

ภาคผนวก ค-5

คุณภาพน้ำทิ้งจากบ่อตรวจสอบคุณภาพน้ำ (Inspection Manhole)

TESTING
NLS-0042

Lot ID: 244978
Date Received : Feb 01, 2024
Date Reported : Feb 08, 2024
Report Number : 2885431-1

Page 1 of 2

Sample Number	244978-1					
Sample Date	Feb 01, 2024 10:57 AM					
Sample Description	Wastewater					
Location	น้ำเสียจากท่อระบายน้ำ : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.					
Date Analysis Commenced	Feb 01, 2024					
Condition of Sample	Contained in one amber glass bottle and three plastic bottles, sample containers comply to pretreatment - preservation standards (APHA, USEPA)					
Analyte	Unit	LOD	LOQ (LOB)	Result	Guideline / Specification	Method Testing Location
Water Testing						
BOD (5 days at 20 degree C)	mg/L	-	2.0	<2.0	≤500	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part §210 B, part 4500 - O G
COD	mg/L	1.5	25	29	≤750	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part §220 D
pH at 25 degree C		-	-	7.5	5.5-9.0	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part §520 - H (B)
Temperature *	Degree C	-	-	31.7	≤40	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2550 B
Total Dissolved Solids Dried at 180 degree C	mg/L	-	5	1496	≤3000	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2540 C
Total Kjeldahl Nitrogen as N	mg/L	-	1.0	4.6	≤100	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 4500-Norg (C), part N13 (D)
Total Suspended Solids Dried at 103-105 degree C	mg/L	-	5	9	≤200	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2540 D

Guideline : Standard of Rojana Industrial park (Rayong) No.2/2559 and No.1/2560, Criteria of wastewater drainage from the factory to central wastewater treatment plant.

Remark :

- LOD
- Limit of Detection
- Lower than LOD (Limit of Quantitation) / LOQ (Limit of Reporting)

Technical Management

Approved by

[illegible]

71-6-14-C7C-7 1000000000000000000

Results apply to the sample(s) as submitted, unless the sampling risk (conducted by ALS) for part of this report may be reproduced in any form without written consent from the laboratory.

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(AC16-S3/FMAT)

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Analysis / Test Report

Lot ID: 23145796
Date Received : Jan 04, 2010
Date Reported : Jan 09, 2010
Report Number : 2868550-

Page 1 of 1

Sample Number	23145796-1						
Sample Date	Jan 04, 2024 11:05 AM						
Sample Description	Wastewater						
Location	บริษัท อีโคโนมิค แอสเซส จำกัด - BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.						
Date Analysis Commenced	Jan 06, 2024						
Condition of Sample	Contained in one amber glass bottle and three plastic bottles, sample containers comply to pretreatment - preservation standards (APHA, USEPA)						
Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, 23rd ed., 2017, and S320 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong) No.2/2559 and No.1/2560, Criteria of wastewater drainage from the factory to central wastewater treatment plant.

Samart Khumphanee 7-204-2-7830

Remark :
 - LOD : Limit of Detection
 : Lower than 1.00 (Limit of Quantization) / 1.08 (Limit of Reporting)

Technical Management

Approved by

...G... 701.2.5417

ทะเบียนเลขที่ ๖-204-๓-6111

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Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Italhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : Test of water quality in the factory (โรงงานน้ำดื่ม)
Project Location : Factory

TESTING
No.0042
Lot ID: 244978

Date Received : Feb 01, 2024
Date Reported : Feb 08, 2024
Report Number : 2885431-1

Page 2 of 2

Analyte(s) marked * is/are not included in scope of Accreditation ISO/IEC 17025.
The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, 23rd ed., 2017, part 5520 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong) No.2/2559 and No.1/2560, Criteria of wastewater drainage from the factory to central wastewater treatment plant.

Sampling BY : Tanasit Wongachai วิศวกร 323-49460, Smart Khumphee วิศวกร 320-47830

Remark :

- LOD : Limit of Detection
- LOQ : Lower then LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

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S:\report\AL_GL.rpt (2.44978)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Italhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : Test of water quality in the factory (โรงงานน้ำดื่ม)
Project Location : Factory

Lot ID: 244978
Date Received : Feb 01, 2024
Date Reported : Feb 07, 2024
Report Number : 2885431-2

Page 1 of 1

Sample Number	244978-1
Sampled Date	Feb 01, 2024 10:57 AM
Sample Description	Wastewater
Location	บริเวณโรงงานน้ำดื่ม (บริเวณน้ำดื่ม) : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.
Date Analysis Commenced	Feb 03, 2024
Condition of Sample	Contained in one amber glass bottle and three plastic bottles, sample containers comply to pretreatment - preservation standards (APHA, USEPA)

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, 23rd ed., 2017, part 5520 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong) No.2/2559 and No.1/2560, Criteria of wastewater drainage from the factory to central wastewater treatment plant.

Sampling BY : Tanasit Wongachai วิศวกร 323-49460, Smart Khumphee วิศวกร 320-47830

Remark :

- LOD : Limit of Detection
- LOQ : Lower then LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

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Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaitai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โรงงานประกอบและบรรจุภัณฑ์พลาสติก (โรงงานพลาสติก)

Project Location: Factory



TESTING
No.0042
Lot ID: 2422642

Date Received : Mar 04, 2024
Date Reported : Mar 11, 2024
Report Number : 2920888-1

Page 1 of 2

Sample Number		2422642-1					
Sample Date		Mar 04, 2024 10:49 AM					
Sample Description		Wastewater					
Location		เขื่อนเก็บกักน้ำบริเวณเขื่อน (บริษัทพญาไท) จำกัด : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.					
Date Analysis Commenced		Mar 04, 2024					
Condition of Sample		Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA / USEPA)					
Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
BOD (5 days at 20 Degree C)	mg/L	-	2.0	<2.0	≤500	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 5210 B, part 4500 - O G	Rayong
COD	mg/L	1.5	25	<25	≤750	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 5220 D	Rayong
pH at 25 degree C		-	-	7.8	5.5-9.0	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 4500 - H (B)	Rayong
Temperature *	Degree C	-	-	34.9	≤40	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2550 B	Rayong
Total Dissolved Solids Dried at 180 degree C	mg/L	-	5	1980	≤3000	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2540 C	Rayong
Total Kjeldahl Nitrogen as N	mg/L	-	1.0	2.8	≤100	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 4500-Norg (C), part N13 (D)	Rayong
Total Suspended Solids Dried at 103-105 degree C	mg/L	-	5	11	≤200	Standard Methods for the Examination of Water and Wastewater. APHA, AWWA & WEF, 23rd ed., 2017, part 2540 D	Rayong

Guideline : Standard of Rojana Industrial park (Rayong), Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)

Sampling By : พิทยา ทองแสง วิบูลย์ 3-323-9-9448, สมาร์ท ภูมิพล วิบูลย์ 3-204-9-0084

Remark :

- LOD : Limit of Detection
- "L" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

วิบูลย์ 3-323-9-9445

วิบูลย์ 3-323-9-9442

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S: Report, JAC-1P (4/3/2016)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaitai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โรงงานประกอบและบรรจุภัณฑ์พลาสติก (โรงงานพลาสติก)

Project Location: Factory



TESTING
No.0042
Lot ID: 2422642

Date Received : Mar 04, 2024
Date Reported : Mar 11, 2024
Report Number : 2920888-1

Page 2 of 2

* Analyte(s) marked * were not included in scope of Accreditation ISO/IEC 17025.
The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025.

Technical Management

Approved by

วิบูลย์ 3-323-9-9445

วิบูลย์ 3-323-9-9442

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S: Report, JAC-1P (4/3/2016)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Italthai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โครงการบริหารจัดการมลพิษทางอากาศ (โรงงานปูนขาว)

Project Location : Factory

TESTING
No.0042
Lot ID: 2434107

Date Received : Apr 01, 2024

Date Reported : Apr 08, 2024

Report Number : 2946704-1

Page 1 of 2

Sample Number 2434107-1

Sample Date Apr 01, 2024 11:11 AM

Sample Description Wastewater

Location บริเวณใกล้ประตูทางออกของโรงงานปูนขาว (บริเวณประตูน้ำ) จังหวัด : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.

Date Analysis Commenced Apr 01, 2024

Condition of Sample Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA / USEPA)

Analysis	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing BOD (5 days at 20 Degree C)	mg/L	-	2.0	14.0	≤500	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5210 B, part 4500 - O G	Rayong
COD	mg/L	1.5	25	67	≤750	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5220 D	Rayong
pH at 25 degree C	-	-	-	7.4	5.5-9.0	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500 - H (B)	Rayong
Temperature *	Degree C	-	-	35.1	≤40	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2550 B	Rayong
Total Dissolved Solids Dried at 180 degree C	mg/L	-	5	1016	≤3000	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 C	Rayong
Total Kjeldahl Nitrogen as N	mg/L	-	1.0	16.9	≤100	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500-Norg	Rayong
Total Suspended Solids Dried at 103-105 degree C	mg/L	-	5	22	≤200	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 D	Rayong

Guideline : Standard of Rojana Industrial park (Rayong), Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)

Sampling By : Pithaya Thongdaeng รหัสพนักงาน 3-323-9-9448

Remark :
- LOD : Limit of Detection
- LOR : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Italthai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โครงการบริหารจัดการมลพิษทางอากาศ (โรงงานปูนขาว)

Project Location : Factory

TESTING
No.0009
Lot ID: 2422642

Date Received : Mar 04, 2024

Date Reported : Mar 11, 2024

Report Number : 2920888-2

Page 1 of 1

Sample Number 2422642-1

Sample Date Mar 04, 2024 10:49 AM

Sample Description Wastewater

Location บริเวณใกล้ประตูทางออกของโรงงานปูนขาว (บริเวณประตูน้ำ) จังหวัด : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.

Date Analysis Commenced Mar 05, 2024

Condition of Sample Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA / USEPA)

Analysis	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing Oil & Grease *	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5520 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong), Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)

Sampling By : Pithaya Thongdaeng รหัสพนักงาน 3-323-9-9448, Smart Khumplinee รหัสพนักงาน 3-204-9-0084

Remark :
- LOD : Limit of Detection
- LOR : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)
- Analysis(s) marked * is/are not included in scope of Accreditation ISO/IEC 17025.
- The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025

Technical Management

Approved by

รหัสพนักงาน 3-204-9-0013

รหัสพนักงาน 3-204-9-0004

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Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itakhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : โรงงานผลิตพลาสติกบรรจุภัณฑ์ (โรงงานพลาสติก)
Project Location : Factory

TESTING
No.0042
Lot ID: 2434107
Date Received : Apr 01, 2024
Date Reported : Apr 08, 2024
Report Number : 2946704-1

Page 2 of 2
Analytical method : is/are not included in scope of Accreditation ISO/IEC 17025.
The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025.



Technical Management

Approved by

หน้างาน
หน้างาน 3-323-9-9445

หน้างาน
หน้างาน 3-323-9-9442

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S. Maenam, M. G. (M) (C. 2019)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itakhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : โรงงานผลิตพลาสติกบรรจุภัณฑ์ (โรงงานพลาสติก)
Project Location : Factory

Lot ID: 24344107
Date Received : Apr 01, 2024
Date Reported : Apr 05, 2024
Report Number : 2946704-2

Page 1 of 1

Sample Number 2434107-1

Sample Date Apr 01, 2024 11:11 AM

Sample Description Wastewater

Location บริษัท โรงงานพลาสติกบรรจุภัณฑ์ (โรงงานพลาสติก) จังหวัด : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.

Date Analysis Commenced Apr 02, 2024

Condition of Sample Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA / USEPA)

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater: APHA, AWWA & WEF, 23rd ed., 2017, part 5520 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong). Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January 2018 (0.E.2561)

Sampling By : Phitaya Thongdaeng หน้างาน 3-323-9-9448

Remark :

- LOD : Limit of Detection
- %± : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

หน้างาน
หน้างาน 3-304-9-0009

หน้างาน
หน้างาน 3-204-9-0004

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S. Maenam, M. G. (M) (C. 2019)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaihai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :
Project Name : โรงงานแปรรูปพลาสติกจากถ่านหินและพลาสติก (โรงงานพลาสติก)
Project Location : Factory

TESTING
No.0042
Lot ID: 2447548
Date Received : May 02, 2024
Date Reported : May 08, 2024
Report Number : 2976932-1

Page 1 of 2

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing							
BOD (5 days at 20 Degree C)	mg/L	-	2.0	10.8	≤500	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5210 B, part 5200 C G	Rayong
COD	mg/L	1.5	25	39	≤750	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5220 D	Rayong
pH at 25 degree C		-	-	7.7	5.5-9.0	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500 H (B)	Rayong
Temperature *	Degree C	-	-	35.3	≤40	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2550 B	Rayong
Total Dissolved Solids Dried at 180 degree C	mg/L	-	5	972	≤3000	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 C	Rayong
Total Kjeldahl Nitrogen as N	mg/L	-	1.0	8.5	≤100	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500-Norg (CL, part NH3 (D)	Rayong
Total Suspended Solids Dried at 103-105 degree C	mg/L	-	5	19	≤200	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 D	Rayong

Guideline : Standard of Rojana Industrial park (Rayong), Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)
Sampling By : Pithaya Thonglaeng รหัสประจำตัว 3-323-9-9448 , Samart Khumpluee รหัสประจำตัว 3-204-3-0084

Remark :
LOD : Limit of Detection
LOQ : Limit of Quantitation / LOR (Limit of Reporting)
"≤" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by



Approved by

Results apply to the samples, as submitted, unless the sampling was conducted by ALS. No part of this report may be reproduced in any form without written consent from the laboratory.

