

## ภาคผนวก 6

หนังสือรับรองห้องปฏิบัติการวิเคราะห์เอกชน



ที่ อก ๐๓๓๐(๓)/ ๕๕๓๓

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

\* ๙ พฤษภาคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมเคมี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒ มีนาคม ๒๕๖๕สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท วิศวกรรมเคมี จำกัด จำนวน ๑ แผ่นตามหนังสือที่อ้างถึง บริษัท วิศวกรรมเคมี จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ว-๐๐๑ สถานที่ตั้งเลขที่ ๑๐๔๘/๒ ซอยสุขุมวิท ๖๖/๑ ถนนสุขุมวิท แขวงพระโขนงใต้  
เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้นกรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท วิศวกรรมเคมี จำกัด ต่ออายุหนังสือรับขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

๑) นางสาวธัญญารัตน์ พลอยกระจำ

ทะเบียนเลขที่ ว-๐๐๑-ค-๐๐๐๑

๒) นางสาวกรานตมา สว่างรุ่งรัตน์

ทะเบียนเลขที่ ว-๐๐๑-ค-๐๐๐๒

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

๑) นางสาวรัชนิษฐ์ วนิชกุลวิริยะ

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๑

๒) นางสาวกมลชนก วงศ์พนาไกร

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๒

๓) นางสาววรลักษณ์ เทียนกระจำ

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๓

๔) นางสาวเกวรินทร์ ศิริวัฒนสกุล

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๔

๕) นางสาวจิราพร เบญจริยาภรณ์

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๕

๖) นางสาวจารุวรรณ ดันสกุล

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๖

๗) นางสาวกาญจนา ลาชุมเหล็ก

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๗

๘) นางสาวกิตติยา นารี

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๘

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้...



- ๒ -

หนังสือฉบับนี้จะหมดอายุในวันที่ ๘ เมษายน ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code  
ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางจันทา เลิศศรีนทร์)

ผู้อำนวยการกองวิจัยและเคมียานเภสัชโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเคมียานเภสัชโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙  
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท วิศวกรรมเคมี จำกัด

เลขทะเบียน ๖-๐๐๑

ที่ อก ๐๓๑๐(๑)/ ๕๕๓๓

ลงวันที่ ๙ พฤษภาคม ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐ รายการ

น้ำเสีย จำนวน 20 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
2	Barium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
3	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
4	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
5	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method <sup>[2]</sup> 2) Closed Reflux, Titrimetric Method <sup>[2]</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
7	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[2]</sup>
8	Copper	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
9	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
10	Lead	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
11	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
12	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
13	Oil & Grease	Soxhlet Extraction Method <sup>[2]</sup>
14	pH	Electrometric Method <sup>[2]</sup>
15	Selenium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
16	Sulfide	Iodometric Method <sup>[2]</sup>
17	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
18	Total Kjeldahl Nitrogen	Macro Kjeldahl Method <sup>[2]</sup>
19	Total Suspended Solids	Dried at 103-105 °C <sup>[2]</sup>
20	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>

#### เอกสารอ้างอิง

1. สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรือนแก้วการพิมพ์, 2547.

2. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23<sup>rd</sup> ed. Washington, DC: APHA, 2017.



## ภาคผนวก 7

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



# Certificate of Calibration

<b>Equipment:</b>	Balance	<b>Certificate No.:</b>	C01212659
<b>Model:</b>	BSA224S-CW	<b>Issued Date:</b>	13 September 2021
<b>Serial No. (or ID.):</b>	28092544 (INS/LB-109)	<b>Job No.:</b>	KSPR2112116
<b>Manufacturer:</b>	Sartorius	<b>Page:</b>	1 of 2
<b>Condition:</b>	In condition		

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 28 °C ± 0.2 °C  
Humidity 50 %RH ± 1.8 %RH

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Adinan Ninviboon

**Calibration Date:** 13 September 2021

**The Method used:** In house method, SPCC-WI-47, base on UKAS Lab 14

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210017

(Mr. Adinan Ninviboon)

Person in charge

**SERT**  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

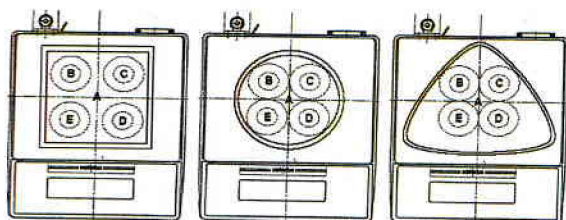
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

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 SPC RT Co., Ltd.

