



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



Certificate of Calibration

Cert.No.: 24CH792

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact pH/Ion S220
Serial No. : B329579021
ID No. : TLC-L020
Condition As-Received: Used Item
Received Date : 02 July 2024
Calibration Date : 03 July 2024
Reference : 2407-0055DN-1
Submitted by : Tops-Lab Consultants Co.,Ltd.
189 Moo. 3, Bangrakphatthana,
Bangbuathong, Nonthaburi 11110

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Approved by :

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

Issue Date :

09 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 24CH792

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

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

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

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

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008 | CPA chem | 970851 | 25 Apr 2026 |
| pH 6.986 | CPA chem | 970852 | 25 Apr 2025 |
| pH 9.997 | CPA chem | 970853 | 25 Apr 2025 |

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor <i>k</i> |
|------------------------------|---------------|------------------------|----------------|--------|---------------------------------------|-----------------------------|
| | pH | mV | mV | pH | | |
| pH Meter S/N.: B329579021 | 4.000 | 177.48 | 177.2 | 4.000 | 0.058 | 2.00 |
| | 7.000 | 0.00 | -0.2 | 7.000 | 0.058 | 2.00 |
| | 10.000 | -177.48 | -177.6 | 10.000 | 0.058 | 2.00 |



Cert.No.: 24CH792

Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH Measurement (\pm) | Coverage factor k |
|-------------------------------|-----------------------------|-------------------|------------------------|---|---------------------|
| pH Electrode S/N.: 4222298 | 4.008 | 4.007 | 184.4 | 0.0047 | 2.00 |
| | 6.986 | 6.995 | 9.2 | 0.0084 | 2.00 |
| | 9.997 | 10.002 | -166.3 | 0.0074 | 2.05 |

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 4222298

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (\pm °C) | Coverage factor k |
|------------------------|---------------------------|-------------------|------------|--|---------------------|
| 23.0 | 23.003 | 23.0 | -0.003 | 0.13 | 2.00 |
| 25.0 | 25.002 | 25.0 | -0.002 | 0.13 | 2.00 |
| 27.0 | 27.004 | 27.0 | -0.004 | 0.13 | 2.00 |

Remark - UUC* = Unit Under Calibration

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

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Certificate of Calibration

Certificate No. : 68-400225-2

Page : 1 of 2

Submitted by : Tops-Lab Consultants Co.,Ltd.
189 Moo 3 Bangrakphatthana, Bangbuathong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Incubator)
Manufacturer : Aqualytic Model : ET 618-4
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0109/13922 ID No. : TLC-L005

Environment : On site calibration was carried out at the Laboratory, Tops-Lab Consultants Co.,Ltd.
Ambient Temperature : (24.0 to 24.5) °C
Relative Humidity : (40 to 45) %
Line Voltage : (220.0 to 228.0) V

Date of Received : 21 April 2025

Date of Calibration : 21 April 2025

Date of Issue : 23 April 2025

Calibrated by : Permpon Chanpu

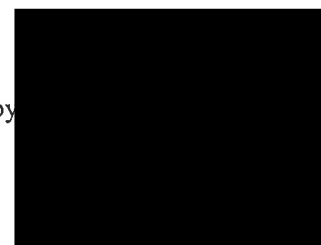
Calibration Method : CAL-M4004, TLAS G-20

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 & 400048 | 68-400063-1 | 01 Aug 2025 | National Institute of Metrology Thailand (NIMT) |

