

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์



Certificate of Calibration

Calibration Certification Information

Cal. Date: January 13, 2026	Rootsmeter S/N: 438320	Ta: 293 °K
Operator: Jim Tisch		Pa: 753.9 mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 4398	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4450	3.2	2.00
2	3	4	1	1.0310	6.4	4.00
3	5	6	1	0.9210	7.9	5.00
4	7	8	1	0.8790	8.8	5.50
5	9	10	1	0.7230	12.8	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
1.0046	0.6952	1.4205	0.9958	0.6891	0.8817
1.0003	0.9702	2.0088	0.9915	0.9617	1.2469
0.9983	1.0839	2.2460	0.9895	1.0744	1.3940
0.9971	1.1343	2.3556	0.9883	1.1244	1.4621
0.9917	1.3717	2.8409	0.9830	1.3596	1.7633
QSTD	m=	2.10187	QA	m=	1.31615
	b=	-0.03487		b=	-0.02164
	r=	0.99993		r=	0.99993

Calculations

Vstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va= $\Delta Vol((Pa-\Delta P)/Pa)$
Qstd= $Vstd/\Delta Time$	Qa= $Va/\Delta Time$
For subsequent flow rate calculations:	
Qstd= $1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa= $1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



S.P.J. Scientific Co.,Ltd
TSP Sampler Calibration
(Dickson recorder/43178)

SITE

ที่ตั้งสถานี (Station Location) โรงแรม วิลล่า สาทร วันที่ 23/5/2569
 ประเภทเครื่อง (TSP หรือ PM-10) TSP เวลา 10.00

CONDITIONS

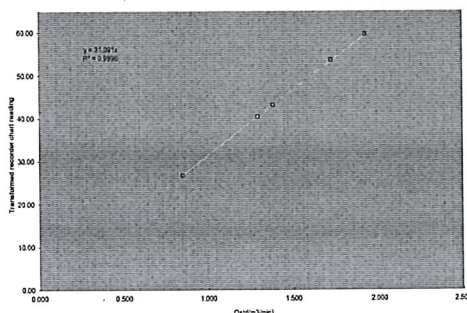
ความกดของอากาศ (in Hg): 29.89 ความกดของอากาศ (mm Hg): 759
 อุณหภูมิบรรยากาศ (deg C): 33.0 อุณหภูมิบรรยากาศ (deg K): 306
 ความกดของอากาศ (in Hg): 29.89 ความกดของอากาศ (mm Hg): 759
 อุณหภูมิเฉลี่ย (deg C): 33.0 อุณหภูมิเฉลี่ย (deg K): 306

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.02255
 Model: TE-5025A Qstd Intercept: -0.00092
 Orifice transfer standard Serial#: 9833620 Date Certified: Original

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	15.50	1.920	56.0	55.23	59.48	Slope = <u>30.5115</u> Intercept = <u>0.8859</u> Corr. coeff. = <u>0.9349</u> of Observations: <u>5</u>
2	12.50	1.725	54.0	53.26	53.51	
3	8.00	1.380	50.0	49.32	42.98	
4	7.00	1.291	44.0	43.40	40.27	
5	3.00	0.845	22.0	21.70	26.67	



Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



S.P.J. Scientific Co.,Ltd
TSP Sampler Calibration
(Dickson recorder/43178)

SITE

ที่ตั้งสถานี (Station Location) โรงเรียนวัดสุวรรณ วันที่ 23/5/2569
 ประเภทเครื่อง (TSP หรือ PM-10) TSP เวลา 10.00

CONDITIONS

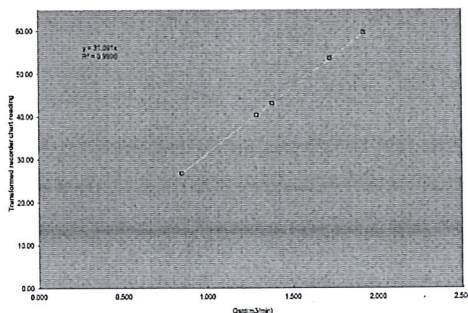
ความกดของอากาศ (in Hg):	<u>29.89</u>	ความกดของอากาศ (mm Hg):	<u>759</u>
อุณหภูมิบรรยากาศ (deg C):	<u>33.0</u>	อุณหภูมิบรรยากาศ (deg K):	<u>306</u>
ความกดของอากาศ. (in Hg):	<u>29.89</u>	ความกดของอากาศ (mm Hg):	<u>759</u>
อุณหภูมิเฉลี่ย. (deg C):	<u>33.0</u>	อุณหภูมิเฉลี่ย. (deg K):	<u>306</u>

CALIBRATION ORIFICE

Make:	<u>Tisch</u>	Qstd Slope:	<u>2.02255</u>
Model:	<u>TE-5025A</u>	Qstd Intercept:	<u>-0.00092</u>
Orifice transfer standard Serial#:	<u>9833620</u>	Date Certified:	<u>Original</u>

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	15.50	1.920	56.0	55.23	59.48	Slope = <u>30.5115</u> Intercept = <u>0.8859</u> Corr. coeff. = <u>0.9349</u> of Observations: <u>5</u>
2	12.50	1.725	54.0	53.26	53.51	
3	8.00	1.380	50.0	49.32	42.98	
4	7.00	1.291	44.0	43.40	40.27	
5	3.00	0.845	22.0	21.70	26.67	



Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

$$1/m((I) [\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



S.P.J. Scientific Co.,Ltd
TSP Sampler Calibration
(Dickson recorder/43178)

SITE

ที่ตั้งสถานี (Station Location) _____ สำนักงานเขตคลองสาน
 ประเภทเครื่อง (TSP หรือ PM-10) _____ TSP

วันที่ 23/5/2569
 เวลา 10.00

CONDITIONS

ความกดของอากาศ (in Hg):	29.89	ความกดของอากาศ (mm Hg):	759
อุณหภูมิบรรยากาศ (deg C):	33.0	อุณหภูมิบรรยากาศ (deg K):	306
ความกดของอากาศ. (in Hg):	29.89	ความกดของอากาศ (mm Hg):	759
อุณหภูมิเฉลี่ย. (deg C):	33.0	อุณหภูมิเฉลี่ย. (deg K):	306

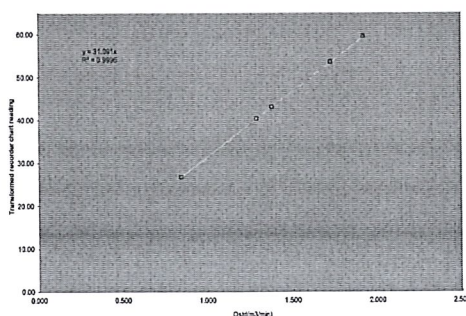
CALIBRATION ORIFICE

Make: Tisch
 Model: TE-5025A
 Orifice transfer standard Serial#: 9833620

Qstd Slope: 2.02255
 Qstd Intercept: -0.00092
 Date Certified: Original

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	15.50	1.920	56.0	55.23	59.48	Slope = 30.5115 Intercept = 0.8859 Corr. coeff. = 0.9349 of Observations: 5
2	12.50	1.725	54.0	53.26	53.51	
3	8.00	1.380	50.0	49.32	42.98	
4	7.00	1.291	44.0	43.40	40.27	
5	3.00	0.845	22.0	21.70	26.67	



Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



S.P.J. Scientific Co.,Ltd
PM-10 Sampler Calibration
(Dickson recorder/1925)

SITE

ที่ตั้งสถานี (Station Location) _____ โรงแรม วิลล่า สาทร
ประเภทเครื่อง (TSP หรือ PM-10) _____ PM-10

วันที่ 23/5/2569

เวลา 10.00

CONDITIONS

ความกดของอากาศ (in Hg): _____ 29.85 ความกดของอากาศ (mm Hg): _____ 758
อุณหภูมิบรรยากาศ (deg C): _____ 33.9 อุณหภูมิบรรยากาศ (deg K): _____ 307
ความกดของอากาศ (in Hg): _____ 29.85 ความกดของอากาศ (mm Hg): _____ 758
อุณหภูมิเฉลี่ย (deg C): _____ 33.9 อุณหภูมิเฉลี่ย (deg K): _____ 307

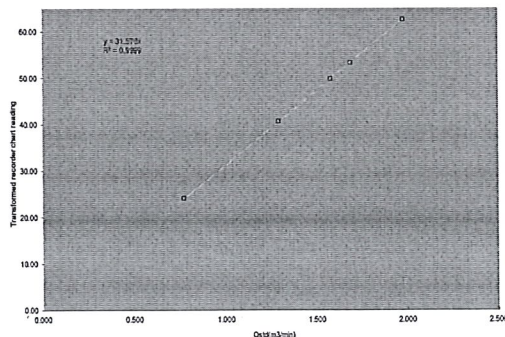
CALIBRATION ORIFICE

Make: _____ Tisch
Model: _____ TE-5025A
Orifice transfer standard Serial#: _____ 9833620

Qstd Slope: _____ 2.02255
Qstd Intercept: _____ -0.00092
Date Certified: _____ Original

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	16.50	1.977	60.0	59.05	62.54	Slope = _____ 31.8367 Intercept = _____ -0.4099 Corr. coeff.= _____ 0.9824 Observations: _____ 5
2	12.00	1.686	56.0	55.12	53.27	
3	10.50	1.577	52.0	51.18	49.81	
4	7.00	1.288	44.0	43.31	40.59	
5	2.50	0.770	22.0	21.65	24.10	



Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a)) - b]$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\text{Sqrt}(P_a/P_{std})(T_{std}/T_a)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I[\text{Sqrt}(298/T_{av})(P_{av}/760)] - b)$$

$$1/m((I[\text{Sqrt}(298/T_{av})(P_{av}/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



S.P.J. Scientific Co.,Ltd
PM-10 Sampler Calibration
(Dickson recorder/1925)

SITE

ที่ตั้งสถานี (Station Location) โรงเรียนวัดสุวรรณ วันที่ 23/5/2569
 ประเภทเครื่อง (TSP หรือ PM-10) PM-10 เวลา 10.00

CONDITIONS

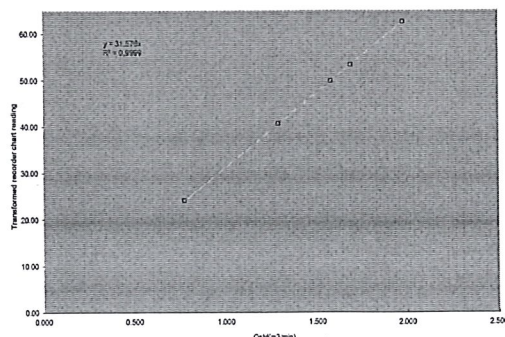
ความกดของอากาศ (in Hg): 29.85 ความกดของอากาศ (mm Hg): 758
 อุณหภูมิบรรยากาศ (deg C): 33.9 อุณหภูมิบรรยากาศ (deg K): 307
 ความกดของอากาศ (in Hg): 29.85 ความกดของอากาศ (mm Hg): 758
 อุณหภูมิเฉลี่ย (deg C): 33.9 อุณหภูมิเฉลี่ย (deg K): 307

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.02255
 Model: TE-5025A Qstd Intercept: -0.00092
 Orifice transfer standard Serial#: 9833620 Date Certified: Original

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	16.50	1.977	60.0	59.05	62.54	Slope = <u>31.8367</u> Intercept = <u>-0.4099</u> Corr. coeff. = <u>0.9824</u> Observations: <u>5</u>
2	12.00	1.686	56.0	55.12	53.27	
3	10.50	1.577	52.0	51.18	49.81	
4	7.00	1.288	44.0	43.31	40.59	
5	2.50	0.770	22.0	21.65	24.10	



Calculations

$$Qstd = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)}] - b$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I)[\sqrt{298/Tav}(Pav/760)] - b]$$

$$1/m[(I)[\sqrt{298/Tav}(Pav/760)] - b]$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



บริษัท เอส.พี.เจ. ไซแอนติฟิก จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

80 ซอยนักกีฬาแหลมทอง 3 แขวงทับช้าง เขตสะพานสูง กรุงเทพฯ 10250
80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ๖-๒๐๖

CO Analyzer Verification Test Report

Calibration Report No.: 6803006

Calibrated Date: 1-Mar-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo S/N: SPTE48CCO96276
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Calibration System

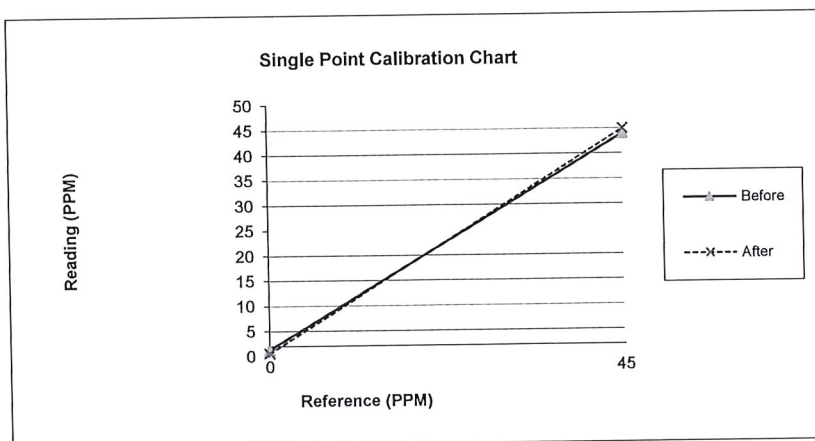
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.5 °C

