

# ภาคผนวก ค-4

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คุณภาพอากาศในสถานประกอบการ



## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148992**

Date Received : Feb 18, 2022

Date Reported : Mar 02, 2022

Report Number : 2183858-1

Page 1 of 4

<b>Sample Number</b>	21148992-1
<b>Sampled Date</b>	Feb 17, 2022
<b>Sample Description</b>	Air Quality
<b>Location</b>	หน่วยโพลีเอทิลีน
<b>Date Analysis Commenced</b>	Feb 19, 2022
<b>Condition of Sample</b>	Drawn into two 10-L air sampling bags and one sorbent tube, refrigerated
<b>Barometric Pressure</b>	760 mmHg
<b>Atmospheric Temperature</b>	30.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Ethylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	200	Based on ASTM, D 2712-91	ACGIH	Bangkok
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	<0.03	500	NIOSH (1994), 1500	MOL	Bangkok
Propylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	500	Based on ASTM, D 2712-91	ACGIH	Bangkok

**Guideline :**

ACGIH : The American Conference of Governmental Industrial Hygiene, The 6th edition of the Documentation of the Threshold Limit Values and Biological Exposure Indices (2020).

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)

**Sampled By :** Nantawat Sarin

Remark :

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

Approved by

*Saranya C.*

Saranya Chalermtamrong  
Scientist (4)

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148992**

Date Received : Feb 18, 2022

Date Reported : Mar 02, 2022

Report Number : 2183858-1

Page 2 of 4

**Sample Number** 21148992-2  
**Sampled Date** Feb 17, 2022  
**Sample Description** Air Quality  
**Location** หน่วยเตรียมตัวเร่งปฏิกิริยา  
**Date Analysis Commenced** Feb 21, 2022  
**Condition of Sample** Drawn into one sorbent tube, refrigerated  
**Barometric Pressure** 760 mmHg  
**Atmospheric Temperature** 30.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	<0.03	500	NIOSH (1994), 1500	MOL	Bangkok

**Guideline :**

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**Sampled By :** Nantawat Sarin

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Scientist (4)

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**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148992**

Date Received : Feb 18, 2022

Date Reported : Mar 02, 2022

Report Number : 2183858-1

Page 3 of 4

**Sample Number** 21148992-3  
**Sampled Date** Feb 17, 2022  
**Sample Description** Air Quality  
**Location** หน่วยบรรจุผลิตภัณฑ์  
**Date Analysis Commenced** Feb 19, 2022  
**Condition of Sample** Drawn into one filter paper placed in plastic cassette  
**Barometric Pressure** 760 mmHg  
**Atmospheric Temperature** 30.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Total Dust	10:00 AM - 12:00 PM	mg/m3	-	0.15	<0.15	15	Based on NIOSH (1994), 0500	OSHA	Rayong

**Guideline :**

OSHA : Occupational Safety and Health Administration

**Sampled By :** Nantawat Sarin

**Remark :**

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148992**

Date Received : Feb 18, 2022

Date Reported : Mar 02, 2022

Report Number : 2183858-1

Page 4 of 4

<b>Sample Number</b>	21148992-4
<b>Sampled Date</b>	Feb 17, 2022
<b>Sample Description</b>	Air Quality
<b>Location</b>	Extruder (หน่วยดัดเม็ด)
<b>Date Analysis Commenced</b>	Feb 19, 2022
<b>Condition of Sample</b>	Drawn into two 10-L air sampling bags and one sorbent tube, refrigerated
<b>Barometric Pressure</b>	760 mmHg
<b>Atmospheric Temperature</b>	30.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Ethylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	200	Based on ASTM, D 2712-91	ACGIH	Bangkok
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	<0.03	500	NIOSH (1994), 1500	MOL	Bangkok
Propylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	500	Based on ASTM, D 2712-91	ACGIH	Bangkok

**Guideline :**

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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)

**Sampled By :** Nantawat Sarin

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10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250318**

Date Received : Jun 15, 2022

Date Reported : Jun 27, 2022

Report Number : 2295758-1

Page 1 of 4

<b>Sample Number</b>	2250318-1
<b>Sampled Date</b>	Jun 14, 2022
<b>Sample Description</b>	Air Quality
<b>Location</b>	หน่วยโพลีเอทิลีน
<b>Date Analysis Commenced</b>	Jun 16, 2022
<b>Condition of Sample</b>	Drawn into two 10-L air sampling bags and one sorbent tube, refrigerated
<b>Barometric Pressure</b>	757 mmHg
<b>Atmospheric Temperature</b>	32.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Ethylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	200	Based on ASTM, D 2712-91	ACGIH	Bangkok
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	<0.03	500	NIOSH (1994), 1500	MOL	Bangkok
Propylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	500	Based on ASTM, D 2712-91	ACGIH	Bangkok

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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)

**Sampled By :** Apichart Wilars

Remark :

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250318**

Date Received : Jun 15, 2022

Date Reported : Jun 27, 2022

Report Number : 2295758-1

Page 2 of 4

**Sample Number** 2250318-2  
**Sampled Date** Jun 14, 2022  
**Sample Description** Air Quality  
**Location** หน่วยเตรียมตัวเร่งปฏิกิริยา  
**Date Analysis Commenced** Jun 16, 2022  
**Condition of Sample** Drawn into one sorbent tube, refrigerated  
**Barometric Pressure** 757 mmHg  
**Atmospheric Temperature** 32.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	0.27	500	NIOSH (1994), 1500	MOL	Bangkok

**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)

**Sampled By :** Apichart Wilars

Remark :

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250318**

Date Received : Jun 15, 2022

Date Reported : Jun 27, 2022

Report Number : 2295758-1

Page 3 of 4

**Sample Number** 2250318-3  
**Sampled Date** Jun 14, 2022  
**Sample Description** Air Quality  
**Location** หน่วยบรรจุผลิตภัณฑ์  
**Date Analysis Commenced** Jun 17, 2022  
**Condition of Sample** Drawn into one filter paper placed in plastic cassette  
**Barometric Pressure** 757 mmHg  
**Atmospheric Temperature** 32.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Total Dust	10:00 AM - 12:00 PM	mg/m3	-	0.15	<0.15	15	Based on NIOSH (1994), 0500	OSHA	Rayong

**Guideline :**

OSHA : Occupational Safety and Health Administration

**Sampled By :** Apichart Wilars

Remark :

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250318**

Date Received : Jun 15, 2022

Date Reported : Jun 27, 2022

Report Number : 2295758-1

Page 4 of 4

**Sample Number** 2250318-4  
**Sampled Date** Jun 14, 2022  
**Sample Description** Air Quality  
**Location** Extruder (หน่วยดัดเม็ด)  
**Date Analysis Commenced** Jun 16, 2022  
**Condition of Sample** Drawn into two 10-L air sampling bags and one sorbent tube, refrigerated  
**Barometric Pressure** 757 mmHg  
**Atmospheric Temperature** 32.0 °C

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Ethylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	200	Based on ASTM, D 2712-91	ACGIH	Bangkok
n-Hexane	10:00 AM - 12:00 PM	ppm	-	0.03	<0.03	500	NIOSH (1994), 1500	MOL	Bangkok
Propylene	10:00 AM - 12:00 PM	ppm	-	1.0	<1.0	500	Based on ASTM, D 2712-91	ACGIH	Bangkok

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**Sampled By :** Apichart Wilars

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## ภาคผนวก ค-5

ระดับเสียงในสถานประกอบการ



## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148996**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number: 2240805-1

Page 1 of 1

**Sample Number** 21148996-1  
**Parameter** Noise (Leq 12 hrs.)  
**Location** หน่วยโพลีเอทิลีน  
**Measurement Date** Feb 17, 2022  
**Measurement by** Nantawat Sarin

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
08:01 AM - 09:01 AM	80.4	95.1	75.8
09:01 AM - 10:01 AM	79.7	82.4	78.9
10:01 AM - 11:01 AM	79.9	82.5	78.9
11:01 AM - 12:01 PM	80.0	82.8	78.9
12:01 PM - 01:01 PM	79.9	82.4	78.9
01:01 PM - 02:01 PM	80.1	91.9	78.9
02:01 PM - 03:01 PM	79.9	91.7	78.7
03:01 PM - 04:01 PM	79.8	82.3	78.8
04:01 PM - 05:01 PM	79.9	82.7	78.8
05:01 PM - 06:01 PM	79.8	82.4	78.8
06:01 PM - 07:01 PM	79.8	82.5	79.0
07:01 PM - 08:01 PM	78.2	79.3	77.8

Leq Average 12 hrs. (dB(A))

79.8

Lmax (dB(A))

95.1

Standard (dB(A))

87

140

Reference Method : ISO1996-1 and 1996-2

Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
ในการประกอบกิจการโรงงานเกี่ยวกับสภาวะแวดล้อมในการทำงาน พ.ศ.๒๕๕๖

**Technical Management**

*Thanita K.*

Thanita Kulsuriwong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name** : Environmental Monitoring

**Project Location** : PP1

**Lot ID: 21148996**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number: 2240806-1

Page 1 of 1

**Sample Number** 21148996-2  
**Parameter** Noise (Leq 12 hrs.)  
**Location** Extruder (หน่วยดัดเม็ด)  
**Measurement Date** Feb 17, 2022  
**Measurement by** Nantawat Sarin

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
08:38 AM - 09:38 AM	82.6	93.3	78.8
09:38 AM - 10:38 AM	82.5	86.6	80.5
10:38 AM - 11:38 AM	82.0	83.5	81.6
11:38 AM - 12:38 PM	82.4	85.9	80.9
12:38 PM - 01:38 PM	81.4	83.3	80.3
01:38 PM - 02:38 PM	81.8	83.3	81.4
02:38 PM - 03:38 PM	81.8	83.5	81.3
03:38 PM - 04:38 PM	82.1	83.6	81.7
04:38 PM - 05:38 PM	81.4	83.6	80.6
05:38 PM - 06:38 PM	81.2	84.9	80.5
06:38 PM - 07:38 PM	81.9	84.3	80.9
07:38 PM - 08:38 PM	82.0	86.3	81.2

