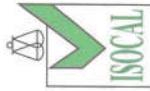


## ภาคผนวกที่ 5

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

สรุปตารางรายการเอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวิเคราะห์คุณภาพน้ำ

รายการตรวจวิเคราะห์	เครื่องมือตรวจวิเคราะห์ ชื่อเครื่องมือ
- pH	- pH Meter
- Total Suspended Solids	- Electronic Balance
- Total Dissolved Solids	- Electronic Balance
- BOD <sub>5</sub>	- BOD Analyzer
- COD	- COD Reactor
- TKN	- Electronic Balance
- Sulfide	- Electronic Balance
- Grease & Oil	- Electronic Balance
- Total Coliform Bacteria (TCB)	- Incubator
- Fecal Coliform Bacteria (FCB)	- Water Bath



CERT NO.: C22/0066B

PAGE : 1 OF 3

# ISOCAL TECHNOLOGY CO.,LTD. INDUSTRIAL INSTRUMENT CALIBRATION CENTER

170/405 Moo 3 Serithai Rd., Kannayao Bangkok 10230  
Tel. 0-2906-3040-1 Fax. 0-2919-9948

## Certificate of Calibration

EQUIPMENT : PH METER  
MODEL : HI98190  
SERIAL NO. : 04260035101  
ID NO. : B01  
MANUFACTURER : HANNA  
MADE IN : ROMANIA  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO.,LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,JOMPOL,  
CHATUCHAK . BANGKOK  
AMBIENT TEMPERATURE : ( 23 ± 2 ) °C  
RELATIVE HUMIDITY : ( 50 ± 15 ) %  
CALIBRATED BY : WATCHARA INCHADEE

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL, EXCEPT WITH THE PRIOR  
WRITTEN APPROVAL OF THE HEAD OF THE INDUSTRIAL INSTRUMENTS CALIBRATION CENTER.



ISOCAL TECHNOLOGY CO., LTD.

CERT NO.: C22/0066B  
PAGE : 2 OF 3

## CALIBRATION REPORT

EQUIPMENT : PH METER  
MANUFACTURER : HANNA  
MODEL : HI98190  
SERIAL NO. : 04260035101  
ID NO. : B01  
CALIBRATION DATE : 19-Mar-2022  
RECEIVED DATE : 17-Mar-2022  
PROCEDURE USED :

CALIBRATION WERE CONDUCTED USING IN-HOUSE CALIBRATION PROCEDURE WI-18-22 ACCORDING TO  
COMPARISON WITH PH SOLUTION STANDARD.

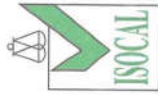
### CONDITION OF THIS RESULT OF CALIBRATION

1. THIS RESULT OF CALIBRATION WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
2. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL OF THIS RESULT OF CALIBRATION.
3. REFERENCE STANDARDS INSTRUMENTS :-

PH SOLUTION MODEL PH 4.01 SERIAL NO. 1.09435.1000 CERT. NO HC02910035 DATE 24-APR-2022  
- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY(NIST), U.S.A  
-PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB),GERMANY.  
THROUGH SUPELCO CO., LTD.

PH SOLUTION MODEL PH 7.01 SERIAL NO. 1.09439.1000 CERT. NO HC02387439 DUE DATE 18-APR-2022  
- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY(NIST), U.S.A  
-PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB),GERMANY.  
THROUGH SUPELCO CO., LTD.

PH SOLUTION MODEL PH 10.01 SERIAL NO. 1.09438.1000 CERT. NO HC01501438 DUE DATE 27-MAR-2022  
- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY(NIST), U.S.A  
-PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB),GERMANY.  
THROUGH SUPELCO CO., LTD.