**Calibration Results:****Without Adjustment**

**Eccentric Error:** Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 50 (g)

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

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

Nominal test value (g)	Standard Deviation
20	0.00005
200	0.00006

**Departure of indication from nominal value.,** Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00011	2.05
2	2.00002	2.0000	0.0000	0.00011	2.05
5	4.99999	5.0000	0.0000	0.00012	2.05
10	10.00000	10.0000	0.0000	0.00012	2.05
20	19.99999	20.0000	0.0000	0.00012	2.04
50	49.99997	50.0000	0.0000	0.00013	2.03
100	100.00000	100.0000	0.0000	0.00018	2.01
120	119.99999	120.0000	0.0000	0.00021	2.00
150	149.99997	150.0000	0.0000	0.00024	2.00
200	199.99990	200.0000	-0.0001	0.00030	2.00

**The End of Certificate**

## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :**
- ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA
  - ☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Specific Risk < 2.5% PFA
  - ☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ) .  
; PFA – Probability of False Accept

### Without Adjustment

Readability; 0.0001 g

Tolerances : 0.0005 g

Nominal Value g	Correction of Balance g	Guard band (w) g	Tolerance ( $\pm$ ) g	Conformity
1	0.0000	0.00011	0.0005	Pass
2	0.0000	0.00011	0.0005	Pass
5	0.0000	0.00012	0.0005	Pass
10	0.0000	0.00012	0.0005	Pass
20	0.0000	0.00012	0.0005	Pass
50	0.0000	0.00013	0.0005	Pass
100	0.0000	0.00018	0.0005	Pass
120	0.0000	0.00021	0.0005	Pass
150	0.0000	0.00024	0.0005	Pass
200	-0.0001	0.00030	0.0005	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

### The End of Statements of Certificate





# Certificate of Calibration

<b>Equipment:</b>	Hot Air Oven	<b>Certificate No.:</b>	C31211853
<b>Model:</b>	UF 55	<b>Issued Date:</b>	16 September 2021
<b>Serial No.(or ID):</b>	B218.3817 (IN-LB-134 )	<b>Job No.:</b>	KSPR2112118
<b>Manufacturer:</b>	Memmert	<b>Page:</b>	1 of 4
<b>Condition:</b>	In Condition	<b>Ventilation Valve:</b>	Closed
<b>Shelves(pc.):</b>	2		

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:**

Temperature:	26 °C	±	0.3 °C
Humidity:	54 %RH	±	2.2 %RH
Voltage:	225 VAC	±	1.9 VAC

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory)  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Tharanid Fasawang TR  
**Calibration Date:** 13 September 2021  
**The Method used:** In house method, SPCC-WI-16, base on TLAS-G20  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210008



(Mr. Tharanid Fasawang)

Person in charge


  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.



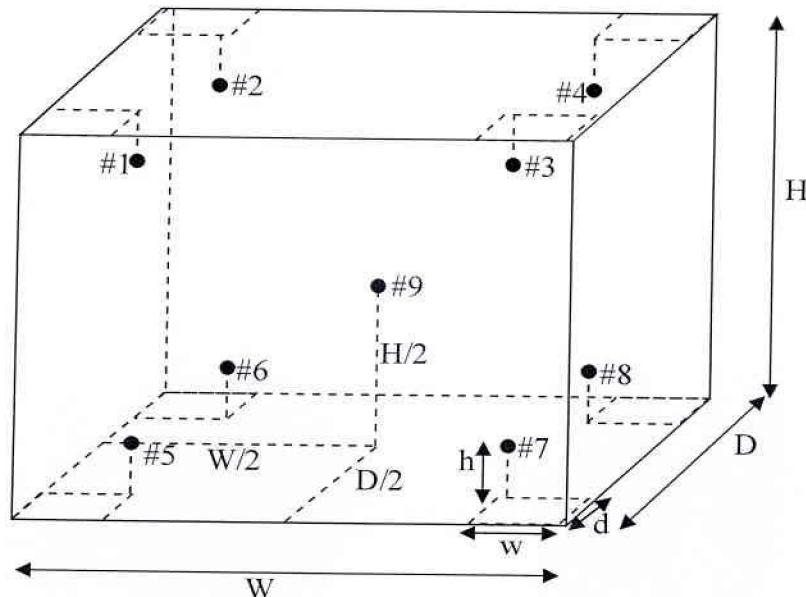
(Mr. Udon Srichana)

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 SPC RT Co., Ltd.