Leq Average 12 hrs. (dB(A)) 81.9  
Lmax (dB(A)) 93.3  
Standard (dB(A)) 87  
Reference Method : ISO1996-1 and 1996-2  
Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
ในการประกอบกิจการโรงงานเกี่ยวกับสภาวะแวดล้อมในการทำงาน พ.ศ.๒๕๕๖

**Technical Management**

*Thanita K.*

Thanita Kulsuriwong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

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10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21148996**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number: 2240807-1

Page 1 of 1

**Sample Number** 21148996-3  
**Parameter** Noise (Leq 12 hrs.)  
**Location** Compressor (ท่อขนส่ง Vent Gas และ Nitrogen)  
**Measurement Date** Feb 17, 2022  
**Measurement by** Nantawat Sarin

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
08:50 AM - 09:50 AM	78.1	82.0	77.7
09:50 AM - 10:50 AM	77.8	78.7	77.5
10:50 AM - 11:50 AM	77.8	78.8	77.4
11:50 AM - 12:50 PM	77.9	78.9	77.6
12:50 PM - 01:50 PM	78.3	80.0	77.9
01:50 PM - 02:50 PM	78.3	79.7	78.0
02:50 PM - 03:50 PM	78.1	79.2	77.8
03:50 PM - 04:50 PM	78.1	79.2	77.7
04:50 PM - 05:50 PM	78.4	79.5	78.1
05:50 PM - 06:50 PM	78.1	79.1	77.8
06:50 PM - 07:50 PM	78.0	79.1	77.7
07:50 PM - 08:50 PM	78.0	79.0	77.6

Leq Average 12 hrs. (dB(A))

78.1

Lmax (dB(A))

82.0

Standard (dB(A))

87

140

Reference Method : ISO1996-1 and 1996-2

Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
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**Technical Management**

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Thanita Kulsuriwong  
Scientist (4)

**Approved by**

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Supot Salamteh  
Section Head

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## Analysis / Test Report

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10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2272639**

Date Received : Jun 15, 2022

Date Reported : Jun 21, 2022

Report Number: 2351370-1

Page 1 of 1

**Sample Number** 2272639-1  
**Parameter** Noise (Leq 12 hrs.)  
**Location** หน่วยโพลีเอทิลีน  
**Measurement Date** Jun 14, 2022  
**Measurement by** Apichart Wilars

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
08:00 AM - 09:00 AM	80.4	89.2	79.3
09:00 AM - 10:00 AM	80.2	94.4	79.9
10:00 AM - 11:00 AM	80.2	82.4	79.9
11:00 AM - 12:00 PM	80.3	81.1	80.1
12:00 PM - 01:00 PM	80.9	87.4	80.6
01:00 PM - 02:00 PM	80.9	82.8	80.5
02:00 PM - 03:00 PM	81.7	84.9	80.4
03:00 PM - 04:00 PM	82.1	84.4	80.5
04:00 PM - 05:00 PM	82.7	86.2	80.8
05:00 PM - 06:00 PM	81.7	82.6	81.4
06:00 PM - 07:00 PM	81.6	82.6	81.3
07:00 PM - 08:00 PM	82.3	89.3	82.0

Leq Average 12 hrs. (dB(A))

81.3

Lmax (dB(A))

94.4

Standard (dB(A))

87

140

Reference Method : ISO1996-1 and 1996-2

Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
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**Technical Management**

*Thanita K.*

Thanita Kulsuriwong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name** : Environmental Monitoring

**Project Location** : PP1

**Lot ID: 2272639**

Date Received : Jun 15, 2022

Date Reported : Jun 21, 2022

Report Number: 2351371-1

Page 1 of 1

**Sample Number** 2272639-2  
**Parameter** Noise (Leq 12 hrs.)  
**Location** Extruder (หน่วยดัดเม็ด)  
**Measurement Date** Jun 14, 2022  
**Measurement by** Apichart Wilars

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
08:08 AM - 09:08 AM	80.1	83.6	79.2
09:08 AM - 10:08 AM	80.9	82.7	80.3
10:08 AM - 11:08 AM	80.4	82.2	79.5
11:08 AM - 12:08 PM	80.2	81.5	79.4
12:08 PM - 01:08 PM	80.0	81.7	79.0
01:08 PM - 02:08 PM	79.7	81.7	78.7
02:08 PM - 03:08 PM	80.5	82.2	79.7
03:08 PM - 04:08 PM	80.5	82.4	79.5
04:08 PM - 05:08 PM	80.4	82.6	79.4
05:08 PM - 06:08 PM	80.5	99.3	77.5
06:08 PM - 07:08 PM	80.8	93.2	79.6
07:08 PM - 08:08 PM	79.3	95.5	73.1

Leq Average 12 hrs. (dB(A))

80.3

Lmax (dB(A))

99.3

Standard (dB(A))

87

140

Reference Method : ISO1996-1 and 1996-2

Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
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**Technical Management**

*Thanita K.*

Thanita Kulsuriwong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250320**

Date Received : May 17, 2022

Date Reported : May 20, 2022

Report Number: 2295765-1

Page 1 of 1

**Sample Number** 2250320-3  
**Parameter** Noise (Leq 12 hrs.)  
**Location** Compressor (ท่อขนส่ง Vent Gas และ Nitrogen)  
**Measurement Date** May 13, 2022  
**Measurement by** Sittichai Kaewket

Time	Leq (dB(A))	Lmax (dB(A))	L90 (dB(A))
09:00 AM - 10:00 AM	76.9	80.1	76.3
10:00 AM - 11:00 AM	76.6	79.5	76.1
11:00 AM - 12:00 PM	76.6	78.5	76.1
12:00 PM - 01:00 PM	76.7	79.2	76.2
01:00 PM - 02:00 PM	76.6	81.4	76.0
02:00 PM - 03:00 PM	76.6	79.7	75.9
03:00 PM - 04:00 PM	76.5	82.7	76.0
04:00 PM - 05:00 PM	76.7	80.1	76.3
05:00 PM - 06:00 PM	76.7	80.1	76.4
06:00 PM - 07:00 PM	77.7	81.1	77.4
07:00 PM - 08:00 PM	76.6	82.8	76.1
08:00 PM - 09:00 PM	76.7	79.8	76.0

Leq Average 12 hrs. (dB(A))

76.8

Lmax (dB(A))

82.8

Standard (dB(A))

87

140

Reference Method : ISO1996-1 and 1996-2

Standard : ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัย  
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**Technical Management**

*Thanita K.*

Thanita Kulsuriwong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21149000**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number : 2242229-1

Page 1 of 1

**Sample Number** 21149000-1  
**Parameter** Octave Band  
**Location** หน่วยโพลีเอทิลีน  
**Measurement Date** Feb 17, 2022  
**Measurement By** Nantawat Sarin

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
08:01 AM - 09:01 AM	80.4	21.9	38.0	50.4	58.1	62.6	70.6	77.9	73.8	69.8	60.8	47.2
09:01 AM - 10:01 AM	79.7	25.1	41.2	53.5	60.7	65.1	70.8	76.0	72.1	72.8	63.6	49.1
10:01 AM - 11:01 AM	79.9	26.0	41.5	54.1	61.5	65.9	71.2	76.1	72.5	72.5	63.2	49.7
11:01 AM - 12:01 PM	80.0	27.1	42.2	54.9	62.2	66.6	72.2	76.1	72.5	72.1	62.0	49.4
12:01 PM - 01:01 PM	79.9	27.2	42.3	55.0	62.3	66.3	72.1	76.1	72.3	72.0	61.9	49.4
01:01 PM - 02:01 PM	80.1	28.6	43.1	55.8	62.9	67.0	72.4	76.3	72.4	71.9	61.6	49.9
02:01 PM - 03:01 PM	79.9	28.4	42.9	55.6	62.7	66.8	72.2	76.1	72.2	71.7	61.4	49.7
03:01 PM - 04:01 PM	79.8	27.1	42.2	54.9	62.2	66.2	72.0	76.0	72.2	71.9	61.8	49.3
04:01 PM - 05:01 PM	79.9	27.0	42.1	54.8	62.1	66.5	72.1	76.0	72.4	72.0	61.9	49.3
05:01 PM - 06:01 PM	79.8	25.9	41.4	54.0	61.4	65.8	71.1	76.0	72.4	72.4	63.1	49.6
06:01 PM - 07:01 PM	79.8	25.2	41.3	53.6	60.8	65.2	70.9	76.1	72.2	72.9	63.7	49.2
07:01 PM - 08:01 PM	78.2	21.0	37.9	50.3	56.5	65.0	69.7	74.0	73.1	68.1	59.5	45.4
Average	79.8	26.4	41.6	54.2	61.4	65.9	71.5	76.1	72.5	71.8	62.2	49.1

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

*Saranya C.*

Saranya Chalermthamrong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

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**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21149000**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number : 2242230-1

Page 1 of 1

**Sample Number** 21149000-2  
**Parameter** Octave Band  
**Location** Extruder (หน่วยตัดเม็ด)  
**Measurement Date** Feb 17, 2022  
**Measurement By** Nantawat Sarin

