

ภาคผนวก 3ค

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เอกสารการสอบเทียบเครื่องมือตรวจวัด

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## การตรวจวัดคุณภาพอากาศในบรรยากาศ

**บริษัท ท็อปส์-แลบ คอนซัลแตนท์ จำกัด**

TOPS-LAB Consultants CO., LTD.

189 หมู่ที่ 3 ตำบลบางรักพัฒนา อำเภอบางบัวทอง จังหวัดนนทบุรี 11110

189 Moo. 3 Bangrakphatthana Bangbuathong Nonthaburi 11110

Tel : (662) 159-0121 Fax : (662) 159-0122

**TSP High Volume Sampler Calibration**

Calibration Report No. TSP-6711015

TSP No.: 1940 Date: 6-Nov-24  
Location: หน้าท่าเทียบเรือโชคชัย (A1) Technical: C.Kunlapat  
Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa): 1009.0 Corrected Pressure (mm Hg): 756.8  
Temperature (deg C): 33.0 Temperature (deg K): 306.0  
Seasonal SL Press. (hPa): 1000.7 Corrected Seasonal (mm Hg): 750.6  
Seasonal Temp. (deg C): 20.0 Seasonal Temp. (deg K): 293.0

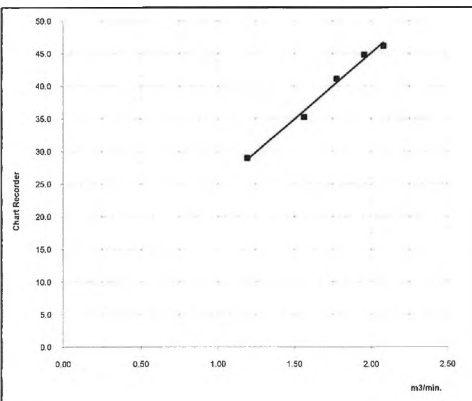
**CALIBRATION ORIFICE**

Make: Tisch Environmental, Inc Qstd Slope: 1.29243  
Model: TE-5025A Qstd Intercept: -0.01962  
Serial#: 3092 Date Certified: 18-Jun-24

**CALIBRATIONS**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.40	1.196	29.42	28.97	Slope = 20.3040 Intercept = 4.4417 Corr. coeff.= 0.9950  # of Observations: 5
2	4.13	1.564	35.79	35.24	
3	5.35	1.778	41.77	41.13	
4	6.49	1.956	45.50	44.81	
5	7.36	2.082	46.88	46.17	

Range of Chart at 40-60 CFM 49.80

Calibrated by :   
(Kunlapat Chuichoti)Approved by :   
(Metawee Khumkham)

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Tel : (662) 159-0121 Fax : (662) 159-0122

**TSP High Volume Sampler Calibration**

Calibration Report No. TSP-6711016

TSP No.: 1947 Date: 6-Nov-24  
Location: หลังท่าเทียบเรือโชคชัย (A2) Technical: C.Kunlapat  
Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa): 1009.0 Corrected Pressure (mm Hg): 756.8  
Temperature (deg C): 34.0 Temperature (deg K): 307.0  
Seasonal SL Press. (hPa): 1000.7 Corrected Seasonal (mm Hg): 750.6  
Seasonal Temp. (deg C): 20.0 Seasonal Temp. (deg K): 293.0

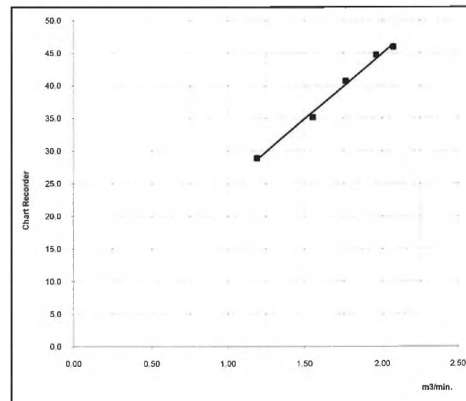
**CALIBRATION ORIFICE**

Make: Tisch Environmental, Inc Qstd Slope: 1.29243  
Model: TE-5025A Qstd Intercept: -0.01962  
Serial#: 3092 Date Certified: 18-Jun-24

**CALIBRATIONS**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.39	1.191	29.40	28.91	Slope = 20.0685 Intercept = 4.7646 Corr. coeff.= 0.9960  # of Observations: 5
2	4.10	1.556	35.75	35.15	
3	5.29	1.765	41.40	40.70	
4	6.55	1.962	45.47	44.70	
5	7.33	2.075	46.70	45.91	

Range of Chart at 40-60 CFM 49.80

Calibrated by :   
(Kunlapat Chuichoti)Approved by :   
(Metawee Khumkham)

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Tel : (662) 159-0121 Fax : (662) 159-0122

**TSP High Volume Sampler Calibration**

Calibration Report No. TSP-6711017

TSP No.: 5336 Date: 6-Nov-24  
Location: ชุมชนบ้านมอญ หมู่ 1 ตำบลคลองสระแก (A3) Technical: C.Kunlapat  
Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa): 1009.0 Corrected Pressure (mm Hg): 756.8  
Temperature (deg C): 33.0 Temperature (deg K): 306.0  
Seasonal SL Press. (hPa): 1000.7 Corrected Seasonal (mm Hg): 750.6  
Seasonal Temp. (deg C): 20.0 Seasonal Temp. (deg K): 293.0

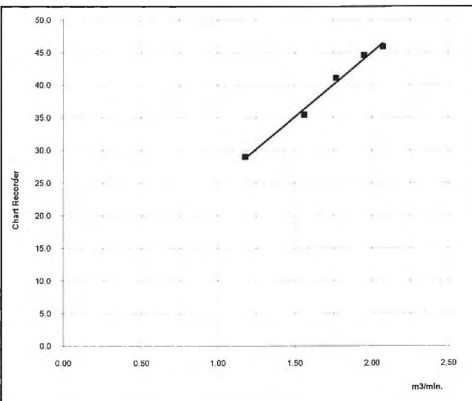
**CALIBRATION ORIFICE**


Make: Tisch Environmental, Inc Qstd Slope: 1.29243  
Model: TE-5025A Qstd Intercept: -0.01962  
Serial#: 3092 Date Certified: 18-Jun-24

**CALIBRATIONS**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.33	1.178	29.47	29.02	Slope = 19.6680 Intercept = 5.6467 Corr. coeff. = 0.9951  # of Observations: 5
2	4.12	1.562	36.02	35.47	
3	5.29	1.768	41.73	41.09	
4	6.45	1.950	45.25	44.56	
5	7.30	2.074	46.60	45.89	

Range of Chart at 40-60 CFM 49.80



Calibrated by :   
(Kunlapat Chuichoti)

Approved by :   
(Metawee Khumkham)

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**TSP High Volume Sampler Calibration**

Calibration Report No. TSP-6711018

TSP No.: 1941 Date: 6-Nov-24  
Location: ชุมชนบ้านใหม่ทิศใต้ หมู่ 5 ตำบลบ่อโพธิ์ (A4) Technical: C.Kunlapat  
Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa): 1009.0 Corrected Pressure (mm Hg): 756.8  
Temperature (deg C): 34.0 Temperature (deg K): 307.0  
Seasonal SL Press. (hPa): 1000.7 Corrected Seasonal (mm Hg): 750.6  
Seasonal Temp. (deg C): 20.0 Seasonal Temp. (deg K): 293.0

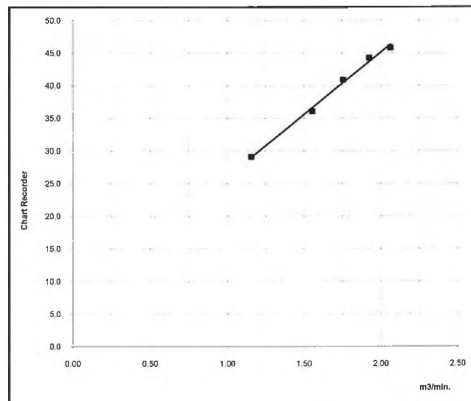
**CALIBRATION ORIFICE**


Make: Tisch Environmental, Inc Qstd Slope: 1.29243  
Model: TE-5025A Qstd Intercept: -0.01962  
Serial#: 3092 Date Certified: 18-Jun-24