Humidity: 45 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.3	1.3	45.0	44.0	-1.1
After	0.0	0.6	0.6	45.0	45.0	0.0



Calibrate By :

Date:

Sirirat Poonlak
1-Mar-25

Approve By :

Date:

Direk Chenrueng
1-Mar-25



บริษัท เอส.พี.เจ. ไซแอนติฟิค จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

80 ซอยนักกีฬาแหลมทอง 3 แขวงทับช้าง เขตสะพานสูง กรุงเทพฯ 10250
80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ว-๒๐๖

CO Analyzer Verification Test Report

Calibration Report No.: 6803007

Calibrated Date: 1-Mar-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo S/N: SPTE48CCO27380
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Calibration System

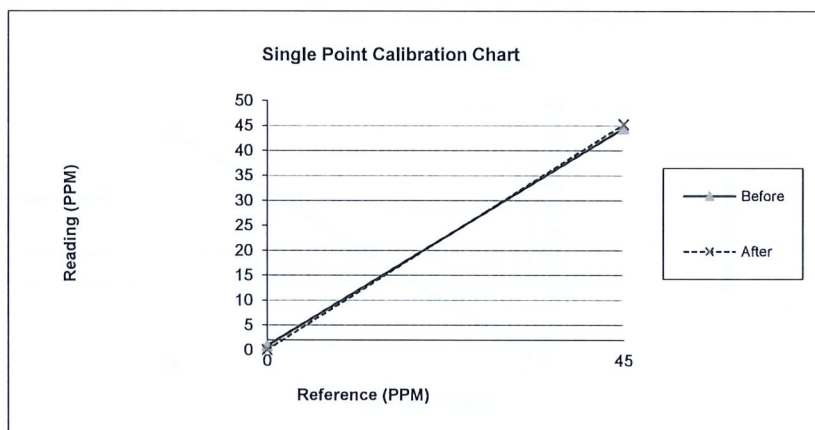
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.4 °C

Humidity: 47 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.9	0.9	45.0	44.5	-0.6
After	0.0	0.1	0.1	45.0	45.3	0.3



Calibrate By :

Date:

Sirirat Poonlak
1-Mar-25

Approve By :

Date:

Direk Chenrueng
1-Mar-25



บริษัท เอส.พี.เจ. ไซแอนติฟิก จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

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80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ๖-๒๐๖

CO Analyzer Verification Test Report

Calibration Report No.: 6803008

Calibrated Date: 1-Mar-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo S/N: SPTE48CCO06936
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Calibration System

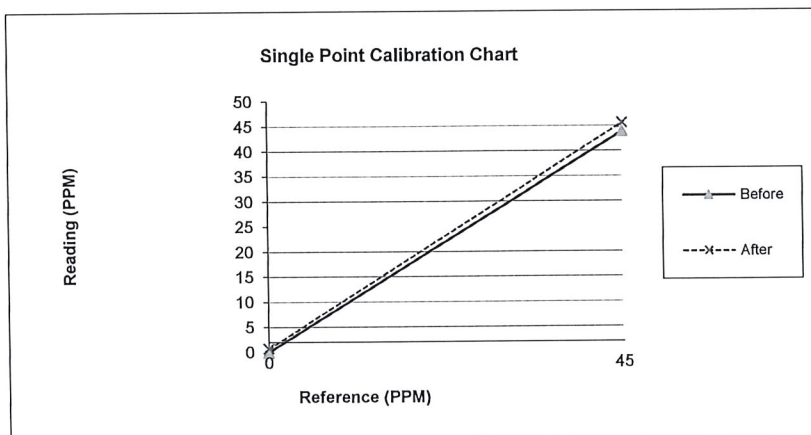
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.7 °C

Humidity: 59 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.0	2.0	45.0	43.9	-1.2
After	0.0	0.7	0.7	45.0	45.6	0.7



Calibrate By :

Date:

Sirrat Poonlak
1-Mar-25

Approve By :

Date:

Direk Chenrueng
1-Mar-25



บริษัท เอส.พี.เจ. ไซแอนติฟิก จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

80 ซอยนักกีฬาแหลมทอง 3 แขวงทับช้าง เขตสะพานสูง กรุงเทพฯ 10250
80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ๖-๒๐๐๖

CO Analyzer Verification Test Report

Calibration Report No.: 6803009

Calibrated Date: 1-Mar-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo S/N: SPTE48CCO69358
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Calibration System

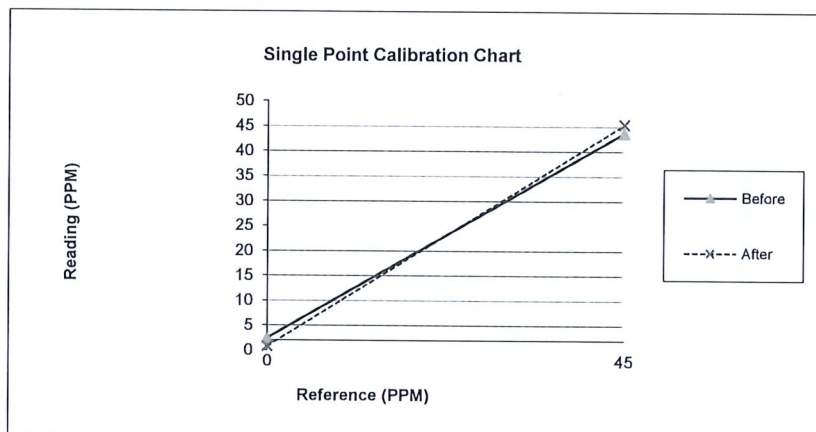
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.8 °C

Humidity: 60 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.4	2.4	45.0	43.7	-1.5
After	0.0	0.8	0.8	45.0	45.4	0.4



Calibrate By :

Date:

Sirirat Poonlak
1-Mar-25

Approve By :

Date:

Direk Chenrueng
1-Mar-25



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Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ว-๒๐๖

NOx Analyzer Verification Test Report

Calibration Report No.: 6902003

Page:1/2

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: SPTE42CNO95384
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.9 °C

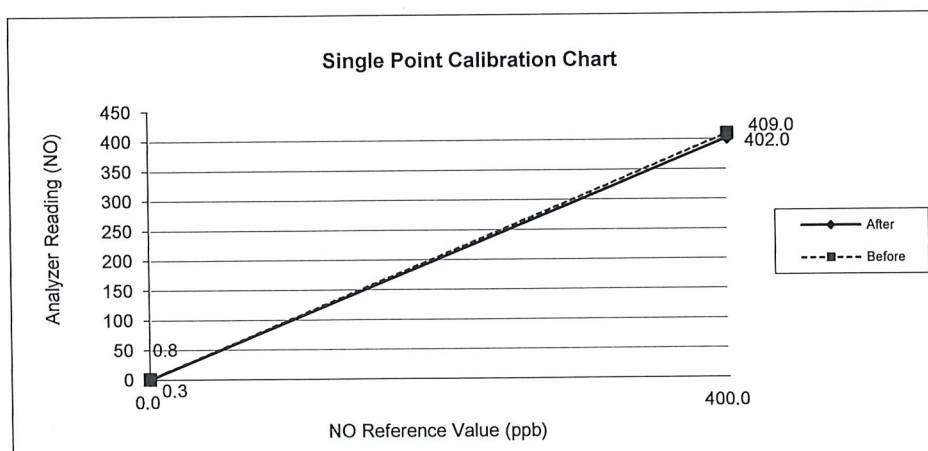
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.8	0.0	0.8	409	400.0	1.1
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	1.0	0.0	1.0	411	400.0	1.4