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S. Rojana, ALG, opt (4.31PH)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaihai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310

P/O :
Project Name : โรงงานแปรรูปพลาสติกจากถ่านหินและพลาสติก (โรงงานพลาสติก)
Project Location : Factory

TESTING
No.0042
Lot ID: 2447548
Date Received : May 02, 2024
Date Reported : May 08, 2024
Report Number : 2976932-1

Page 2 of 2

* Analytes marked * is/are not included in scope of Accreditation ISO/IEC 17025.
The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025.

Technical Management

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S. Rojana, ALG, opt (4.31PH)



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaitai Tower, New Petchburi Road, Bangkapi, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โครงการพัฒนาระบบบำบัดน้ำเสีย (โรงงานปูนขาว)

Project Location : Factory

Lot ID: 2447548
Date Received : May 02, 2024
Date Reported : May 06, 2024
Report Number : 2976932-2

Page 1 of 1

Sample Number 2447548-1
Sample Date May 02, 2024 11:05 AM
Sample Description Wastewater
Location หน่วยบำบัดน้ำเสียปูนขาว (โรงงานปูนขาว) จ.ฉะเชิงเทรา : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.
Date Analysis Commenced May 03, 2024
Condition of Sample Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA / USEPA)

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5520 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong). Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)

Sampling By : Pithaya Thonglaeng รหัสผู้ตรวจ 3-323-3-9448, Smart Khumplee รหัสผู้ตรวจ 3-204-3-0084

Remark :
LOD : Limit of Detection
LOQ : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

รหัสผู้ตรวจ 3-204-3-0009

รหัสผู้ตรวจ 3-204-3-0004

Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. No part of this report may be reproduced in any form without written consent from the laboratory.

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S. Rojana, A. Gl. Ref. 3.18019



Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Itaitai Tower, New Petchburi Road, Bangkapi, Huaykwang, Bangkok
Thailand 10310

P/O :

Project Name : โครงการพัฒนาระบบบำบัดน้ำเสีย (โรงงานปูนขาว)

Project Location : Factory

Sample Number 2457918-1

Sample Date Jun 04, 2024 9:40 AM

Sample Description Wastewater

Location หน่วยบำบัดน้ำเสียปูนขาว (โรงงานปูนขาว) จ.ฉะเชิงเทรา : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.

Date Analysis Commenced Jun 04, 2024

Condition of Sample Contained in one amber glass bottle and three plastic bottles. Sample containers comply to pretreatment - preservation standards (APHA, USEPA)

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing BOD (5 days at 20 Degree C)	mg/L	-	2.0	<2.0	≤500	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5210 B, part 4500 - O.G.	Rayong

COD	mg/L	1.5	25	<25	≤750	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 5220 D	Rayong
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pH at 25 degree C	-	-	-	7.6	5.5-9.0	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500 - H (B)	Rayong
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Temperature *	Degree C	-	-	34.5	≤40	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2550 B	Rayong
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Total Dissolved Solids Dried at 180 degree C	mg/L	-	5	1444	≤3000	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 C	Rayong
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Total Kjeldahl Nitrogen as N	mg/L	-	1.0	<1.0	≤100	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 4500 - N (C), part N45 (D)	Rayong
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Total Suspended Solids Dried at 103-105 degree C	mg/L	-	5	10	≤200	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 2540 D	Rayong
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Guideline : Standard of Rojana Industrial park (Rayong). Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)

Sampling By : Suphannat Sakul รหัสผู้ตรวจ 3-323-3-0021, Smart Khumplee รหัสผู้ตรวจ 3-204-3-0084

Remark :

LOD : Limit of Detection
LOQ : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Technical Management

Approved by

รหัสผู้ตรวจ 3-323-3-9446

รหัสผู้ตรวจ 3-323-3-9442

Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. No part of this report may be reproduced in any form without written consent from the laboratory.

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Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Ittalhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : โรงงานแปรรูปพลาสติกจากคาร์บอน (โรงงานพลาสติก)
Project Location : Factory

* Analytes marked * is/are not included in scope of Accreditation ISO/IEC 17025.
The laboratory has been accepted as an accredited laboratory complying with the ISO/IEC 17025.

Page 2 of 2



TESTING
No.0042
Lot ID: 2457918
Date Received : Jun 04, 2024
Date Reported : Jun 11, 2024
Report Number : 3000341-1

Analysis / Test Report

Client : Rojana Industrial Management Co., Ltd.
2034/115 26TH Fl. Ittalhai Tower, New Petchburi Road, Bangkok, Huaykwang, Bangkok
Thailand 10310
P/O :
Project Name : โรงงานแปรรูปพลาสติกจากคาร์บอน (โรงงานพลาสติก)
Project Location : Factory

Page 1 of 1

Sample Number : 2457918-1
Sample Date : Jun 04, 2024 9:40 AM
Sample Description : Wastewater
Location : อ่างเก็บน้ำคลองท่าช้าง อำเภอเมือง จังหวัดบุรีรัมย์ : BRIDGESTONE CARBON BLACK (THAILAND) CO., LTD.
Date Analysis Commenced : Jun 05, 2024
Condition of Sample : Contained in one amber glass bottle and three plastic bottles, sample containers comply to pretreatment - preservation standards (APHA, USEPA)

Analyte	Unit	LOD	LOQ (LOR)	Result	Guideline / Specification	Method	Testing Location
Water Testing Oil & Grease	mg/L	-	3	<3	≤10	Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, 23rd ed., 2017, part 550 D	Bangkok

Guideline : Standard of Rojana Industrial park (Rayong), Criteria of wastewater drainage from the factory to central wastewater treatment plant, dated 1 January, 2018 (B.E.2561)
Sampling By : Suphant Sakulchai รหัสประจำตัว 3-323-3-0021, Samart Klumphlee รหัสประจำตัว 3-204-3-0084

Remark :
- LOD : Limit of Detection
- <LOD : Lower than LOD (Limit of Quantitation) / LOQ (Limit of Reporting)

Technical Management

Approved by

รหัสประจำตัว 3-323-3-0046

รหัสประจำตัว 3-323-3-0942

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ภาคผนวก ค-6

ระดับความร้อนในบริเวณการทำงาน



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2451372
Date Received : May 24, 2024
Date Reported : May 29, 2024
Report Number: 2985161-1

Page 1 of 8

Sample Number	2451372-2				
Parameter	Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)				
Measurement Date	May 23, 2024				
Measurement by	Nattakarn Vonginyoo				
Location	บริเวณงาน 1 ชั้น (ใต้-บนอาคาร บริเวณ : - บน : -)				
Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Reactor Line 2	120	32.5	29.4	39.8	38.8
Average (WBGT)		32.5			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

- Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2561)
- Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E.2559

Technical Management



Section Head

Approved by



Assistant Manager

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S. Visornont, Air Heat ref (/ 2046)



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2451372
Date Received : May 24, 2024
Date Reported : May 29, 2024
Report Number: 2985161-1

Page 2 of 8

Sample Number	2451372-3				
Parameter	Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)				
Measurement Date	May 23, 2024				
Measurement by	Nattakarn Vonginyoo				
Location	บริเวณงาน 1 ชั้น (ใต้-บนอาคาร บริเวณ : - บน : -)				
Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Reactor Line 3	120	33.0	29.6	40.9	40.4
Average (WBGT)		33.0			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

- Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2561)
- Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E.2559

Technical Management



Section Head

Approved by



Assistant Manager

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S. Visornont, Air Heat ref (/ 2046)



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2451372

Date Received : May 24, 2024
Date Reported : May 29, 2024
Report Number: 2985161-1

Page 3 of 8

Sample Number	2451372-5
Parameter	Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)
Measurement Date	May 23, 2024
Measurement by	Nattakarn Vonginyoo
Location	ปฏิบัติงาน 1 ชั้น (ใต้-นาฬิกา ปฏิบัติงาน : - นอก :-)

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Dryer Line 2	120	30.8	28.6	36.0	34.4
Average (WBGT)		30.8			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

1. Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2561)
2. Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E.2559

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Section Head

Assistant Manager

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S Report_Air Heat ref (7.20AM)



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2451372

Date Received : May 24, 2024
Date Reported : May 29, 2024
Report Number: 2985161-1

Page 4 of 8

Sample Number	2451372-6
Parameter	Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)
Measurement Date	May 23, 2024
Measurement by	Nattakarn Vonginyoo
Location	ปฏิบัติงาน 1 ชั้น (ใต้-นาฬิกา ปฏิบัติงาน : - นอก :-)

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Dryer Line 3	120	30.1	27.7	35.6	33.9
Average (WBGT)		30.1			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

1. Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2561)
2. Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E.2559

Technical Management

Approved by

Section Head

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S Report_Air Heat ref (7.20AM)



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2463745

Date Received : Jun 06, 2024
Date Reported : Jun 10, 2024
Report Number: 3013415-1

Page 1 of 4

Sample Number	2463745-1
Parameter	Heat Stress (Sampling Time : 09.00 AM - 11.00 AM)
Measurement Date	Jun 06, 2024
Measurement by	Wichan Choonharat
Location	เบญจรัตน์ 1 ชั้น 1 (ผ้า-ขนสาเก ผึ่งเบญจรัตน์ : - แดด : -)

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Dryer Line 1	120	32.3	28.5	41.1	39.1
Average (WBGT)		32.3			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

- Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2553)
- Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E. 2559

Technical Management



Approved by



Assistant Manager

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Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :

Lot ID: 2463745

Date Received : Jun 06, 2024
Date Reported : Jun 10, 2024
Report Number: 3013415-1

Page 2 of 4

Sample Number	2463745-2
Parameter	Heat Stress (Sampling Time : 09.00 AM - 11.00 AM)
Measurement Date	Jun 06, 2024
Measurement by	Wichan Choonharat
Location	เบญจรัตน์ 1 ชั้น 1 (ผ้า-ขนสาเก ผึ่งเบญจรัตน์ : - แดด : -)

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Dryer Line 1	120	32.1	28.6	40.3	39.5
Average (WBGT)		32.1			
Guideline WBGT (°C)		34.0			

Reference Method : Wet Bulb Globe Temperature

Guideline:

- Notification of Department Labour Protection and Welfare on the Criteria and Procedures for Measurement and Analysis of Working Conditions in relation to Heat, Light or Noise Levels, including Duration and Types of Business that must perform (B.E. 2561)
- Ministerial Regulation on Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Heat, Light and Noise, B.E.2559

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S:\Report\Air Heat\ref 1543796

ภาคผนวก ค-7

คุณภาพอากาศในสถานที่ทำงาน



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :
Lot ID: 2463747
Date Received : Jun 06, 2024
Date Reported : Jun 14, 2024
Report Number : 3013430-1

Page 1 of 2

Sample Number 2463747-1
Sampled Date Jun 06, 2024
Sample Description Air Quality
Location Loading Line 1
Personal Sampling ภาณุรักษ์ 3000 (Respirable Dust)
Date Analysis Commenced Jun 06, 2024
Condition of Sample Drawn into two filter papers placed in plastic cassette and one amber plastic bottle, refrigerated
Barometric Pressure 754 mmHg
Atmospheric Temperature 30.4 °C

Analyte	Sampled Date/Time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Testing Location
Air Testing	Respirable Dust	mg/m3	-	0.15	0.20	5	Based on NIOSH (1998), OSHA 0600	Rayong
	Sulfur dioxide	ppm	-	0.004	<0.004	5	NIOSH (1994), P&CAM146	Bangkok
	Total Dust	mg/m3	-	0.15	<0.15	15	Based on NIOSH (1994), OSHA 0500	Rayong

Guideline :
MOL : Announcement of the Department of Labour Protection and Welfare on Threshold Limit Values of Hazardous Chemical Substances Dated August 3, B.E. 2560 (2017)
OSHA : Occupational Safety and Health Administration
Sampled By : Wichan Choonharat

Remark :
- LOD : Limit of Detection
- "L" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

Approved by

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Scientist (3)