**CALIBRATIONS**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.25	1.156	29.59	29.09	Slope = 19.0493 Intercept = 6.9877 Corr. coeff. = 0.9973  # of Observations: 5
2	4.10	1.556	36.70	36.08	
3	5.25	1.758	41.60	40.90	
4	6.32	1.928	45.00	44.24	
5	7.26	2.065	46.61	45.83	

Range of Chart at 40-60 CFM 49.80



Calibrated by :   
(Kunlapat Chuichoti)

Approved by :   
(Metawee Khumkham)

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**TSP High Volume Sampler Calibration**

Calibration Report No. TSP-6711019

TSP No.: 4862

Date: 6-Nov-24

Location: องค์การบริหารส่วนตำบลบ่อโพธิ์ หมู่ 4 ตำบลบ่อโพธิ์ (A5)

Technical: C.Kunlapat

Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	32.0	Temperature (deg K):	305.0
Seasonal SL Press. (hPa):	1000.7	Corrected Seasonal (mm Hg):	750.6
Seasonal Temp. (deg C):	20.0	Seasonal Temp. (deg K):	293.0

**CALIBRATION ORIFICE**

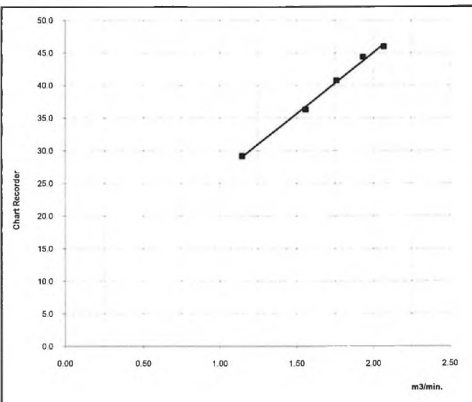
Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092

Qstd Slope: 1.29243  
Qstd Intercept: -0.01962  
Date Certified: 18-Jun-24

**CALIBRATIONS**

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.20	1.147	29.59	29.19	Slope = 18.7026 Intercept = 7.6243 Corr. coeff. = 0.9979 # of Observations: 5
2	4.09	1.559	36.80	36.30	
3	5.23	1.761	41.33	40.77	
4	6.32	1.934	44.97	44.36	
5	7.26	2.072	46.59	45.96	

Range of Chart  
at 40-60 CFM 49.80



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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Tel: (662) 159-0121 Fax: (662) 159-0122

**PM10 High Volume Sampler Verification**

Verification Report No. PM-6711015

**SITE**

PM-10 No.: 1942

Date: 6-Nov-24

Location: หน้าท่าเทียบเรือโซเซียล (A1)

Test: C.Kunlapat

Approval: K.Metawee

**CONDITIONS**

Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	33.0	Temperature (deg K):	306.0
Seasonal SL Press. (hPa):	1005.8	Corrected Seasonal (mm Hg):	754.4
Seasonal Temp. (deg C):	21.0	Seasonal Temp. (deg K):	294.0

**CALIBRATION ORIFICE**

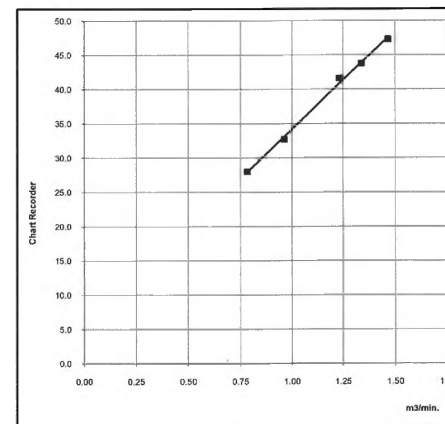
Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092

Slope: 1.29243  
Intercept: -0.01962  
Date Certified: 18-Jun-24

**TEST**

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.43	0.782	28.45	28.02	Slope (m) = 28.7239 Intercept (b) = 5.4834 Corr. coeff. (r) = 0.9984 SFR = 1.172 SSP = 61.58 # of Observations: 5
2	3.70	0.962	33.20	32.69	
3	6.11	1.231	42.25	41.61	
4	7.23	1.338	44.46	43.78	
5	8.69	1.466	47.74	47.30	

0.00  
Range of Chart  
at 36-44 CFM 39.70



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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189 Moo. 3 Bangrakphatthana Bangbua Thong Nonthaburi 11110

Tel : (662) 159-0121 Fax : (662) 159-0122

**PM10 High Volume Sampler Verification**

Verification Report No. PM-6711016

**SITE**

PM-10 No.: 1950

Date: 6-Nov-24

Location: หลังท่าเทียบเรือโซซัย (A2)

Test: C.Kunlapat

Approval: K.Metawee

**CONDITIONS**

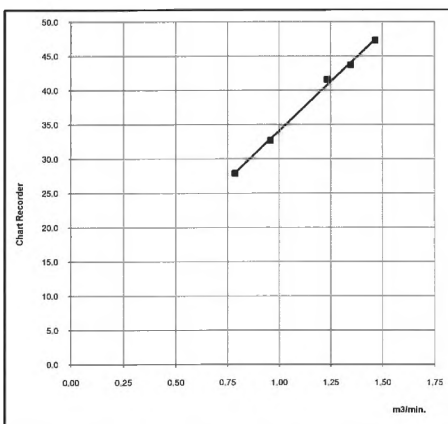
Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	34.0	Temperature (deg K):	307.0
Seasonal SL Press. (hPa):	1005.8	Corrected Seasonal (mm Hg):	754.4
Seasonal Temp. (deg C):	21.0	Seasonal Temp. (deg K):	294.0

**CALIBRATION ORIFICE**Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092Slope: 1.29243  
Intercept: -0.01962  
Date Certified: 18-Jun-24**TEST**

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.44	0.785	28.40	27.92	Slope (m)= 28.6758
2	3.65	0.957	33.26	32.70	Intercept (b)= 5.4670
3	6.10	1.232	42.30	41.59	Corr. coeff.(r)= 0.9984
4	7.29	1.346	44.44	43.69	SFR = 1.176
5	8.65	1.465	47.75	47.30	SSP = 61.54

0.00 # of Observations: 5

Range of Chart at 36-44 CFM 39.70



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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Tel : (662) 159-0121 Fax : (662) 159-0122

**PM10 High Volume Sampler Verification**

Verification Report No. PM-6711017

**SITE**

PM-10 No.: 1944

Date: 6-Nov-24

Location: ชุมชนบ้านมอญ หมู่ 1 ตำบลคลองสนแก (A3)

Test: C.Kunlapat

Approval: K.Metawee

**CONDITIONS**

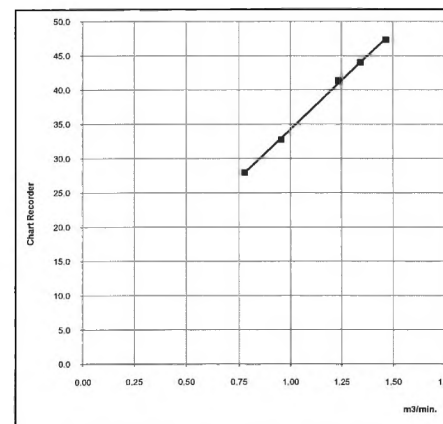
Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	33.0	Temperature (deg K):	306.0
Seasonal SL Press. (hPa):	1005.8	Corrected Seasonal (mm Hg):	754.4
Seasonal Temp. (deg C):	21.0	Seasonal Temp. (deg K):	294.0

**CALIBRATION ORIFICE**Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092Slope: 1.29243  
Intercept: -0.01962  
Date Certified: 18-Jun-24**TEST**

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.40	0.777	28.39	27.96	Slope (m)= 28.4128
2	3.64	0.954	33.26	32.75	Intercept (b)= 5.8607
3	6.13	1.233	41.98	41.34	Corr. coeff.(r)= 0.9994
4	7.29	1.344	44.70	44.02	SFR = 1.172
5	8.70	1.466	47.74	47.30	SSP = 61.60

0.00 # of Observations: 5

Range of Chart at 36-44 CFM 39.70



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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189 Moo. 3 Bangrakphatthana Bangbua Thong Nonthaburi 11110

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**PM10 High Volume Sampler Verification**Verification Report No. PM-6711018**SITE**