Approved by



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Certificate of Calibration

Certificate No. : 68-400225-2

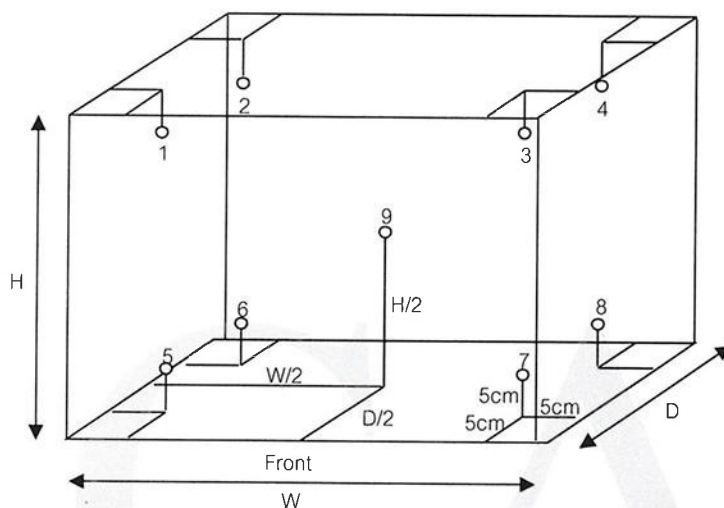
Page : 2 of 2

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 = 0.55 m

D = 0.48 m

H = 0.72 m

Capacity = 0.19 m³

| 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 | 20.02 | 19.83 | 19.79 | 19.82 | 19.77 | 19.72 | 19.85 | 19.84 | 19.80 | 0.58 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 20.0 | 20.0 | 20.0 | 0.32 | 0.27 | 0.67 |

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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Certificate of Calibration

Certificate No. : 68-400225-1

Page : 1 of 2

Submitted by : Tops-Lab Consultants Co.,Ltd.
189 Moo 3 Bangrakphatthana, Bangbuathong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Binder Model : FED 53
Range : N/A °C Resolution : 1 °C
Serial No. : 07-29050 ID No. : TLC-L004

Environment : On site calibration was carried out at the Laboratory, Tops-Lab Consultants Co.,Ltd.
Ambient Temperature : (32.0 to 34.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (220.0 to 228.0) V

Date of Received : 21 April 2025

Date of Calibration : 21 April 2025

Date of Issue : 23 April 2025

Calibrated by : Perinpon Chanpu

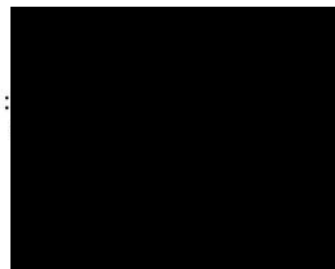
Calibration Method : CAL-M4004, TLAS G-20

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 & 400032 | 67-400584-1 | 29 Apr 2025 | National Institute of Metrology Thailand (NIMT) |

Approved by :



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Certificate of Calibration

Certificate No. : 68-400225-1

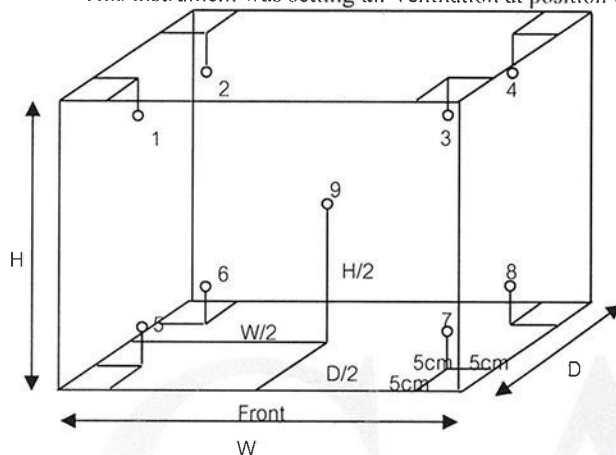
Page : 2 of 2

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 = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

| 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 | 104 | 104 | 105.5 | 104.4 | 103.8 | 104.0 | 105.7 | 104.4 | 104.3 | 104.8 | 104.1 | 0.97 |
| 180 | 180 | 180 | 181.9 | 179.5 | 179.3 | 179.3 | 182.8 | 180.7 | 181.0 | 181.3 | 179.7 | 1.3 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|----------------------|-------------------------------|----------------------------------|-------------------------------|------------------------------|-----------------------------|
| 104 | 104 | 104 | 1.7 | 0.1 | 2.2 |
| 180 | 180 | 180 | 3.5 | 0.3 | 3.9 |

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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Certificate of Calibration

Certificate No. : 68-400225-4

Page : 1 of 2

Submitted by : Tops-Lab Consultants Co., Ltd.
189 Moo 3 Bangrakphatthana, Bangbuathong, Nonthaburi 11110

Equipment : Water Bath
 Manufacturer : Memmert Model : WNB 14
 Range : N/A °C Resolution : 0.1 °C
 Serial No. : L410.1294 ID No. : TLC-L009

Environment : On site calibration was carried out at the Laboratory, Tops-Lab Consultants Co., Ltd.
 Ambient Temperature : (32.0 to 34.0) °C
 Relative Humidity : (45 to 50) %
 Line Voltage : (220.0 to 228.0) V