### Standard Installation Locations

Volume (Calibration Zone)= 16 (Liters)

Inside chamber:  $W = 40$  (cm)  $D = 33$  (cm)  $H = 40$  (cm)

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

Standard Locations (#5, #6, #7, #8):  $w = 5$  (cm)  $d = 5$  (cm)  $h = 12$  (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

### 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.

Certificate No.: C31211853

Page: 3 of 4

**Calibration Results:**  
**Without 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	104.06	0.06	0.40
#2	103.89	-0.11	0.40
#3	103.99	-0.01	0.40
#4	103.87	-0.13	0.40
#5	104.23	0.23	0.41
#6	104.26	0.26	0.40
#7	105.03	1.03	0.40
#8	104.06	0.06	0.40
#9	104.07	0.07	0.40

**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	104.06	103.89	103.99	103.87	104.23	104.26	105.03	104.06	104.07	0.41

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	1.03	0.11	1.33

Note: \* Maximum uncertainty of the each position

Certificate No.: C31211853

Page: 4 of 4

**Without 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	179.55	-0.45	0.50
#2	179.36	-0.64	0.50
#3	179.45	-0.55	0.50
#4	179.04	-0.96	0.50
#5	180.27	0.27	0.52
#6	180.38	0.38	0.50
#7	181.33	1.33	0.52
#8	179.69	-0.31	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)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	179.55	179.36	179.45	179.04	180.27	180.38	181.33	179.69	179.77	0.52

**Chamber Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.68	0.13	2.50

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



Certificate No.: C31211853 Page: 1 of 2

## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA  
☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Specific Risk < 2.5% PFA  
☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ).  
; PFA – Probability of False Accept

### Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

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

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.06	0.06	0.40	1.0	Pass
#2	103.89	-0.11	0.40	1.0	Pass
#3	103.99	-0.01	0.40	1.0	Pass
#4	103.87	-0.13	0.40	1.0	Pass
#5	104.23	0.23	0.41	1.0	Pass
#6	104.26	0.26	0.40	1.0	Pass
#7	105.03	1.03	0.40	1.0	Condition Fail
#8	104.06	0.06	0.40	1.0	Pass
#9	104.07	0.07	0.40	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Certificate No.: C31211853 Page: 2 of 2

**Statements of conformity:(Cont.)****Without adjustment (Cont.)**

Desired Temperature : 180.0°C Tolerances : 2.0 °C

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

Locations	Measured (°C)	Correction of UUC.* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.55	-0.45	0.50	2.0	Pass
#2	179.36	-0.64	0.50	2.0	Pass
#3	179.45	-0.55	0.50	2.0	Pass
#4	179.04	-0.96	0.50	2.0	Pass
#5	180.27	0.27	0.52	2.0	Pass
#6	180.38	0.38	0.50	2.0	Pass
#7	181.33	1.33	0.52	2.0	Pass
#8	179.69	-0.31	0.50	2.0	Pass
#9	179.77	-0.23	0.50	2.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

**The End of Statements of Conformity**



## CALIBRATION CERTIFICATE

**Date of Issue** Jul 12, 2021 **Cert No.** 21/2561  
**Site Calibration** **Order No.** 21070314

**Customer** Thai Chemical & Engineering Co., Ltd.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road, Prakanong Tai, Prakanong, Bangkok 10260

**Place of Calibration** 1350, 1352 Sutthisarnwinitchai Rd, Dindaeng, Bangkok 10400. (Calibration Room)

**Description** Cooled Incubator  
**Model** IPP750eco  
**Serial No.** V821.0094  
**ID.No.** -  
**Date of Receipt** Jul 07, 2021  
**Date of Calibration** Jul 07, 2021

**Environment**

<b>Temperature</b>	(Min)	23.2	°C	(Max)	26.6	°C
<b>Relative Humidity</b>	(Min)	51.3	%RH	(Max)	76.7	%RH

TR

### Calibration Method

WI-17 : The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.  
The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

### Standard

1) Data Acquisition with Sensor Model 34972A S/N. MY49013906, Certificate No. QR21-0136, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292.