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2731-41/EMAIL



Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bankhai, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :
Lot ID: 2451377
Date Received : May 24, 2024
Date Reported : May 31, 2024
Report Number : 2985138-1

Page 1 of 9

Sample Number 2451377-2
Sampled Date May 23, 2024
Sample Description Air Quality
Location Loading Line 2
Personal Sampling ภาณุรักษ์ 3000 (Respirable Dust)
Date Analysis Commenced May 25, 2024
Condition of Sample Drawn into two filter papers placed in each cassette and one amber plastic bottle, refrigerated
Barometric Pressure 754 mmHg
Atmospheric Temperature 31.0 °C

Analyte	Sampled Date/Time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Testing Location
Air Testing	Respirable Dust	mg/m3	-	0.15	0.31	5	Based on NIOSH (1998), OSHA 0600	Rayong
	Sulfur dioxide	ppm	-	0.004	<0.004	5	NIOSH (1994), P&CAM146	Bangkok
	Total Dust	mg/m3	-	0.15	0.85	15	Based on NIOSH (1994), OSHA 0500	Rayong

Guideline :
MOL : Announcement of the Department of Labour Protection and Welfare on Threshold Limit Values of Hazardous Chemical Substances Dated August 3, B.E. 2560 (2017)
OSHA : Occupational Safety and Health Administration
Sampled By : Nattakarn Vornginyoo

Remark :
- LOD : Limit of Detection
- "L" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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Analysis / Test Report

Client : Bridgestone Carbon Black (Thailand) Co., Ltd.
4/11 Moo 2, T. Nongbua, A. Bangkok, Rayong Thailand 21120
P/O : 4800043002
Project Name :
Project Location :
Lot ID: 2451377
Date Received : May 24, 2024
Date Reported : May 31, 2024
Report Number : 2985138-1

Page 2 of 9

Sample Number 2451377-3
Sampled Date May 23, 2024
Sample Description Air Quality
Location Loading Line 3
Personal Sampling ณสถานี ตู้ดูด (Respirable Dust)
Date Analysis Commenced May 25, 2024
Condition of Sample Drawn into two filter papers placed in each cassette and one amber plastic bottle, refrigerated
Barometric Pressure 754 mmHg
Atmospheric Temperature 31.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline Testing Location
Air Testing								
Respirable Dust	01:00 PM - 03:00 PM	mg/m ³	-	0.15	0.27	5	Based on NIOSH (1998), OSHA 0600	Rayong
Sulfur dioxide	01:00 PM - 03:00 PM	ppm	-	0.004	<0.004	5	NIOSH (1994), MCL P&CAM146	Bangkok
Total Dust	01:00 PM - 03:00 PM	mg/m ³	-	0.15	0.38	15	Based on NIOSH (1994), OSHA 0500	Rayong

Guideline :
MCL : Announcement of the Department of Labour Protection and Welfare on Threshold Limit Values of Hazardous Chemical Substances Dated August 3, B.E. 2560 (2017)
OSHA : Occupational Safety and Health Administration
Sampled By : Natikarn Vonginyoo

Remark :
- LOD : Limit of Detection
- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

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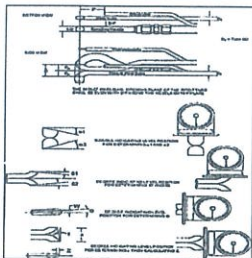
2724-41/ENAL

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



Certificate of Calibration
S-Type Geometric Plot Tube Calibration
See the Code of Federal Regulations, Title 40, Part 60, Appendix A,
Method 2, Item 4



Parameter	Value	Allowable Range	Check
Plot tube/Probe No.	No. 59/A10404		
Assembly Level?	Y	Yes or y	PASS
Parts Damaged?	N	No or n	PASS
a1	1.2	-10° < a1 < +10°	PASS
a2	-2	-10° < a2 < +10°	PASS
b1	-1	-5° < b1 < +5°	PASS
b2	-1.7	-5° < b2 < +5°	PASS
γ	-1.8	N/A	-
θ	-2	N/A	-
D1	0.375	0.188" to 0.375"	PASS
A	0.966142	2.1D1 < A ≤ 3.0D1	PASS
A/2D1	1.288189	1.05 ≤ A/D1 ≤ 1.5	PASS
Z = A tan γ	-0.03036	Z ≤ 0.125"	PASS
W = A tan θ	-0.03374	W ≤ 0.031"	PASS

I certify that plot tube/probe No. 59/A10404 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a plot tube certification factor of 0.84. See 40 CFR Pt. 60, App A, EPA Method 2

Standard Device
Device Name Digital Inclometer
Manufacturer BASELINE
Model 12-1057
ID No. QC-1824

Expiration date 18 Dec 24
ENSS No. ENSS 22159

Certified by Nattawat S.
Date Jan 8, 2024

Approved by [Signature]
Date Jan 9, 2024



PT-TH-48E-IN-332/Ver.01/06.01.22/ Page 1 of 1



Meter Console Verification

Dry Gas Meter ID : ENSS 071 Date of Calibration : 08/10/2023
Instrument Brand : Apex / Model 572 Calibrated By : CS

Wet gas meter Information

Wet gas Brand : Shingewa Wet gas S/N : 644122
Wet gas Model : W-NK-2.5A Expire Date : August 30, 2025

Orifice Setting ΔH@ (mm H ₂ O)	Wet gas		Metering System		Time (min)	Y1	ΔH@
	V _g (L)	T _g (°C)	V _g (L)	T _g (°C)			
13	142.80	23.3	140.0	22.0	11.93	1.0144	42.780
13	142.68	23.4	140.0	22.0	11.90	1.0131	42.656
26	141.22	23.5	140.0	22.5	8.40	1.0028	43.402
26	141.32	23.6	140.0	22.0	8.42	1.0016	43.601
40	283.58	23.7	280.0	22.5	13.57	1.0048	43.311
40	283.72	23.9	280.0	23.0	13.52	1.0065	42.921
50	281.04	24.0	280.0	23.0	12.22	0.9955	44.755
50	280.76	24.2	280.0	23.0	12.20	0.9940	44.768
70	280.44	24.3	280.0	23.0	10.27	0.9906	44.802
70	279.90	24.4	280.0	23.0	10.23	0.9884	44.514
90	277.40	24.4	280.0	24.0	9.08	0.9808	45.857
90	277.10	24.4	280.0	24.0	9.07	0.9798	45.768
Average						0.9977	44.079

Remark : Y1 ≤ ± 0.02 from average
Y1 = 1.00 ± 0.05
ΔH@ ≤ ± 6.08 mm.H₂O from average
ΔH@ = 46.7 ± 6.4 mm.H₂O

Checked By : Nattawat S. (Nattawat Sirichoti)
Position : Store Manager
Date : 09/10/2023
Approved By : [Signature] (Thepsan Yommana)
Position : Technical Manager
Date : 09/10/2023



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Temperature Display Verification

Dry Gas Meter ID : ENSS 071 Date of Calibration : 8/10/2023
Instrument Brand : Apex / Model 572 Calibrated By : MW

Temperature Simulator Information

Simulator Brand : Handy Cal Simulator S/N : T1L1015
Simulator Model : CA11E Expire Date : 11/07/2024

Standard Value	Instrument Display				
	Stack	Probe	Filter	Aux	Exit
300	301	301	301	300	-
200	200	201	201	200	-
150	151	150	151	151	-
100	101	102	102	101	101
50	50	51	51	50	51
0	0	0	0	0	0
Difference	0.4%	2.0	2.0	1.0	1.0

Remark : Stack ≤ ± 1.5 % Absolute
Probe ≤ ± 3.0 °C
Filter ≤ ± 3.0 °C
Aux ≤ ± 3.0 °C
Exit ≤ ± 3.0 °C

Checked By : Nattawat S. (Nattawat Sirichoti)
Position : Store Manager
Date : 09/10/2023
Approved By : [Signature] (Thepsan Yommana)
Position : Technical Manager
Date : 09/10/2023



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Manometer Verification

Dry Gas Meter ID : ENSS 071 Date of Calibration : 7/10/2023
Instrument Brand : Apex / Model 572 Calibrated By : MW

Magnehelic gauge Information

Magnehelic Brand : Dwyer Industries, Inc. Magnehelic S/N : R000822A1109
Magnehelic Model : 2000-100MM Expire Date : 2/10/2023

Manometer data				
Test No.	Manometer Reference ΔP (mm.H ₂ O); A	Manometer monitoring ΔP (mm.H ₂ O); B	Difference	Reference/Monitoring A/B
1	2.0	2.0	0.00	1.00
2	6.0	6.2	0.20	0.96
3	10.0	10.2	0.20	0.98
4	16.0	15.8	0.20	1.01
5	20.0	20.2	0.20	0.99
Average			0.16	0.99

Remark : [Reference(Avg) / Monitoring(Avg)] must be = 0.95 to 1.05

Checked By : Nattawat S. (Nattawat Sirichoti)
Position : Store Manager
Date : 09/10/2023
Approved By : [Signature] (Thepsan Yommana)
Position : Technical Manager
Date : 09/10/2023



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Gas Analyzer Calibration Data Sheet

Equipment Status

Name: Flux gas analyzer Brand: Testo
No.: EN55 21159 Model: Testo 340
Date of Calibration: 9-Jan-24 Serial No.: 62812889

Standard Gas Status

Component	Unit	Gas Conc.	Cylinder No.	In Pressure (bar)	Cylinder Pressure (bar)	Expiration Date
UKP	% by vol.	0.0	MLC69188	-	1200.0	-
NO	ppm	89.7	ND11201	10.0	1200.0	15-Sep-30
NO ₂	ppm	-	-	-	-	-
SO ₂	ppm	90.5	ND11201	10.0	1200.0	15-Sep-30
CO	ppm	90.1	ND11201	10.0	1200.0	15-Sep-30
O ₂	% by vol.	20.9	GND018334	10.0	1700.0	14-Feb-27
CO ₂	% by vol.	-	-	-	-	-

Calibration Status

Before Calibrate Result

Component	Unit	Reference Gas		Gas Analyzer Reading		Difference				Criteria
		Zero	Span	Zero	Span	Zero Value	%	Span Value	%	
NO	ppm	0.00	89.68	0.00	91.00	0.00	0.00	-1.32	-1.47	±2.0% of STD
NO ₂	ppm	-	-	-	-	-	-	-	-	±2.0% of STD
SO ₂	ppm	0.00	90.49	0.00	89.00	0.00	0.00	1.49	1.85	±2.0% of STD
CO	ppm	0.00	90.10	0.00	88.00	0.00	0.00	1.10	1.22	±2.0% of STD
O ₂	% by vol.	0.00	20.90	0.04	20.80	-0.04	-0.19	0.00	0.00	±0.5% by vol.
CO ₂	% by vol.	-	-	-	-	-	-	-	-	±0.5% by vol.

After Calibrate Result

Component	Unit	Reference Gas		Gas Analyzer Reading		Difference				Criteria
		Zero	Span	Zero	Span	Zero Value	%	Span Value	%	
NO	ppm	0.00	89.68	0.00	90.00	0.00	0.00	-0.32	-0.36	±2.0% of STD
NO ₂	ppm	-	-	-	-	-	-	-	-	±2.0% of STD
SO ₂	ppm	0.00	90.49	0.00	90.00	0.00	0.00	0.49	0.54	±2.0% of STD
CO	ppm	0.00	90.10	0.00	90.00	0.00	0.00	0.10	0.11	±2.0% of STD
O ₂	% by vol.	0.00	20.90	0.00	20.90	0.00	0.00	0.00	0.00	±0.5% by vol.
CO ₂	% by vol.	-	-	-	-	-	-	-	-	±0.5% by vol.