PM-10 No.: 7550

Date: 6-Nov-24

Location: ชุมชนบ้านใหม่ทิศใต้ หมู่ 5 ตำบลบ่อโพธิ์ (A4)Test: C.KunlapatApproval: K.Metawee**CONDITIONS**

Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	34.0	Temperature (deg K):	307.0
Seasonal SL Press. (hPa):	1005.8	Corrected Seasonal (mm Hg):	754.4
Seasonal Temp. (deg C):	21.0	Seasonal Temp. (deg K):	294.0

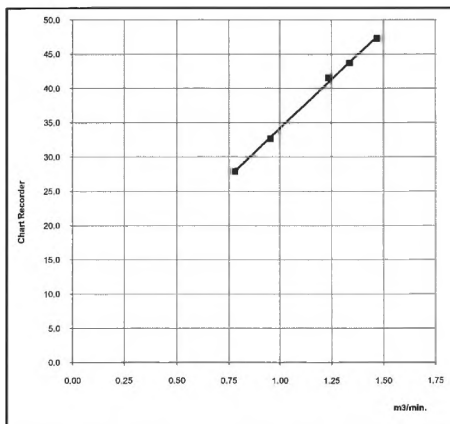
**CALIBRATION ORIFICE**

Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092

Slope: 1.29243  
Intercept: -0.01962  
Date Certified: 18-Jun-24

**TEST**

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.41	0.780	28.41	27.93	Slope (m)= 28.5169
2	3.63	0.954	33.25	32.69	Intercept (b)= 5.7132
3	6.12	1.234	42.30	41.59	Corr. coeff. (r)= 0.9988
4	7.20	1.337	44.46	43.71	SFR = 1.176
5	8.69	1.468	47.76	47.30	SSP = 61.63
				0.00	# of Observations: 5
				Range of Chart at 36-44 CFM	39.70



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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Tel : (662) 159-0121 Fax : (662) 159-0122

**PM10 High Volume Sampler Verification**Verification Report No. PM-6711019**SITE**

PM-10 No.: 1939

Date: 6-Nov-24

Location: องค์การบริหารส่วนตำบลบ่อโพธิ์ หมู่ 4 ตำบลบ่อโพธิ์ (A5)Test: C.KunlapatApproval: K.Metawee**CONDITIONS**

Sea Level Pressure (hPa):	1009.0	Corrected Pressure (mm Hg):	756.8
Temperature (deg C):	32.0	Temperature (deg K):	305.0
Seasonal SL Press. (hPa):	1005.8	Corrected Seasonal (mm Hg):	754.4
Seasonal Temp. (deg C):	21.0	Seasonal Temp. (deg K):	294.0

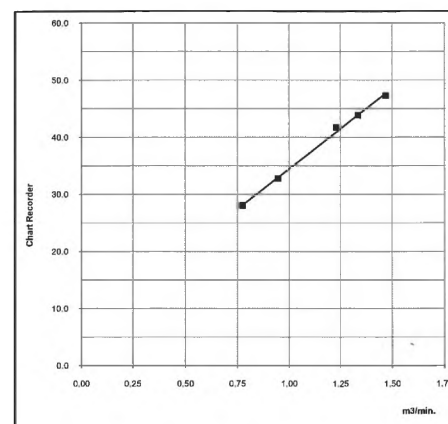
**CALIBRATION ORIFICE**

Make: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 3092

Slope: 1.29243  
Intercept: -0.01962  
Date Certified: 18-Jun-24

**TEST**

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	2.39	0.775	28.45	28.06	Slope (m)= 28.1165
2	3.59	0.946	33.22	32.77	Intercept (b)= 6.3855
3	6.10	1.228	42.31	41.73	Corr. coeff. (r)= 0.9983
4	7.23	1.336	44.44	43.83	SFR = 1.169
5	8.76	1.469	47.73	47.30	SSP = 61.81
				0.00	# of Observations: 5
				Range of Chart at 36-44 CFM	39.70



Calibrated by :

(Kunlapat Chuichoti)

Approved by :

(Metawee Khumkham)

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189 หมู่ที่ 3 ตำบลบางรักพัฒนา อำเภอบางบัวทอง จังหวัดนนทบุรี 11110  
189 Moo. 3 Bangrakphatthana Bangbuaathong Nonthaburi 11110  
Tel : (662) 159-0121 Fax : (662) 159-0122

## Verification Test Report

Report No.: 6711009

Calibrated Date: November 6, 2024

Equipment: Instrumex Micro Dustec Real Time Dust Monitor

Manufacturer: Instrumex

Model: PQ200

Serial or ID No. 161586

Environment : Temperature 33.0 °C Humidity: 47.0 %RH Barometer: 1009

Reference Standard: Flow Meter : BIOS Dry Cal DCL-H

Model : DCL-H S/N 7154

### Result of Test

Reference Standard (Liter per Minute)	Instrument reading (Liter per Minute)	Error (Liter per Minute)	Adjust
16.67	16.68	0.01	16.67

Calibrated By:   
(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By:   
(Metawee Khumkham)

Date: November 6, 2024

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## Verification Test Report

Report No.: 6711010

Calibrated Date: November 6, 2024

Equipment: Instrumex Micro Dustec Real Time Dust Monitor

Manufacturer: Instrumex

Model: PQ200

Serial or ID No. 170799


Environment : Temperature 34.0 °C Humidity: 47.0 %RH Barometer: 1009

Reference Standard: Flow Meter : BIOS Dry Cal DCL-H


Model : DCL-H S/N 7154

### Result of Test

Reference Standard (Liter per Minute)	Instrument reading (Liter per Minute)	Error (Liter per Minute)	Adjust
16.67	16.68	0.01	16.67

Calibrated By:   
(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By:   
(Metawee Khumkham)

Date: November 6, 2024

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## Verification Test Report

Report No.: 6711011

Calibrated Date: November 6, 2024

Equipment: Instrumex Micro Dustec Real Time Dust Monitor

Manufacturer: Instrumex

Model: PQ200

Serial or ID No. 170755

Environment : Temperature 33.0 °C Humidity: 47.0 %RH Barometer: 1009

Reference Standard: Flow Meter : BIOS Dry Cal DCL-H

Model : DCL-H S/N 7154

### Result of Test

Reference Standard (Liter per Minute)	Instrument reading (Liter per Minute)	Error (Liter per Minute)	Adjust
16.67	16.68	0.01	16.67

Calibrated By: \_\_\_\_\_

(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By: \_\_\_\_\_

(Metawee Khumkham)

Date: November 6, 2024

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## Verification Test Report

Report No.: 6711012

Calibrated Date: November 6, 2024

Equipment: Instrumex Micro Dustec Real Time Dust Monitor

Manufacturer: Instrumex

Model: 2000

Serial or ID No. 200A201819604

Environment : Temperature 34.0 °C Humidity: 47.0 %RH Barometer: 1009

Reference Standard: Flow Meter : BIOS Dry Cal DCL-H

Model : DCL-H S/N 7154

### Result of Test

Reference Standard (Liter per Minute)	Instrument reading (Liter per Minute)	Error (Liter per Minute)	Adjust
16.67	16.68	0.01	16.67

Calibrated By: \_\_\_\_\_

(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By: \_\_\_\_\_

(Metawee Khumkham)

Date: November 6, 2024

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## Verification Test Report

Report No.: 6711013

Calibrated Date: November 6, 2024

Equipment: Instrumex Micro Dustec Real Time Dust Monitor

Manufacturer: Instrumex

Model: RAAS2.5-100

Serial or ID No. RAAS2.5-100-00075

Environment : Temperature 32.0 °C Humidity: 47.0 %RH Barometer: 1009

Reference Standard: Flow Meter : BIOS Dry Cal DCL-H

Model : DCL-H S/N 7154

### Result of Test

Reference Standard (Liter per Minute)	Instrument reading (Liter per Minute)	Error (Liter per Minute)	Adjust
16.67	16.68	0.01	16.67

Calibrated By:   
(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By:   
(Metawee Khumkham)

Date: November 6, 2024

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## Analyzer Performance Test

Calibration Report No.: 6711008

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: NO2 Analyzer Model: 42C	Manufacturer: Thermo S/N: 362
---	----------------------------------