This certificate is traceable to SI unit.

0.00



## CALIBRATION CERTIFICATE

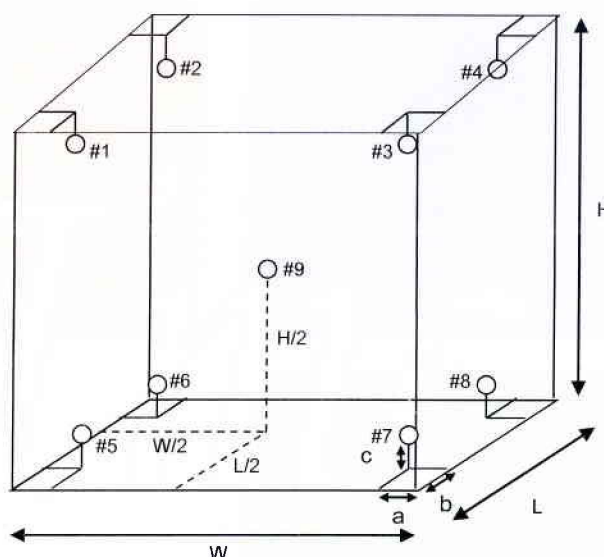
Date of Issue Jul 12, 2021

Cert No. 21/2561

Site Calibration

Order No. 21070314

Results (without adjustment)



Position of reference thermometers were placed

### Note.

- 1). Dimension (W x L x H) is 104 x 60 x 120 cm.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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. The reference sensor should preferably be located at the geometric center of the chamber.





## CALIBRATION CERTIFICATE

Date of Issue Jul 12, 2021

Cert No. 21/2561

Site Calibration

Order No. 21070314

Results (without adjustment)

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability $\pm$ (°C)	Uniformity (°C)	Uncertainty $\pm$ (°C)
20.0	20.0	Position 1	20.230	0.031	0.143	0.30
		Position 2	20.130			
		Position 3	20.137			
		Position 4	20.167			
		Position 5	20.234			
		Position 6	20.212			
		Position 7	20.192			
		Position 8	20.214			
		Position 9	20.129			

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

APPROVED SIGNATORY :

(MR. DAMRONG MULSING)



## Certificate of Calibration

<b>Equipment:</b>	Incubator	<b>Certificate No.:</b>	C31211845
<b>Model:</b>	IN 55	<b>Issued Date:</b>	14 September 2021
<b>Serial No.(or ID):</b>	D213.0681 (INS/LB-121)	<b>Job No.:</b>	KSPR2112121
<b>Manufacturer:</b>	Memmert	<b>Page:</b>	1 of 3
<b>Condition:</b>	In Condition	<b>Ventilation Valve:</b>	Closed
<b>Shelves(pc.):</b>	1		

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:**

Temperature:	27 °C	±	0.6 °C
Humidity:	59 %RH	±	3.8 %RH
Voltage:	225 VAC	±	0.8 VAC

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Chanachol Moohammudrosol

**Calibration Date:** 13 September 2021

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

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210006

(Mr. Chanachol Moohammudrosol)