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
08:38 AM - 09:38 AM	82.6	26.3	41.7	50.6	60.0	67.0	80.8	74.6	72.5	69.7	62.2	48.2
09:38 AM - 10:38 AM	82.5	23.0	37.5	46.6	56.3	63.1	81.9	70.6	66.6	64.1	56.2	42.2
10:38 AM - 11:38 AM	82.0	24.9	38.7	44.8	63.1	71.6	76.1	76.2	75.2	73.1	66.6	51.8
11:38 AM - 12:38 PM	82.4	28.7	43.0	52.7	62.3	68.4	78.5	77.9	73.2	70.0	62.0	48.6
12:38 PM - 01:38 PM	81.4	23.7	35.6	42.4	59.9	70.2	76.3	75.4	75.1	71.6	65.2	49.6
01:38 PM - 02:38 PM	81.8	24.7	38.5	44.6	62.9	71.4	75.9	76.0	75.0	72.9	66.4	51.6
02:38 PM - 03:38 PM	81.8	24.3	38.6	44.4	63.4	71.5	76.0	75.8	75.0	73.1	66.7	51.6
03:38 PM - 04:38 PM	82.1	25.0	38.8	44.9	63.2	71.7	76.2	76.3	75.3	73.2	66.7	51.9
04:38 PM - 05:38 PM	81.4	23.2	36.8	43.6	62.6	71.5	75.7	75.4	74.4	72.8	67.0	50.9
05:38 PM - 06:38 PM	81.2	23.0	36.7	43.8	62.0	70.8	75.5	75.1	74.3	72.9	67.4	52.0
06:38 PM - 07:38 PM	81.9	24.8	37.4	43.4	63.4	72.0	76.0	76.4	74.6	72.9	66.8	50.9
07:38 PM - 08:38 PM	82.0	24.9	38.0	44.0	63.0	72.0	76.1	76.2	74.9	73.5	67.9	52.8
Average	81.9	25.0	39.0	46.8	62.2	70.7	77.7	75.8	74.3	72.2	65.9	50.8

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

*Saranya C.*

Saranya Chalermthamrong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

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Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21149000**

Date Received : Feb 18, 2022

Date Reported : Feb 23, 2022

Report Number : 2242231-1

Page 1 of 1

**Sample Number** 21149000-3  
**Parameter** Octave Band  
**Location** Compressor (ท่อขนส่ง Vent Gas และ Nitrogen)  
**Measurement Date** Feb 17, 2022  
**Measurement By** Nantawat Sarin

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
08:50 AM - 09:50 AM	78.1	20.9	37.9	49.6	55.9	62.6	69.5	73.6	72.9	69.7	61.5	43.2
09:50 AM - 10:50 AM	77.8	20.2	36.7	48.9	55.4	62.5	69.3	73.4	72.6	69.5	60.8	42.7
10:50 AM - 11:50 AM	77.8	20.0	36.4	48.9	55.4	62.5	69.3	73.3	72.6	69.5	61.0	42.6
11:50 AM - 12:50 PM	77.9	21.0	37.7	49.2	55.6	62.6	69.2	73.5	72.6	69.7	61.2	43.0
12:50 PM - 01:50 PM	78.3	21.8	39.2	49.8	56.2	62.7	69.4	73.9	72.9	70.0	61.8	44.7
01:50 PM - 02:50 PM	78.3	21.1	38.7	50.7	56.1	63.1	69.1	73.9	73.1	70.4	62.6	45.5
02:50 PM - 03:50 PM	78.1	21.0	38.0	49.5	55.9	63.1	69.1	73.8	73.0	69.8	61.5	43.4
03:50 PM - 04:50 PM	78.1	21.2	37.9	49.6	55.6	63.2	68.9	73.7	73.0	69.7	62.3	44.4
04:50 PM - 05:50 PM	78.4	21.3	38.3	49.8	56.2	63.4	69.4	74.1	73.3	70.1	61.8	43.7
05:50 PM - 06:50 PM	78.1	21.2	37.9	49.4	55.8	62.8	69.4	73.7	72.8	69.9	61.4	43.2
06:50 PM - 07:50 PM	78.0	20.9	37.9	49.4	55.8	63.0	69.0	73.7	72.9	69.7	61.4	43.3
07:50 PM - 08:50 PM	78.0	20.2	36.6	49.1	55.6	62.7	69.5	73.5	72.8	69.7	61.2	42.8
Average	78.1	20.9	37.8	49.5	55.8	62.9	69.3	73.7	72.9	69.8	61.6	43.6

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

*Saranya C.*

Saranya Chalermthamrong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250321**

Date Received : May 17, 2022

Date Reported : May 23, 2022

Report Number : 2321367-1

Page 1 of 1

**Sample Number** 2250321-3  
**Parameter** Octave Band  
**Location** Compressor (ท่อขนส่ง Vent Gas และ Nitrogen)  
**Measurement Date** May 13, 2022  
**Measurement By** Sittichai Kaewket

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
09:00 AM - 10:00 AM	76.9	20.0	37.7	49.3	55.8	62.1	66.8	72.8	71.9	67.8	61.0	44.2
10:00 AM - 11:00 AM	76.6	19.8	37.2	49.6	56.4	61.6	66.5	72.5	71.6	67.6	61.0	44.2
11:00 AM - 12:00 PM	76.6	19.7	36.5	48.9	56.6	62.4	66.5	72.5	71.6	67.7	61.1	44.3
12:00 PM - 01:00 PM	76.7	19.5	36.3	48.6	56.0	62.0	66.6	72.9	71.5	67.5	61.0	44.1
01:00 PM - 02:00 PM	76.6	19.3	36.6	48.9	56.1	62.3	66.6	72.5	71.5	67.5	61.0	44.2
02:00 PM - 03:00 PM	76.6	19.7	36.5	48.7	55.8	61.5	66.6	72.7	71.5	67.3	60.9	44.8
03:00 PM - 04:00 PM	76.5	19.7	36.6	48.3	55.4	61.4	66.7	72.4	71.6	67.3	60.6	44.1
04:00 PM - 05:00 PM	76.7	19.4	37.2	49.0	55.7	61.7	66.8	72.4	71.8	68.0	61.1	44.5
05:00 PM - 06:00 PM	76.7	19.8	37.3	49.0	55.0	61.6	67.0	72.5	71.9	67.6	60.7	44.6
06:00 PM - 07:00 PM	77.7	20.8	38.3	50.0	56.0	62.6	68.0	73.5	72.9	68.6	61.7	45.6
07:00 PM - 08:00 PM	76.6	19.8	36.7	48.4	55.5	61.5	66.8	72.5	71.7	67.4	60.7	44.2
08:00 PM - 09:00 PM	76.7	19.8	36.6	48.8	55.9	61.6	66.7	72.8	71.6	67.4	61.0	44.9
Average	76.8	19.8	37.0	49.0	55.9	61.9	66.8	72.7	71.8	67.7	61.0	44.5

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

Sararat Mongkonjirawut  
Supervisor

**Approved by**

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2272640**

Date Received : Jun 15, 2022

Date Reported : Jun 21, 2022

Report Number : 2352035-1

Page 1 of 1

**Sample Number** 2272640-1  
**Parameter** Octave Band  
**Location** หน่วยโพลีเอทิลีน  
**Measurement Date** Jun 14, 2022  
**Measurement By** Apichart Wilars

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
08:00 AM - 09:00 AM	80.4	26.3	42.8	55.8	60.8	71.0	73.2	75.5	74.3	69.8	64.7	53.5
09:00 AM - 10:00 AM	80.2	26.7	43.7	57.3	60.5	69.9	73.6	75.6	73.6	69.5	64.6	53.4
10:00 AM - 11:00 AM	80.2	25.7	43.7	57.4	60.3	70.1	73.5	75.6	73.6	69.6	65.0	53.7
11:00 AM - 12:00 PM	80.3	24.6	43.8	57.6	60.9	70.5	74.0	75.4	73.7	69.4	64.6	53.1
12:00 PM - 01:00 PM	80.9	26.7	44.5	57.9	61.2	71.5	74.7	76.2	74.0	69.5	64.6	53.3
01:00 PM - 02:00 PM	80.9	27.1	43.9	57.6	62.3	72.4	74.3	76.2	73.6	69.3	64.2	53.1
02:00 PM - 03:00 PM	81.7	29.1	44.7	57.2	62.6	72.3	75.0	77.7	73.9	70.0	65.1	54.2
03:00 PM - 04:00 PM	82.1	29.8	42.9	56.8	62.3	72.4	75.6	78.4	74.1	69.6	64.6	53.3
04:00 PM - 05:00 PM	82.7	29.9	43.2	57.1	62.7	72.8	76.2	79.1	74.5	69.7	64.6	53.4
05:00 PM - 06:00 PM	81.7	18.6	36.6	50.0	63.8	67.9	72.3	74.9	74.5	76.6	72.0	63.0
06:00 PM - 07:00 PM	81.6	18.4	36.3	49.9	63.8	67.8	72.2	74.8	74.4	76.5	71.9	62.9
07:00 PM - 08:00 PM	82.3	19.3	37.3	51.1	63.5	68.6	72.8	75.5	75.1	77.2	72.4	63.5
Average	81.3	26.6	42.8	56.3	62.2	70.9	74.1	76.5	74.1	72.7	68.0	58.3

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

*Saranya C.*

Saranya Chalermthamrong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2272640**

Date Received : Jun 15, 2022

Date Reported : Jun 21, 2022

Report Number : 2352036-1

Page 1 of 1

**Sample Number** 2272640-2  
**Parameter** Octave Band  
**Location** Extruder (หน่วยตัดเม็ด)  
**Measurement Date** Jun 14, 2022  
**Measurement By** Apichart Wilars