Date of Received : 21 April 2025

Date of Calibration : 22 April 2025

Date of Issue : 23 April 2025

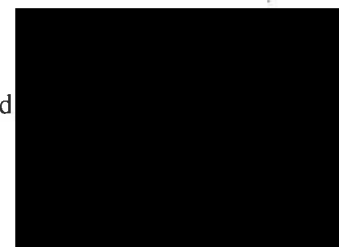
Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
 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 |
|-----------------|-------------|-------------|---|
| 400046 & 400024 | 68-400148-2 | 30 Sep 2025 | National Institute of Metrology Thailand (NIMT) |

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Certificate of Calibration

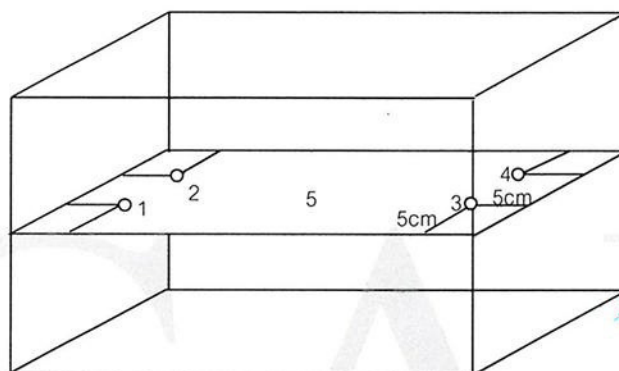
Certificate No. : 68-400225-4

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

| Test Point (° C) | Setting Temperature (° C) | Indicating Temperature (° C) | Measured Temperature (° C) @ Sensor | | | | | Uncertainty (± ° C) | Measured Uniformity (° C) | Measured Stability (° C) |
|-----------------------|--------------------------------|-----------------------------------|---------------------------------------|-------|-------|-------|-------|--------------------------|--------------------------------|-------------------------------|
| | | | No. | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | | | |
| 85.0 | 75.8 | 75.8 | 85.06 | 84.90 | 85.02 | 84.93 | 85.06 | 0.29 | 0.36 | 0.17 |
| 95.0 | 85.9 | 85.9 | 95.12 | 94.94 | 95.01 | 94.95 | 95.01 | 0.24 | 0.24 | 0.14 |

Remark The uncertainty is not combine uniformity of the water bath

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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Certificate of Calibration

Certificate No. : 68-400225-1

Page : 1 of 2

Submitted by : Tops-Lab Consultants Co.,Ltd.
189 Moo 3 Bangrakphatthana, Bangbuathong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Binder Model : FED 53
Range : N/A °C Resolution : 1 °C
Serial No. : 07-29050 ID No. : TLC-L004

Environment : On site calibration was carried out at the Laboratory, Tops-Lab Consultants Co.,Ltd.
Ambient Temperature : (32.0 to 34.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (220.0 to 228.0) V

Date of Received : 21 April 2025

Date of Calibration : 21 April 2025

Date of Issue : 23 April 2025

Calibrated by : Perinpon Chanpu

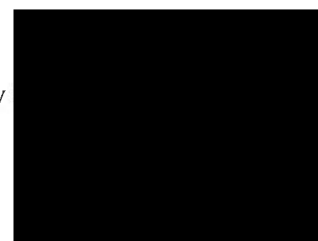
Calibration Method : CAL-M4004, TLAS G-20

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

| <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> | <u>Traceability</u> |
|-----------------|------------------|-----------------|---|
| 400029 & 400032 | 67-400584-1 | 29 Apr 2025 | National Institute of Metrology Thailand (NIMT) |

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Certificate of Calibration

Certificate No. : 68-400225-1

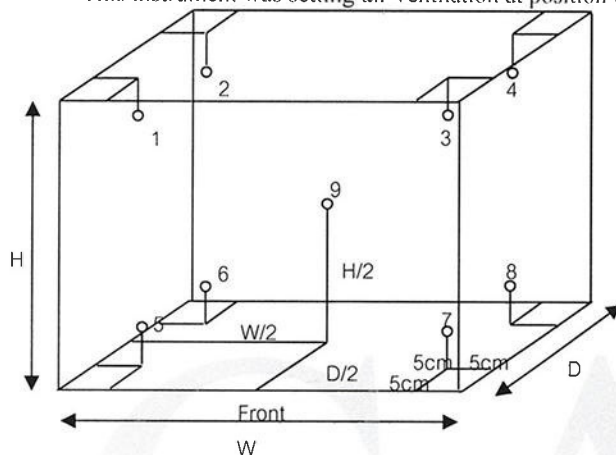
Page : 2 of 2

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 = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