Person in charge

บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

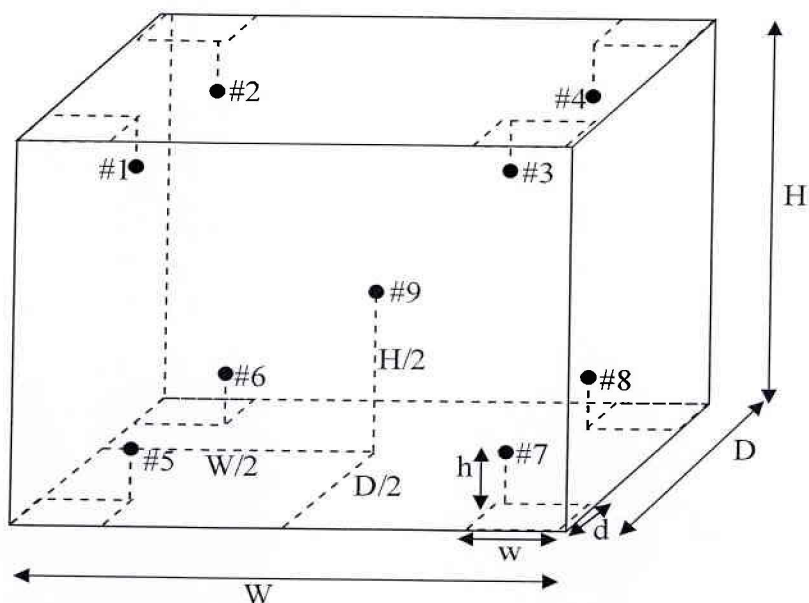
(Mr. Udon Srichana)

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 SPC RT Co., Ltd.



### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

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

Standard Locations (#5, #6, #7, #8): w = 5 (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	1	2	3	4	5	6	7	8	9

### 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.

Certificate No.: C31211845

Page: 3 of 3

**Calibration Results:****Without adjustment**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	34.92	-0.08	0.23
#2	34.96	-0.04	0.23
#3	34.93	-0.07	0.23
#4	34.82	-0.18	0.23
#5	34.78	-0.22	0.23
#6	35.10	0.10	0.23
#7	34.76	-0.24	0.25
#8	34.89	-0.11	0.23
#9	34.92	-0.08	0.23

## 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	
35.0	35.0	35.0	34.92	34.96	34.93	34.82	34.78	35.10	34.76	34.89	34.92	0.25

## Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.27	0.13	0.49

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



Certificate No.: C31211845 Page: 1 of 1

## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA  
☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Specific Risk < 2.5% PFA  
☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ) .  
; PFA – Probability of False Accept

### Without adjustment

Desired Temperature : 35.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	34.92	-0.08	0.23	1.0	Pass
#2	34.96	-0.04	0.23	1.0	Pass
#3	34.93	-0.07	0.23	1.0	Pass
#4	34.82	-0.18	0.23	1.0	Pass
#5	34.78	-0.22	0.23	1.0	Pass
#6	35.10	0.10	0.23	1.0	Pass
#7	34.76	-0.24	0.25	1.0	Pass
#8	34.89	-0.11	0.23	1.0	Pass
#9	34.92	-0.08	0.23	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

## The End of Statements of Conformity



# Certificate of Calibration

<b>Equipment:</b>	Incubator	<b>Certificate No.:</b>	C31211846
<b>Model:</b>	IN 55	<b>Issued Date:</b>	14 September 2021
<b>Serial No.(or ID):</b>	D215.1344 (INS/LB-022)	<b>Job No.:</b>	KSPR2112123
<b>Manufacturer:</b>	Memmert	<b>Page:</b>	1 of 3
<b>Condition:</b>	In Condition	<b>Ventilation Valve:</b>	Closed
<b>Shelves(pc.):</b>	2		

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:**

Temperature:	25 °C	±	0.8 °C
Humidity:	60 %RH	±	3.5 %RH
Voltage:	225 VAC	±	1.6 VAC


**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Chanachol Moohammudrosol

**Calibration Date:** 13 September 2021


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

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210006


  
(Mr. Chanachol Moohammudrosol)