Time	Result (dB(A))											
	Leq	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
08:08 AM - 09:08 AM	80.1	27.2	41.2	53.7	62.1	65.8	72.3	76.2	72.3	73.0	62.9	50.1
09:08 AM - 10:08 AM	80.9	27.1	41.1	53.7	62.2	65.9	72.9	77.1	73.9	73.2	63.0	50.1
10:08 AM - 11:08 AM	80.4	26.9	41.1	53.6	62.1	65.7	72.3	76.5	73.0	73.1	63.0	50.0
11:08 AM - 12:08 PM	80.2	27.4	41.2	53.6	62.2	65.6	72.2	76.1	72.5	73.1	63.0	49.9
12:08 PM - 01:08 PM	80.0	27.7	41.3	53.8	62.4	65.8	72.5	75.8	71.8	73.1	62.9	49.9
01:08 PM - 02:08 PM	79.7	27.5	41.3	53.8	62.4	65.9	72.2	75.4	71.3	73.0	62.8	49.8
02:08 PM - 03:08 PM	80.5	27.2	41.3	53.9	62.2	66.0	72.2	77.1	72.5	73.0	62.8	49.8
03:08 PM - 04:08 PM	80.5	27.2	41.3	54.0	62.4	66.0	72.3	76.9	72.5	73.0	62.8	49.8
04:08 PM - 05:08 PM	80.4	27.4	41.4	54.1	62.5	66.1	72.6	76.6	72.5	73.1	62.9	49.8
05:08 PM - 06:08 PM	80.5	15.4	30.3	45.8	54.8	64.0	69.8	72.4	75.7	75.4	69.7	54.2
06:08 PM - 07:08 PM	80.8	16.6	31.3	45.1	55.9	64.7	69.4	71.0	75.5	77.1	69.9	53.3
07:08 PM - 08:08 PM	79.3	14.7	29.5	43.4	54.7	63.3	68.9	72.7	74.8	73.0	67.6	51.9
Average	80.3	26.1	40.1	52.7	61.3	65.5	71.8	75.7	73.4	73.8	65.5	51.0

Reference Method : ANSI Standard S1.6-1984

**Technical Management**

*Saranya C.*

Saranya Chalermthamrong  
Scientist (4)

**Approved by**

*Supot S.*

Supot Salamteh  
Section Head

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.  
10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21149002**

Date Received : Feb 18, 2022

Date Reported : Feb 22, 2022

Report Number : 2183869-1

Page 1 of 1

**Sample Number** 21149002-1  
**Sampled Date** Feb 17, 2022  
**Sample Description** Noise Dose  
**Location** พนักงานบริเวณ CCR  
**Personal Sampling** คุณภานุพงศ์ ศรีสุวรรณ  
**Date Analysis Commenced** Feb 21, 2022

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Noise Dose (12 hrs.) (Calculated from Lavg)	08:00 AM - 08:00 PM	%	-	-	6.0	No Standard	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
Noise Dose (8 hrs.)	08:00 AM - 08:00 PM	%	-	1	5.6	No Standard	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
TWA (12 hrs.) (Calculated from Lavg)	08:00 AM - 08:00 PM	dB(A)	-	-	70.8	83*	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
TWA (8 hrs.)	08:00 AM - 08:00 PM	dB(A)	-	-	72.5	85	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok

### Guideline :

- MOL : 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. Notification of Department of Labour Protection and Welfare on the Standard of Time Weighted Average (TWA) Noise Level (B.E. 2561)  
\* MOL: Recommended guideline limit for 12 working hours should not be over 83 dB(A)

**Sampled By :** Natthapon Jiengwareewong

Remark :

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

Approved by

Wichan Choonharat  
Assistant Manager

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.

10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District, Rayong  
Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250323**

Date Received : Jun 15, 2022

Date Reported : Jun 18, 2022

Report Number : 2295781-1

Page 1 of 1

**Sample Number** 2250323-1  
**Sampled Date** Jun 14, 2022  
**Sample Description** Noise Dose  
**Location** พนักงานบริเวณ CCR  
**Personal Sampling** คุณชิตชนันท์ ศรีคำมี  
**Date Analysis Commenced** Jun 16, 2022

Analyte	Sampled Date/time	Unit	LOD	LOQ (LOR)	Result	Guideline Limit	Method	Guideline	Testing Location
<b>Air Testing</b>									
Noise Dose (12 hrs.) (Calculated from Lavg)	08:00 AM - 08:00 PM	%	-	-	58.9		MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
Noise Dose (8 hrs.)	08:00 AM - 08:00 PM	%	-	1	55.0		MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
TWA (12 hrs.) (Calculated from Lavg)	08:00 AM - 08:00 PM	dB(A)	-	-	80.7	83*	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok
TWA (8 hrs.)	08:00 AM - 08:00 PM	dB(A)	-	-	82.4	85	MOL, Department Labour Protection and Welfare (B.E.2561)	MOL	Bangkok

### Guideline :

- MOL : 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. Notification of Department of Labour Protection and Welfare on the Standard of Time Weighted Average (TWA) Noise Level (B.E. 2561)  
\* MOL: Recommended guideline limit for 12 working hours should not be over 83 dB(A)

**Sampled By :** Natthapon Jiengwareewong

Remark :

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

Approved by

Wichan Choonharat  
Assistant Manager

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## ภาคผนวก ค-6

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ระดับความร้อนในสถานประกอบการ



## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.  
10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District,  
Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 21149005**

Date Received : Feb 18, 2022

Date Reported : Feb 22, 2022

Report Number: 2183871-1

Page 1 of 2

**Sample Number** 21149005-1  
**Parameter** Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)  
**Measurement Date** Feb 17, 2022  
**Measurement by** Nantawat Sarin  
**Location** ปฏิบัติงาน 1 พื้นที่ (ชื่อ-นามสกุล ผู้ปฏิบัติงาน : - แผนก : - )

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Extruder (หน่วยตัดเม็ด)	120	29.3	27.6	33.2	33.0
Average (WBGT)		29.3			
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**

Supot Salamteh  
Section Head

**Approved by**

Wichan Choonharat  
Assistant Manager

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Life Sciences

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## Analysis / Test Report

**Client :** Thai Polyethylene Co., Ltd.  
10, Map Ta Phut Industrial Estate I-1 Road, Map Ta Phut, Muang District,  
Rayong Thailand 21150

**P/O :**

**Project Name :** Environmental Monitoring

**Project Location :** PP1

**Lot ID: 2250327**

Date Received : Jun 15, 2022

Date Reported : Jun 18, 2022

Report Number: 2295788-1

Page 1 of 2

**Sample Number** 2250327-1  
**Parameter** Heat Stress (Sampling Time : 10.00 AM - 12.00 PM)  
**Measurement Date** Jun 14, 2022  
**Measurement by** Apichart Wilars  
**Location** ปฏิบัติงาน 1 พื้นที่ (ชื่อ-นามสกุล ผู้ปฏิบัติงาน : - แผนก : - )

Location	Duration (min)	WBGT (°C)	NWB (°C)	GT (°C)	DB (°C)
Extruder (หน่วยตัดเม็ด)	120	30.1	28.2	34.4	34.2
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**

Supot Salamteh  
Section Head

**Approved by**

Wichan Choonharat  
Assistant Manager

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# ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์





## ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	01 Apr 22	$Y = 1.0202x + 0.1976$	1.0000
BKK_FS0579	01 Apr 22	$Y = 1.0078x + 0.4789$	0.9998
BKK_FS0583	01 Apr 22	$Y = 1.016x + 0.3922$	1.0000
BKK_FS0584	01 Apr 22	$Y = 1.0036x + 2.2262$	0.9997
BKK_FS0585	01 Apr 22	$Y = 1.0189x - 5.6476$	0.9997
BKK_FS0586	01 Apr 22	$Y = 1.0095x - 1.1524$	0.9995
BKK_FS0587	01 Apr 22	$Y = 1.013x - 3.6619$	0.9996
BKK_FS0588	01 Apr 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Apr 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	01 Apr 22	$Y = 1.0038x - 0.4857$	0.9996
BKK_FS0591	01 Apr 22	$Y = 0.9705x - 52.174$	0.9986
BKK_FS0592	01 Apr 22	$Y = 0.9646x - 37.642$	0.9985
BKK_FS0593	01 Apr 22	$Y = 0.9767x - 58.445$	0.9988
BKK_FS0594	01 Apr 22	$Y = 0.9902x - 62.87$	0.9999
BKK_FS0595	01 Apr 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	01 Apr 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	01 Apr 22	$Y = 0.9802x - 61.653$	0.9978
BKK_FS1004	01 Apr 22	$Y = 0.9696x + 17.69$	0.9990
BKK_FS1005	01 Apr 22	$Y = 1.0065x + 5.6786$	0.9997
BKK_FS1006	01 Apr 22	$Y = 1.2142x - 7.1037$	0.9993
BKK_FS1007	01 Apr 22	$Y = 0.9917x + 1.6592$	1.0000
BKK_FS1008	01 Apr 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Apr 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	01 Apr 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Apr 22	$Y = 1.0234x + 0.1759$	0.9996
BKK_FS1012	01 Apr 22	$Y = 1.0106x - 2.0048$	0.9997
BKK_FS1013	01 Apr 22	$Y = 0.9677x - 35.851$	0.9997
BKK_FS1014	01 Apr 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	01 Apr 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	01 Apr 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	01 Apr 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	01 Apr 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Apr 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	01 Apr 22	$Y = 1.0547x - 0.666$	0.9998
BKK_FS1021	01 Apr 22	$Y = 1.018x - 3.3286$	0.9998
BKK_FS1022	01 Apr 22	$Y = 0.9932x - 57.035$	0.9986
BKK_FS1023	01 Apr 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	01 Apr 22	$Y = 1.0042x + 0.4086$	0.9997



## ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1025	01 Apr 22	$Y = 1.0132x - 88.507$	0.9996
BKK_FS1026	01 Apr 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Apr 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Apr 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Apr 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Apr 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Apr 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	01 Apr 22	$Y = 0.9868x + 7.8119$	0.9993
BKK_FS1040	01 Apr 22	$Y = 1.0096x - 7.2905$	0.9990
BKK_FS1041	01 Apr 22	$Y = 1.076x - 2.0503$	0.9999
BKK_FS1042	01 Apr 22	$Y = 1.0054x + 1.6095$	0.9995
BKK_FS1043	01 Apr 22	$Y = 1.0108x - 11.048$	0.9999
BKK_FS1044	01 Apr 22	$Y = 1.0468x - 0.9391$	0.9997
BKK_FS1161	01 Apr 22	$Y = 1.0126x + 0.7738$	0.9999
BKK_FS1162	01 Apr 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1163	01 Apr 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1164	01 Apr 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	01 Apr 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	01 Apr 22	$Y = 1.0031x - 77.881$	0.9996
RYG_FS0197	01 Apr 22	$Y = 1.0055x + 1.1914$	0.9998
RYG_FS0198	01 Apr 22	$Y = 0.996x + 23.788$	0.9996
RYG_FS0199	01 Apr 22	$Y = 1.1166x - 3.3942$	0.9998

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jittrantont)

Assistant General Manager

# Certificate of System Qualification

GC-OQ

System ID: GC-7  
Organization Name: ALS Laboratory Groups (Thailand) Co., Ltd.  
Organization Location: 104 Phattanakarn 40, Phattanakarn Rd., Suan Luang, Bangkok 10250  
Date: January 27, 2022 4:43:18 PM  
EQP Name: AgilentRecommended  
EQP Revision: GC.02.52  
Overall Qualification Status: Pass

REVIEW BY	Suchada T.
APPROVED BY	Sararat M.
NEXT CAL. DATE	27 Jul 23

## CDS Logon Verification - GC

Logon: suchada

## Overall CDS Logon Verification - GC Test Status

Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi /5 minutes

Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$

Date: January 27, 2022 4:43:18 PM

System ID: GC-7

**Overall Inlet Pressure Decay Test Status**

Pass

**Inlet Pressure Accuracy**

Name:

7890

Front

SSL

**Setpoint Status:**

Pass

Setpoint

Actual

Inlet Pressure:

25.0

psi

24.9

psi

Accuracy:

0.1

psi

Agilent Recommended:

&lt;=

1.2

**Overall Inlet Pressure Accuracy Test Status**

Pass

**Inlet Pressure Decay**

Name:

7890

Back

SSL

**Setpoint Status:**

Pass

Pressure:

25.0

psi

Pressure Change:

-0.1

psi

/5 minutes

Agilent Recommended:

&gt;=

-2.0

and

&lt;=

0.5

**Overall Inlet Pressure Decay Test Status**

Pass

**Inlet Pressure Accuracy**

Name:

7890

Back

SSL

Date:

January 27, 2022 4:43:18 PM

System ID:

GC-7

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.2	psi
Accuracy:			0.2	psi
Agilent Recommended:		<=	1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Front

FID

## Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.8

mL/min

Accuracy:

0.8

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

3.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

402.2

mL/min

Accuracy:

2.2

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.2

mL/min

Accuracy:

0.8

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date: January 27, 2022 4:43:18 PM  
System ID: GC-7

## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Back

FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.3

mL/min

Accuracy:

0.3

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

3.0

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

401.3

mL/min

Accuracy:

1.3

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.1

mL/min

Accuracy:

0.1

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Date:

January 27, 2022 4:43:18 PM

System ID:

GC-7

Setpoint Status:	Pass			
Zone:	Oven			
	Setpoint/Actual			
Temperature:	230.0	229.5	°C	
Accuracy:		-0.5	°C	
Agilent Recommended:	>=	-1.0	% setpoint in K	( -5.0 °C )
	<=	1.0	% setpoint in K	( 5.0 °C )

Setpoint Status:	Pass			
Zone:	Oven			
	Setpoint/Actual			
Temperature:	100.0	100.9	°C	
Accuracy:		0.9	°C	
Agilent Recommended:	>=	-1.0	% setpoint in K	( -3.7 °C )
	<=	1.0	% setpoint in K	( 3.7 °C )

**Overall GC Oven Temperature Accuracy Test Status**

Pass

**GC Oven Temperature Stability**

Name:	7890			
Setpoint Status:	Pass			
	Setpoint/Average			
Temperature:	100.0	100.7667	°C	
Stability:		0.3	°C	
Agilent Recommended:	<=	0.5		

**Overall GC Oven Temperature Stability Test Status**

Pass

**Scouting Run**

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7693A			

Date: January 27, 2022 4:43:18 PM  
System ID: GC-7

## Setpoint Status:

Completed

Injection Volume on Column:

1.0  $\mu$ L

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1

Front

SSL

/ Front

FID

Name:

7890

## Setpoint Status:

Pass

Base Signal:

13.7 pA

ASTM Noise

pA

0.05

Drift

pA/Hr

0.07

Agilent Recommended:

&lt;= 0.10

&lt;= 2.50

Status:

Pass

Pass

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1

Front

SSL

/ Front

FID

Name:

7693A

## Setpoint Status:

Pass

Injection Volume on Column:

1.0  $\mu$ L

Area RSD:

1.22 %

Retention Time RSD:

0.15 %

Agilent Recommended:

&lt;= 3.00

&lt;= 1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Date:

January 27, 2022 4:43:18 PM

System ID:

GC-7



Tested Combination1 Front SSL / Front FID

Injection Tower

Name: 7890

Setpoint Status: Pass

Signal to Noise: 826956

Agilent Recommended:  $\geq$  300000

Overall Signal to Noise Test Status

Pass

## Scouting Run

Tested Combination2 Back SSL / Back FID

Injection Tower

Name: 7693A

Setpoint Status: Completed

Injection Volume on Column: 1.0  $\mu$ L

Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2 Back SSL / Back FID

Name: 7890

Setpoint Status: Pass

Base Signal: 12.0 pA

ASTM Noise

pA

0.07

Agilent Recommended:

 $\leq$  0.10

Status:

Pass

Drift

pA/Hr

0.56

 $\leq$  2.50

Pass

Date: January 27, 2022 4:43:18 PM

System ID: GC-7

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2

Back

SSL

/ Back

FID

Name:

7693A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

uL

Area RSD:

0.46

%

Retention Time RSD:

0.06

%

Agilent Recommended:

&lt;=

3.00

&lt;=

1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination2

Back

SSL

/ Back

FID

Injection Tower

Name:

7890

Setpoint Status:

Pass

Signal to Noise:

896824

Agilent Recommended:

&gt;=

300000

## Overall Signal to Noise Test Status

Pass

Date:

January 27, 2022 4:43:18 PM

System ID:

GC-7

## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	GC-7
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No

#### Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Back
Detector	Back
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16310209
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

---

**Date:** January 27, 2022 4:43:18 PM  
**System ID:** GC-7

## Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16310204
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

## Sampler 3

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN13440001
Firmware Revision	A.11.03
Vial Heater	Not installed

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440B
Serial Number	CN16363138
Firmware Revision	B.02.04.2
Component ID/Asset No.	GC-7
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

## Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

## Electronic Signature

### Purpose

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### Details

Full Name of Signer:	Tanin-ek Sriwitool
Logged On User Name:	tanin-ek.sriwitool@agilent.com
Signature Creation Date:	January 27, 2022
Reason for Signature:	Executed protocol and published this original version of document

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Date:	January 27, 2022 4:43:18 PM
System ID:	GC-7

User Name: tanin-ek.sriwitoool  
 Hostname: ASBKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 2:58:28 PM	Audit	SessionCreated	Session	None
January 27, 2022 2:58:28 PM	Start	Configuration	Session	None
January 27, 2022 2:58:28 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
January 27, 2022 3:06:22 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended]
January 27, 2022 3:06:41 PM	End	Configuration	Session	None
January 27, 2022 4:00:12 PM	End	Configuration	Session	None
January 27, 2022 4:00:18 PM	Start	Qualification	Session	OQ
January 27, 2022 4:00:18 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
January 27, 2022 4:04:22 PM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
January 27, 2022 4:04:26 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
January 27, 2022 4:04:41 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

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Date: January 27, 2022 4:43:18 PM  
 System ID: GC-7

User Name: tanin-ek.sriwitool  
 Hostname: ASBKKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:04:43 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
January 27, 2022 4:05:29 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
January 27, 2022 4:05:39 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
January 27, 2022 4:05:51 PM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
January 27, 2022 4:05:56 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
January 27, 2022 4:06:14 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
January 27, 2022 4:06:17 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
January 27, 2022 4:06:30 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
January 27, 2022 4:06:32 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None

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Date: January 27, 2022 4:43:18 PM  
 System ID: GC-7



User Name: tanin-ek.sriwitool  
 Hostname: ASBKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:06:39 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
January 27, 2022 4:06:40 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
January 27, 2022 4:07:18 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:07:25 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:07:31 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
January 27, 2022 4:08:07 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:08:14 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:08:20 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
January 27, 2022 4:08:37 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:08:47 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:08:56 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None

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User Name: tanin-ek.sriwitoool  
 Hostname: ASBKKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:09:28 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:09:32 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:09:34 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
January 27, 2022 4:10:01 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:10:05 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:10:08 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
January 27, 2022 4:10:35 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
January 27, 2022 4:10:39 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
January 27, 2022 4:10:42 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
January 27, 2022 4:11:22 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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User Name: tanin-ek.sriwitool  
 Hostname: ASBKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional information
January 27, 2022 4:11:25 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
January 27, 2022 4:11:29 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
January 27, 2022 4:12:05 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
January 27, 2022 4:12:07 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
January 27, 2022 4:12:09 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
January 27, 2022 4:13:38 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
January 27, 2022 4:13:41 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
January 27, 2022 4:13:47 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None

User Name: tanin-ek.sriwitoool  
 Hostname: ASBKKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:14:45 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ SCOUTING 2022-01-27 14-34-42\SCOUT_F.D\FID1A .ch
January 27, 2022 4:15:05 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
January 27, 2022 4:15:16 PM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	None
January 27, 2022 4:15:26 PM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ SCOUTING 2022-01-27 14-34-42\SCOUT_B.D\FID3B .ch
January 27, 2022 4:15:38 PM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Run Count : 1
January 27, 2022 4:15:43 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
January 27, 2022 4:16:20 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NOISED F 2022-01-27 14-45-01\NOISED F_F.D\FID 1A.ch