Calibrated by: Norant C. (Norant Claiter)
Date: 9-Jan-24

Approved by: (Phatkean Sathapornphol)
Date: 9 Jan 2024

PF-TM-M&E-RN-003 Rev 01/22/03 2/1 Page 1 of 1



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

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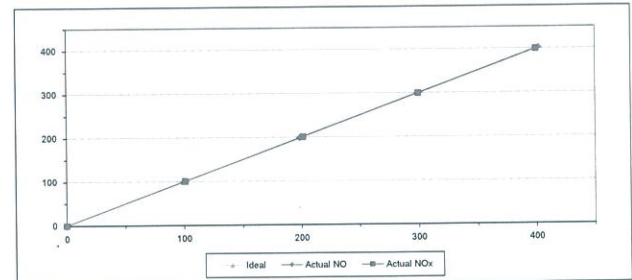
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Nitrogen Dioxide	NO _x Analyzer	B00_150797	2-Jan-24	2-Jan-25	6
Ambient	Nitrogen Dioxide	NO _x Analyzer	B00_150764	2-Jan-24	2-Jan-25	6
Ambient	Nitrogen Dioxide	NO _x Analyzer	R00_150657	4-Jan-24	4-Jan-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	B00_150796	4-Jul-24	4-Jan-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	R00_150666	4-Jul-24	4-Jan-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	R00_150646	6-Jan-24	6-Jan-24	6
Ambient	Particulate Matter (PM-10)	High Volume	R00_150666	-	-	On-site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	R00_150797	-	-	On-site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	R00_150665	-	-	On-site Calibration
Ambient	Particulate Matter (PM-10)	Dust Balance	R00_150603	22-Feb-24	22-Feb-25	12
Ambient	Total Suspended Particulate	High Volume	R00_150714	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	R00_150795	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	R00_150661	22-Feb-24	22-Feb-25	12
Ambient	Air Speed / Wind Direction	Air Speed / Wind Direction	R00_150649	20-Jan-23	20-Jan-24	18
Ambient	Air Speed / Wind Direction	Air Speed / Wind Direction	R00_150685	19-Jan-23	19-Jan-24	18
Noise	Leq 24 hrs	Sound Level Meter	R00_150113	2-Feb-24	2-Feb-25	12
Noise	Leq 24 hrs	Sound Level Meter	R00_150636	5-Jan-24	4-Jan-25	12
Noise	Leq 24 hrs	Sound Level Meter	R00_150615	5-Jan-24	4-Jan-25	12
Noise	Leq 8 hrs	Sound Calibrator	R00_150496	26-Jan-24	25-Jan-25	12
Noise	Leq 8 hrs	Sound Level Meter	R00_150812	5-Jan-24	4-Jan-25	12
Noise	Leq 8 hrs	Sound Level Meter	R00_150818	12-Jan-24	11-Jan-25	12
Noise	Leq 8 hrs	Sound Level Meter	R00_150615	5-Jan-24	4-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	R00_150525	26-Jan-24	25-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	R00_150520	25-Jan-24	24-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	R00_150579	26-Jan-24	25-Jan-24	12
Heat	Heat Stress	Heat Stress Monitor	R00_150577	15-Jan-24	14-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	R00_150529	11-Jan-24	10-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	R00_150546	32-Jan-24	31-Jan-25	12
Workplace	Total Dust	Dust Balances	R00_150659	1-Apr-24	3-Jul-24	9
Workplace	Total Dust	Dust Balance	R00_150604	22-Feb-24	22-Feb-25	12
Workplace	Respirable Dust	Fed-3 Rotameter	R00_150659	1-Apr-24	1-Jul-24	9
Workplace	Respirable Dust	Dust Balance	R00_150604	22-Feb-24	22-Feb-25	12
Working Lab	Gas (x, y, z) °C	Gas Meter	R00_150152	14-Dec-23	14-Dec-24	12
Receiving Lab	Temperature	GH Meter	R00_150374	1-Apr-24	1-Apr-25	12
Receiving Lab	BOD	DO meter with Sensor	R00_150662	24-Sep-23	24-Sep-23	18
Receiving Lab	BOD	Burette	R00_150616	25-Sep-23	25-Sep-24	18
Receiving Lab	BOD	Burette	R00_150616	25-Sep-23	25-Sep-24	18
Receiving Lab	COD	Refractometer	R00_150637	18-Sep-23	18-Mar-25	18
Receiving Lab	Total Suspended Solids	Electronic Balance	R00_150602	22-Feb-24	22-Feb-25	12
Receiving Lab	Total Suspended Solids	Hot Air Oven	R00_150610	21-Mar-24	21-Sep-25	18
Receiving Lab	Total Dissolved Solids 180°C	Electronic Balance	R00_150602	22-Feb-24	22-Feb-25	12
Receiving Lab	Total Dissolved Solids 180°C	Hot Air Oven	R00_150610	21-Mar-24	21-Sep-25	18
Receiving Lab	Total Dissolved Solids 180°C	Refractometer	R00_150618	11-Mar-24	11-Sep-25	18
Receiving Lab	Total Dissolved Solids	Refractometer	R00_150615	15-Dec-23	14-Dec-24	12
Water Lab	Oil & Grease (Fischer)	Fischer Test Loading Balance	B00_150643	9-Aug-23	9-Aug-24	12
Water Lab	Oil & Grease (Fischer)	Water Bath	B00_150145	4-Jun-23	4-Jan-25	18



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-24	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	H73KYD1M	Equipment ID	BKK_F80797
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN002722
Cylinder Pressure (psi)	1800	Certified By	A/rgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.60	-1.40	-0.70	201.30	1.30	0.65
3	300.00	299.10	-0.90	-0.30	299.70	-0.30	-0.10
4	400.00	402.10	2.10	0.53	399.50	-0.50	-0.13
	AVERAGE (%)			-0.13			0.31



Calibrated By

Approved By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

(Mr.Sarayuth Jittranont)
Assistant General Manager

ALS Laboratory Group

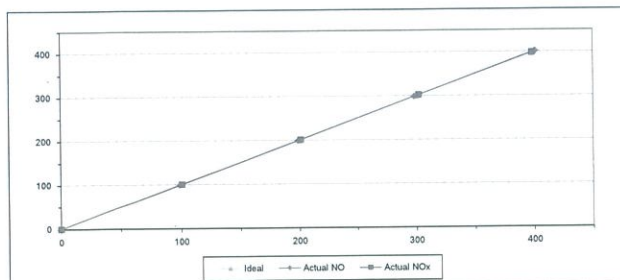
FORM NO. F 06-056 REVISION NO. - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-24	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	148EH0E0	Equipment ID	BKK-FS1064
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.70	0.70	0.70
2	200.00	199.30	-0.70	-0.35	201.40	1.40	0.70
3	300.00	298.50	-1.50	-0.50	302.30	2.30	0.77
4	400.00	401.40	1.40	0.35	398.30	-1.70	-0.42
AVERAGE (%)				-0.28			0.37



Calibrated By

Approved By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

(Mr.Sarsyuth Jittranont)
Assistant General Manager

A/S Laboratory Group

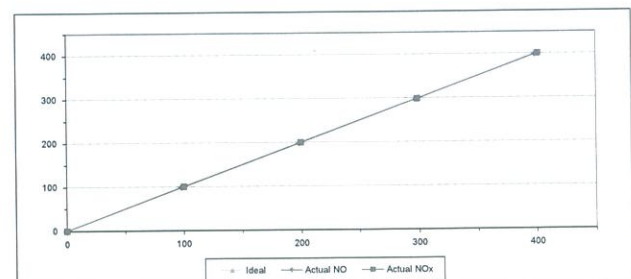
FORM NO. F 06-056 REVISION NO. - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-24	Equipment Name	Nox Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T2TBYRLL	Equipment ID	RYG_F80457
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algeas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70	100.20	0.20	0.20
2	200.00	198.40	-1.60	-0.80	199.80	-0.20	-0.10
3	300.00	297.90	-2.10	-0.70	298.50	-1.50	-0.50
4	400.00	398.60	-1.40	-0.35	400.80	0.80	0.20
AVERAGE (%)				-0.69			-0.02



Calibrated By

Approved By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

(Mr.Sarayuth Jittranont)
Assistant General Manager

A/ S Laboratory Group

FORM NO. F-06-056 REVISION NO. : ISSUE DATE 02/04/12

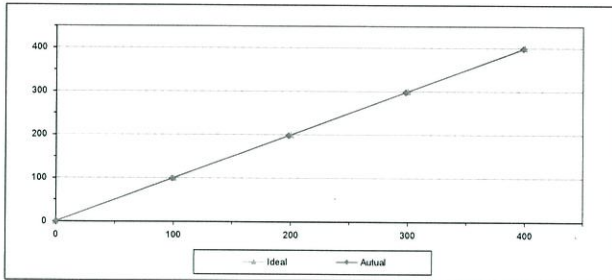


MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jul-24
 Manufacturer: HORIBA
 Serial No.: G2CH4368
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: BKK_FS0796
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	98.91	-1.09	-1.09
2	200.00	198.10	-1.90	-0.95
3	300.00	298.00	-2.00	-0.67
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.61



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12

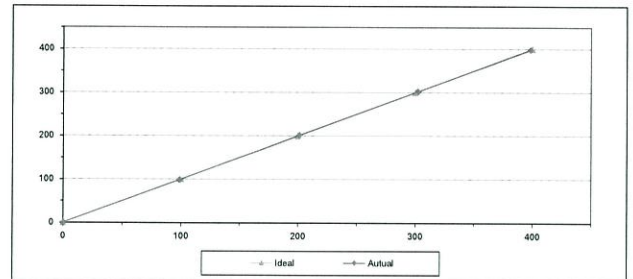


MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jul-24
 Manufacturer: HORIBA
 Serial No.: NM3M2D5M
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: RYG_FS0286
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	201.40	1.40	0.70
3	300.00	302.30	2.30	0.77
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.03



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12

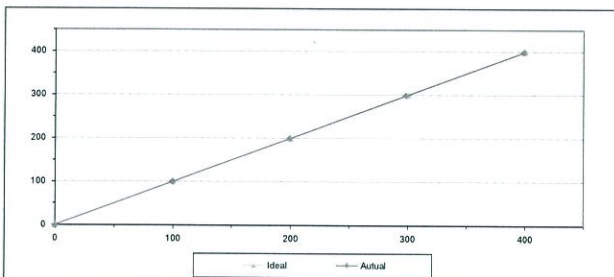


MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-24
 Manufacturer: HORIBA
 Serial No.: RDHWYDVW
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: RYG_FS0458
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.50	-0.50	-0.25
3	300.00	298.30	-1.70	-0.57
4	400.00	398.80	-1.20	-0.30
AVERAGE (%)				-0.28



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

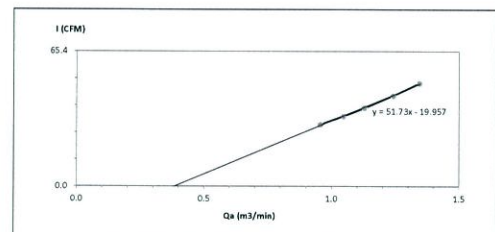
ALS Laboratory Group
 FORM NO. F 06-056 REVISION NO. - ISSUE DATE: 02/04/12



High Volume Air Sampler Calibration Worksheet

Project Site: Bridstone Carbon Black
 Barometric Pressure (mm Hg): 757.2
 Calibrate Location: บ้านบึง
 Temperature (°C): 29
 Calibrate Date: 3-Jul-24
 High Volume ID: RYG_FS0666
 Calibration Sheet No.: C-030724-RYG_FS0666
 High Volume Model: TE-5000X
 Calibrator ID: RYG_FS0205
 High Volume S/N: 6265
 Calibrator Model: TE-5028A
 Calibrator Slope: 0.95561
 Calibrator S/N: 1166
 Calibrator Intercept: -0.02266

Test No.	Delta H ₂ O (inch)	Q _a (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.0	0.957	30	Slope: 51.7295
2	2.4	1.046	34	Intercept: -19.9570
3	2.8	1.129	38	Correlation Coefficient: 0.9987
4	3.4	1.241	44	
5	4.0	1.344	50	



Calibrated by

(Mr. Suphanut Pitsaipan)
 Field Scientist(2)

Approved by

(Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (3)

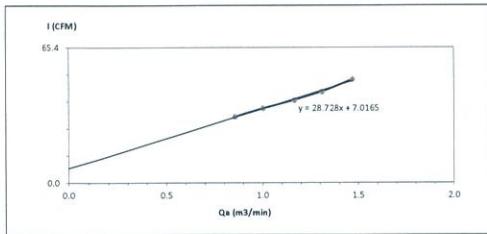
FORM NO. F 06-074 REVISION NO. 2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Bridstone Carbon Black Barometric Pressure (mm Hg) : 757.2
Calibrate Location : สนามบ่ม Temperature (°C) : 29
Calibrate Date : 3-10-24 High Volume ID : RYG-FS0397
Calibration Sheet No. : C-030724-RYG-FS0397 High Volume Model : TE-5009X
Calibrator ID : RYG-FS0205 High Volume S/N : 5687
Calibrator Model : TE-5028A Calibrator Slope : 0.95561
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.859	32	Slope: 28.7278
2	2.2	1.003	36	Intercept: 7.0165
3	3.0	1.167	40	Correlation Coefficient: 0.9963
4	3.8	1.311	44	
5	4.8	1.471	50	



Calibrated by: [Signature]
(Mr. Suphanut Pisalpan)
Field Scientist (2)

Approved by: [Signature]
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

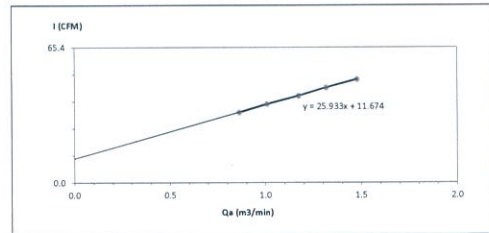
FORM NO. F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Bridstone Carbon Black Barometric Pressure (mm Hg) : 755
Calibrate Location : บ้านบ่ม Temperature (°C) : 32
Calibrate Date : 10-May-24 High Volume ID : RYG-FS0665
Calibration Sheet No. : C-100524-RYG-FS0665 High Volume Model : TE-5009X
Calibrator ID : RYG-FS0205 High Volume S/N : 6264
Calibrator Model : TE-5028A Calibrator Slope : 0.95561
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.864	34	Slope: 25.9335
2	2.2	1.009	38	Intercept: 11.6741
3	3.0	1.175	42	Correlation Coefficient: 0.9998
4	3.8	1.319	46	
5	4.8	1.480	50	



Calibrated by: [Signature]
(Mr. Suphanut Pisalpan)
Field Scientist (2)

Approved by: [Signature]
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

FORM NO. F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8381-6, e-mail: service.thailand@sartorius.com



NSC-TISI-715 17025
CALIBRATION 0426

SARTORIUS

Certificate of Calibration

Model Number : LA130S-F Certificate No. : 24BCI0068
Description : Analytical Balance Issued Date : Friday, February 23, 2024
Serial Number : 25409664 Reference No. : 229196
ID No. : RYG_EN0001
Manufacturer : Sartorius Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Piuk Daeng, Rayong 21140, Thailand
Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Piuk Daeng, Rayong 21140, Thailand.