Person in charge


  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

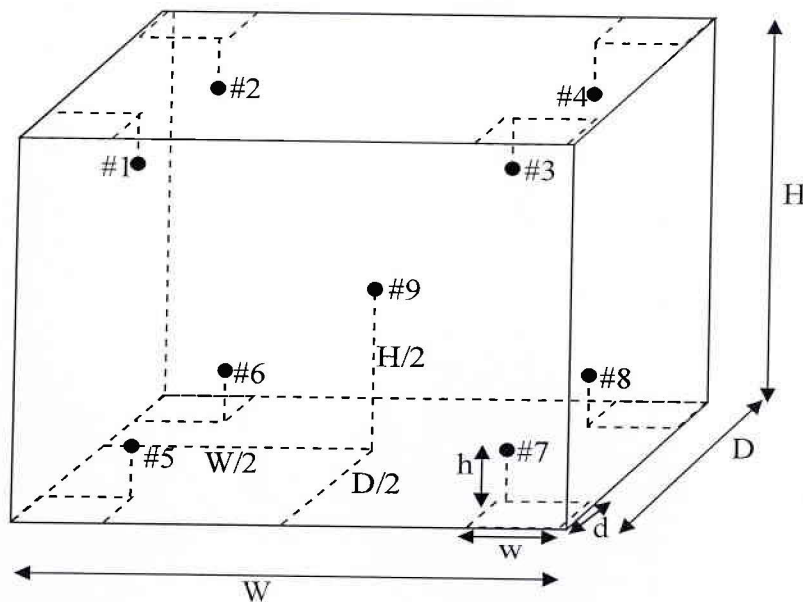

  
(Mr. Udon Srichana)

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 SPC RT Co., Ltd.



### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

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

Standard Locations (#5, #6, #7, #8): w = 5 (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	1	2	3	4	5	6	7	8	9

### 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.



Certificate No.: C31211846

Page: 3 of 3

## Calibration Results:

### Before adjustment

Setting:            Indicating:    #1:    #2:    #3:    #4:    #5:    #6:    #7:    #8:    #9:  
45.0                45.0            44.93 44.85 45.03 44.97 44.48 44.41 44.57 44.80 44.85

### After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 45.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	45.33	0.33	0.23
#2	45.21	0.21	0.23
#3	45.41	0.41	0.23
#4	45.31	0.31	0.23
#5	44.90	-0.10	0.23
#6	44.76	-0.24	0.23
#7	44.99	-0.01	0.23
#8	45.18	0.18	0.23
#9	45.23	0.23	0.24

### 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	
45.0	45.0	45.0	45.33	45.21	45.41	45.31	44.90	44.76	44.99	45.18	45.23	0.24

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
45.0	0.53	0.06	0.72

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA  
☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Specific Risk < 2.5% PFA  
☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ) .  
; PFA – Probability of False Accept

### After adjustment

Desired Temperature : 45.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 45.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	45.33	0.33	0.23	1.0	Pass
#2	45.21	0.21	0.23	1.0	Pass
#3	45.41	0.41	0.23	1.0	Pass
#4	45.31	0.31	0.23	1.0	Pass
#5	44.90	-0.10	0.23	1.0	Pass
#6	44.76	-0.24	0.23	1.0	Pass
#7	44.99	-0.01	0.23	1.0	Pass
#8	45.18	0.18	0.23	1.0	Pass
#9	45.23	0.23	0.24	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

## The End of Statements of Conformity



# Certificate of Calibration

**Equipment:** pH METER  
**Model:** Seven Compact S220  
**Serial No. (or ID.):** B914466655  
**Manufacturer:** Mettler Toledo  
**Electrode Serial No.:** 8473213  
**Condition:** In Condition

**Certificate No.:** C07210227  
**Issued Date:** 6 May 2021  
**Job No.:** KSPR2106247  
**Page:** 1 of 3  
**Model:** InLab Expert Pro-ISM **Brand:** Mettler Toledo

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
 Humidity 50 %RH ± 15 %RH

**Calibration Place:** Environment Laboratory, SPC RT Co., Ltd.  
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Vanasapol Lerksanthia

**Calibration Date:** 6 May 2021

**The Method used:** In house method, SPCC-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. 724708, 724716, 724715 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. 0627EL20

*Vanasapol*

(Mr. Vanasapol Lerksanthia)

Person in charge

**SERT**  
 บริษัท เอสพีซี อาร์ที จำกัด  
 SPC RT Co., Ltd.

*[Signature]*

(Mr. Dumrong Boonsopon)

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 SPC RT Co., Ltd.