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Date: January 27, 2022 4:43:18 PM  
 System ID: GC-7

User Name: tanin-ek.sriwitoool  
 Hostname: ASBKKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:16:32 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
January 27, 2022 4:16:36 PM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
January 27, 2022 4:16:56 PM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Users\Public\Documents\C hemStation1\1\Data\OQ2022\I NOISEDF 2022-01-27 14-45-01\NOISEDF_B.D\FID 3B.ch
January 27, 2022 4:17:13 PM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
January 27, 2022 4:17:17 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation1\1\Data\OQ2022\I NJPRE 2022-01-27 15-15-51\NJPRE_F2.D\FID1 A.ch
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation1\1\Data\OQ2022\I NJPRE 2022-01-27 15-15-51\NJPRE_F3.D\FID1 A.ch

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User Name: tanin-ek.sriwitool  
 Hostname: ASBKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_F4.D\FID1 A.ch
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_F5.D\FID1 A.ch
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_F6.D\FID1 A.ch
January 27, 2022 4:19:27 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_F7.D\FID1 A.ch
January 27, 2022 4:19:49 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
January 27, 2022 4:20:05 PM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None

User Name: tanin-ek.sriwito

System Id: GC-7

Hostname: ASBKKWX007

Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B2.D\FID3 B.ch
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B3.D\FID3 B.ch
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B4.D\FID3 B.ch
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B5.D\FID3 B.ch
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B6.D\FID3 B.ch
January 27, 2022 4:20:29 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Public\Documents\C hemStation\1\Data\OQ2022\ NJPRE 2022-01-27 15-15-51\NJPRE_B7.D\FID3 B.ch

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User Name: tanin-ek.sriwitool  
 Hostname: ASBKKWX007

System Id: GC-7  
 Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:20:45 PM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
January 27, 2022 4:20:51 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
January 27, 2022 4:21:18 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : C:\Users\Public\Documents\C hemStation\1\1Data\OQ2022\ NJPRE 2022-01-27 15-43-29\SIGTON_F1.D\FID 1A.ch
January 27, 2022 4:21:33 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
January 27, 2022 4:21:39 PM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	None
January 27, 2022 4:21:50 PM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Data files Path : C:\Users\Public\Documents\C hemStation\1\1Data\OQ2022\ NJPRE 2022-01-27 15-43-29\SIGTON_B1.D\FID 3B.ch
January 27, 2022 4:22:15 PM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Run Count : 1
January 27, 2022 4:22:32 PM	End	Qualification	Session	OQ
January 27, 2022 4:22:32 PM	Start	Reporting	Session	None



User Name: tanin-ek.sriwitool  
Hostname: ASBKKWX007

System Id: GC-7  
Print Date: January 27, 2022 4:43:21 PM

## GC-OQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 27, 2022 4:37:18 PM	Audit	Reporting	Session	Report Generated : Certificate
January 27, 2022 4:37:47 PM	End	Reporting	Session	None
January 27, 2022 4:37:47 PM	Start	Configuration	Session	None
January 27, 2022 4:37:50 PM	End	Configuration	Session	None
January 27, 2022 4:37:50 PM	Start	Qualification	Session	OQ
January 27, 2022 4:38:41 PM	End	Qualification	Session	OQ
January 27, 2022 4:38:41 PM	Start	Reporting	Session	None
January 27, 2022 4:41:07 PM	Audit	Reporting	Session	Report Generated : Report
January 27, 2022 4:42:36 PM	Audit	Reporting	Session	Report Signed : Report PDF Name: GC-OQ_20220127_OQ Report_1.pdf User Name: tanin-ek.sriwitool@agilent.com Full Name of Signer: Tanin-ek Sriwitool Reason for signature: Executed protocol and published this original version of document

## CERTIFICATE OF CALIBRATION

Certificate No: WS-01102021

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.  
: Cup anemometer: Novalynx.

Model/Type : Data logger: 200-WS-25DL  
: Cup anemometer: WS-02F

Serial Number : Data logger: A4985  
: Cup anemometer: -

ID No : Data logger: RYG\_FS0085  
: Cup anemometer: -

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions	: Wind tunnel cross test section area	900	cm <sup>2</sup>
	: Anemometer frontal area	100	cm <sup>2</sup>
	: Diameter of mounting pipe	-	mm
	: Blockage ratio of test object	0.111	[-]

Test Conditions	: Air temperature	24.0	±0.8 °C
	: Air pressure	1008.1	±0.4 hPa
	: Relative air humidity	58.1	±3.5 %RH

Calibration Procedure : Calibration was carried out base on;  
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;  
M&SNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability : This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Oct 08, 2021.

Issued Date : Oct 11, 2021.

REVIEW BY	<i>Narakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	8/4/23

**Calibrated by**

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: .....

*[Signature]*  
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-01102021

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>STD</sub> Reading m/s	V <sub>UUC*</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.049	1.9	-0.1	2.7
4.103	4.0	-0.1	1.3
6.01	6.0	0.0	1.1
8.01	8.0	0.0	0.99
9.99	10.0	0.0	1.0
11.99	12.1	0.1	0.64
13.98	14.1	0.1	0.55
16.02	16.2	0.2	0.40
15.03	15.2	0.2	0.78
12.99	13.1	0.1	0.61
11.00	11.0	0.0	1.1
9.00	9.0	0.0	0.75
7.02	7.0	0.0	0.84
5.147	5.0	-0.1	0.98
2.974	2.9	-0.1	1.7
1.013	0.9	-0.1	4.5

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%

#### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 – 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 – 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

\*\*\*End of certificate of calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No.: WD-01102021

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25DL  
: Wind direction sensor: WS-02F

Serial Number : Data logger: A4985  
: Wind direction sensor: -

ID No : Data logger: RYG\_FS0085  
: Wind direction sensor: -

Customer : ALS laboratory group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260  
Thailand.

### Environmental Condition:

The measurement was carried out in an ambient temperature of  $(23 \pm 3) ^\circ\text{C}$ , and relative humidity of  $(40 \pm 10) \%$ .

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at  $45^\circ$  intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: CC563-07-0045, Certificate No.: KWS64/0025.

Measurement Date : Oct 08, 2021.

Issued Date : Oct 11, 2021.

### Performed by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:.....



Mr. Parinya Booncharoen.  
Technical Support  
and Calibration Manager



Continuation of Certificate of Calibration Number

Certificate No: WD-01102021

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	88	-2	3.0
4		135	135	135	0	3.0
5		180	180	182	2	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	135	0	3.0
13		180	180	182	2	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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 of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WS-04072021

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.  
: Cup anemometer: Novalynx.

Model/Type : Data logger: 200-WS-25DL.  
: Cup anemometer: WS-02F.

Serial Number : Data logger: A4987.  
: Cup anemometer: -.

ID No : Data logger: RYG\_FS0089.  
: Cup anemometer: -.

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250  
Thailand.

Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
: Anemometer frontal area 100 cm<sup>2</sup>  
: Diameter of mounting pipe - mm  
: Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 24.0 ±0.8 °C  
: Air pressure 1005.9 ±0.4 hPa  
: Relative air humidity 63.3 ±3.5 %RH

Calibration Procedure Calibration was carried out base on;  
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind  
Turbines;  
MEASNET Anemometer Calibration Procedure - Version 2: 2009;

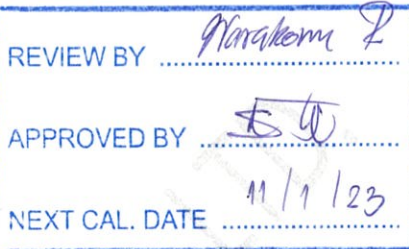
Traceability This calibration documents the traceable to national standard, Which realize the unit of  
measurements according to the international system of units (SI) through National Institute of  
Metrology Thailand (NIMT).

Measurement Date : Jul 13, 2021.

Issued Date : Jul 14, 2021.

### Calibrated by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: \_\_\_\_\_

*Parinya Booncharoen*

Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-04072021

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>STD</sub> Reading m/s	V <sub>UUC</sub> * Reading m/s	Error (m/s)	Uncertainty (%)
2.084	1.8	-0.3	2.7
4.112	4.0	-0.1	1.4
6.00	6.0	0.0	1.2
8.02	8.1	0.1	0.70
10.02	10.1	0.1	0.63
11.98	12.3	0.3	0.57
13.98	14.2	0.2	0.49
16.02	16.5	0.5	0.53
15.03	15.4	0.4	0.80
12.99	13.3	0.3	0.63
11.02	11.1	0.1	0.66
9.02	9.1	0.1	0.63
7.02	7.1	0.1	0.77
5.177	5.0	-0.2	0.97
3.007	3.0	0.0	1.7
1.053	0.6	-0.5	5.4

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%

#### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	T&STO INC.	06352145	July 16, 2020	MW-0035-20	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	July 16, 2020	MW-0035-20	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	July 20, 2020	MW-0036AA-20	0 – 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 – 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

\*\*\*End of certificate of calibration\*\*\*





## CERTIFICATE OF CALIBRATION

Certificate No.: WD-04072021

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25DL.  
: Wind direction sensor: WS-02F.

Serial Number : Data logger: A4987.  
: Wind direction sensor: -.

ID No : Data logger: RYG\_FS0089.  
: Wind direction sensor: -.

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

### Environmental Condition:

The measurement was carried out in an ambient temperature of  $(23\pm3)^{\circ}\text{C}$ , and relative humidity of  $(40\pm10)\%$ .

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at  $45^{\circ}$  intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: CC563-07-0045,  
Certificate No.: KWS63/0044.

Measurement Date : Jul 14, 2021.

Issued Date : Jul 14, 2021.



### Performed by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya

Approved Signatory:.....

