CO.,LTD.

## Calibration Report

Certificate Number : 23-06-202/2TO

Page : 3 of 3

**Result of Calibration :** Adjustment ( No )  
**Function :** Temperature Generator  
**Scale Range :** 85 °C to 93 °C  
**Resolution :** 0.1 °C



Position of Test

UUC		Position	Standard Reading ( °C )	Error ( °C )	Uniformity ( °C )	Stability ( °C )	Uncertainty ( °C )
Setting ( °C )	Reading ( °C )						
85.0	85.0	1	85.46	-0.46	0.64	0.32	0.77
		2	85.39	-0.39			
		3	85.36	-0.36			
		4	85.52	-0.52			
		5	85.48	-0.48			
93.0	93.0	1	93.18	-0.18	0.54	0.33	0.77
		2	93.27	-0.27			
		3	93.44	-0.44			
		4	93.46	-0.46			
		5	93.39	-0.39			

... END ...



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www.qcalibration.com



CERTIFICATE No : 23T7163

REFERENCE No : 69975-3

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : WATER BATH

**MANUFACTURER** : MEMMERT

**MODEL** : WTB24

**SERIAL No** : LD21.0296

**ID No** : WAB 04

**CONDITION AS RECEIVED** : USED ITEM

**SUBMITTED BY** : STS GREEN CO., LTD.  
3/23 MOO 5, TAMBOL LAT SAWAI, AMPHUR LAM LUK KA,  
PATHUM THANI 12150

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 24-Jul-23

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 31-Jul-23

**RECEIVED DATE** : 24-Jul-23

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





CERTIFICATE No : 23T7163

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : WAB 04  
RECEIVED DATE : 24-Jul-23  
AMBIENT TEMPERATURE : 27 °C ± 1 °C

MODEL : WTB24  
SERIAL NUMBER : LD21.0296  
CALIBRATION DATE : 24-Jul-23  
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

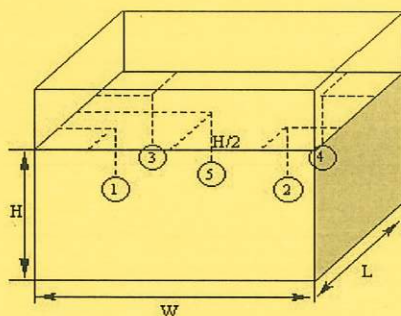
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	22T7513	05-Aug-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT



PROBE INSTALLATION  
POSITION IN THE BATH

### GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 1.3
Overall Variation of Line Voltage (V) : 10
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 50.5*30*20.5 cm

### BATH PERFORMANCE

Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
85.0	0.14	0.10	0.09	0.32
93.0	0.28	0.22	0.07	0.59

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
85.0	85.0	85.08	85.16	85.12	85.14	85.17	0.23
93.0	93.0	92.80	93.02	92.93	93.00	93.02	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT



## Certificate of Calibration

**Certificate No. :** 67-400083-1

**Page : 1 of 2**

**Submitted by :** STS Green Company Limited  
3/23 Moo 5, T. Lad Sawai, A. Lumlukka, Pathumthani 12150

**Equipment :** Temperature controlled enclosure (Oven)  
**Manufacturer :** Memmert **Model :** UFE 500  
**Range :** N/A °C **Resolution :** 0.5 °C  
**Serial No. :** G509.0607 **ID No. :** HOA 03

**Environment :** On site calibration was carried out at the Laboratory, STS Green Company Limited  
**Ambient Temperature :** (29.0 to 30.0) °C  
**Relative Humidity :** (60 to 65) %  
**Line Voltage :** (223.5 to 224.5) V

**Date of Received :** 16 February 2024

**Date of Calibration :** 16 February 2024

**Date of Issue :** 20 February 2024

**Calibrated by :** Permpon Chanpu

**Calibration Method :** CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

**Reference Standard Instruments :** This certification is traceable to the International System of Units  
 Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	66-400595-1	26 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 67-400083-1