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	402	400.0	0.2
NO ₂	0.3	0.0	0.3	3.0	0.0	0.4
NOx	0.6	0.0	0.6	405	400.0	0.6





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Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ว-๒๑๖

MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-02-2026

S/N : SPTE42CNO95384

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	44	43
CHAMBER TEMP 47 - 51 C	50	50
COOLER TEMP -5 - (-2) DEG C	-3	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

Sirirat Poonlak

Date:

1-Feb-26

Approve By :

Direk Chanrueng

Date:

1-Feb-26



NOx Analyzer Verification Test Report

Calibration Report No.: 6902004

Page:1/2

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: SPTE42CNO21361
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25 °C

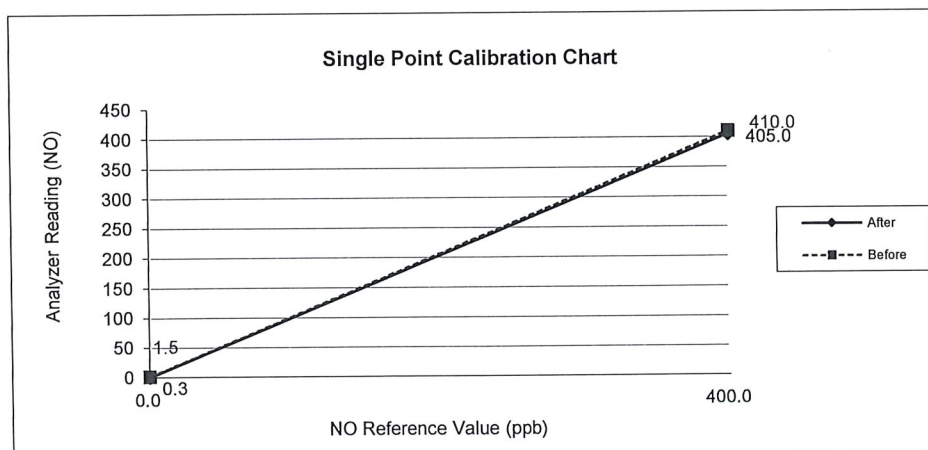
Humidity: 50.2 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.5	0.0	1.5	410	400.0	1.2
NO ₂	0.3	0.0	0.3	5.0	0.0	0.6
NOx	1.8	0.0	1.8	415	400.0	1.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	405	400.0	0.6
NO ₂	0.2	0.0	0.2	3.0	0.0	0.4
NOx	0.5	0.0	0.5	408	400.0	1.0





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Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกชนเลขที่ ว-๒๐๖

MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-02-2026

S/N : SPTE42CNO21361

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	44	43
CHAMBER TEMP 47 - 51 C	50	50
COOLER TEMP -5 - (-2) DEG C	-3	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

[Redacted Signature]

Sirirat Poonlak

Date:

1-Feb-26

Approve By :

[Redacted Signature]

Direk Chanrueng

Date:

1-Feb-26



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NOx Analyzer Verification Test Report

Calibration Report No.: 6902005

Page:1/2

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: SPTE42CNO40037
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.3 °C

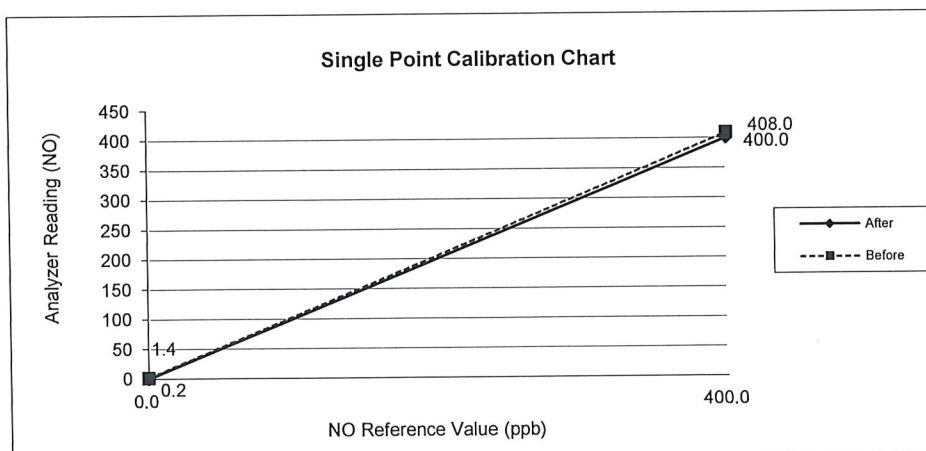
Humidity: 50 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.4	0.0	1.4	408	400.0	1.0
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	1.6	0.0	1.6	410	400.0	1.2

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	400	400.0	0.0
NO ₂	0.1	0.0	0.1	3.0	0.0	0.4
NOx	0.3	0.0	0.3	403	400.0	0.4





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MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-02-2026

S/N : SPTE42CNO40037

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	44	43
CHAMBER TEMP 47 - 51 C	50	50
COOLER TEMP -5 - (-2) DEG C	-3	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

Sirirat Poonlak

Date:

1-Feb-26

Approve By :

Direk Chanrueng

Date:

1-Feb-26



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NOx Analyzer Verification Test Report

Calibration Report No.: 6902006

Page:1/2

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: SPTE42CNO12345
--	--

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.0 °C

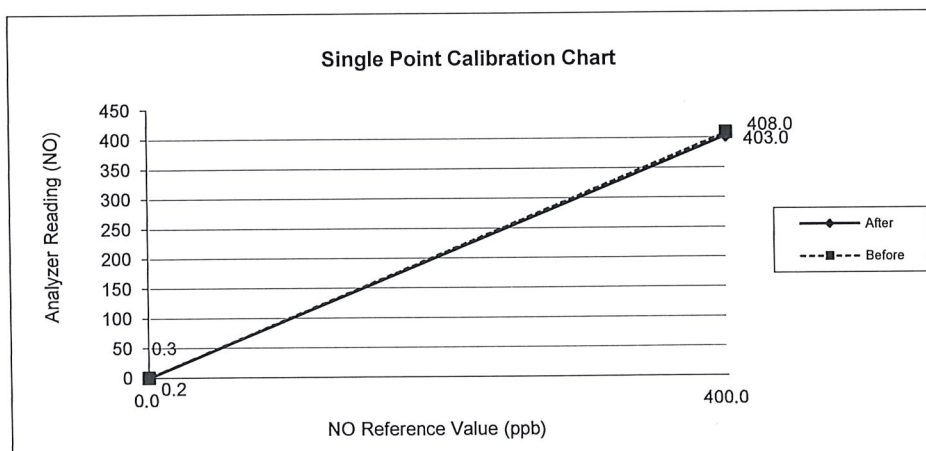
Humidity: 50 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	408	400.0	1.0
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	0.5	0.0	0.5	410	400.0	1.2