Mr. Parinya Booncharoen.  
Technical Support  
and Calibration Manager



Continuation of Certificate of Calibration Number

Certificate No: WD-04072021

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	0	0	0	3.0
2		45	45	42	-3	3.0
3		90	90	88	-2	3.0
4		135	135	133	-2	3.0
5		180	180	181	1	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	0	0	0	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	133	-2	3.0
13		180	180	181	1	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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 of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WS-14072021

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.  
: Cup anemometer: Novalynx.

Model/Type : Data logger: 200-WS-25LB.  
: Cup anemometer: WS-02F.

Serial Number : Data logger: A5376.  
: Cup anemometer: -.

ID No : Data logger: RYG\_FS0414.  
: Cup anemometer: -.

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

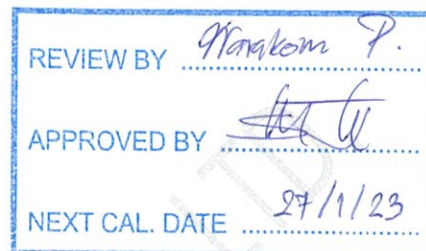
Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
: Anemometer frontal area 100 cm<sup>2</sup>  
: Diameter of mounting pipe - mm  
: Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 25.2 ±0.8 °C  
: Air pressure 1006.6 ±0.4 hPa  
: Relative air humidity 51.4 ±3.5 %RH

Calibration Procedure Calibration was carried out base on;  
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;  
MCASNET Anemometer Calibration Procedure - Version 2: 2009;

Traceability This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Jul 29, 2021.  
Issued Date : Jul 29, 2021.



**Calibrated by**

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: .....

*[Signature]*  
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-14072021

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>STD</sub> Reading m/s	V <sub>UUC</sub> * Reading m/s	Error (m/s)	Uncertainty (%)
2.057	1.8	-0.3	3.1
4.135	4.0	-0.1	1.3
6.02	6.0	0.0	2.1
7.99	8.0	0.0	0.74
10.00	10.1	0.1	0.69
11.99	12.0	0.0	0.72
13.98	14.2	0.2	0.48
15.98	16.2	0.2	0.77
14.99	15.2	0.2	0.49
13.00	13.1	0.1	0.52
11.01	11.0	0.0	0.94
9.01	9.0	0.0	0.81
6.99	7.0	0.0	2.0
5.189	5.1	-0.1	0.96
2.987	3.0	0.0	2.0
1.034	0.8	-0.2	5.3

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%

#### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	July 16, 2020	MW-0035-20	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	July 16, 2020	MW-0035-20	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	July 20, 2020	MW-0036AA-20	0 – 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 – 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

\*\*\*End of certificate of calibration\*\*\*





## CERTIFICATE OF CALIBRATION

Certificate No.: WD-14072021

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25LB.  
: Wind direction sensor: WS-02P.

Serial Number : Data logger: A5376.  
: Wind direction sensor: -.

ID No : Data logger: RYG\_FS0414.  
: Wind direction sensor: -.

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

### Environmental Condition:

The measurement was carried out in an ambient temperature of  $(23 \pm 3)^{\circ}\text{C}$ , and relative humidity of  $(40 \pm 10)\%$ .

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at  $45^{\circ}$  intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: CC563-07-0045, Certificate No.: KWS63/0044.

Measurement Date : Jul 29, 2021.

Issued Date : Jul 29, 2021.

### Performed by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:.....



Mr. Parinya Booncharoen.  
Technical Support  
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-14072021

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	43	-2	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	179	-1	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	43	-2	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	179	-1	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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 of Calibration\*\*\*





## ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	05 Jan 22	$Y = 0.9899x + 0.9112$	0.9999
BKK_FS0579	05 Jan 22	$Y = 1.007x - 0.0299$	1.0000
BKK_FS0583	05 Jan 22	$Y = 1.0513x + 1.869$	0.9967
BKK_FS0584	05 Jan 22	$Y = 1.0048x - 1.069$	1.0000
BKK_FS0585	05 Jan 22	$Y = 1.0076x - 1.1036$	0.9999
BKK_FS0586	05 Jan 22	$Y = 0.9933x + 3.2655$	1.0000
BKK_FS0587	05 Jan 22	$Y = 1.0401x - 17.457$	0.9996
BKK_FS0588	05 Jan 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	05 Jan 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	05 Jan 22	$Y = 0.9861x + 10.07$	0.9995
BKK_FS0591	05 Jan 22	$Y = 1.0117x - 92.415$	0.9995
BKK_FS0592	05 Jan 22	$Y = 1.0031x - 69.305$	0.9996
BKK_FS0593	05 Jan 22	$Y = 1.0131x - 98.198$	0.9996
BKK_FS0594	05 Jan 22	$Y = 1.0075x - 7.0829$	0.9999
BKK_FS0595	05 Jan 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	05 Jan 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	05 Jan 22	$Y = 1.0203x - 122.14$	0.9999
BKK_FS1004	04 Jan 22	$Y = 0.9651x + 19.648$	0.9989
BKK_FS1005	04 Jan 22	$Y = 1.0096x + 4.6643$	0.9997
BKK_FS1006	04 Jan 22	$Y = 1.2188x - 7.1214$	0.9994
BKK_FS1007	05 Jan 22	$Y = 1.0563x - 1.0912$	1.0000
BKK_FS1008	05 Jan 22	$Y = 0.9689x + 1.9061$	1.0000
BKK_FS1009	05 Jan 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	05 Jan 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1014	05 Jan 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	05 Jan 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	05 Jan 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	05 Jan 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	05 Jan 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	05 Jan 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	05 Jan 22	$Y = 0.9887x + 2.8844$	0.9999
BKK_FS1021	05 Jan 22	$Y = 0.9659x + 1.4905$	0.9978
BKK_FS1022	05 Jan 22	$Y = 1.022x - 17.957$	0.9997
BKK_FS1023	05 Jan 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	05 Jan 22	$Y = 1.0042x + 0.4086$	0.9997
BKK_FS1025	05 Jan 22	$Y = 1.0132x - 88.507$	0.9996
BKK_FS1026	05 Jan 22	$Y = 0.9902x + 0.9554$	1.0000
BKK_FS1027	05 Jan 22	$Y = 1.0086x - 2.279$	1.0000
BKK_FS1028	05 Jan 22	$Y = 1.0105x - 81.055$	0.9997



## ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	05 Jan 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	05 Jan 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	05 Jan 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	04 Jan 22	$Y = 0.9916x + 6.1524$	0.9988
BKK_FS1040	04 Jan 22	$Y = 1.0133x - 10.177$	0.9985
BKK_FS1041	04 Jan 22	$Y = 1.0805x - 1.7381$	0.9998
BKK_FS1042	04 Jan 22	$Y = 1.0061x + 1.3405$	0.9994
BKK_FS1043	04 Jan 22	$Y = 1.0112x - 10.393$	0.9999
BKK_FS1044	04 Jan 22	$Y = 1.0495x - 1.0136$	0.9996
BKK_FS1161	05 Jan 22	$Y = 0.9812x + 15571$	1.0000
BKK_FS1162	05 Jan 22	$Y = 0.9932x + 5.0014$	0.9997
BKK_FS1163	05 Jan 22	$Y = 1.0082x - 82.062$	0.9998
BKK_FS1164	05 Jan 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	05 Jan 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	05 Jan 22	$Y = 1.0031x - 77.881$	0.9996
RYG_FS0197	04 Jan 22	$Y = 1.0068x + 1.7152$	0.9998
RYG_FS0198	04 Jan 22	$Y = 0.9986x + 18.196$	0.9995
RYG_FS0199	04 Jan 22	$Y = 1.1202x - 3.5782$	0.9999

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jittrantont)

Assistant General Manager



**Sartorius (Thailand) Co., Ltd.**

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

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

**SARTORIUS**

# Certificate

## of Calibration

REVIEW BY	Thamita K.
APPROVED BY	D. [Signature]
NEXT CAL. DATE	6/5/22

Model Number : **MSE125P-100-DU**

Description : **Semi-micro Balance**

Serial Number : **33108993 (RYG\_EN0004)**

Manufacturer : **Sartorius**

Certificate No. : **21BCI0164**

Issued Date : **Monday, May 10, 2021**

Reference No. : **501644**

Page No. : **1 Of 3**

Customer Name : **ALS Laboratory Group (Thailand) Co., Ltd.(Rayong Branch)**  
**616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, 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, May 06, 2021**

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

**Metrological data :**

Capacity : **60 / 120** g Readability : **0.01/0.1** mg

**Ambients Conditions:**

Temperature : **21.4 °C** ± **5.0 °C**

Humidity : **50.0 % RH** ± **10.0 % RH**

Pressure : **—** ± **—**

**Reasons for calibration**

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

Equipment Condition: ☒ Good Operate ☐ Fair

**Measurement Method UKAS Publication Ref :Lab 14**

The measurement uncertainty stated is the expended 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 - 200g E2,YCS011-522-00	Sartorius	119934 D-K-19398-01-00	10-Sep-2021
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	SPC-RT	C19203076	1-Sep-2021

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.