## Calibration Results:

### pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414.1	-0.02	0.000	0.065	2.00
354.96	355.0	0.04	1.000	0.065	2.00
295.80	295.8	0.00	2.000	0.065	2.00
236.64	236.7	0.06	3.000	0.065	2.00
177.48	177.5	0.02	4.000	0.065	2.00
118.32	118.4	0.08	5.000	0.065	2.00
59.16	59.2	0.04	6.000	0.065	2.00
0.00	0.1	0.10	7.000	0.065	2.00
-59.16	-59.1	0.06	8.000	0.065	2.00
-118.32	-118.3	0.02	9.000	0.065	2.00
-177.48	-177.4	0.08	10.000	0.065	2.00
-236.64	-236.5	0.14	11.000	0.065	2.00
-295.80	-295.7	0.10	12.000	0.065	2.00
-354.96	-354.8	0.16	13.000	0.065	2.00
-414.12	-414.0	0.12	14.000	0.065	2.00

### Electrode Test Results\*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 10.012

The practical slope of the pH electrode; 57.90 (mV/pH), 97.87%

The zero point of the pH electrode; 6.94 (pH)

### Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.008	0.000	0.0070	2.00
6.985	6.986	0.001	0.0078	2.00
10.012	10.013	0.001	0.0070	2.00

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

**The End of Certificate**





## Certificate of Calibration

<b>Equipment:</b>	Digital Thermometer	<b>Certificate No.:</b>	C15210165
<b>Model:</b>	Seven Compact S220	<b>Issued Date:</b>	07 May 2021
<b>Serial No.(or ID):</b>	B914466655	<b>Job No.:</b>	KSPR2106245
<b>Manufacturer:</b>	METTLER TOLEDO	<b>Page:</b>	1 of 2
<b>Condition:</b>	In Condition		

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature: 22 °C ± 3.0 °C  
Humidity: 50 %RH ± 15.0 %RH  
Voltage: 230 VAC ± 11.0 VAC

**Calibration Place:** Sensor Laboratory, SPC RT Co., Ltd.  
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Anat Karapitak

**Calibration Date:** 07 May 2021

**The Method used:** In house method, SPCC-WI-19, by comparison with standard thermometer

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality Reborn Co.,Ltd. (QR) Certificate No. QR21-0415

(Mr. Anat Karapitak)

Person in charge

**SPC RT**  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

(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 SPC RT Co., Ltd.

**Calibration Results:**

**Without Adjustment**

Sensor Type: Thermistor

Channel: -

Diameter (mm) 12

Length (mm): 100

Immersion (mm): 110

Desired Temp.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
20.0	20.004	19.8	0.204	0.10
25.0	25.000	24.9	0.100	0.10
30.0	30.004	29.8	0.204	0.10

**The End of Certificate**

# Preventive Maintenance Kjeldahl

Service No. PM21-S08-141

## 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260  คุณธัญญารัตน์ Tel: Fax:	K-350	0700000546	09 Sep 2021 PM 2/2

## 2. Instrument

2.1 Cooling water (If it connected)	OK	NOT OK	Remark
- Temperature 15 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Control Temperature	/		

2.2 Cleaning	DONE	NOT DONE	Remark
- Outside Instrument	/		
- Inside Instrument	/		
- Splash protector	/		
- Condenser	/		

## Preventive Maintenance Kjeldahl

### 2.3 Visual Test

	OK	NOT OK	Remark
- Screw Coupling (between splash protector and condenser)	/		
- Condenser	/		
- Splash protector	/		
- Hypalon connection (connection tube)	/		
- Rubber bung	/		
- Ventilation valve	/		
- PTFE tube	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Magnetic valve	/		

### 2.4 System control

	OK	NOT OK	Remark
- Key board	/		
- Display	/		
- Program	/		
- Adding H <sub>2</sub> O	-	-	Do not have
- Adding NaOH	/		
- Adding H <sub>3</sub> BO <sub>3</sub>	-	-	Do not have
- Aspiration	-	-	Do not have



## Preventive Maintenance Kjeldahl



2.5 System Distillation	OK	NOT OK	Remark
- Boiler	/		
- Water level sensor	/		
- One way valve	/		
- Pressure switch	/		
- Thermostat	/		
- Steam valve1 (Y4)	/		
- Steam valve2 (Y5)	/		
- Drain valve (Y3)	-	-	Do not have
- Water 3/2 way valve (Y1)	-	-	Do not have

2.6 Hose	OK	NOT OK	Remark
- Unisil hose	/		
- Hypalon hose	/		
- Drain hose	-	-	Do not have
- Viton hose	/		
- Silicone hose	/		