# ISOCAL TECHNOLOGY CO., LTD.

## CALIBRATION REPORT

CERT.NO.: C22/0066B  
PAGE : 3 OF 3

RESULT OF CALIBRATION: ADJUSTMENT ( YES )

FUNCTION: PH MEASUREMENT WITH SOLUTION @ 25 °C

SCALE RANGE : 4.01 pH TO 10.01 pH

RESOLUTION: 0.01 pH

STANDARD VALUE ( pH )	UUC READING ( pH )	ERROR ( pH )	UNCERTAINTY ( pH )
4.01	3.97	-0.04	0.012
7.01	7.03	0.02	0.012
10.01	10.04	0.03	0.012

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

UUC = UNIT UNDER CALIBRATE

- oOo -



CERTIFICATE No : 22M2568  
REFERENCE No : 64386-2

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BSA224S-CW  
SERIAL No : 36591842  
ID No : BA 08/61  
CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22M2568

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
ID No : BA 08/61  
AIR PRESSURE : 1008mbar  $\pm$  1mbar  
AMBIENT TEMPERATURE : 22°C  $\pm$  1°C  
MODEL : BSA224S-CW  
S/N : 36591842  
RECEIVED DATE : 11-Mar-22  
CALIBRATION DATE : 11-Mar-22  
RELATIVE HUMIDITY : 51 %RH  $\pm$  10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

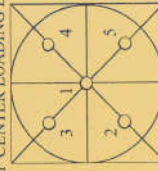
1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-
  - 1) STANDARD WEIGHT SET E2 QK-1-151 C02210415 09-Feb-23
  3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON 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 CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000079
2.00	2.0000	0.0000	0.000080
5.00	5.0000	0.0000	0.000081
10.00	10.0000	0.0000	0.000084
20.00	20.0000	0.0000	0.000089
50.00	50.0000	0.0000	0.00011
100.00	100.0000	0.0000	0.00019
200.00	199.9999	0.0001	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	100.0000
3	99.9999
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION 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

F-G010 REV 02





Cert.No.: 22TW98  
Page.: 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5000-230V  
**Serial No. :** 15B100751  
**ID No. :** -  
**Received Date :** 20 April 2022  
**Test Date :** 21 April 2022  
**Reference :** 2204-0429WC-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road.,  
Jompol, Chatuchak, Bangkok 10900  
**Laboratory Condition :** Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Walailak Sirithean  
**Approved by :**   
( ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagitrakul  
**Issue Date :** 25 April 2022



Cert.No.: 22TW98  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.14	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory

-o0o-

CERTIFICATE No : 22T0569  
REFERENCE No : 63773-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
MODEL : DRB 200  
SERIAL No : 15110C0235  
ID No : DRB 05/59  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 21-Jan-22

APPROVED BY :  
ISSUED DATE : 21-Jan-22  
RECEIVED DATE : 19-Jan-22

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

F-G010 REV : 02



CERTIFICATE No : 22T0569

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 05/59  
RECEIVED DATE : 19-Jan-22  
AMBIENT TEMPERATURE : 23°C ± 1°C  
MODEL : DRB 200  
SERIAL NUMBER : 15110C0235  
CALIBRATION DATE : 21-Jan-22  
RELATIVE HUMIDITY : 52%RH ± 10% RH

## CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

## 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :  
1) DATA LOGGER WITH TC TYPE K HYDRA 2635A 8009008 21T6767 10-Jul-22  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON 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

BLOCK No.1 FRONT					BLOCK No.2 FRONT				
13	14	15	13	14	15	13	14	15	13
10	11	12	10	11	12	10	11	12	10
7	8	9	7	8	9	7	8	9	7
4	5	6	4	5	6	4	5	6	4
1	2	3	1	2	3	1	2	3	1

## TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
1	150.1	149.8
2	150.3	149.6
3	150.1	150.0
4	150.4	150.0
5	150.1	149.9
6	150.1	149.5
7	150.6	150.0
8	150.4	150.3
9	149.8	150.1
10	149.5	149.5
11	150.6	150.1
12	150.0	150.2
13	149.6	150.1
14	150.2	149.6
15	149.5	149.7
Uncertainty of Measurement(± °C)	0.86	0.86

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

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

F-G010 REV : 02





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



## CALIBRATION CERTIFICATE

Certificate No. : SS2110-013-0003

Date Issued : 04-Oct-21

### Customer &

: S.P.S. CONSULTING SERVICE CO., LTD.