Calibrated By : Mr.Chonchai Inthana Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (WI-003) Based on UKAS LAB 14 : 2019
Calibration Date : Thursday, February 22, 2024

Metrological data :
Capacity : 150 g Readability : 0.0001 g
Reasons for calibration
☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance
Ambients Conditions:
Temperature : 23.6 °C ± 5.0 °C
Humidity : 54.0 % RH ± 10.0 % RH
Pressure : ±
Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14
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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 8000g E2,YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C1923184S	23-Aug-2024

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr.chonchai Inthana(Technical Manager)





Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8381-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : LA130S-F Certificate No. : 24BCI0068
Description : Analytical Balance Issued Date : Friday, February 23, 2024
Serial Number : 25409664 Reference No. : 229196
ID No. : RYG_EN0001
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the difference between the resultant of the load, i.e. 1/2 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (4 positions defined according to GIML R76).		
Nominal Value : (Low Load)	10.0000	99.9999	Nominal value :	50	g
10 g	10.0000	100.0000	Tolerance	0.0004	g
Tolerance	10.0000	100.0001		Difference	
0.0001 g	10.0000	100.0001		1	-
	9.9999	100.0000		2	-0.0001
Nominal Value : (High Load)	10.0000	100.0001		3	0.0001
100 g	10.0000	100.0000		4	0.0002
Tolerance	10.0000	100.0001		5	0.0000
0.0001 g	9.9999	100.0002		6	-
	9.9999	100.0001			
Standard Deviation	0.00005	0.00008			

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00020
0.05	0.0500	0.0500	0.0000	0.00021
0.1	0.1000	0.1000	0.0000	0.00021
0.5	0.5000	0.5000	0.0000	0.00021
1	1.0000	1.0000	0.0000	0.00021
2	2.0000	2.0000	0.0000	0.00021
5	5.0000	5.0000	0.0000	0.00021
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00021
100	100.0000	99.9999	-0.0001	0.00024

End of Report

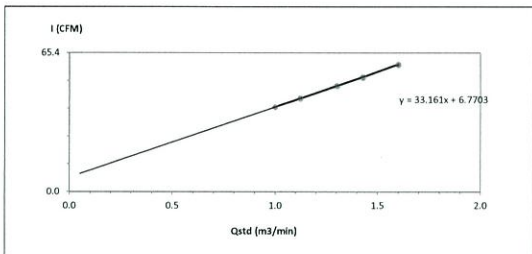
SOP FM 33 03 February 2022



High Volume Air Sampler Calibration Worksheet

Project Site :	Bridstone Carbon Black	Barometric Pressure (mm Hg) :	757.2
Calibrate Location :	บ้านฉาง	Temperature (°C) :	29
Calibrate Date :	3-Jul-24	High Volume ID :	RYG-FS0174
Calibration Sheet No. :	C-030724-RYG-FS0174	High Volume Model :	TE-5170D
Calibrator ID :	RYG-FS0205	High Volume S/N :	4800
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0001	40	Slope : 33.1605
2	2.8	1.1286	44	Intercept : 6.7703
3	3.8	1.3030	50	Correlation Coefficient : 0.9999
4	4.6	1.4300	54	
5	5.8	1.6013	60	



Calibrated by :
(Mr. Suphanut Pitsaipan)
Field Scientist (2)

Approved by :
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

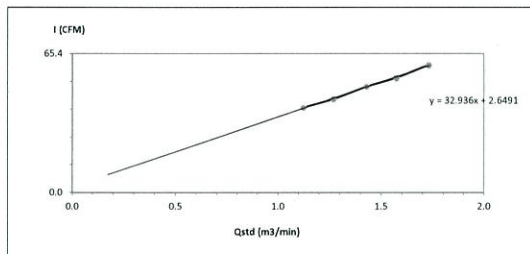
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Bridstone Carbon Black	Barometric Pressure (mm Hg) :	757.2
Calibrate Location :	บ้านฉาง	Temperature (°C) :	29
Calibrate Date :	3-Jul-24	High Volume ID :	RYG-FS0292
Calibration Sheet No. :	C-030724-RYG-FS0292	High Volume Model :	TE-5170D
Calibrator ID :	RYG-FS0205	High Volume S/N :	5497
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1236	40	Slope : 32.9356
2	3.6	1.2692	44	Intercept : 2.6491
3	4.6	1.4300	50	Correlation Coefficient : 0.9985
4	5.6	1.5740	54	
5	6.8	1.7308	60	



Calibrated by :
(Mr. Suphanut Pitsaipan)
Field Scientist (2)

Approved by :
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

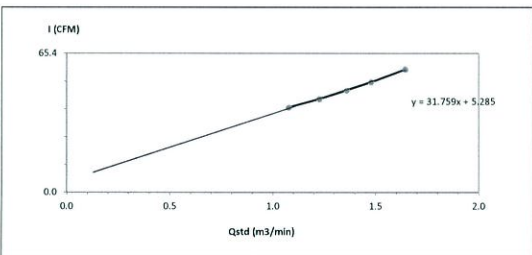
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Bridstone Carbon Black	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านฉาง	Temperature (°C) :	32
Calibrate Date :	5-Oct-24	High Volume ID :	RYG-FS0396
Calibration Sheet No. :	C-051024-RYG-FS0396	High Volume Model :	TE-5170D
Calibrator ID :	RYG-FS0205	High Volume S/N :	5688
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0774	40	Slope : 31.7592
2	3.4	1.2268	44	Intercept : 5.2850
3	4.2	1.3595	48	Correlation Coefficient : 0.9978
4	5.0	1.4801	52	
5	6.2	1.6440	58	



Calibrated by :
(Mr. Suphanut Pitsaipan)
Field Scientist (2)

Approved by :
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

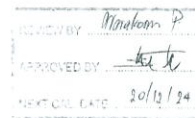
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



J NAC
JIRANATE ASSOCIATES CO., LTD.
Jirante Associates Co., Ltd.
63/24-11, 61/35-36
Kanchana 1/1, Rd. Wattana, Bangkok
Bangkok 10250 (Thailand)
Tel : +662-080812
Mobile : +662-7999453
E-mail : jirante.calibration@jirante.com
Web site : www.jirante.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC 158-115 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department



Certificate Number
CC-015-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Cup anemometer
Novalyra
Sensor: WS-02FA
Data logger: 110-WS-2500-D
Sensor: WSD-AS580
Data logger: AS580
RYG-FS0649
New item
ALS laboratory group (Thailand) Co., Ltd.
104 Phrayothanaraj Road, Phrayothanaraj Road, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

16 Jun 2023
20 Jun 2023
20 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

23.0 ± 3.0 °C
55.0 ± 15.0 %RH
1010 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jirante Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹ 900 cm²
Win direction frontal area² 100 cm²
Diameter of mounting pipe³ mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning

Measurement Condition

24 hours at ambient conditions.
The average values during measurement are (24.4) °C, (41.8) %RH and (1011.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by :

Mr. Sornrat Thachakul
Miss Jiraporn Jirapornphol



Approved signatory

Mr. Parinyai Booncharoen
Calibration Department Manager

Remarks:

¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a"/"b"

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

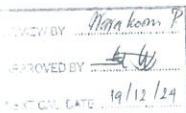




Jiranatee Associates Co., Ltd.
63/14 35, 61/75 36
Petchkasem 2/75, Rd. Wattana, Bangkok,
Bangkok 10600 (Thailand)
Tel: +66(0)830812
Mobile: +66(0)8309453
E-mail: jnc.calibrator@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
MSC-TIS-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department



Certificate Number

CC-008-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM Cup anemometer
MANUFACTURER Novalyne
MODEL/TYPE Sensor: WS-02F
Data logger: 200-WS-25DL
SERIAL NUMBER Sensor: WSD-A4985
Data logger: A4985
ID NUMBER RYG_F50085
CONDITION AS-RECEIVED Used item
CUSTOMER ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE 16 Jun 2023
MEASUREMENT DATE 19 Jun 2023
ISSUE DATE 19 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature 23.0 ± 3.0 °C
Relative Humidity 55.0 ± 15.0 %RH
Atmospheric Pressure 1010 ± 10 hPa

PLACE OF CALIBRATION Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS
Wind tunnel cross-section area¹ 900 cm²
Win direction frontal area² 100 cm²
Diameter of mounting pipe³ 129 mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning 24 hours at ambient conditions.
Measurement Condition The average values during measurement are (25.0) °C, (42.7) %RH and (1011.7) hPa.

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
Mr. Sorawet Thachalad
Miss Jittaporn Lertsomphol



Approved signatory

Mr. Parinye Booncharoen
Calibration Department Manager

Remarks:
¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object includes mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "to"

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CC-008-66

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V _{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V _{uuc} (m/s)	Error (m/s)	U (k=2) (m/s)
1.025	24.90	24.95	0.9	-0.1	0.31
2.028	24.96	24.95	1.9	-0.1	0.31
2.997	25.00	24.95	2.9	-0.1	0.31
4.126	25.00	24.95	4.0	-0.1	0.31
5.02	24.90	24.95	4.9	-0.1	0.31
6.00	24.88	24.95	5.9	-0.1	0.31
7.05	24.90	24.95	7.0	-0.1	0.31
8.18	24.74	24.95	8.0	-0.1	0.31
9.09	24.84	24.95	9.0	0.0	0.31
10.07	24.70	24.95	10.0	-0.1	0.31
11.14	24.78	24.95	11.1	-0.1	0.31
12.12	24.70	24.95	12.0	-0.1	0.31
13.17	24.70	24.95	13.1	0.0	0.35
14.24	24.70	24.95	14.1	-0.2	0.31
15.20	24.70	24.95	15.2	0.0	0.44
16.28	24.70	24.95	16.2	-0.1	0.31

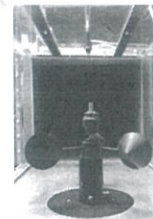
Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

¹ Velocity of standard

² Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry



Jiranatee Associates Co., Ltd.
63/14 35, 61/75 36
Petchkasem 2/75, Rd. Wattana, Bangkok,
Bangkok 10600 (Thailand)
Tel: +66(0)830812
Mobile: +66(0)8309453
E-mail: jnc.calibrator@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
MSC-TIS-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CD-008-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM Wind Direction Sensor
MANUFACTURER Novalyne
MODEL/TYPE Sensor: WS-02F
Data logger: 200-WS-25DL
SERIAL NUMBER Sensor: WSD-A4985
Data logger: A4985
ID NUMBER RYG_F50085
CONDITION AS-RECEIVED Used item
CUSTOMER ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE 16 Jun 2023
MEASUREMENT DATE 19 Jun 2023
ISSUE DATE 19 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature 23.0 ± 3.0 °C
Relative Humidity 55.0 ± 15.0 %RH
Atmospheric Pressure 1010 ± 10 hPa

PLACE OF CALIBRATION Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION
Wind tunnel cross-section area¹ 900 cm²
Win direction frontal area² 129 cm²
Diameter of mounting pipe³ 129 mm
Blockage ratio of test object⁴ 0.143 [-]

Preconditioning 24 hours at ambient conditions.
Measurement Condition The average values during measurement are (24.1) °C, (55.4) %RH and (1008.5) hPa.