### Calibration System

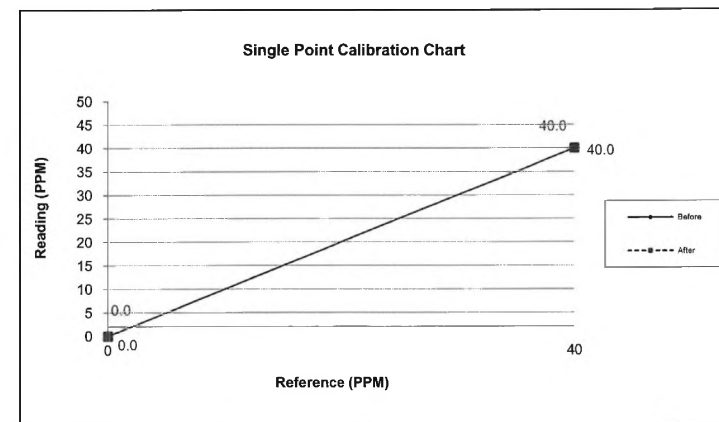
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 54.81 PPM SO2 Conc 52.99 PPM CO Conc 4.469 PPM Expire Date: 6 November 2027

Environment: Temperature 33.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By:   
(Kunlapat Chuichoti)

Date: November 6, 2024

Approve By:   
(Metawee Khumkham)

Date: November 6, 2024

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## Analyzer Performance Test

Calibration Report No.: 6711009

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: NO2 Analyzer Model: 200A	Manufacturer API S/N: 615
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### Calibration System

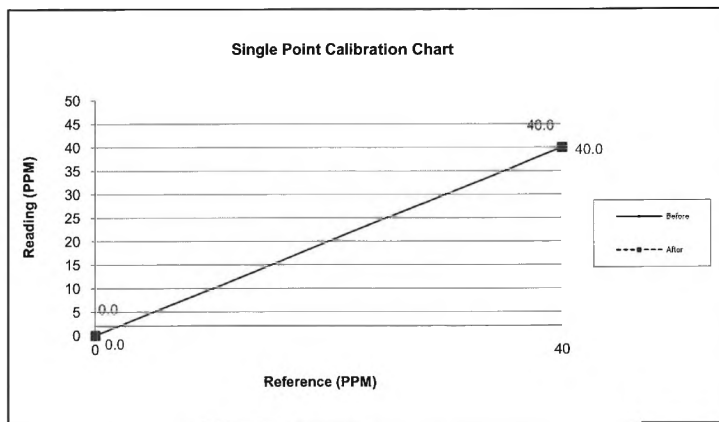
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 54.81 PPM SO2 Conc 52.99 PPM CO Conc 4,469 PPM Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711010

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: NO2 Analyzer Model: T200	Manufacturer API S/N: 2014
--	-------------------------------

### Calibration System

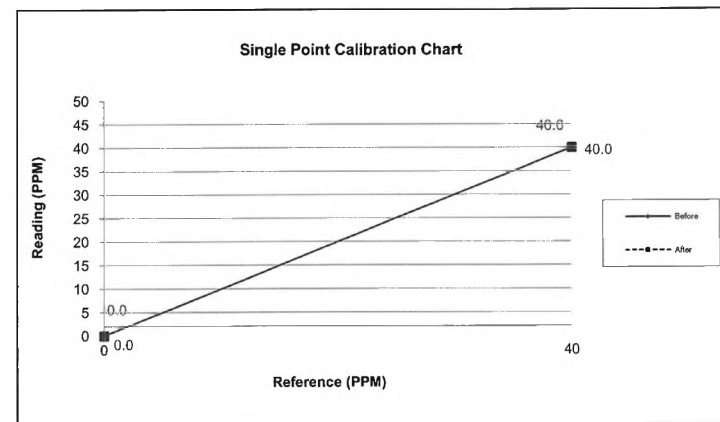
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 54.81 PPM SO2 Conc 52.99 PPM CO Conc 4,469 PPM Expire Date: 6 November 2027

Environment: Temperature 33.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711011

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: NO2 Analyzer Model: 42C	Manufacturer: Thermo S/N: 321
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### Calibration System

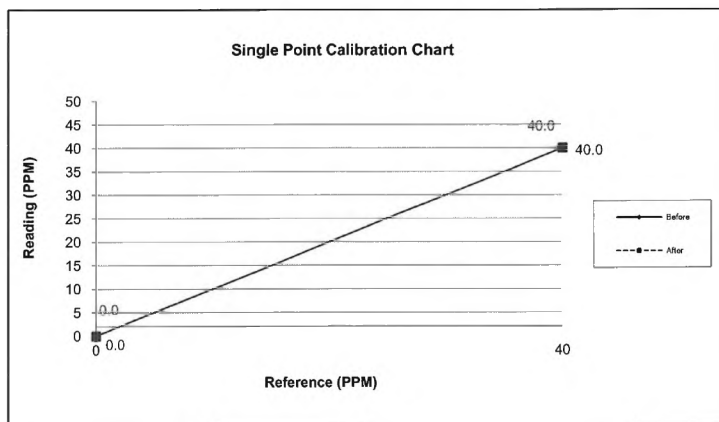
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07N199E15A0002 S/N: EB0125123	NO Conc 54.81 PPM SO2 Conc 52.99 PPM CO Conc 4,469 PPM Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711012

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: NO2 Analyzer Model: 42C	Manufacturer: Thermo S/N: 362
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### Calibration System

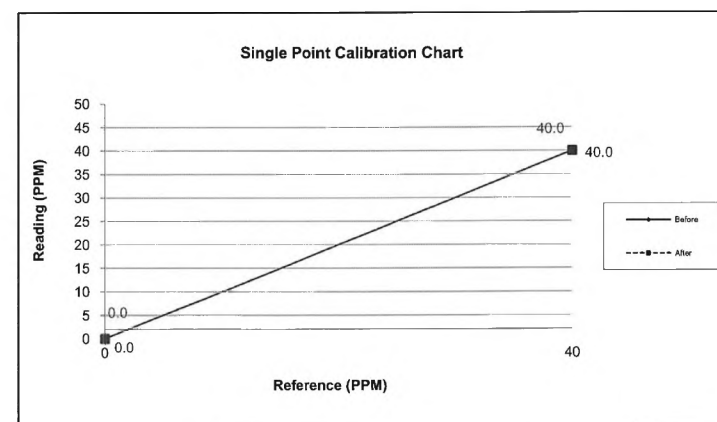
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07N199E15A0002 S/N: EB0125123	NO Conc 54.81 PPM SO2 Conc 52.99 PPM CO Conc 4,469 PPM Expire Date: 6 November 2027

Environment: Temperature 32.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711008

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo S/N: 383
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### Calibration System

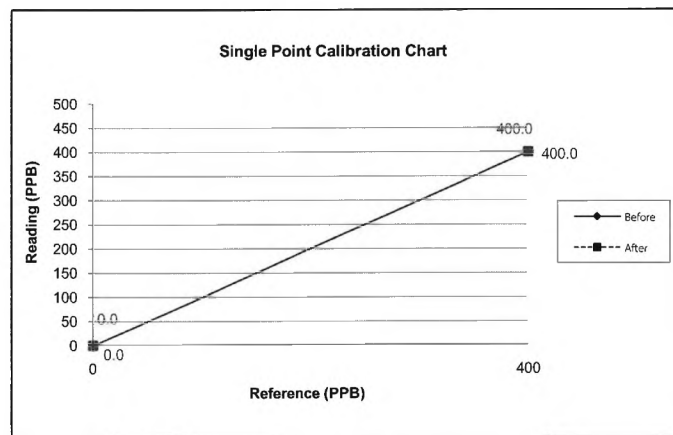
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 45.74 PPM SO2 Conc 44.9 PPM CO Conc 4,490 PPM Expire Date: 6 November 2027

Environment: Temperature 31.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.0	0.0	400.0	400.0	0.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711009

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: SO2 Analyzer Model: M102E	Manufacturer API S/N: 1116
---	-------------------------------