### Calibrated Place

7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,  
Bangkok 10900

### Equipment

: Incubator

### Manufacturer

: BINDER

### Model

: BD 115

### Serial No.

: 12-16967

### ID No./Tag No.

: IN 05/56

### Date Received

: 01-Oct-21

### Date Calibrated

: 01-Oct-21

### Calibrated by

: Mr. Jame Khaothong

### Calibration Method or Calibration Procedure Used

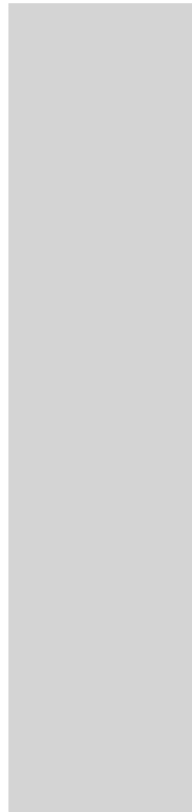
Standard method : CP-05 TLAS G-20.

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 Miracle International Technology Company Limited.



Certificate No. :

SS2110-013-0003

Environment :

Ambient Temperature :

Start record 26.0 °C, Stop record 25.7 °C

Relative Humidity :

Start record 56.5 %RH, Stop record 55.7 %RH

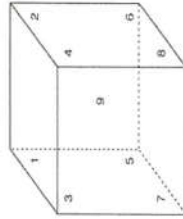
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability <sup>1</sup> (°C)	Measured Uniformity <sup>2</sup> (°C)	Overall Variation <sup>3</sup> (°C)
35	35.0	35.0	0.12	0.40	0.45
41.5	41.5	41.5	0.11	0.39	0.51

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)	Uncertainty <sup>4</sup> (°C)
35	35.01	35.11	34.95	35.00	34.99	34.95	35.07	35.07	35.23	0.23
41.5	41.47	41.47	41.40	41.49	41.37	41.33	41.43	41.51	41.62	0.22

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. AD2107-034-0001 for Digital Thermometer with Probe (Agilent) Module 1 (245) Serial No. US37005130, Due 04-Feb-22

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 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



CERTIFICATE No : 22T2575  
REFERENCE No : 64387-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNB 29  
SERIAL No : L614.0123  
ID No : WB 05/58  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 11-Mar-22

APPROVED BY :  
ISSUED DATE : 17-Mar-22  
RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22T2575

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : WB 05/58  
RECEIVED DATE : 11-Mar-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
MODEL : WNB 29  
SERIAL NUMBER : L614.0123  
CALIBRATION DATE : 11-Mar-22  
RELATIVE HUMIDITY : 50 %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

1) DATA LOGGER WITH RTD

MODEL : 2625A

SERIAL No : 6603614

CERTIFICATE No : 2116761

DUE DATE : 05-Jul-22

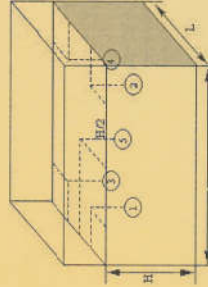
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

## GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.8  
Overall Variation of Line Voltage (V) : 4  
Instrument Condition : Normal  
Bath Inner Size (W\*L\*H) : 59\*35\*14 cm

PROBE INSTALLATION  
POSITION IN THE BATH

## BATH PERFORMANCE

Calibration Point (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.0	0.05	0.04	0.05	0.09
60.0	0.04	0.05	0.05	0.12

## TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations				Uncertainty (± °C)
		#1	#2	#3	#4	
50.3	50.3	50.07	50.08	50.05	50.04	50.07
60.3	60.3	60.03	60.07	60.07	60.07	60.03
						0.14
						0.14

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