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
Mr. Sorawet Thachalad
Miss Jittaporn Lertsomphol



Approved signatory

Mr. Parinye Booncharoen
Calibration Department Manager

Remarks:
¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object includes mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "to"

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate Number

CD-008-66

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D ¹ _{uuc} Degree (°)	D ² _{uuc} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.01	45.000	44	-1	1.0
	90.001	87	-3	1.0
	135.000	132	-3	1.0
	180.000	179	-1	1.0
	225.000	228	3	1.0
	270.000	273	3	1.0
	315.000	319	4	1.0
	360.000	359	-1	1.0

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

¹ Direction of standard

² Direction of Unit Under Calibration

End of Certificate of Calibration





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292

MTC No. EEL. BP. 83/0267

CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre, Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.
Instrument Calibrated :
Description : Sound Calibrator
Manufacturer : Rion
Model : NC-74
Serial No. : 34178121 (ID:RYG_FS0213)
Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N4106495.
7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1,500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 19 Feb. 2024

Date of Calibration : 28 Feb. 2024

1/2

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.5

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Office/Laboratory
168/169-1 Tambon Bangpoo Muang Amphoe Muang Samutprakan
Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672 80 ext. 115, 116
(66) 08 3219 9440
E-mail: info@eelsr.or.th Website: www.eelsr.or.th

Office
155 Phatthanasathit Road, Bangkok 10900, Thailand
Tel: (66) 0 2579 1121 30 ext. 5219, 5225, 5217
(66) 08 1619 6821



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292

MTC No. EEL. BP. 83/0267

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.01	0.01	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1003.1	3.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	±3.0%

Note : 1. No adjustment.
2. The calibrator pressure correction was not included.
3. The microphone volume correction was included at level of 0.16 dB from manual.

Calibrated by : (Mr. Weerachai Deechaiyae)

Approved by : (Mr. Prawale Khuaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Feb. 2024

Date of Issue : 29 Feb. 2024

Ref : 2011267021900719001

End of Certificate

2 / 2

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FM.BLMTC.002 Rev.4

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Office/Laboratory
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Tel: (66) 0 2323 1672 80 ext. 115, 116
Fax: (66) 0 2323 9165
E-mail: info@eelsr.or.th Website: www.eelsr.or.th

Office
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Tel: (66) 0 2579 1121 30 ext. 5219, 5225, 5217
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E-mail: info@tistr.or.th Website: www.tistr.or.th

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN ASSOCIATES



Cert. No. : ACL24013

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623391 / 198638 / 26419
ID No.: RYG_FS0616

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : *
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 19 DECEMBER 2023

Calibration Date : 05-08 JANUARY 2024

Date of Issue : 09 JANUARY 2024

Calibrated by : Nadekorn Pisupaisan

Approved by :

(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24013

Job No. : VC67AC0044

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

G. Rattan

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	13.8
C - weight	20.3
Flat	25.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.5	1.6	1.6	±5.0

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Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.3	0.3	± 1.1

G. Rattan

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.3	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACL24012
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623390 / 198637 / 26418
ID No.: RYG_FS0615

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24012
Job No. : VC67AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24012
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Job No. : VC67AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	19.2
Flat	24.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

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Job No. : VC67AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Job No. : VC67AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

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Cert. No. : ACC24008
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No. : 35002736
ID No. : RYG_FS0496

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 19 JANUARY 2024
Calibration Date : 26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchur)

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Cert. No. : ACC24008
Job No. : VC67AC0058
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow on IEC 60942-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACC24008
Job No. : VC67AC0058
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.98	-0.02	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.83	0.10	3.0

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

End of Calibration Certificate

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Cert. No. : ACL24009
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623387 / 198634 / 26415
ID No.: RYG_FS0612

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nathakorn Pisutpaissan

Approved by :

T. Petchur
(Thanakul Petchurai)

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Cert. No. : ACL24009
Job No. : VC67AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24009
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Job No. : VC67AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.6

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

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Job No. : VC67AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Job No. : VC67AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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Job No. : VC67AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Job No. : VC67AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

T. Petchurai

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CALIBRATION LABORATORY

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Cert. No. : ACL24034
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623393 / 198640 / 26421
ID No.: RYG_FS0618

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 05 JANUARY 2024
Calibration Date : 12-15 JANUARY 2024
Date of Issue : 16 JANUARY 2024



Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchurai*
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced
other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Job No. : VC67AC0052
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.4
Flat	23.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.3	-0.2	-0.2	±5.0

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Job No. : VC67AC0052
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Job No. : VC67AC0052
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.5	-0.9	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

T. Petchurai

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Cert. No. : ACL24012
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623390 / 198637 / 26418
ID No.: RYG_FS0615

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchurai*
(Thanakul Petchurai)

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Cert. No. : ACL24012
Job No. : VC67AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24012
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	19.2
Flat	24.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

T. Peth.

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Peth.

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Job No. : VC67AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

G. Petch



Jirarat Associates Co., Ltd.
63/14-15, 67/35-36
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Bangkok 10500 (Thailand)
Tel: +6628080812
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E-mail: jrac-calibration@jirarat.com
Web site: www.jirarat.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-031-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 20032243
ID NUMBER : RVG_F50523
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 24 Jan 2024
MEASUREMENT DATE : 26 Jan 2024
ISSUE DATE : 30 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY : *Man Korn P.*
APPROVED BY : *Man Korn P.*
ISSUE DATE : 26/1/25



Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jittaporn Lertsomphol
☒ Miss Ruangrumpai Phoommit

Approved signatory:

Man Korn P.
Mr. Panyia Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY



Continuation of Certificate of Calibration Number CDT-031-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1. This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001219.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.056	19.9	-0.1	0.099
80	25.047	25.0	0.0	0.099
90	30.041	30.0	0.0	0.099
80	35.033	35.0	0.0	0.099
80	40.023	40.0	0.0	0.099

Table 2. This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023935.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.1	0.0	0.099
110	25.047	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.033	35.0	0.0	0.099
110	40.023	40.0	0.0	0.099

Table 3. This equipment was connected with temperature probe Model: TP3107.2 S/N: 21001766.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.056	20.1	0.0	0.099
75	25.047	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.033	34.9	-0.1	0.099
75	40.023	39.9	-0.1	0.099

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor $k=2.21$ providing a level of confidence of approximately 95%.

End of Certificate of Calibration



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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-028-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 20032240
ID NUMBER : RVG_F50520
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 24 Jan 2024
MEASUREMENT DATE : 25 Jan 2024
ISSUE DATE : 30 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY : *Man Korn P.*
APPROVED BY : *Man Korn P.*
ISSUE DATE : 24/1/25



Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jittaporn Lertsomphol
☒ Miss Ruangrumpai Phoommit

Approved signatory:

Man Korn P.
Mr. Panyia Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001213.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	20.1	0.0	0.099
80	25.054	25.2	0.1	0.099
80	30.046	30.2	0.2	0.099
80	35.043	35.2	0.2	0.099
80	40.033	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001245.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.055	25.3	0.0	0.099
110	30.046	30.1	0.1	0.099
110	35.043	35.1	0.1	0.099
110	40.033	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001785.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.1	0.0	0.16
75	25.055	25.0	-0.1	0.099
75	30.046	30.0	0.0	0.099
75	35.043	35.0	0.0	0.099
75	40.033	39.9	-0.1	0.099

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.1 providing a level of confidence of approximately 95%.

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: CDT-034-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 22016389
ID No: RYG_FS0579

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Received date: 11 Jul 2023
Calibration date: 20 Jul 2023
Issue date: 20 Jul 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000A MK II,
Serial No: 671407-00591 Due date: 22 July 2023

Calibration Condition
Temperature: (23±3) °C
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038.23. Certificate number: ER-0092-22

Noted: The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory: Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22015701.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	-0.1	0.099
80	25.051	25.0	-0.1	0.099
80	30.043	30.0	0.0	0.099
80	35.038	34.9	-0.1	0.099
80	40.032	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22025934.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.051	25.1	0.0	0.099
110	30.043	30.1	0.1	0.099
110	35.038	35.1	0.1	0.099
110	40.031	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025053.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.054	20.1	0.0	0.099
75	25.051	25.0	-0.1	0.099
75	30.043	29.9	-0.1	0.099
75	35.038	34.9	-0.1	0.099
75	40.032	39.8	-0.2	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



CERTIFICATE OF CALIBRATION

Certificate No.: CDT-023-67

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor
MANUFACTURER: Delta OHM
MODEL/TYPE: HD32.2
SERIAL NUMBER: 22016387
ID NUMBER: RYG_FS0577
CONDITION AS-RECEIVED: Used item
CUSTOMER: ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE: 11 Jan 2024
MEASUREMENT DATE: 15 Jan 2024
ISSUE DATE: 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23. Certificate number: ER-0101-23

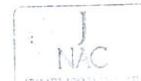
Reference Used During Calibration:

1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000A MK II, Serial No: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data Guide to the expression of uncertainty in measurement

Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory: Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22025572.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.060	19.9	-0.2	0.099
80	25.051	24.9	-0.2	0.099
80	30.042	29.9	-0.1	0.099
80	35.035	34.9	-0.1	0.099
80	40.025	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001243.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.0	-0.1	0.099
110	25.051	25.0	-0.1	0.099
110	30.042	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.025	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025042.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.060	20.0	-0.1	0.099
75	25.051	24.9	-0.2	0.099
75	30.042	29.8	-0.2	0.099
75	35.035	34.7	-0.3	0.099
75	40.025	39.7	-0.3	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



Jiranteer Associates Co., Ltd.
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Petchburi 27/1, Rd. Watthana, Bangkok,
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Temperature measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-015-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Heat Stress Monitor
: Delta OHM
: HD32.2
: 15006715
: RYG_F50220
: Used item
: ALS laboratory group (thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd.,
: Khwaeng Suan Luang, Khet Suan Luang,
: Bangkok 10250 Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 11 Jan 2024
: 11 Jan 2024
: 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The temperature calibration was done by
In-House calibration method as WP-CL-001
according to comparison method with standard
digital temperature indicator and standard
temperature probe. The temperature scale was
based on ITS-90.

Traceability:
The measurement results are traceable to the
international system of units (SI) through
National Institute of Metrology (NIMT).
Certificate number: TT-0038-23. Certificate
number: ER-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No. 667682-09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000 A MK II, Serial No. 671407-
00591 Due date: 14 Sep 2024

Uncertainty of Measurement:
The reported uncertainty of measurement is
based on the standard uncertainty multiplied by a
coverage factor k=2, which for a normal
distribution corresponds to a coverage
probability of approximately 95%. The standard
uncertainty has been determined in accordance
with the GUM "Evaluation of measurement data
Guide to the expression of uncertainty in
measurement"

Naikom P
10/1/25

Calibrated by:
☒ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 17022563
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.050	20.0	0.0	0.099
80	25.042	25.0	0.0	0.099
80	30.040	30.0	0.0	0.099
80	35.034	35.0	0.0	0.099
80	40.026	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20019632.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.0	0.0	0.099
110	25.042	25.0	0.0	0.099
110	30.040	30.1	0.1	0.099
110	35.034	35.1	0.1	0.099
110	40.026	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015507.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.050	20.2	0.2	0.099
75	25.042	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.034	35.0	0.0	0.099
75	40.026	39.9	-0.1	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



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Temperature measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-018-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Heat Stress Monitor
: Delta OHM
: HD32.2
: 18018311
: RYG_F50356
: Used item
: ALS laboratory group (thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd.,
: Khwaeng Suan Luang, Khet Suan Luang,
: Bangkok 10250 Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 11 Jan 2024
: 12 Jan 2024
: 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The temperature calibration was done by
In-House calibration method as WP-CL-001
according to comparison method with standard
digital temperature indicator and standard
temperature probe. The temperature scale was
based on ITS-90.