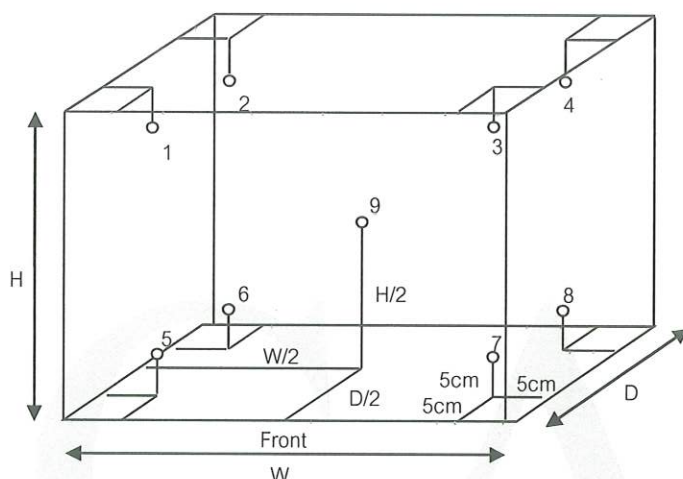
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.56 m

D = 0.40 m

H = 0.48 m

Capacity = 0.11 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	104.2	104.0	104.2	104.2	103.9	103.9	103.8	103.8	103.8	0.80
180.0	180.0	180.0	180.9	180.3	180.6	180.4	180.1	180.1	179.7	179.7	179.7	1.0

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.7	0.3	0.8
180.0	180.0	180.0	1.4	0.3	1.6

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found 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%

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*Signature*





## Certificate of Calibration

**Certificate No. :** 67-400083-3

**Page : 1 of 2**

**Submitted by :** STS Green Company Limited  
3/23 Moo 5, T. Lad Sawai, A. Lumlukka, Pathumthani 12150

**Equipment :** Temperature controlled enclosure (Incubator)  
**Manufacturer :** Memmert **Model :** IPP 500  
**Range :** N/A **Resolution :** 0.1 °C  
**Serial No. :** R509.0061 **ID No. :** COI 01

**Environment :** On site calibration was carried out at the Laboratory, STS Green Company Limited  
**Ambient Temperature :** (26.0 to 26.5) °C  
**Relative Humidity :** (60 to 65) %  
**Line Voltage :** (223.5 to 224.5) V

**Date of Received :** 16 February 2024

**Date of Calibration :** 16 February 2024

**Date of Issue :** 20 February 2024

**Calibrated by :** Permpon Chanpu

**Calibration Method :** CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

**Reference Standard Instruments :** This certification is traceable to the International System of Units  
Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	66-400593-1	25 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 67-400083-3

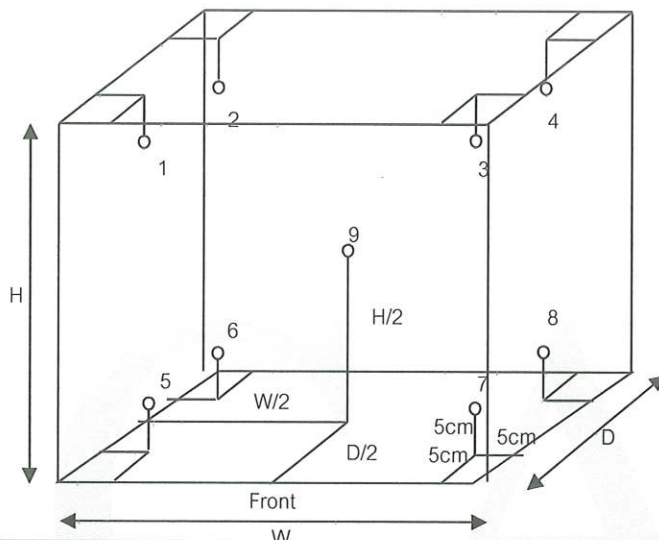
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.56 m

D = 0.40 m

H = 0.48 m

Capacity = 0.11 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.68	19.76	19.75	19.80	19.64	19.60	19.96	20.01	19.69	0.30

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.34	0.03	0.45

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found 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%

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