### Calibration System

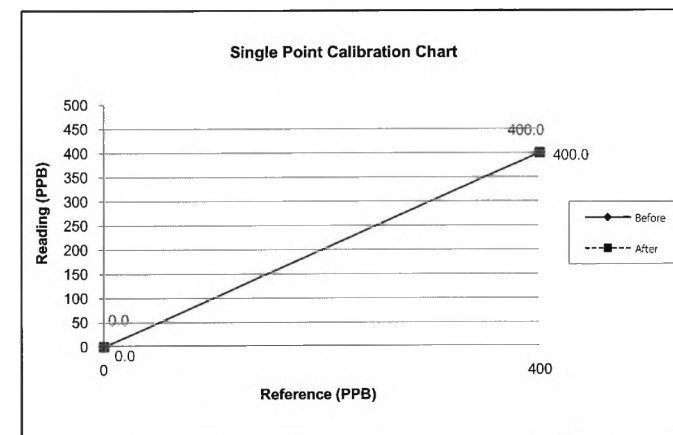
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 45.74 PPM SO2 Conc 44.9 PPM CO Conc 4,490 PPM Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.0	0.0	400.0	400.0	0.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711010

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซิลแตนท์ จำกัด

### Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo S/N: 357
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### Calibration System

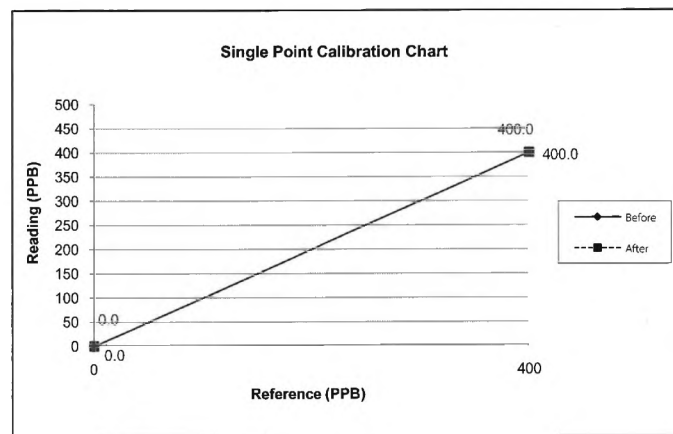
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 45.74 PPM SO2 Conc 44.9 PPM CO Conc 4,490 PPM Expire Date: 6 November 2027

Environment: Temperature 33.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.0	0.0	400.0	400.0	0.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711011

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซิลแตนท์ จำกัด

### Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo S/N: 306
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### Calibration System

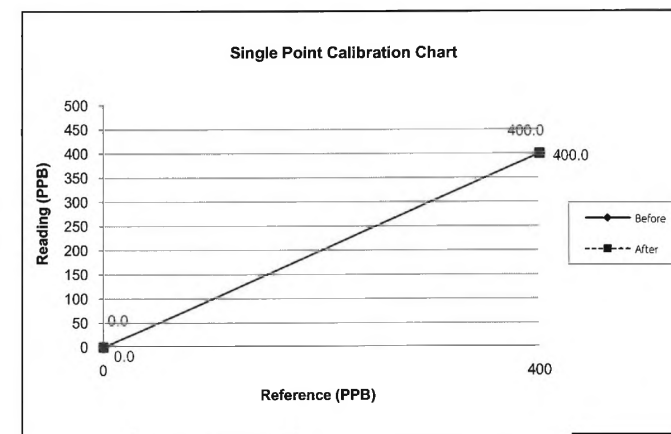
Calibrator Unit	Standard Gas
Dilutor Model B22019 S/N: APPVD ZERO AIR Generator E07NI99E15A0002 S/N: EB0125123	NO Conc 45.74 PPM SO2 Conc 44.9 PPM CO Conc 4,490 PPM Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.0	0.0	400.0	400.0	0.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711012

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Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer Thermo
Model: 43C	S/N: 297

### Calibration System

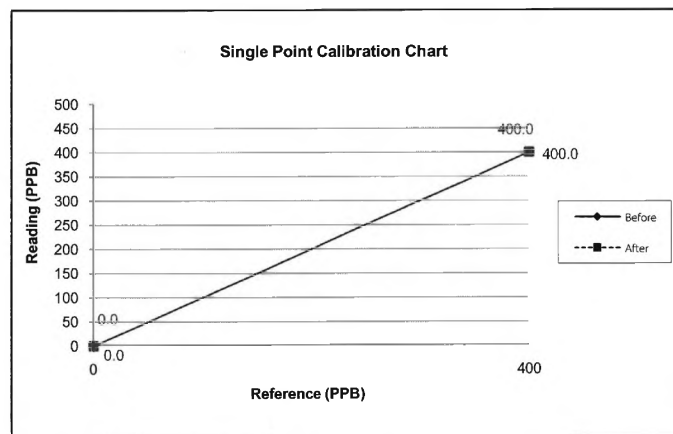
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 45.74 PPM
S/N: APPVD	SO2 Conc 44.9 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,490 PPM
S/N: EB0125123	Expire Date: 6 November 2027


Environment: Temperature 32.0 °C


Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.0	0.0	400.0	400.0	0.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



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## Analyzer Performance Test

Calibration Report No.: 6711004

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: CO Analyzer	Manufacturer AIP
Model: T300	S/N: 1757

### Calibration System

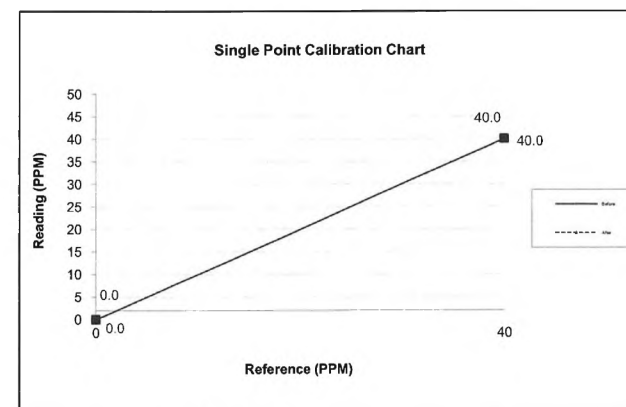
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 54.81 PPM
S/N: APPVD	SO2 Conc 52.99 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,469 PPM
S/N: EB0125123	Expire Date: 6 November 2027

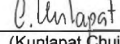
Environment: Temperature 33.0 °C


Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :   
(Kunlapat Chuichoti)  
Date : November 6, 2024

Approve By :   
(Metawee Khumkham)  
Date : November 6, 2024



บริษัท ท็อปส์-แลบ คอนซัลแตนท์ จำกัด  
TOPS-LAB Consultants CO., LTD.  
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189 Moo. 3 Bangrakphatthana Bangbuathong Nonthaburi 11110  
Tel : (662) 159-0121 Fax : (662) 159-0122

## Analyzer Performance Test

Calibration Report No.: 6711005

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: CO Analyzer	Manufacturer AIP
Model: M300E	S/N: 2088

### Calibration System

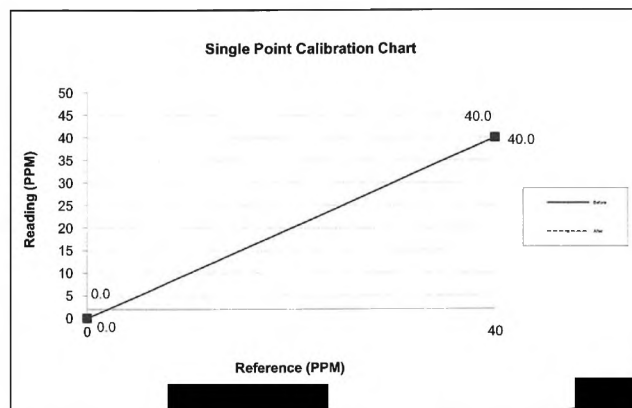
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 54.81 PPM
S/N: APPVD	SO2 Conc 52.99 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,469 PPM
S/N: EB0125123	Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By : [Redacted]  
(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By : [Redacted]  
(Metawee Khumkham)

Date : November 6, 2024

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## Analyzer Performance Test

Calibration Report No.: 6711006

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: CO Analyzer	Manufacturer AIP
Model: TML-30U	S/N: 167