| 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 | 104 | 104 | 105.5 | 104.4 | 103.8 | 104.0 | 105.7 | 104.4 | 104.3 | 104.8 | 104.1 | 0.97 |
| 180 | 180 | 180 | 181.9 | 179.5 | 179.3 | 179.3 | 182.8 | 180.7 | 181.0 | 181.3 | 179.7 | 1.3 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|----------------------|-------------------------------|----------------------------------|-------------------------------|------------------------------|-----------------------------|
| 104 | 104 | 104 | 1.7 | 0.1 | 2.2 |
| 180 | 180 | 180 | 3.5 | 0.3 | 3.9 |

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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Certificate of Calibration

Certificate No. : 68-400225-8

Page : 1 of 2

Submitted by : Tops-Lab Consultants Co., Ltd.
189 Moo 3 Bangrakphatthana, Bangbuathong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Incubator)
Manufacturer : Memmert **Model :** IF55
Range : N/A °C **Resolution :** 0.1 °C
Serial No. : D215.1343 **ID No. :** TLC-L069

Environment : On site calibration was carried out at the Laboratory, Tops-Lab Consultants Co., Ltd.
Ambient Temperature : (24.0 to 25.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (220.0 to 228.0) V

Date of Received : 21 April 2025

Date of Calibration : 21 April 2025

Date of Issue : 23 April 2025

Calibrated by : Permpon Chanpu

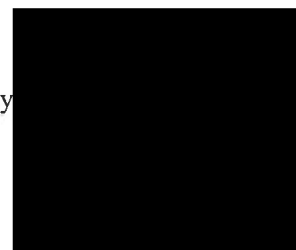
Calibration Method : CAL-M4004, TLAS G-20

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 |
|-----------------|-------------|-------------|---|
| 400046 & 400042 | 68-400007-1 | 28 Jul 2025 | National Institute of Metrology Thailand (NIMT) |

Approved by



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Certificate of Calibration

Certificate No. : 68-400225-8

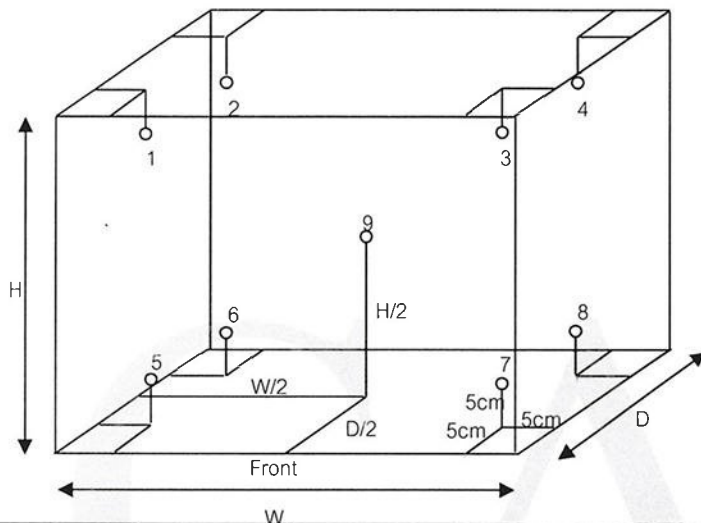
Page : 2 of 2

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 = 0.40 m

D = 0.33 m

H = 0.41 m

Capacity = 0.05 m³

| 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 | |
| 35.0 | 35.0 | 35.0 | 34.94 | 35.00 | 35.02 | 34.99 | 35.03 | 34.99 | 34.82 | 34.97 | 34.96 | 0.30 |
| 44.5 | 44.5 | 44.5 | 44.59 | 44.63 | 44.64 | 44.62 | 44.65 | 44.58 | 44.40 | 44.62 | 44.58 | 0.30 |

| Test Point (° C) | Setting Temperature (° C) | Indicating Temperature (° C) | Measured Uniformity (° C) | Measured Stability (° C) | Overall Variation (° C) |
|-----------------------|--------------------------------|-----------------------------------|--------------------------------|-------------------------------|------------------------------|
| 35.0 | 35.0 | 35.0 | 0.16 | 0.02 | 0.24 |
| 44.5 | 44.5 | 44.5 | 0.19 | 0.02 | 0.28 |

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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