Traceability:
The measurement results are traceable to the
international system of units (SI) through
National Institute of Metrology (NIMT).
Certificate number: TT-0038-23. Certificate
number: ER-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No. 667682-09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000 A MK II, Serial No. 671407-
00591 Due date: 14 Sep 2024

Uncertainty of Measurement:
The reported uncertainty of measurement is
based on the standard uncertainty multiplied by a
coverage factor k=2, which for a normal
distribution corresponds to a coverage
probability of approximately 95%. The standard
uncertainty has been determined in accordance
with the GUM "Evaluation of measurement data
Guide to the expression of uncertainty in
measurement"

Naikom P
11/1/25

Calibrated by:
☒ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY

Continuation of Certificate of Calibration Number CDT-018-27

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021465.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	-0.1	0.099
80	25.045	25.0	0.0	0.099
80	30.040	30.0	0.0	0.099
80	35.039	35.0	0.0	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020493.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.0	0.0	0.14
110	25.045	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.030	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021258.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.2	0.1	0.099
75	25.045	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.039	34.9	-0.1	0.099
75	40.030	39.9	-0.1	0.099

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2, 14 providing a level of confidence of approximately 95%

End of Certificate of Calibration



ROTA METER CALIBRATION RESULT APRIL 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0585	23 Apr 24	Y = 1.0322x + 2.25	0.9997
BKK_FS0587	23 Apr 24	Y = 1.0111x + 16.357	0.9994
BKK_FS0592	23 Apr 24	Y = 1.001x + 14.551	1.0000
BKK_FS0594	23 Apr 24	Y = 1.0048x + 4.9762	1.0000
BKK_FS1004	01 Apr 24	Y = 0.9826x + 12.32	0.9998
BKK_FS1005	01 Apr 24	Y = 1.0183x + 0.0633	0.9998
BKK_FS1006	01 Apr 24	Y = 1.1534x - 3.3241	0.9989
BKK_FS1007	23 Apr 24	Y = 1.1084x + 2.9017	0.9994
BKK_FS1008	06 May 24	Y = 1.1347x + 2.1915	0.9996
BKK_FS1011	07 May 24	Y = 1.3995x - 7.1671	0.9994
BKK_FS1012	07 May 24	Y = 1.0488x - 26.533	0.9998
BKK_FS1013	07 May 24	Y = 1.0255x - 57.741	1.0000
BKK_FS1017	04 Apr 24	Y = 1.0213x + 0.1156	1.0000
BKK_FS1018	04 Apr 24	Y = 1.0007x + 1.3933	0.9999
BKK_FS1019	04 Apr 24	Y = 1.0038x - 1.3381	1.0000
BKK_FS1020	04 Apr 24	Y = 1.003x + 5.7656	1.0000
BKK_FS1021	04 Apr 24	Y = 1.0096x - 25.605	0.9926
BKK_FS1022	04 Apr 24	Y = 1.0937x - 103.66	0.9980
BKK_FS1023	07 May 24	Y = 1.1613x - 2.675	1.0000
BKK_FS1024	07 May 24	Y = 1.0157x - 4.3362	1.0000
BKK_FS1025	07 May 24	Y = 1.0018x - 4.6236	0.9999
BKK_FS1039	01 Apr 24	Y = 0.9909x + 11.357	0.9991
BKK_FS1040	01 Apr 24	Y = 1.0121x - 19.203	0.9996
BKK_FS1041	01 Apr 24	Y = 1.0176x + 1.4813	0.9996
BKK_FS1042	01 Apr 24	Y = 0.9927x + 10.76	0.9995
BKK_FS1043	01 Apr 24	Y = 0.9965x + 13.696	1.0000
BKK_FS1044	01 Apr 24	Y = 1.1159x - 0.9354	0.9978
PHK_FS0027	06 May 24	Y = 1.1281x + 0.4949	0.9997
PHK_FS0028	06 May 24	Y = 1.0332x - 1.8233	0.9999
PHK_FS0029	06 May 24	Y = 1.001x + 10.848	1.0000
RYG_FS0197	01 Apr 24	Y = 1.0045x + 10.275	1.0000
RYG_FS0198	01 Apr 24	Y = 1.0061x + 0.715	0.9999
RYG_FS0199	01 Apr 24	Y = 0.976x + 3.1497	0.9998
RYG_FS0654	01 Apr 24	Y = 1.0354x + 0.3361	0.9998
RYG_FS0655	01 Apr 24	Y = 0.978x + 13.603	0.9991
RYG_FS0656	01 Apr 24	Y = 1.0035x + 6.879	0.9999
RYG_FS0657	01 Apr 24	Y = 1.0233x + 0.8908	0.9982
RYG_FS0658	01 Apr 24	Y = 0.9905x + 9.8867	0.9996
RYG_FS0659	01 Apr 24	Y = 0.9994x + 13.924	1.0000

Page 1 of 2

ALS Laboratory Group



ROTA METER CALIBRATION RESULT APRIL 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
SGK_FS0135	23 Apr 24	Y = 1.0117x + 4.8833	1.0000
SGK_FS0136	23 Apr 24	Y = 1.0134x + 3.6467	1.0000
SGK_FS0138	04 Apr 24	Y = 1.0449x - 0.3684	0.9988
SGK_FS0139	04 Apr 24	Y = 1.0086x + 3.1267	0.9988
SGK_FS0140	04 Apr 24	Y = 1.0029x + 7.5181	1.0000
SGK_FS0141	23 Apr 24	Y = 1.1129x - 0.0619	0.9997
SGK_FS0142	23 Apr 24	Y = 1.0136x + 2.4267	0.9999
SGK_FS0143	23 Apr 24	Y = 1.0036x + 8.3162	1.0000

Review By: Wichan Choonhara
(Mr. Wichan Choonhara)
Enviro Field Services Manager

Approved By: [Signature]
(Mr. Sarayuth Jitranont)
Assistant General Manager

Sartorius (Thailand) Co., Ltd.
128 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8351-6, e-mail: service.thailand@sartorius.com



NBC-TS-15-17025
CALIBRATION 0426

SARTORIUS

Certificate of Calibration

REVIEW BY	<u>Thawit</u>
APPROVED BY	<u>[Signature]</u>
NEXT CAL. DATE	01/01/2025

Model Number: MSE125P-100-DU Certificate No.: 24BC10071
Description: Semi-micro Balance Issued Date: Friday, February 23, 2024
Serial Number: 0033108993 Reference No.: 229196
ID No.: RYG_EN0004
Manufacturer: Sartorius Page No.: 1 of 3

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
618/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated By: Mr.Chonchai Inthana Calibration Procedure No.: This calibration was conducted by Using in-house calibration procedure number (WI-003)
Calibration Date: Thursday, February 22, 2024 Based on UKAS LAB 14: 2019

Metrological data: Capacity: 60./120. g Readability: 0.00001./0.0001 g
Reasons for calibration: ☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance
Ambients Conditions: Temperature: 24.0 °C ± 5.0 °C
Humidity: 60.0 % RH ± 10.0 % RH
Pressure: ±
Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method **UKAS Publication Ref :Lab 14**
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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C1923184S	23-Aug-2024

This certificate relate and apply this equipment only.

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SOP FM 33 03 February 2022

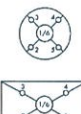
Mr.chonchai Inthana(Technical Manager)



Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 24BCI0071
Description : Semi-micro Balance Issued Date : Friday, February 23, 2024
Serial Number : 0033108993 Reference No. : 229196
ID No. : RYG_EN0004
Manufacturer : Sartorius Page No. : 2 of 3

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	5.00003	50.00003	Nominal value :	50	g
5 g	5.00001	50.00003	Tolerance	0.00015	g
Tolerance	5.00003	50.00002			
0.000015 g	5.00002	50.00003			
	5.00001	50.00003			
Nominal Value : (High Load)	5.00002	50.00003			
50 g	5.00001	50.00003			
Tolerance	5.00001	50.00002			
0.000015 g	5.00002	50.00003			
	5.00002	50.00002			
Standard Deviation	0.000008	0.000005			


Linearity				
The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.00004	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.01000	0.01000	0.00000	0.000024
0.1	0.10000	0.10000	0.00000	0.000025
1	1.00000	1.00000	0.00000	0.000027
2	2.00002	2.00002	0.00000	0.000028
5	5.00002	5.00003	0.00001	0.000031
10	10.00002	10.00004	0.00002	0.000036
20	20.00002	20.00002	0.00000	0.000049
30	30.00004	30.00003	-0.00001	0.000089
40	40.00005	40.00003	-0.00002	0.000089
50	50.00002	50.00001	-0.00001	0.000089

SOP FM 33 03 February 2022

Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 24BCI0071
Description : Semi-micro Balance Issued Date : Friday, February 23, 2024
Serial Number : 0033108993 Reference No. : 229196
ID No. : RYG_EN0004
Manufacturer : Sartorius Page No. : 3 of 3

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	100.0000	100.0000	Nominal value :	50	g
100 g	100.0000	100.0000	Tolerance	0.00015	g
Tolerance	100.0000	100.0000			
0.000015 g	100.0000	100.0000			
	100.0000	100.0000			
Nominal Value : (High Load)	100.0000	100.0000			
100 g	100.0000	100.0000			
Tolerance	100.0000	100.0000			
0.000015 g	100.0000	100.0000			
	100.0000	100.0000			
Standard Deviation	0.00003	0.00003			

Linearity				
The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.0001	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
65	65.0000	65.0000	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00015
75	75.0001	75.0000	-0.0001	0.00015
80	80.0001	80.0000	-0.0001	0.00016
85	85.0001	85.0001	0.0000	0.00018
90	90.0001	90.0001	0.0000	0.00017
95	95.0001	95.0001	0.0000	0.00019
100	100.0000	100.0000	0.0000	0.00024
110	110.0000	110.0000	0.0000	0.00026
120	120.0000	120.0000	0.0000	0.00026

End of Report.

SOP FM 33 03 February 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

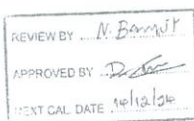
Certificate No. : 23E3924
Page : 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used item
Received Date : 08 December 2023
Calibration Date : 14 December 2023
Reference : 2312-0151DSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 10) %
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu. A.Pluakzaeng,
Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15

Condition of this result of calibration

1. Reference standards instruments :
- | Instrument | Model | Serial No. | Certificate No. | Due Date |
|-----------------------------|-------|------------|-----------------|-------------|
| 1) Multi-Product Calibrator | 5502A | 2435802 | EE-0041-23 | 26 Apr 2024 |
- 2 This result of calibration was made on requested at the point specified by customer
3 The certificate is valid only to the item calibrated on date and place of calibration
4 This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology Thailand (NIMT)



Calibrated by : Napachanok Prasomsosiri
Issue Date : 15 December 2023
Approved Signatory :
() Phalinee Prabpaipal
(x) Nuntawat Khanchai
() Pongsagorn Boonyaporn

B 0331106



Cert. No.: 23E3924
Page: 2 of 2

Result of calibration :- (*) Without adjustment () After adjustment

Function: DC voltage measurement		Range: 2000	mV		
Standard Value	UUC* Reading	Error	Uncertainty		
(mV)	(mV)	(mV)	(± μV)		
-200.0000	-199.9	0.1	68		
-150.0000	-150.0	0.0	65		
-100.0000	-100.0	0.0	63		
-50.0000	-50.0	0.0	61		
0.0000	0.0	0.0	58		
50.0000	50.0	0.0	61		
100.0000	100.0	0.0	63		
150.0000	150.0	0.0	65		
200.0000	199.9	-0.1	68		

The 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 %

UUC*= Unit Under Calibration.

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Cert.No.: 23CH1574
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 08 December 2023
Calibration Date : 15 December 2023
Reference : 2312-0151DSC-3
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul

Approved by :

() Sathip Meangmai
() Warakorn Lernagatrakul
(✓) Ponpan Palpim

Issue Date : 19 December 2023

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

A 0061696



Cert.No.: 23CH1574
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4962054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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Cert.No.: 23CH1574
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 (±)	Coverage factor k
pH Electrode S/N.: 3225368	4.008	4.013	184.1	0.0045	2.00
	6.986	6.996	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225368

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 (± °C)	Coverage factor k
25.0	25.003	24.3	-0.703	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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a 1193851



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Certificate of Calibration

Cert.No.: 24CH383
Page.: 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGoTM pHmV S2
Serial No. : C202355606
ID No. : RYG_FS0574

Condition As-Received: Used Item

Received Date : 29 March 2024

Calibration Date : 01 April 2024

Reference : 2403-1017DSC-9

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand

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)

Calibrated by : Warakorn Lernagatrakul

Approved by :

() Ponpan Palpim
() Unnopphol Harachai
(✓) Sathip Meangmai

Issue Date : 02 April 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.: 24CH383
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

This certification is traceable to the International System of Unit maintained 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: C202355606	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

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.: 2015870	4.008	4.01	167	0.0071	2.00
	6.986	6.99	-10	0.010	2.00
	9.997	10.00	-178	0.0092	2.00

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

Cert. No.: 24LM61
Page: 1 of 2

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seven2GoTM pH/mV S2
Serial No. : C202355606
ID No. : RYG_FS0574
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 29 March 2024
Calibrated Date : 02 April 2024
Ambient Temperature : (26 \pm 10) °C
Relative Humidity : (50 \pm 30) %
AC Line Voltage : (220 \pm 22) V
Calibrated by : Warakorn Lemgagrakul
Approved by :
() Pornthippa Tameyakul
(✓) Ponpan Paipim
() Suwit Imjai
Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2403-1017DSC-10

Cert. No.: 24LM61
Page: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	A52847	2311222	TPA	10 Oct 2024

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

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 2015780

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (\pm °C)	Coverage Factor k
25.0	100	25.002	25.0	-0.002	0.16	2.00
40.0	100	40.003	40.1	0.097	0.16	2.00
60.0	100	60.004	60.1	0.096	0.16	2.00

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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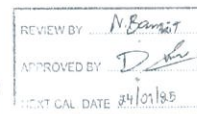


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TEL.0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW168
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 \pm 5) °C
Humidity (50 \pm 20) %
Test Procedure : In-house method : CP-CH8
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by :
() Malee Bulkruea
(✓) Saitthip Meangmai
() Warakorn Lemgagrakul
Issue Date : 26 July 2023





Cert.No.: 23TW168
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	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

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.: 15E100464

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.18	8.17	0.0055

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-

Signature

a 1172155



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



Cert. No.: 23LM125
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5 T. Maenam Khu. A. Pluakdaeng,
Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Preecha Hiahb
Approved by : *Signature*
Approved Signatory
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0053616



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-2
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	2211285	TPA	21 Oct 2023

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

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 1228475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

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 %.