### Calibration System

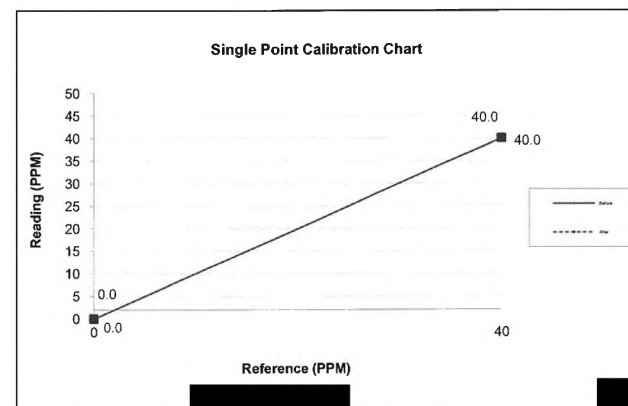
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 54.81 PPM
S/N: APPVD	SO2 Conc 52.99 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,469 PPM
S/N: EB0125123	Expire Date: 6 November 2027

Environment: Temperature 33.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By : [Redacted]  
(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By : [Redacted]  
(Metawee Khumkham)

Date : November 6, 2024

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Tel : (662) 159-0121 Fax : (662) 159-0122

## Analyzer Performance Test

Calibration Report No.: 6711007

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: CO Analyzer	Manufacturer AIP
Model: TML-30	S/N: 2340

### Calibration System

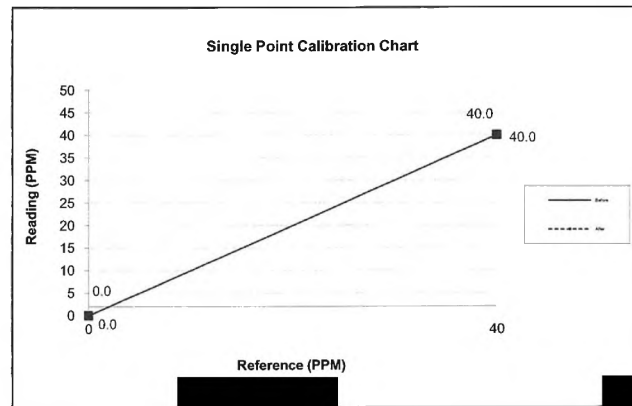
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 54.81 PPM
S/N: APPVD	SO2 Conc 52.99 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,469 PPM
S/N: EB0125123	Expire Date: 6 November 2027

Environment: Temperature 34.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024

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189 Moo. 3 Bangrakphatthana Bangbuathong Nonthaburi 11110  
Tel : (662) 159-0121 Fax : (662) 159-0122

## Analyzer Performance Test

Calibration Report No.: 6711008

Page:1/1

Calibrated Date: 06 November 2024

Calibrated For: บริษัท ทีแอลที คอนซัลแตนท์ จำกัด

### Instruments Information

Analyzer Type: CO Analyzer	Manufacturer AIP
Model: 300E	S/N: 173-S

### Calibration System

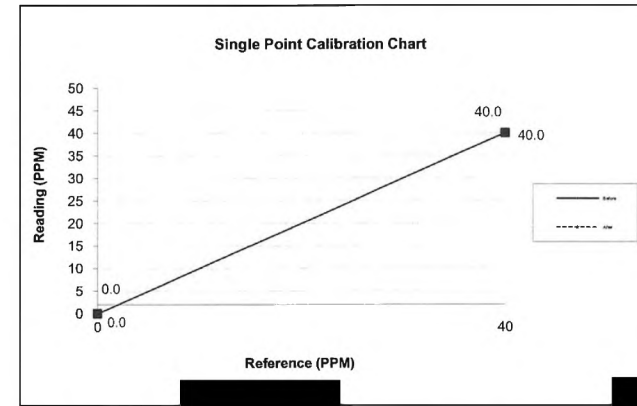
Calibrator Unit	Standard Gas
Dilutor Model B22019	NO Conc 54.81 PPM
S/N: APPVD	SO2 Conc 52.99 PPM
ZERO AIR Generator E07NI99E15A0002	CO Conc 4,469 PPM
S/N: EB0125123	Expire Date: 6 November 2027

Environment: Temperature 32.0 °C

Humidity: 47.0 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.0	0.0	40.0	40.0	0.0
After	0.0	0.0	0.0	40.0	40.0	0.0



Calibrate By :

(Kunlapat Chuichoti)

Date : November 6, 2024

Approve By :

(Metawee Khumkham)

Date : November 6, 2024

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**National Institute of Metrology (Thailand)**  
Ministry of Higher Education, Science, Research and Innovation

**Certificate of Calibration**

**Certificate No. :** MW-0058-24  
**Issued by :** Flow and Volume of Liquid Laboratory  
Mechanical Metrology Department

Page 1 of 3 pages

**MEASUREMENT ITEM :** Orifice Gas Flow Device

**MANUFACTURER :** Tisch Environmental, Inc.

**MODEL/TYPE :** TE-5025A

**SERIAL NUMBER :** 3092

**CUSTOMER :** TOPS-LAB Consultants CO., LTD  
189 Moo 3 Bangrakphatthana Bangbuathong  
Nonthaburi 11110 Thailand

**MEASUREMENT DATE :** June 18, 2024

*The reported measurement result relates only to the measurand and applies only at the time of measurement.*

<b>Reference:</b> MEC10221-01/24	<b>Date:</b> July 1, 2024	<b>Approved by:</b>  ( Wirun Laopornpichayanuwat )	<b>Performed by:</b>  ( Terdsak Neadkratoke )
-------------------------------------	------------------------------	---	--

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Technopolis Office, 3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120 Thailand, Telephone: 66 2577 5100, Facsimile: 66 2577 3659



**National Institute of Metrology (Thailand)**

Continuation of Certificate of Calibration Number MW-0058-24

Page 2 of 3 pages

**ENVIRONMENTAL CONDITIONS:**

Ambient condition in the laboratory are as follows :

Temperature :  $23.0 \pm 2.0$  °C  
Relative Humidity :  $55 \pm 15$  %RH

**Calibration Condition:**

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  
23.7°C and 53 %RH.

**MEASUREMENT METHOD:**

The Orifice gas flow device was calibrated against NIMT's Standard Gas Meter Model DELTA S-Flow G65. The CP-MW 0009 was used as a calibration guideline.

**TABULATION OF RESULTS:**

The tables on the next page give the measured values.

**UNCERTAINTY OF MEASUREMENT:**

The stated uncertainty is the expanded uncertainty which is obtained by multiplying the standard uncertainty by the coverage factor  $k = 2$ . It has been determined in accordance with EA publication EA-4/02M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and "JCGM 100:2008 Evaluation of measurement data - Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measurand lies within the assigned range of values with a probability of 95 %.

**TRACEABILITY:**

This certificate provides a traceability of the measurement to recognized the national standards, and to the realization of the International System of Units (SI).



# National Institute of Metrology (Thailand)

NIMT

Continuation of Certificate of Calibration Number

MW-0058-24

Page 3 of 3 pages

## MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Gas Meter standard. The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1. The results of  $Q$  actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p$ _Meter mmHg	$\Delta p$ _Orifice inH <sub>2</sub> O	Y	Actual Flow [ $Q_a$ ] m <sup>3</sup> /min
1	0.696	755.108	23.55	23.58	55.760	1.792	0.839	0.644
2	0.909	755.169	23.58	23.60	53.403	3.083	1.101	0.845
3	0.997	755.156	23.59	23.59	37.881	3.884	1.235	0.947
4	1.067	755.181	23.58	23.57	31.216	4.546	1.337	1.023
5	1.165	755.206	23.63	23.57	27.319	5.509	1.471	1.124

Slope ( $m$ ): 1.31814  
Intercept ( $b$ ): -0.01144  
Correlation coefficient ( $r$ ): 0.99988  
Uncertainty ( $k=2$ ): 0.015 m<sup>3</sup>/min

Table 2. The results of  $Q$  standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p$ _Meter mmHg	$\Delta p$ _Orifice inH <sub>2</sub> O	Y	Standard Flow [ $Q_{sc}$ ] m <sup>3</sup> /min
1	0.696	755.108	23.55	23.58	55.760	1.792	1.338	0.643
2	0.909	755.169	23.58	23.60	53.403	3.083	1.754	0.843
3	0.997	755.156	23.59	23.59	37.881	3.884	1.969	0.945
4	1.067	755.181	23.58	23.57	31.216	4.546	2.131	1.022
5	1.165	755.206	23.63	23.57	27.319	5.509	2.345	1.122

Slope ( $m$ ): 2.10451  
Intercept ( $b$ ): -0.01824  
Correlation coefficient ( $r$ ): 0.99988  
Uncertainty ( $k=2$ ): 0.016 m<sup>3</sup>/min

End of Certificate of Calibration



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-67/0481

MTC.No.23-67/0481

Number of page(s) 2

## CALIBRATION CERTIFICATE

Nomenclature : DRYCAL DC-LITE FLOWMETER

Manufacturer : BIOS International Corporation, USA.