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	403	400.0	0.4
NO ₂	0.1	0.0	0.1	1.0	0.0	0.1
NOx	0.3	0.0	0.3	404	400.0	0.5





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MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-02-2026

S/N : SPTE42CNO12345

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	44	43
CHAMBER TEMP 47 - 51 C	50	50
COOLER TEMP -5 - (-2) DEG C	-3	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

[Redacted Signature]

Sirirat Poonlak

Date:

1-Feb-26

Approve By :

[Redacted Signature]

Direk Chanrueng

Date:

1-Feb-26



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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6902003

Page:1/1

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO.,43C	Manufacturer THERMO S/N: SPTE43CSO86366
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Calibration System

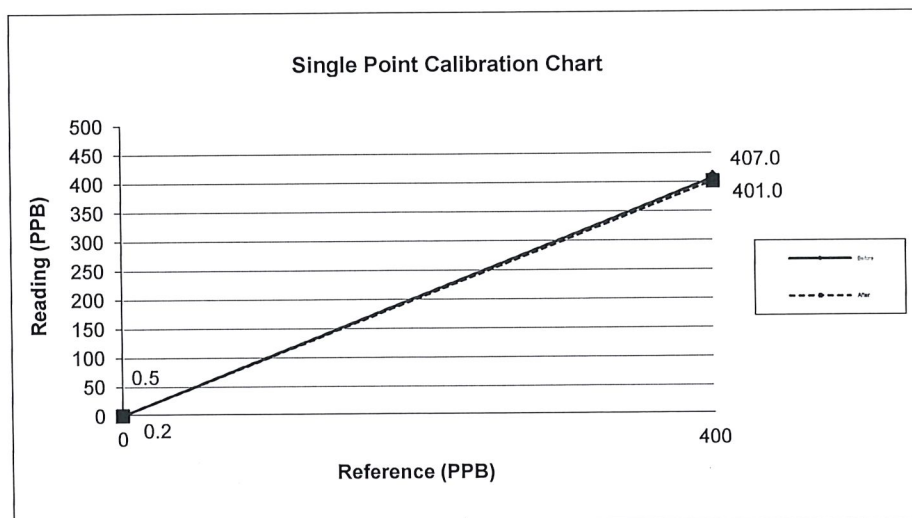
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.0 °C

Humidity: 49 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.5	0.5	400.0	407	1.8
After	0.0	0.2	0.2	400.0	401	0.3





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Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกสารเลขที่ ว-๒๐๖

MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-02-2026

S/N : SPTE43CSO37334

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	48.5	48.5
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By :



Sirirat Poonlak

Date:

1-Feb-26

Approve By :



Direk Chanrueng

Date:

1-Feb-26



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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6902004

Page:1/1

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO.,43C	Manufacturer THERMO S/N: SPTE43CS004026
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Calibration System

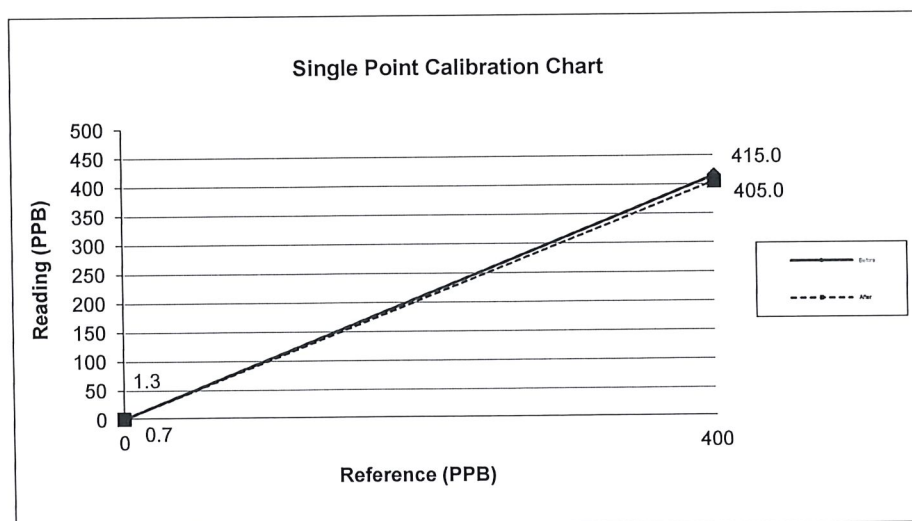
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.4 °C

Humidity: 49 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	1.3	1.3	400.0	415	3.8
After	0.0	0.7	0.7	400.0	405	1.3





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Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกลักษณ์ที่ ๖-๒๐๖

MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-02-2026

S/N : SPTE43CSO86366

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	48.5	48.5
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By :



Sirirat Poonlak

Date:

1-Feb-26

Approve By :



Direk Chanrueng

Date:

1-Feb-26



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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6902005

Page:1/1

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO.,43C	Manufacturer THERMO S/N: SPTE43CSO44328
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Calibration System

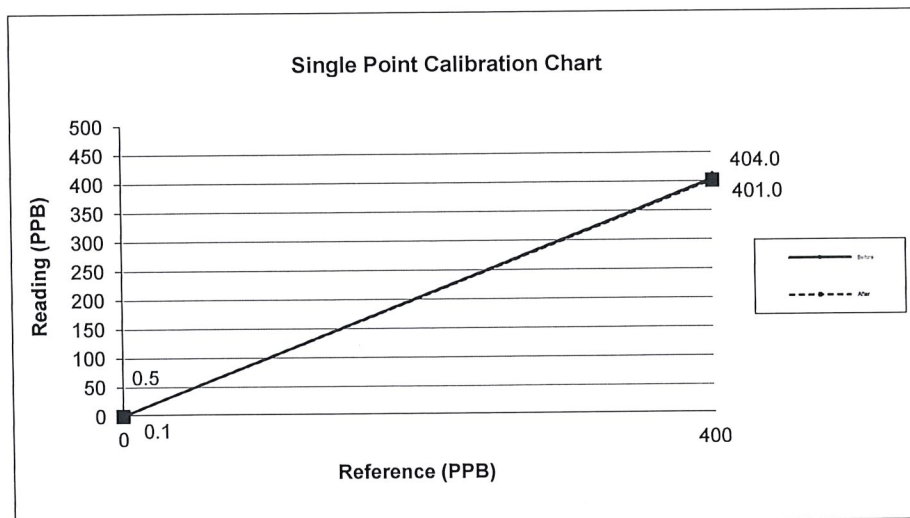
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.3 °C