2.7 Diaphragm pump	OK	NOT OK	Remark
- Diaphragm pump for H <sub>2</sub> O	-	-	Do not have
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H <sub>3</sub> BO <sub>3</sub>	-	-	Do not have

2.8 Program test	OK	NOT OK	Remark
- Distillation	/		
- Aspiration	-	-	Do not have
- Preheating	/		
- Cleaning	/		



## Preventive Maintenance Kjeldahl

### 3. Function Test

Addition H <sub>2</sub> O	0 ml	Reaction time	0 min
Addition NaOH	0 ml	Distillation time	5 min
Addition H <sub>3</sub> BO <sub>3</sub>	0 ml	Steam capacity	100%
		Aspiration	SAM

**Result:** Water in receiving vessel now approximately 161 ml, 166 ml

### 4. Summary



All specifications OK	Specification not OK
OK	

#### Comments

PM K-350 In PM contract 2/2:ok

#### Signature BUCHI

- Service by Tada S.

Date 09 Sep 2021

- Approve by Suphan C.

Date 13 Sep 2021



Buchi (Thailand) Limited

# Preventive Maintenance IR Digestion

Service No. PM21-S08-141

## 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	K-424	0600004943	09 Sep 2021 PM 2/2
คุณธัญญารัตน์ Tel: Fax:			

## 2. Instrument

2.1 Housing	OK	NOT OK	Remark
- Clean the housing	/		
- Visual check	/		
- Check for defects (e.g. cracks)	/		

2.2 Heating	OK	NOT OK	Remark
- Clean insulation plate	/		
- Visual check	/		
- Check heating element	/		

## Preventive Maintenance IR Digestion

2.3 Visual Check	OK	NOT OK	Remark
- Connection to suction	/		
- PTFE seal	/		
- O-ring	/		
- Glass holder set	/		
- Suction module	/		

2.4 System control (for K-439 only)	OK	NOT OK	Remark
- Keyboard	/		
- Display	/		
- Program	/		

**BUCHI**



## Preventive Maintenance IR Digestion

### 3. Summary

All specifications OK	Specification not OK
OK	

#### Comments

PM K-424 In contract 2/2 : OK



Signature BUCHI



Buchi (Thailand) Limited

- Service by Tada S.

Date 09 Sep 2021

- Approve by Suraphan C.

Date 13 Sep 2021

# Preventive Maintenance Scrubber

Service No. PM21-S08-141

## 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260  คุณธัญญารัตน์ Tel: Fax:	B-414	0700002972	09 Sep 2021 PM 2/2

## 2. Instrument

2.1 Cooling water (If it connected)	OK	NOT OK	Remark
- Temperature 10 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		

2.2 Cleaning	DONE	NOT DONE	Remark
- Housing	/		
- Condenser	/		
- Swirl disc	/		

## Preventive Maintenance Scrubber

2.3 Visual Check	OK	NOT OK	Remark
- Hose connection to suction	/		
- Glassware	/		
- Lip gasket	/		
- GL-14 connector	/		
- Activated charcoal	/		

### 2.4 Flush Pump



Make sure, the bypass valve is closed completely (for maximum suction power).

- Disconnect the silencer, move it down (or take it away from the instrument), and flush out the pump with at least 500 mL of distilled water through the pump inlet, until the collected washing water is clean.
- Switch on the instrument and collect the waste water from the pump output in a suitable vessel.

Flush pump

☒ OK

☐ NOT OK

### 2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
  - dissolve 600 g  $\text{Na}_2\text{CO}_3$  in 3 L distilled warm water, or
  - dissolve 1.7 kg  $\text{Na}_2\text{CO}_3$  in 10  $\text{H}_2\text{O}$  in 3 L distilled warm water

Washing solution

☒ OK

☐ NOT OK

## Preventive Maintenance Scrubber

### 3. Summary

All specifications OK	Specification not OK
OK	

#### Comments

PM B-414 In PM contract 2/2:ok



Signature BUCHI



Buchi (Thailand) Limited

- Service by Tada S.

Date 09 Sep 2021

- Approve by Suvaphan C.

Date 13 Sep 2021