Serial No.: 7154

Model : DCL-H

Scale range : 500 ml/min to 30 l/min

Subdivision : ( 0.001, 0.01 ) l/min

Submitted by : TOPS-LAB Consultants CO., LTD.

189 Moo 3 Bangrukphatthana Bangbuathong

Nonthaburi 11110, thailand

Received date : 27 May 2024

Condition of measured item : Normal

Calibration date : 30 May 2024

Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 643/65	1-Jun-24	TISTR
Molbox/Pressure Transducer/UpStream	MP-0076-23	2-Apr-25	NIMT
Primary Flow Calibrator S/N 119216	MW-0035-23	31-May-25	NIMT

Calibrated by : (Mr.Terasak Panna)

Approved by : (Ms.Kirana Luanghirun)

Director

Mechanical Engineering Standards Laboratory

Ref. 2013267052701887001

Issued Date 4 June 2024

The results relate only to the items tested/calibrated or value assigned.  
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FM.BL.MTC.002 Rev.4

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Fax. (66) 0 2577 9009  
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

### Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

### Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-67/0481

2/2

MTC.No.23-67/0481

Calibration point : (1, 5, 10, 15, 20) l/min

Ambient condition : Temperature (23 ± 3) °C , Relative humidity (55 ± 15) %

Atmospheric pressure (1010±13) hPa

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

#### Measurement data :

UUC Value	Standard Value	Temperature	Pressure	Deviation	Uncertainty
(l/min)	(l/min)	(°C)	(hPa)	(%)	(%)
1.006	1.0047	25.515	1006.55	+0.17	0.97
5.009	4.9874	25.509	1008.94	+0.43	0.92
10.04	9.9687	25.439	1012.35	+0.68	0.92
15.03	14.885	25.368	1016.19	+1.00	0.91
20.02	19.756	25.389	1020.57	+1.32	0.91

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor  $k=2$ , which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : surmalee@tistr.or.th



Airgas Specialty Gases  
Airgas USA, LLC  
630 United Drive  
Durham, NC 27713  
Airgas.com

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E07NI99E15A0002 Reference Number: 122-401652592-1  
Cylinder Number: EB0125123 Cylinder Volume: 143.7 Cubic Feet  
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2016 PSIG  
PGVP Number: B22019 Valve Outlet: 660  
Gas Code: APPVD Certification Date: Nov 06, 2019

Expiration Date: Nov 06, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	54.81 PPM	G1	+/- 0.9% NIST Traceable	10/29/2019, 11/06/2019
NITRIC OXIDE	55.00 PPM	54.80 PPM	G1	+/- 0.9% NIST Traceable	10/29/2019, 11/06/2019
SULFUR DIOXIDE	55.00 PPM	52.99 PPM	G1	+/- 1.0% NIST Traceable	10/29/2019, 11/06/2019
METHANE	180.0 PPM	172.9 PPM	G1	+/- 0.7% NIST Traceable	10/29/2019
PROPANE	180.0 PPM	178.5 PPM	G1	+/- 1.3% NIST Traceable	10/30/2019
CARBON DIOXIDE	950.0 PPM	958.7 PPM	G1	+/- 0.6% NIST Traceable	10/29/2019
CARBON MONOXIDE	4500 PPM	4469 PPM	G1	+/- 0.7% NIST Traceable	10/30/2019
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060657	CC465102	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	PRM	D562879	10.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.9%	Aug 17, 2018
NTRM	17080225	EB0079096	100.3 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Jul 23, 2023
RGM	12362	SG916305BAL	4.701% % PROPANE/NITROGEN	+/- 0.3%	Jun 04, 2020
GMIS	124206889114	CC322698	4.432 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Aug 15, 2021
NTRM	14010338	ND48595	49.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.9%	Apr 17, 2024
NTRM	12060910	CC356255	98.05 PPM METHANE/NITROGEN	+/- 0.6%	Dec 22, 2023
NTRM	10060806	CC317625	933.7 PPM CARBON DIOXIDE/NITROGEN	+/- 0.5	May 09, 2020
NTRM	080123	KAL004604	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2024
GMIS	124504060104	CC86856	4.8803 % PROPANE/NITROGEN	+/- 0.4%	Oct 22, 2023

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801549 CO2	FTIR	Oct 17, 2019
Horiba VIA510 CO RS2EGL6K	Nondispersive Infrared (NDIR)	Oct 30, 2019
Nicolet 6700 AHR0801549 CH4	FTIR	Oct 17, 2019
Nicolet 6700 AHR0801549 NO	FTIR	Oct 17, 2019
Nicolet 6700 AHR0801549 NO	FTIR	Oct 17, 2019
Varian 3800 C3H8	Gas Chromatograph	Oct 02, 2019
Nicolet 6700 AHR0801549 SO2	FTIR	Oct 17, 2019

Triad Data Available Upon Request

NOTES:GROSS WEIGHT: 28,750 g

NET WEIGHT: 4,327.9 g

Approved for Release

Page 1 of 122-401652592-1

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การตรวจวัดคุณภาพน้ำผิวดินและคุณภาพน้ำทิ้ง



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CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert.No.: 24CH792  
Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenCompact pH/Ion S220  
**Serial No. :** B329579021  
**ID No. :** TLC-L020  
**Condition As-Received:** Used Item  
**Received Date :** 02 July 2024  
**Calibration Date :** 03 July 2024  
**Reference :** 2407-0055DN-1  
**Submitted by :** Tops-Lab Consultants Co.,Ltd.  
189 Moo. 3, Bangrakphatthana,  
Bangbuathong, Nonthaburi 11110  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with DC voltage  
standard and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**

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

**Issue Date :** 09 July 2024

**The Uncertainties are for a confidence probability of approximately 95%**

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



Cert.No.: 24CH792  
Page.: 2 of 3

### Condition of this calibration result

#### 1. Reference Standard Instrument

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

### Calibration Results

#### Function : mV Measurement

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

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



Cert.No.: 24CH792  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

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

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 4222298

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

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

Remark - UUC\* = Unit Under Calibration

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

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QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



PAGE : 1 OF 2

CERTIFICATE No : 24M4139  
REFERENCE No : 73037-1

#### Certificate of Calibration

EQUIPMENT : ELECTRONIC BALANCE  
MANUFACTURER : METTLER TOLEDO  
MODEL : MS205DU  
SERIAL No : B420605448  
ID No : TLC-L038  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTABURI 11110

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 07-May-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 09-May-24

RECEIVED DATE : 07-May-24

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 24M4139

PAGE : 2 OF 2

**Calibration Report**

EQUIPMENT : ELECTRONIC BALANCE MODEL : MS205DU  
MANUFACTURER : METTLER TOLEDO S/N : B420605448  
ID No : TLC-L038 RECEIVED DATE : 07-May-24  
AIR PRESSURE : 1014mbar  $\pm$  1mbar CALIBRATION DATE : 07-May-24  
AMBIENT TEMPERATURE : 25°C  $\pm$  1°C RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

**2. REFERENCE STANDARD INSTRUMENTS :-**

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

**RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**

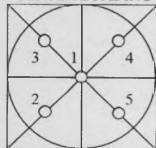
1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.0	0.00000	0.00000	0.000053
0.1	0.10001	-0.00001	0.000053
0.2	0.19999	0.00001	0.000054
0.5	0.49999	0.00001	0.000054
1.0	0.99999	0.00001	0.000055
2.0	1.99997	0.00003	0.000055
5.0	4.99998	0.00002	0.000057
10.0	10.00001	-0.00001	0.000064
20.0	20.00003	-0.00003	0.000078
50.0	49.9998	0.0003	0.00012
100.0	100.0000	0.0000	0.00019
200.0	200.0001	-0.0001	0.00032