Humidity: 50 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.5	0.5	400.0	404	1.0
After	0.0	0.1	0.1	400.0	401	0.3





บริษัท เอส.พี.เจ. ไซแอนติฟิก จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

80 ซอยโกกักฟ้าแหลมทอง 3 แขวงหิบบ้าง เขตสะพานสูง กรุงเทพฯ 10250
80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกสารเลขที่ ๑-๒๐๖

MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-02-2026

S/N : SPTE43CSO00426

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	48.5	48.5
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By :



Sirirat Poonlak

Date:

1-Feb-26

Approve By :



Direk Chanrueng

Date:

1-Feb-26



บริษัท เอส.พี.เจ. ไซแอนติฟิก จำกัด
S. P. J. SCIENTIFIC COMPANY LIMITED

80 ซอยนักกีฬาแหลมทอง 3 แขวงหิบบ้าง เขตสะพานสูง กรุงเทพฯ 10250
80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250

Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกลักษณ์เลขที่ ๖-๒๐๖

SO₂ Analyzer Verification Test Report

Calibration Report No.: 6902006

Page:1/1

Calibrated Date: 1-Feb-26

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO.,43C	Manufacturer THERMO S/N: SPTE43CSO65580
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Calibration System

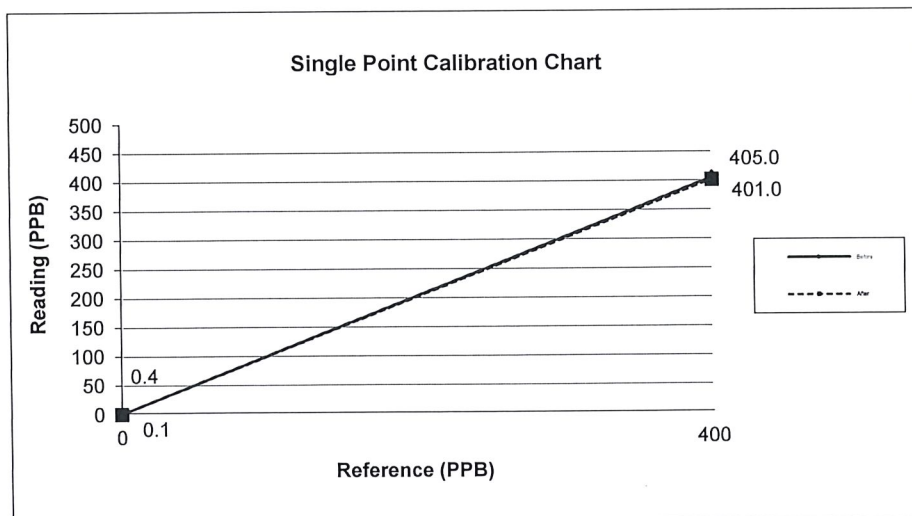
Calibrator Unit	Standard Gas
Dilutor Model Thermo 146C S/N: 146C-70368-365 ZERO AIR Generator Thermo Mode 111 S/N: 111-71984-370	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.2 °C

Humidity: 50 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.4	0.4	400.0	405	1.3
After	0.0	0.1	0.1	400.0	401	0.3





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S. P. J. SCIENTIFIC COMPANY LIMITED

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80 Soi Nakkilalaemthong 3, Thab Chang, Saphansoong, Bangkok 10250
Tel. 0 2735-7520-2 E-mail: spj.sci@gmail.com ห้องปฏิบัติการวิเคราะห์เอกลักษณ์ที่ ว-๒๐๖

MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-02-2026

S/N : SPTE43CSO65580

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	48.5	48.5
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

Calibrate By :



Sirirat Poonlak

Date:

1-Feb-26

Approve By :



Direk Chanrueng

Date:

1-Feb-26



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0318

MTC No. EEL. BP. 10/0468

CALIBRATION CERTIFICATE

Submitted by : S.P.J. Scientific Company Limited.

Address : 80 Soi Nakkilalacmthong 3, Thap Chang, Saphansoong, Bangkok, 10250.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Tenmars

Model : TM-100

Serial No. : 200703994

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 10 Apr. 2026

Date of Calibration : 21 Apr. 2026

1 / 3

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office

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Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

(66) 08 3219 9440

E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

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Bangkok 10900, Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0318

MTC No. EEL. BP. 10/0468

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 HzAcoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0°C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	94.18	0.18	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	985.8	-14.2	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.50	± 0.60	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 21 Apr. 2026

2 / 3



The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office

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Fax. (66) 0 2577 9009

Office/Laboratory

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Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0318

MTC No. EEL. BP. 10/0468

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 HzAcoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	114.12	0.12	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	981.4	-18.6	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.44	± 0.60	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

...
(Mr. Weerachai Deechaiyae)

Approved by :

...
(Mr. Pongsa Khaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011268041001494001

Date of Calibration : 21 Apr. 2026

Date of Issue : 21 Apr. 2026

End of Certificate

3 / 3

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office

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(66) 08 1889 6827



Inctech Metrological Center Co.Ltd.

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,
Saimai, Bangkok 10220, Thailand

Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : ME26-1240

Page : 1 of 2

Customer : S.P.J. Scientific Co.,Ltd.

Address : 80 Soi Nakkila Lam Thong 3, Thap Chang, Saphansoong, Bangkok 10250

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222333

Identification No. : N/A

Calibration Place : Acoustical Laboratory (IMC)

Order No. : 0459/26

Received date : Jan 30, 2026

Calibration date : Jan 31, 2026

Environment Condition :

Temperature : (23 +/- 3) °C

Humidity : (50 +/- 15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-ME-004*.
According to comparison with Sound Level Calibrator.
The calibration methods based on IEC 60942 : 2017.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Sound Level Calibrator	336	080807177	EEL. BP. 22/1068	Oct 11, 2026

The effect that the result relate only to the items Calibrated. It was found accurate as shown on date and place of calibration only

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%

Calibrated by : Miss Nisachon Praiyong

Approved by

Issue date : Feb 02, 2026

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate No. : ME26-1240

Page : 2 of 2

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 100 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 100 dB	93.88	94.0	0.12	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 110 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 110 dB	93.88	94.0	0.12	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 30 dB to 120 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
30 dB to 120 dB	93.88	94.1	0.22	0.6
	113.84	113.9	0.06	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 40 dB to 130 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
40 dB to 130 dB	93.88	94.0	0.12	0.6
	113.84	114.0	0.16	0.6

UUC* = Unit Under Calibration

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Inctech Metrological Center Co.Ltd.