ISO17025-RF-015 26/03/2020 R2

  
 MrChonchai Inthana(Technical Manager)

S  
T  
A  
M  
P





## Certificate

## of Calibration

Model Number : **MSE125P-100-DU**  
 Description : **Semi-micro Balance**  
 Serial Number : **33108993 (RYG\_EN0004)**  
 Manufacturer : **Sartorius**

Certificate No. : **21BCI0164**  
 Issued Date : **Monday, May 10, 2021**  
 Reference No. : **501644**  
 Page No. : **2 of 3**

## Calibration Results : Without Adjustment

## Repeatability

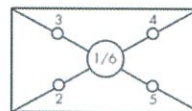
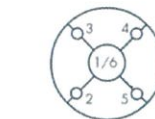
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	5.00002	50.00004
5 g	5.00001	50.00004
Tolerance	5.00001	50.00005
0.000015 g	5.00002	50.00004
	5.00002	50.00003
Nominal Value : (High Load)	5.00002	50.00003
50 g	5.00001	50.00003
Tolerance	5.00003	50.00004
0.000015 g	5.00001	50.00003
	5.00002	50.00004
Standard Deviation	0.000007	0.000007

## Eccentricity (Off-center loading error)

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 : 50 g  
 Tolerance 0.00015 g



	Difference
1	—
2	0.00000
3	-0.00002
4	0.00000
5	-0.00002
6	—

## Linearity

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

Tolerance 0.00004 g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.00000	0.00000	0.00000	0.000016
0.05	0.05000	0.05000	0.00000	0.000016
0.1	0.10000	0.10000	0.00000	0.000017
0.5	0.50000	0.50000	0.00000	0.000018
1	1.00000	1.00000	0.00000	0.000019
5	5.00002	5.00002	0.00000	0.000024
10	10.00003	10.00003	0.00000	0.000047
20	20.00001	20.00002	0.00001	0.000089
40	40.00005	40.00004	-0.00001	0.000089
50	50.00005	50.00003	-0.00002	0.000089

## Certificate

## of Calibration

Model Number : MSE125P-100-DU

Description : Semi-micro Balance

Serial Number : 33108993 (RYG\_EN0004)

Manufacturer : Sartorius

Certificate No. : 21BCI0164

Issued Date : Monday, May 10, 2021

Reference No. : 501644

Page No. : 3 of 3

## Calibration Results : Without Adjustment

## Repeatability

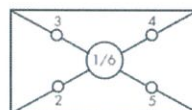
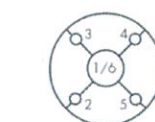
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	100.0000
g	100.0000
Tolerance	100.0000
0.000015 g	100.0000
	100.0000
	100.0000
Nominal Value : (High Load)	100.0000
100 g	100.0000
Tolerance	100.0000
0.000015 g	100.0000
	100.0000
	100.0001
Standard Deviation	0.00003

## Eccentricity (Off-center loading error)

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 : 50 g  
Tolerance 0.00015 g



	Difference
1	-
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 0.0001 g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
65	65.0001	65.0001	0.0000	0.00016
70	70.0001	70.0001	0.0000	0.00016
75	75.0001	75.0001	0.0000	0.00016
80	80.0001	80.0001	0.0000	0.00016
85	85.0001	85.0001	0.0000	0.00016
90	90.0001	90.0000	-0.0001	0.00016
95	95.0001	95.0000	-0.0001	0.00017
100	100.0001	100.0000	-0.0001	0.00017
110	110.0001	110.0000	-0.0001	0.00026
120	120.0001	120.0000	-0.0001	0.00026

End of Report





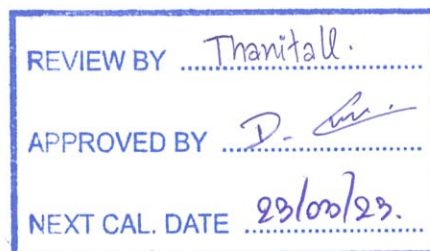
# Certificate of Calibration



Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.:	PTC/07/22104	Page:	1 of 3
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	33108993
Model:	MSE125P-100-DU	ID No:	RYG_EN0004
Type of Balance:	Single interval		

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



Environment Condition: Temperature 23.9 °C ± 0.3 °C  
 Humidity 58.1 %RH ± 4.4 %RH  
 Air density 1.17 kg/m<sup>3</sup>

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd.  
 616/10 Moo 5 T.Maenamkoo, A.Pluakdaeng,  
 Rayong 21140, Thailand

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

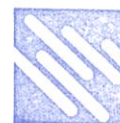
Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.  
 , NSC-ONSC Accreditation No.: Calibration 0189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD

( Mr.Kriangsak Kalasri )

Reviewed by

Approved By :

( Mr. Keattisak Kerdto )

Laboratory Manager

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 recognised 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). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co ., ltd



Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104

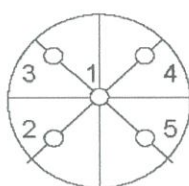
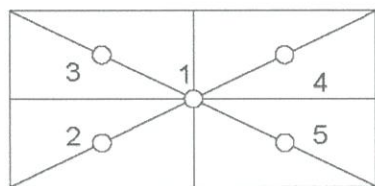
Page: 2 of 3

### Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3 ,1/2 or of Maximum capacity



Eccentricity test 50 (g)

Position (g)				
1	2	3	4	5
0.00000	-0.00004	-0.00001	0.00000	0.00001
Maximum deviation:			0.00004	

Repeatability Test : Weight to be  $1/2 \leq L_1 \leq$  Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
50	0.000007

Error of indication : from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000020	2.65
0.01	0.010001	0.01000	0.00000	0.000022	2.17
0.05	0.050002	0.04999	0.00001	0.000022	2.17
0.1	0.099999	0.09999	0.00001	0.000022	2.17
0.5	0.500001	0.50001	-0.00001	0.000022	2.17
1	1.000004	0.99999	0.00001	0.000022	2.14
2	1.999999	1.99999	0.00001	0.000022	2.14
5	5.000015	4.99999	0.00002	0.000023	2.14
10	10.000004	10.00000	0.00000	0.000024	2.10
20	20.000029	20.00000	0.00003	0.000032	2.00
50	50.000043	49.99999	0.00005	0.000069	2.00

Note: Weight of adjust - (g)



Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104

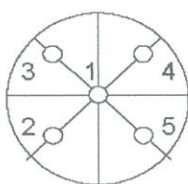
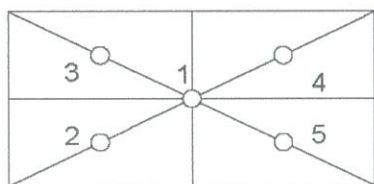
Page: 3 of 3

### Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3 ,1/2 or of Maximum capacity



Eccentricity test 50 (g)

Position (g)				
1	2	3	4	5
0.0000	0.0000	0.0000	0.0000	0.0000
Maximum deviation:				0.0000

Repeatability Test : Weight to be  $1/2 \leq L_1 \leq$  Maximum capacity

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

Nominal test value (g)	Standard Deviation
100	0.00000

Error of indication : from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
65	65.00006	65.0000	0.0001	0.00013	2.00
70	70.00007	70.0000	0.0001	0.00013	2.00
75	75.00009	75.0000	0.0001	0.00014	2.00
80	80.00008	80.0000	0.0001	0.00014	2.00
85	85.00009	85.0000	0.0001	0.00015	2.00
90	90.00010	90.0000	0.0001	0.00015	2.00
95	95.00012	95.0000	0.0001	0.00016	2.00
100	100.00004	100.0000	0.0000	0.00014	2.00
110	110.00004	110.0000	0.0000	0.00015	2.00
120	120.00007	120.0000	0.0001	0.00016	2.00

Note: Weight of adjust - (g)

The End of Certificate



## Certificate of System Qualification

GC-OQ

System ID: GC-6  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phattanakan 40, Phattanakan Rd., Suan Luang, Bangkok 10250

Date: October 21, 2021 10:05:40 AM  
EQP Name: AgilentRecommended  
EQP Revision: GC.02.50  
Overall Qualification Status: Pass

REVIEW BY Suchada T.  
APPROVED BY Sararat M.  
NEXT CAL. DATE 21 Apr 2023

### System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

### Overall System Inspection and Basic Safety and Operation Test Status

Pass

### Inlet Pressure Decay

Name: 7890

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.0 psi /5 minutes

Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$ 

### Overall Inlet Pressure Decay Test Status

Pass

### Inlet Pressure Accuracy

Name: 7890

Front SSL

Date: October 21, 2021 10:05:40 AM

System ID: GC-6

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi
Accuracy:			0.1	psi
Agilent Recommended:			<= 1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Decay

Name:

7890

Back

SSL

## Setpoint Status:

Pass

Pressure:

25.0

psi

Pressure Change:

0.0

psi

/5 minutes

Agilent Recommended:

&gt;=

-2.0

and

&lt;=

0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name:

7890

Back

SSL

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi
Accuracy:			0.1	psi
Agilent Recommended:			<= 1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Date: October 21, 2021 10:05:40 AM

System ID: GC-6

Name: 7890  
Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min

Accuracy: 0.5 mL/min

Agilent Recommended: ≤ 10.0 % setpoint ( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 394.0 mL/min

Accuracy: 6.0 mL/min

Agilent Recommended: ≤ 10.0 % setpoint ( 40.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.2 mL/min

Accuracy: 0.8 mL/min

Agilent Recommended: ≤ 10.0 % setpoint ( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

#### Overall Detector Flow Accuracy Test Status

Pass

#### Detector Flow Accuracy

Name: 7890  
Back FID



**Setpoint Status:**

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

29.1

mL/min

Accuracy:

0.9

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

3.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

**Setpoint Status:**

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

397.3

mL/min

Accuracy:

2.7

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

**Setpoint Status:**

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.4

mL/min

Accuracy:

0.6

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

**Overall Detector Flow Accuracy Test Status**

Pass

**GC Oven Temperature Accuracy**

Name:

7890

Date:

October 21, 2021 10:05:40 AM

System ID:

GC-6

## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0 231.5 °C

Accuracy:

1.5 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K ( -5.0 °C )

&lt;= 1.0 % setpoint in K ( 5.0 °C )

## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.5 °C

Accuracy:

0.5 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K ( -3.7 °C )

&lt;= 1.0 % setpoint in K ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:

7890

## Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.4667 °C

Stability:

0.1 °C

Agilent Recommended:

&lt;= 0.5

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1

Front

SSL

/ Front

FID

Injection Tower

Name:

7693A

Date:

October 21, 2021 10:05:40 AM

System ID:

GC-6