**5. OFF CENTER LOADING ERROR**

POINT	READING (g)
1	99.9999
2	99.9998
3	99.9999
4	99.9997
5	99.9998
OFF-CENTER LOADING	0.0002

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

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

END OF CALIBRATION REPORT

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 24T4146

REFERENCE No : 73037-8

PAGE : 1 OF 2

**Certificate of Calibration**

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNE 14  
SERIAL No : L413.1292  
ID No : TLC-L030  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTABURI 11110

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 07-May-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 09-May-24

RECEIVED DATE : 07-May-24

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

F-G010 REV : 03





# QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 24T4146

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : TLC-L030  
RECEIVED DATE : 07-May-24  
AMBIENT TEMPERATURE : 33 °C ± 1 °C  
MODEL : WNE 14  
SERIAL NUMBER : L413.1292  
CALIBRATION DATE : 07-May-24  
RELATIVE HUMIDITY : 56 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

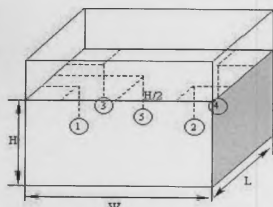
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	23T6641	14-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT



PROBE INSTALLATION  
POSITION IN THE BATH

### GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.3

Overall Variation of Line Voltage (V) : 4

Instrument Condition : Normal

Bath Inner Size (W\*L\*H) : 31\*36.5\*15.5 cm

### BATH PERFORMANCE

Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
85.3	0.05	0.06	0.03	0.15
95.0	0.03	0.05	0.09	0.17

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
85.3	85.3	85.01	84.99	84.98	84.95	84.98	0.15
95.0	95.0	94.67	94.72	94.71	94.70	94.73	0.17

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

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT



# QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

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CERTIFICATE No : 24T4144

REFERENCE No : 73037-6

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UF55  
SERIAL No : B214.0908  
ID No : TLC-L029  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTHABURI 11110

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 07-May-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 09-May-24

RECEIVED DATE : 07-May-24

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

F-G010 REV : 03



# QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkoe, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T4144

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UF55  
ID No : TLC-L029  
RECEIVED DATE : 07-May-24  
AMBIENT TEMPERATURE : 33 °C ± 1 °C  
S/N : B214.0908  
CALIBRATION DATE : 07-May-24  
RELATIVE HUMIDITY : 56 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

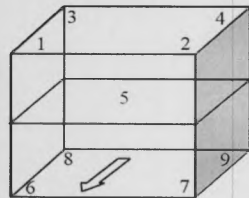
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0  
Overall Line Voltage (V) variation : 6  
Instrument Condition : Normal  
Chamber Size (W\*L\*H): 40\*33\*40 cm; Vent =40%

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.26	0.38	0.83
180.0	180.0	0.46	0.79	1.55

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	103.89	103.93	104.09	103.80	104.09	104.21	103.82	104.23	103.93	0.69
180.0	180.0	180.14	180.05	180.34	180.15	180.60	181.12	180.24	180.86	180.98	1.1

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

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT

F-G



CERT.No.: HS-V025E

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphen, Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 7 May 24

Submitted by : TOPS-LAB CONSULTANTS CO.,LTD.

189 Moo 3 Bangrakphatthana Bangbuathong

Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 13K100714

Probe : YSI 5010

S/N : 13J100364

ID NO. : TLC-L019

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : S/N. 11431

Technician : Kittipong M.

### Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.09	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.09	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Technician Signature

(Kittipong Maekwong)

Laboratory Manager

(Supreecha Sumaritam)



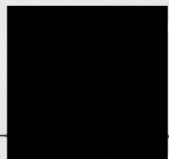
CERTIFICATE No : 24T4147  
REFERENCE No : 73038-1

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : AQUALYTIC  
MODEL : ET618-4  
SERIAL No : 0109/13922  
ID No : TLC-L005  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 07-May-24

APPROVED BY :   
ISSUED DATE : 09-May-24  
RECEIVED DATE : 07-May-24

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

F-G010 REV : 03



CERTIFICATE No : 24T4147

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : AQUALYTIC  
MODEL : ET618-4  
ID No : TLC-L005  
RECEIVED DATE : 07-May-24  
AMBIENT TEMPERATURE : 26 °C ± 1 °C  
S/N : 0109/13922  
CALIBRATION DATE : 07-May-24  
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

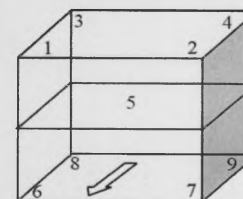
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0

Overall Line Voltage (V) variation : 6

Instrument Condition : Normal

Chamber Size (W\*L\*H): 55\*46\*70 cm

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.26	0.12	0.52

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
20.0	20.0	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
		19.77	19.73	19.72	19.73	19.72	19.73	19.72	19.76	19.78	0.35

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

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

F-G010 REV : 03



CERTIFICATE No : 24T4153  
REFERENCE No : 73038-7

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : ZEALWAY  
MODEL : GI54TW  
SERIAL No : A515D096  
ID No : TLC-L081  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 07-May-24

APPROVED BY :

ISSUED DATE : 09-May-24

RECEIVED DATE : 07-May-24

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



CERTIFICATE No : 24T4153

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : ZEALWAY  
ID NUMBER : TLC-L081  
RECEIVED DATE : 07-May-24  
AMBIENT TEMPERATURE : 33°C ± 1°C  
MODEL : GI54TW  
SERIAL NUMBER : A515D096  
CALIBRATION DATE : 07-May-24  
RELATIVE HUMIDITY : 56 %RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

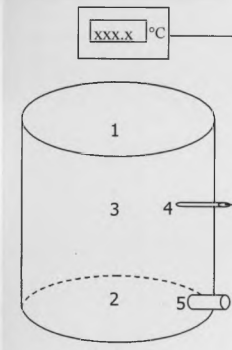
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. THE THIRD SENSOR WAS PLACED WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT CHAMBER. SENSOR NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 15 mm OF ITS TIP. SENSOR NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER	VALPROBE	S350,S367,DV35,DN94	24T0890	26-Jan-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber variation : 0.3 °C  
Autoclave Condition : Normal  
Chamber Size (Diameter\*H): 32 \* 66.5 cm

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
121.0	121.0	0.075	0.250	0.330	0.11	15	60

#### TEMPERATURE MEASUREMENT ACCURACY TEST(° C)

Cont Temp	Ind Temp	Measured Temperature ( °C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
121.0	121.0	121.37	121.40	121.31	121.35	121.36	0.59

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT OF TEMPERATURE MEASUREMENT ACCURACY TEST EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.  
NOTE 2 : THE STABILITY TERM IN THE UNCERTAINTY BUDGET WAS REPLACED BY THE STANDARD REPEATABILITY.  
NOTE 3 : LOCATION 3 WAS REFERENCE LOCATION.  
NOTE 4 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



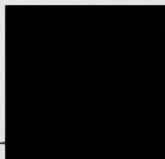
CERTIFICATE No : 24T4149  
REFERENCE No : 73038-3

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF55  
SERIAL No : D215.1343  
ID No : TLC-L070  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TOPS-LAB CONSULTANTS CO., LTD.  
189 MOO.3 BANGRAKPHATTHANA  
BANGBUATHONG NONTHABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 07-May-24

APPROVED BY :   
ISSUED DATE : 09-May-24  
RECEIVED DATE : 07-May-24

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

F-G010 REV : 03



CERTIFICATE No : 24T4149

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF55  
ID No : TLC-L070  
RECEIVED DATE : 07-May-24  
AMBIENT TEMPERATURE : 26 °C ± 1 °C  
S/N : D215.1343  
CALIBRATION DATE : 07-May-24  
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

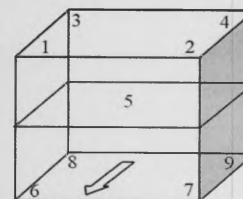
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	6635300	23T6637	19-Jul-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0

Overall Line Voltage (V) variation : 5

Instrument Condition : Normal

Chamber Size (W\*L\*H): 40\*33\*40 cm

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	0.06	0.04	0.17
44.5	44.5	0.01	0.08	0.13

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	35.04	35.03	35.04	35.02	35.01	35.02	34.98	34.99	35.00	0.30
44.5	44.5	44.60	44.59	44.60	44.57	44.56	44.54	44.49	44.55	44.54	0.36

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

F-G