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : ME26-1241

Page : 1 of 2

Customer : S.P.J. Scientific Co.,Ltd.

Address : 80 Soi Nakkila Lam Thong 3, Thap Chang, Saphansoong, Bangkok 10250

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222334

Identification No. : N/A

Calibration Place : Acoustical Laboratory (IMC)

Order No. : 0459/26

Received date : Jan 30, 2026

Calibration date : Jan 31, 2026

Environment Condition :

Temperature : (23 +/- 3) °C

Humidity : (50 +/- 15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-ME-004.
According to comparison with Sound Level Calibrator.
The calibration methods based on IEC 60942 : 2017.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Sound Level Calibrator	336	080807177	EEL. BP. 22/1068	Oct 11, 2026

The effect that the result relate only to the items Calibrated. It was found accurate as shown on date and place of calibration only

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

The reported expandad uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%



Calibrated by : Miss Nisachon Praiyong

Approved by

(Mr. Suthichai Chanthipa)

Issue date : Feb 02, 2026

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate No. : ME26-1241

Page : 2 of 2

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 100 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 100 dB	93.88	94.1	0.22	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 110 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 110 dB	93.88	94.0	0.12	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 30 dB to 120 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
30 dB to 120 dB	93.88	93.9	0.02	0.6
	113.84	113.9	0.06	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 40 dB to 130 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
40 dB to 130 dB	93.88	93.9	0.02	0.6
	113.84	114.0	0.16	0.6

UUC* = Unit Under Calibration

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : ME26-1242

Page : 1 of 2

Customer : S.P.J. Scientific Co.,Ltd.

Address : 80 Soi Nakkila Lam Thong 3, Thap Chang, Saphansoong, Bangkok 10250

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 222335

Identification No. : N/A

Calibration Place : Acoustical Laboratory (IMC)

Order No. : 0459/26

Received date : Jan 30, 2026

Calibration date : Jan 31, 2026

Environment Condition :

Temperature : (23 +/- 3) °C

Humidity : (50 +/- 15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-ME-004.

According to comparison with Sound Level Calibrator.

The calibration methods based on IEC 60942 : 2017.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Sound Level Calibrator	336	080807177	EEL. BP. 22/1068	Oct 11, 2026

The effect that the result relate only to the items Calibrated. It was found accurate as shown on date and place of calibration only

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%



Calibrated by : Miss Nisachon Praiyong

Approved

(Mr.Suthichai Chanthipa)

Issue date : Feb 02, 2026

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Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate No. : ME26-1242

Page : 2 of 2

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 100 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 100 dB	93.88	94.0	0.12	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 110 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 110 dB	93.88	93.9	0.02	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 30 dB to 120 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
30 dB to 120 dB	93.88	93.9	0.02	0.6
	113.84	113.9	0.06	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 40 dB to 130 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
40 dB to 130 dB	93.88	93.9	0.02	0.6
	113.84	114.0	0.16	0.6

UUC* = Unit Under Calibration

-oOo-



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ISO/IEC 17025 : 2017

Certificate of Calibration

Certificate No. : ME26-1468

Page : 1 of 2

Customer : S.P.J. Scientific Co.,Ltd.

Address : 80 Soi Nakkila Lam Thong 3, Thap Chang, Saphansoong, Bangkok 10250

Description : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 212069

Identification No. : N/A

Calibration Place : Acoustical Laboratory (IMC)

Order No. : 1052/26

Received date : Mar 27, 2026

Calibration date : Mar 28, 2026

Environment Condition :

Temperature : (23 +/- 3) °C

Humidity : (50 +/- 15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-ME-004*.
According to comparison with Sound Level Calibrator.
The calibration methods based on IEC 60942 : 2017.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Sound Level Calibrator	336	080807177	EEL. BP. 22/1068	Oct 11, 2026

The effect that the result relate only to the items Calibrated. It was found accurate as shown on date and place of calibration only

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of not less than 95%



Calibrated by : Miss Nisachon Praiyong

Approved by : 
(Mr.Suthichai Chanthipa)

Issue date : Mar 30, 2026

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ISO/IEC 17025 : 2017

Certificate No. : ME26-1468
Page : 2 of 2

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 100 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 100 dB	93.88	94.1	0.22	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 20 dB to 110 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
20 dB to 110 dB	93.88	93.9	0.02	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 30 dB to 120 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
30 dB to 120 dB	93.88	93.9	0.02	0.6
	113.84	113.7	-0.14	0.6

Calibration Result : Without Adjustment
Function : Sound Level Measurement at 1 kHz
Range : 40 dB to 130 dB

Range of UUC*	Standard Value (dB)	UUC* Reading (dB)	UUC* Error (dB)	Uncertainty of Measurement (+/- dB)
40 dB to 130 dB	93.88	93.9	0.02	0.6
	113.84	113.8	-0.04	0.6

UUC* = Unit Under Calibration

-oOo-



CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasert Manukil 29 Yaek 4, Prasert Manukil Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM22391/UM22391
CLID. NO.	:	262002367
JOB CONTROL NO.	:	260227023412
CALIBRATION SERVICE	:	☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.J. SCIENTIFIC COMPANY LIMITED
80 SOI NUKKREELALEMTHONG 3,
THAPCHANG SAPHANSOONG, BANGKOK 10250

DATE OF RECEIVED : 27 February 2026

DATE OF ISSUED : 03 March 2026

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
03 March 2026

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the
International System of Units (SI)

Certificate No. Q26024421

F3-011-05/12-23

page 1 of 3

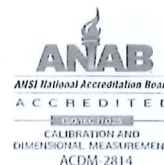


@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM22391/UM22391
DATE OF CALIBRATION : 28 February 2026

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. US36044686.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2625 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0129-24, Due Date 20 November 2026 .
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2026 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0056-24, Due Date 14 December 2026 .

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q26024421

F3-011-05/12-23

page 2 of 3



@clccalibration



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
5.0	160 Hz	peak	5.000	5.023	-0.023	1.6
10.0	160 Hz		10.000	10.199	-0.199	1.1
15.0	160 Hz		15.000	15.132	-0.132	1.0
20.0	160 Hz		20.000	20.212	-0.212	0.9
30.0	160 Hz		30.000	30.144	-0.144	0.9

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 2 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q26024421

F3-011-05/12-23

page 3 of 3



@clc calibration



CALIBRATION LABORATORY Co., LTD.