-o0o-

Signature

a 1159515



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



Cert. No.: 23TM962
Page.: 1 of 3

Certificate of Calibration

Equipment : Low Temp. incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : V818 0084
ID No. : RYG_EN0154
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu. A. Pluakdaeng, Rayong 21140 Thailand
Location : BOD Room
Received Order : 29 May 2023
Calibration Date : 29 May 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by : *Signature*
Approved Signatory
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 7 June 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services

A 0054967

а 1182477



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230441
Issued Date: 19 September 2023
Job No.: WO-00005382
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 23.9 °C ± 0.2
Humidity 65.3 %RH ± 1.4

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wet Chemistry)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungueang

Calibration Date: 18 September 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-06 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 111553 and 111554

The standard for Photometric Certificate No. 9114984 and 111555

The standard for Stray light Certificate No. 111556 and 111555

The standard for Spectral resolution Certificate No. 111557

(Mr. Nattapat Rungueang)
Person in charge

(Mr. Nitinun Srihawan)
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 DKSH Technology Limited.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrasarang, Bangkok 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230441 Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.3	0.31	0.13	
536.66	536.6	0.06	0.13	
637.98	638.3	-0.32	0.13	
748.48	748.7	-0.22	0.13	
807.03	807.4	-0.37	0.13	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
440 nm	1.0298	1.029	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
465 nm	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4852	0.486	-0.0008	0.0045
635 nm	0.9468	0.946	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
635 nm	0.5040	0.506	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
635 nm	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230441 Page 3 of 3

Calibration Results: Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *			
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.62 ± 0.11 nm	260.6	1.3	1.886
391.44 ± 0.11 nm	391.4	1.3	1.886

Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	268.69	1.38	2.00
UUC: Wavelength (nm)	268.2	268.1		
Std Absorbance (A)	0.4566	0.2780		
Absorbance (A)	0.413	0.300		

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

The End of Certificate

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CAL-FM-C06-15: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องวัด: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		ตรวจสอบ (ส่ง)		หมายเหตุ
18 Sep 2023		18 Sep 2023		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Spectrophotometer				
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
pH Meter and Conductivity Meter				
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับยึดอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>
Turbidimeter				
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นาน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>
Automatic titrator				
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>
				9.2 Hours
				741.5 Hours

เพิ่มเติมข้อแนะนำ: *856.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungueang
Service Engineer

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CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius

Certificate No. : 24BCI0069
Issued Date : Friday, February 23, 2024
Reference No. : 229196
Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong,21140, Thailand.

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Thursday, February 22, 2024

Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number: (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data :
Capacity : 220 g Readability : 0.0001 g
Temperature : 24.2 °C ± 5.0 °C
Humidity : 57.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration
☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance
Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref. Lab 14
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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C1923184S	23-Aug-2024

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr.chonchai Inthana(Technical Manager)

SOP FM 33 03 February 2022

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius

Certificate No. : 24BCI0069
Issued Date : Friday, February 23, 2024
Reference No. : 229196
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.	The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).
Nominal Value : (Low Load) 20 g Tolerance 0.0001 g	Nominal value : 100 g Tolerance 0.0004 g
Nominal Value : (High Load) 200 g Tolerance 0.0001 g	
Standard Deviation 0.00007 0.00006	

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00018
0.05	0.0500	0.0500	0.0000	0.00018
0.1	0.1000	0.1000	0.0000	0.00018
0.5	0.5000	0.5000	0.0000	0.00018
1	1.0000	1.0000	0.0000	0.00018
5	5.0000	5.0000	0.0000	0.00018
10	10.0000	10.0000	0.0000	0.00018
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	49.9999	-0.0001	0.00019
100	100.0000	100.0000	0.0000	0.00023
200	200.0000	199.9999	-0.0001	0.00032

End of Report.

SOP FM 33 03 February 2022



Certificate of Calibration

Cert. No.: 24TM632
Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UFE 500
Serial No. : G511.1572
ID No. : RYG_EN0010

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location : Oven Room

Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpalboon

Approved by :
() Ponthippa Tameyakul
() Unnopphol Harachai
(x) Suwit Jaijai

Issue Date : 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3. Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

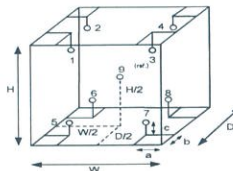
The temperature scale used was based on ITS-90.

Condition of this result of calibration

- Reference standard instrument:-
Instrument Serial No. Cert. No. Traceable Due Date
1) Data Acquisition MY57013711 23LM115 TPA 11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.48 m
Capacity = 0.11 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL Humid. (%)	57	59
AC Supply (Volt)	222	224

Ref. Std. ID No.: @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

Cert. No.: 24TM632
Page : 2 of 3



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM632
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature 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.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

-000-



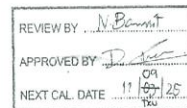
Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

Equipment: Block Digestion Unit
Model: KT-20s
Serial No. (or ID.): 5720210009/5770200073
Manufacturer: Gerhardt
Condition: In Condition
Certificate No.: C29240011
Issued Date: 22 March 2024
Job No.: WO-00020429
Page: 1 of 4
Digestion Block: 20 holes.

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature: 25 °C ± 0.7 °C
Humidity: 54 %RH ± 4.1 %RH
Voltage: 225 VAC ± 1.7 VAC



Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Thanathorn Phunook
Calibration Date: 11 March 2024
The Method used: In house method, base on by comparison with standard
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.: TC22/0080

Signature

(Mr. Thanathorn Phunook)
Person in charge

Signature

(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 DKSH Technology Limited.

Info: Bangkok unit Ltd office
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phraekhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C29-07_20 Jul 2022



Certificate No. C29240011 Page: 2 of 4

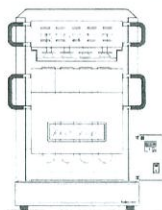
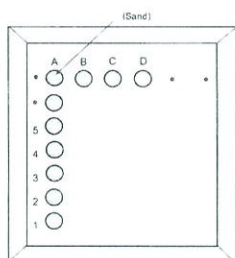


Fig. 1: Front view



Location of standard

Fig. 2 Digestion block

Definitions

Indicating Temperature : The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature : The average reading of working standard at any positions or location.

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CAL-FM-C29-07_20 Jul 2022



Certificate No. C29240011 Page: 3 of 4

Calibration Results: Pre Calibration

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	401.5	21.5	1.5
A2				401.2	21.2	1.5
A3				399.1	19.1	1.5
A4				397.8	17.8	1.5
A5				395.1	15.1	1.5
B1				396.6	16.6	1.5
B2				396.1	16.1	1.5
B3				392.9	12.9	1.5
B4				391.6	11.6	1.5
B5				380.7	10.7	1.5
C1				395.3	15.3	1.5
C2				395.6	15.6	1.5
C3				392.8	12.8	1.5
C4				381.7	11.7	1.5
C5				380.3	10.3	1.5
D1				397.6	17.6	1.5
D2				396.6	16.6	1.5
D3				395.0	15.0	1.5
D4				384.2	14.2	1.5
D5				393.6	13.6	1.5

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CAL-FM-C29-07_20 Jul 2022

Calibration Results: Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	365	365	382.5	17.5	1.5
A2				382.4	17.4	1.5
A3				382.1	17.1	1.5
A4				379.7	14.7	1.5
A5				378.3	13.3	1.5
B1				380.1	15.1	1.5
B2				380.1	15.1	1.5
B3				378.5	13.5	1.5
B4				378.3	13.3	1.5
B5				379.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.9	13.9	1.5
C4				378.2	13.2	1.5
C5				377.3	12.3	1.5
D1				380.5	15.5	1.5
D2				380.6	15.6	1.5
D3				378.1	13.1	1.5
D4				378.7	13.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

DKSH Technology (Thailand) Co., Ltd.
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CAL FM C29 07 20 Jul 2022

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
11 Mar 2024			11 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ชื่อแนะนำ:

Mr. Thanathorn Phunook
Service Engineer

DKSH Technology (Thailand) Co., Ltd.
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Phone: +66 2639 7000 Email: info@calibration@dksh.com Website: www.dksh.com/calibration/thailand
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Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-5 e-mail: service.thailand@sartorius.com



ISO 17025
CALIBRATION 0426

SARTORIUS

Certificate of Calibration

Model Number: MSE224S-100-DU
Description: Analytical Balance
Serial Number: 27405555
ID No.: BKK_EN0003
Manufacturer: Sartorius

Certificate No.: 23BCI0310
Issued Date: Friday, August 11, 2023
Reference No.: 216011
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40 Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250

Calibrated Place: Lab Room

Calibrated By: Mr Chonchai Inthana
Calibration Date: Wednesday, August 09, 2023

Calibration Procedure No.: This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data:

Capacity: 220 g Readability: 0.0001 g

Ambients Conditions:

Temperature: 22.6 °C ± 5.0 °C
Humidity: 59.0 % RH ± 10.0 % RH
Pressure: - ± -

Reasons for calibration

☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance

☒ Equipment Condition ☐ Good Operation ☐ Fair

Measurement Method UKAS Publication Ref: Lab 14

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). The calibration certificate documents the traceability to National Standards which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division
Sartorius (Thailand) Co., Ltd.

Mr Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.

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Tel: +66 2643 8361-6 Fax: +66 2643-8367 e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number: MSE224S-100-DU
Description: Analytical Balance
Serial Number: 27405555
ID No.: BKK_EN0003
Manufacturer: Sartorius

Certificate No.: 23BCI0310
Issued Date: Friday, August 11, 2023
Reference No.: 216011
Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	20 g	20.0000	Nominal value :	100 g	
Tolerance	0.0001 g	20.0000	Tolerance	0.0004 g	
Nominal Value : (High Load)	200 g	200.0000			
Tolerance	0.0001 g	200.0000			
Standard Deviation			Difference		
0.00003			1		
0.00005			2		
			3		
			4		
			5		
			6		

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance	0.0002 g			
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0001	0.0001	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	200.0001	0.0001	0.00030

End of Report.

SOP FM 33 03 February 2022.



Metrological Center

SCI ECO Services Company Limited

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Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T231303

Page 1 of 3

Certificate of Calibration

Equipment : Liquid Bath (Water)

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK_EN0148

ID No. : T6455A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Nakhakred (Site Calibration Manager)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L 14118 31-08-64



Metrological Center

SCI ECO Services Company Limited

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Certificate No. T231303

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)

Date of Calibration : 4 July 2023

Environment : Temperature : 22.2-22.5 °C

Line Voltage : 221.6-224.8 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)). All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M18 (CH1,CH6-CH7,CH9-CH110)	T230545	10 April 2024
DATA LOGGER	34970A	T149	T230545	10 April 2024
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
- Condition of calibrated item : good
Equipment Description :
Time Constant 3 Hour 45 Minute At 60 °C
- Adjustment :
(X) without adjustment () after adjustment

Approved By : Boonchai Suriyawong

FM-L15 117 15-05-63



Metrological Center

SCI ECO Services Company Limited

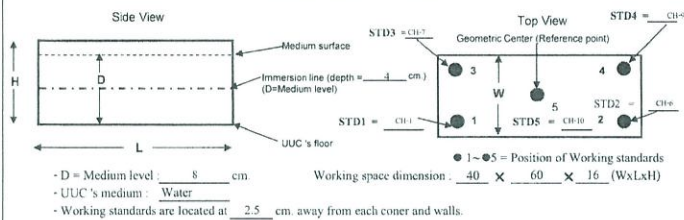
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Certificate No. T231303

Page 3 of 3

Calibration Report



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-6	CH-7	CH-9	CH-10
60	60.03	60.06	60.24	60.11	60.18
85	84.79	84.83	85.42	85.05	85.20
95	93.71	93.83	94.62	94.15	94.42

Liquid Bath (Water)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (± °C)	Uncertainty (± °C)	Coverage Factor k
	Min.	Max.					
61.0	60.9	61.1	61.0	0.13	0.19	0.29	2.04
86.0	85.8	86.2	86.0	0.19	0.47	0.44	2.17
95.0	94.6	95	94.9	0.32	0.65	0.55	2.13

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By : Boonchai Suriyawong

FM-L15 117 15-05-63