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Tel.02-578-0353-4 Fax.02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11162/UM11162
CLID. NO. : 252102369
JOB CONTROL NO. : 260304028050
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.J. SCIENTIFIC COMPANY LIMITED
80 SOI NUKKREELALEMTHONG 3,
THAPCHANG SAPHANSOONG, BANGKOK 10250

DATE OF RECEIVED : 04 March 2026

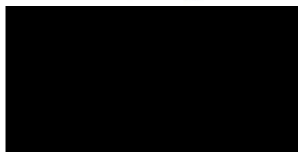
DATE OF ISSUED : 09 March 2026

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong

Calibration Engineer

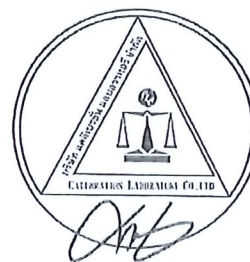


Approved By :

Mongkol Yotsoontorn

Authorized Signatory

09 March 2026



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the
International System of Units (SI)

Certificate No. Q26028050

F3-011-05/12-23

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Road, Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM11162/UM11162
DATE OF CALIBRATION	:	05 March 2026

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. US36044686.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0037-25, Due Date 22 July 2026.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0133-25, Due Date 19 November 2026.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0054/25, Due Date 11 June 2026.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q26028050

F3-011-05/12-23

page 2 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
5.0	160 Hz	peak	5.000	5.029	-0.029	2.1
10.0	160 Hz		10.000	10.203	-0.203	1.8
15.0	160 Hz		15.000	15.245	-0.245	1.7
20.0	160 Hz		20.000	20.316	-0.316	1.6
30.0	160 Hz		30.000	30.395	-0.395	1.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 018 Page 2 of 73

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q26028050

F3-011-05/12-23

page 3 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Road, Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM17691/UM17691
CLID. NO. : 252102369
JOB CONTROL NO. : 260304028050
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.J. SCIENTIFIC COMPANY LIMITED
80 SOI NUKKREELALEMTHONG 3,
THAPCHANG SAPHANSOONG, BANGKOK 10250

DATE OF RECEIVED : 04 March 2026

DATE OF ISSUED : 09 March 2026

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong
Calibration Engineer



Approved By :

Mongkol Yotsoontorn
Authorized Signatory
09 March 2026



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the
International System of Units (SI)

Certificate No. Q26028050

F3-011-05/12-23

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353 4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM17691/UM17691
DATE OF CALIBRATION	:	05 March 2026

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. US36044686.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0037-25, Due Date 22 July 2026.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0133-25, Due Date 19 November 2026.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0054/25, Due Date 11 June 2026.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q26028050

F3-011-05/12-23





CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Road, Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	$\pm$ (% of rdg.)
5.0	160 Hz	peak	5.000	5.029	-0.029	2.1
10.0	160 Hz		10.000	10.203	-0.203	1.8
15.0	160 Hz		15.000	15.245	-0.245	1.7
20.0	160 Hz		20.000	20.316	-0.316	1.6
30.0	160 Hz		30.000	30.395	-0.395	1.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 018 Page 2 of 73

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q26028050

F3-011-05/12-23

page 3 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Road, Ladphrao, Bangkok 10230
Tel. 02-578 0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM17692/UM17692
CLID. NO. : 252102370
JOB CONTROL NO. : 260304028051
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.J. SCIENTIFIC COMPANY LIMITED
80 SOI NUKKREELALEMTHONG 3,
THAPCHANG SAPHANSOONG, BANGKOK 10250

DATE OF RECEIVED : 04 March 2026

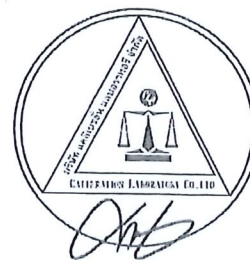
DATE OF ISSUED : 09 March 2026

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong

Calibration Engineer



Approved By :

Mongkol Yotsoontorn

Authorized Signatory

09 March 2026

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q26028051

F3-011-05/12-23

page 1 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Road, Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM17692/UM17692
DATE OF CALIBRATION	:	05 March 2026

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. US36044686.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0037-25, Due Date 22 July 2026.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0133-25, Due Date 19 November 2026.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0054/25, Due Date 11 June 2026.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q26028051

F3-011-05/12-23

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
5.0	160 Hz	peak	5.000	4.944	+0.056	2.1
10.0	160 Hz		10.000	9.886	+0.114	1.8
15.0	160 Hz		15.000	14.724	+0.276	1.7
20.0	160 Hz		20.000	19.899	+0.101	1.6
30.0	160 Hz		30.000	29.972	+0.028	1.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 018 Page 2 of 73

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q26028051

F3-011-05/12-23

page 3 of 3



@clcalibration



S.P.J. Scientific Co.,Ltd
PM-10 Sampler Calibration
(Dickson recorder/1925)

SITE

ที่ตั้งสถานี (Station Location) _____ สำนักงานเขตคลองสาน _____ วันที่ 23/5/2569
 ประเภทเครื่อง (TSP หรือ PM-10) _____ PM-10 _____ เวลา 10.00

CONDITIONS

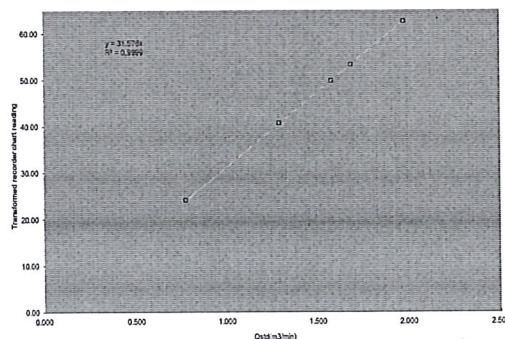
ความกดของอากาศ (in Hg): _____ 29.85 ความกดของอากาศ (mm Hg): _____ 758
 อุณหภูมิบรรยากาศ (deg C): _____ 33.9 อุณหภูมิบรรยากาศ (deg K): _____ 307
 ความกดของอากาศ (in Hg): _____ 29.85 ความกดของอากาศ (mm Hg): _____ 758
 อุณหภูมิเฉลี่ย (deg C): _____ 33.9 อุณหภูมิเฉลี่ย (deg K): _____ 307

CALIBRATION ORIFICE

Make: _____ Tisch _____ Qstd Slope: _____ 2.02255
 Model: _____ TE-5025A _____ Qstd Intercept: _____ -0.00092
 Orifice transfer standard Serial#: _____ 9833620 _____ Date Certified: _____ Original

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	IT (corrected)	LINEAR REGRESSION
1	16.50	1.977	60.0	59.05	62.54	Slope = 31.8367
2	12.00	1.686	56.0	55.12	53.27	Intercept = -0.4099
3	10.50	1.577	52.0	51.18	49.81	Corr. coeff.= 0.9824
4	7.00	1.288	44.0	43.31	40.59	
5	2.50	0.770	22.0	21.65	24.10	Observations: 5



Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(Pa/Pstd)(Tstd/Ta)) - b]$$

Qstd = standard flow rate

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I)[\text{Sqrt}(298/Tav)(Pav/760)] - b]$$

$$1/m[(I)[\text{Sqrt}(298/Tav)(Pav/760)] - b]$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure