

ภาคผนวก จ



เอกสารสอบเทียบเครื่องมือวิเคราะห์

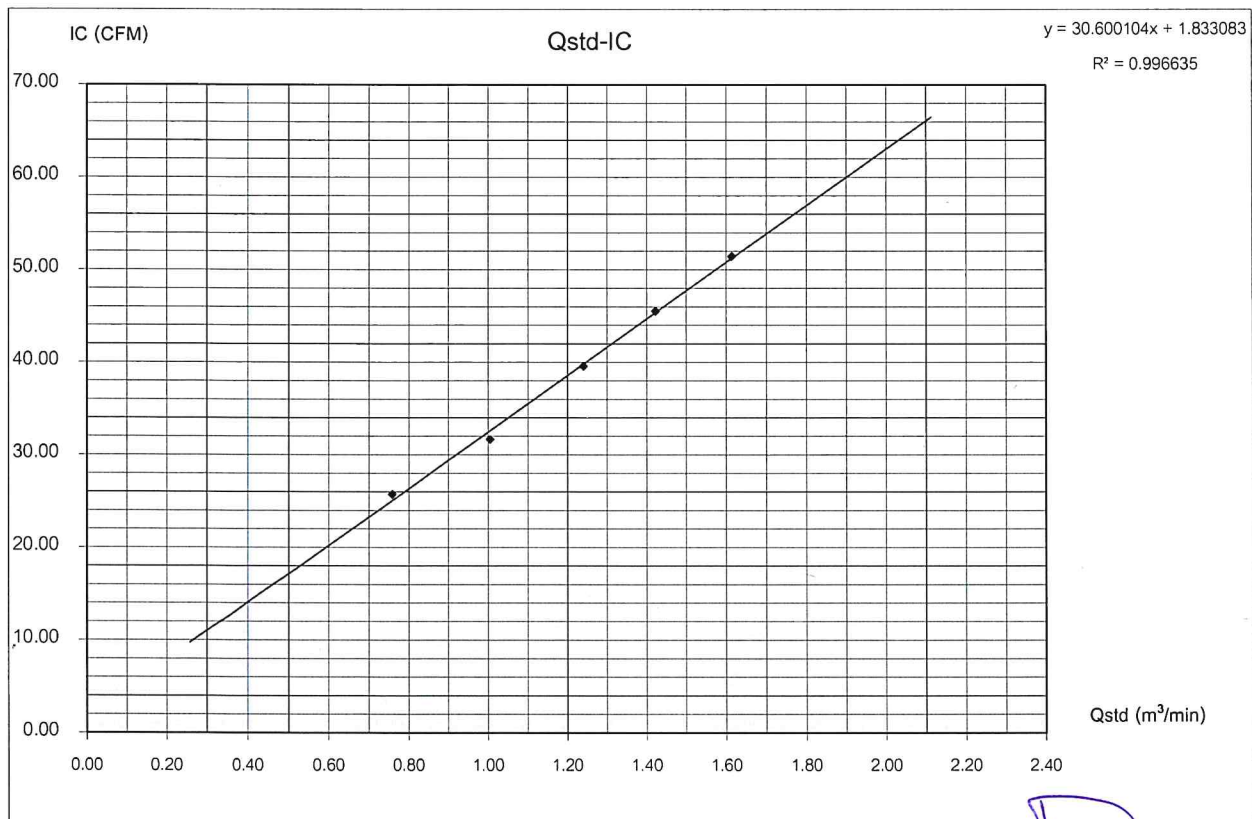
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|---|-------------|--------------------------|----------|---------------|--------------------|
| Sampler Location | | | | Date | June 8, 2020 |
| โรงพยาบาลส่งเสริมสุขภาพตำบล บ้านคลองหนึ่ง | | | | Start Time | 11:50 AM |
| Sampler Number | TSP No.A18 | Transfer Standard Type | Orifice | Stop Time | 12:00 PM |
| Instrument Model | HIVOL-BBCBE | Calibrator Model | TE-5025A | Calibrated By | Mr.Nigul Phokhamla |
| Motor Serial Number | 2014-03 | Calibrator Serial Number | 3362 | | |
| Recorder Serial Number | 7373 | | | | |

| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|--------------------------------------|---|----------|-------------------|---|---|---|--|---------------------------|---------------------|------------------|-------------|
| | Pressure Drop Across Orifice (inH ₂ O) | | | $[\Delta H_{2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | Qstd = (1/m)[(A-b)] (m ³ /min) | Sample Flow Rate Indication (ft ³ /min) | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | (*K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.2 | 1.2 | 2.4 | 1.53332 | 0.75819 | 26.0 | 25.73 | 303.0 | 757.0 | | |
| 7 | 2.1 | 2.1 | 4.2 | 2.02840 | 1.00452 | 32.0 | 31.67 | 303.0 | 757.0 | | |
| 10 | 3.2 | 3.2 | 6.4 | 2.50391 | 1.24112 | 40.0 | 39.59 | 303.0 | 757.0 | | |
| 13 | 4.2 | 4.2 | 8.4 | 2.86858 | 1.42257 | 46.0 | 45.53 | 303.0 | 757.0 | | |
| 18 | 5.4 | 5.4 | 10.8 | 3.25267 | 1.61367 | 52.0 | 51.47 | 303.0 | 757.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 757.0 | | |
| 1 | Slope (m) | | | 2.00980 | Linear Equation | | | r ² | 0.996635 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.00951 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9983161 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99999 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | | 0.97961612 |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | | 0.989755586 |

COMMENT

Andersen Instruments, Inc.



Checked By

Prayun

(Mr. Prayun Detkla)

Technician



Approved By

Mr. Panupon Podang

(Mr. Panupon Podang)

Environmental Scientist

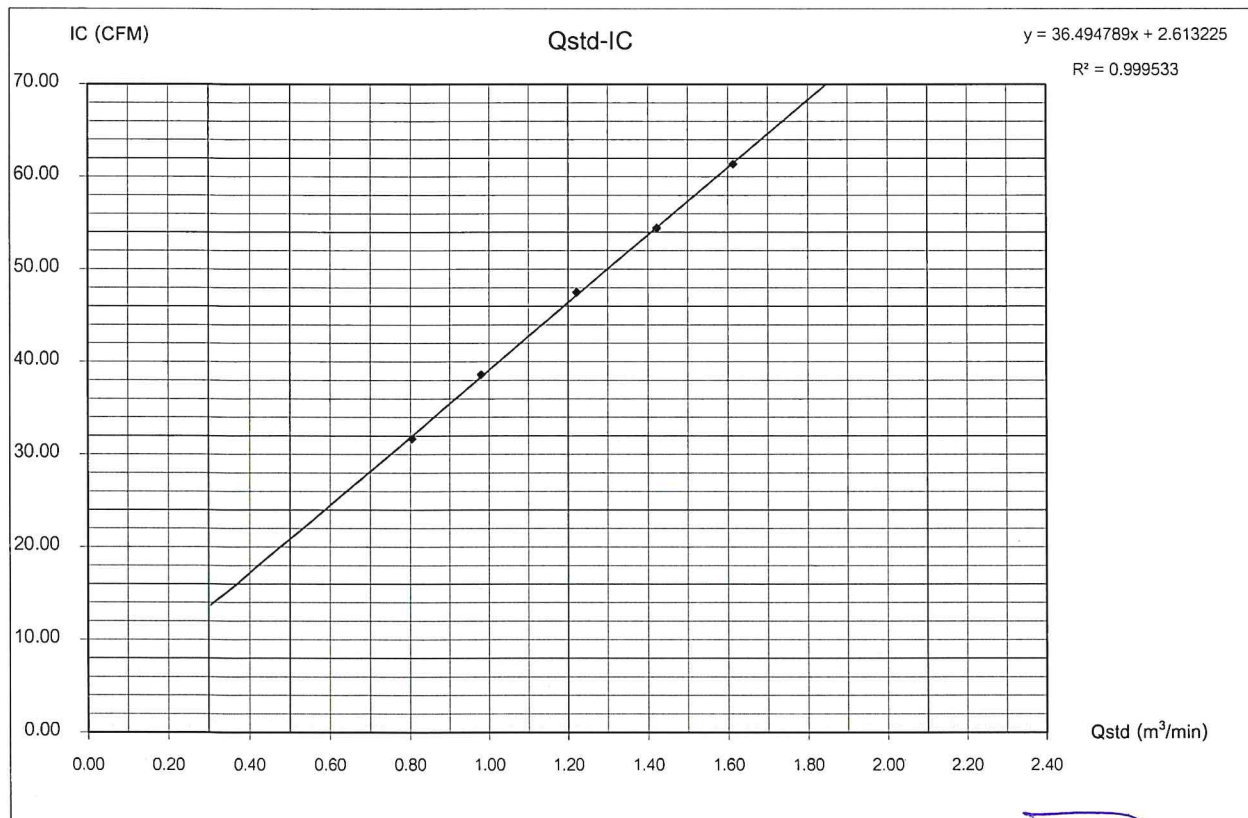
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|---|-------------|--------------------------|----------|---------------|--------------------|
| Sampler Location | | | | Date | June 8, 2020 |
| โรงพยาบาลส่งเสริมสุขภาพตำบล บ้านคลองหนึ่ง | | | | Start Time | 11:40 AM |
| Sampler Number | PM-10 No.18 | Transfer Standard Type | Orifice | Stop Time | 11:50 AM |
| Instrument Model | HIVOL-BMBBE | Calibrator Model | TE-5025A | Calibrated By | Mr.Nigul Phokhamla |
| Motor Serial Number | 2139 | Calibrator Serial Number | 3362 | | |
| Recorder Serial Number | 2390 | | | | |

| Plate | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric | Start | Stop |
|--------------------------------------|---|----------|-------------------|--|--|---|---|---------------------------|----------------------|------------------|-------|
| No. | Pressure Drop Across Orifice (inH ₂ O) | | | [ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2} | Qstd = (1/m)[(A-b)] (m ³ /min) | ample Flow Rate Indication (l ³ /min) | IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2} | ("K = °C+273) | Pressure (mmHg) | Meter | Meter |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62633 | 0.80447 | 32.0 | 31.67 | 303.0 | 757.0 | | |
| 7 | 2.0 | 2.0 | 4.0 | 1.97951 | 0.98020 | 39.0 | 38.60 | 303.0 | 757.0 | | |
| 10 | 3.1 | 3.1 | 6.2 | 2.46447 | 1.22150 | 48.0 | 47.51 | 303.0 | 757.0 | | |
| 13 | 4.2 | 4.2 | 8.4 | 2.86858 | 1.42257 | 55.0 | 54.44 | 303.0 | 757.0 | | |
| 18 | 5.4 | 5.4 | 10.8 | 3.25267 | 1.61367 | 62.0 | 61.36 | 303.0 | 757.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 757.0 | | |
| 1 | Slope (m) | | | 2.00980 | Linear Equation | | | r ² | 0.999533 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.00951 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9997665 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99999 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | 0.97961612 | |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.989755586 | |

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician

Approved By

(Mr. Panupon Podang)
Environmental Scientist

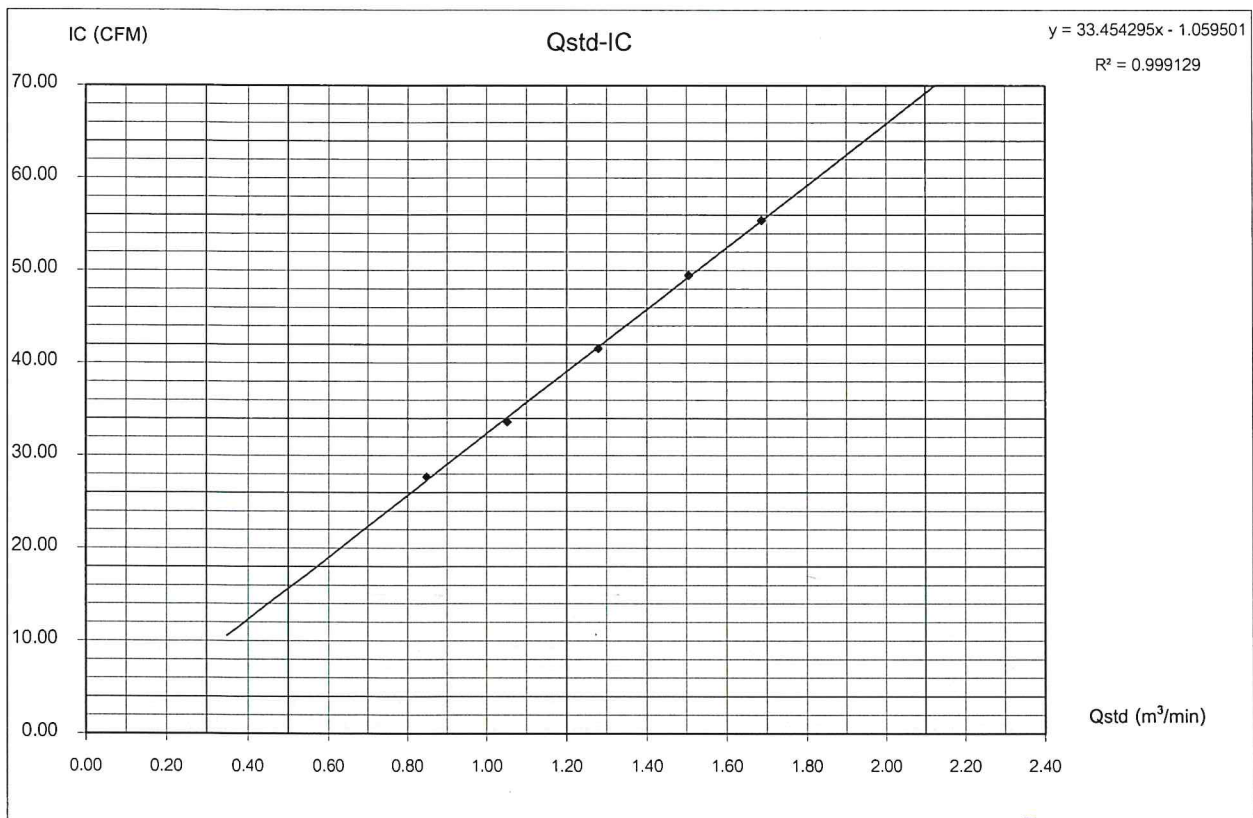
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|--------------------------------------|-------------|--------------------------|----------|---------------|--------------------|
| Sampler Location | | | | Date | June 8, 2020 |
| บ้านเลขที่ 60 บ้านคลองสอง หมู่ที่ 12 | | | | Start Time | 2:30 PM |
| Sampler Number | TSP No.A29 | Transfer Standard Type | Orifice | Stop Time | 2:40 PM |
| Instrument Model | HIVOL-BBCBE | Calibrator Model | TE-5025A | Calibrated By | Mr.Nigul Phokhamla |
| Motor Serial Number | 2014-02 | Calibrator Serial Number | 3362 | | |
| Recorder Serial Number | 2135 | | | | |

| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|--------------------------------------|---|----------|-------------------|--|--|---|---|---------------------------|---------------------|------------------|------------|
| | Pressure Drop Across Onifice (inH ₂ O) | | | $[\Delta H_o(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | Qstd = (1/m)[(A-b)] (m ³ /min) | Sample Flow Rate Indication (ft ³ /min) | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ (°K = °C+273) | (mmHg) | | | |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.5 | 1.5 | 3.0 | 1.71431 | 0.84824 | 28.0 | 27.71 | 303.0 | 757.0 | | |
| 7 | 2.3 | 2.3 | 4.6 | 2.12279 | 1.05149 | 34.0 | 33.65 | 303.0 | 757.0 | | |
| 10 | 3.4 | 3.4 | 6.8 | 2.58097 | 1.27946 | 42.0 | 41.57 | 303.0 | 757.0 | | |
| 13 | 4.7 | 4.7 | 9.4 | 3.03453 | 1.50514 | 50.0 | 49.49 | 303.0 | 757.0 | | |
| 18 | 5.9 | 5.9 | 11.8 | 3.39992 | 1.68694 | 56.0 | 55.43 | 303.0 | 757.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 757.0 | | |
| 1 | Slope (m) | | | 2.00980 | Linear Equation | | | r ² | 0.999129 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.00951 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9995644 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99999 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | 0.97961612 | |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.989755586 | |

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician



Approved By

(Mr. Panupon Podang)
Environmental Scientist

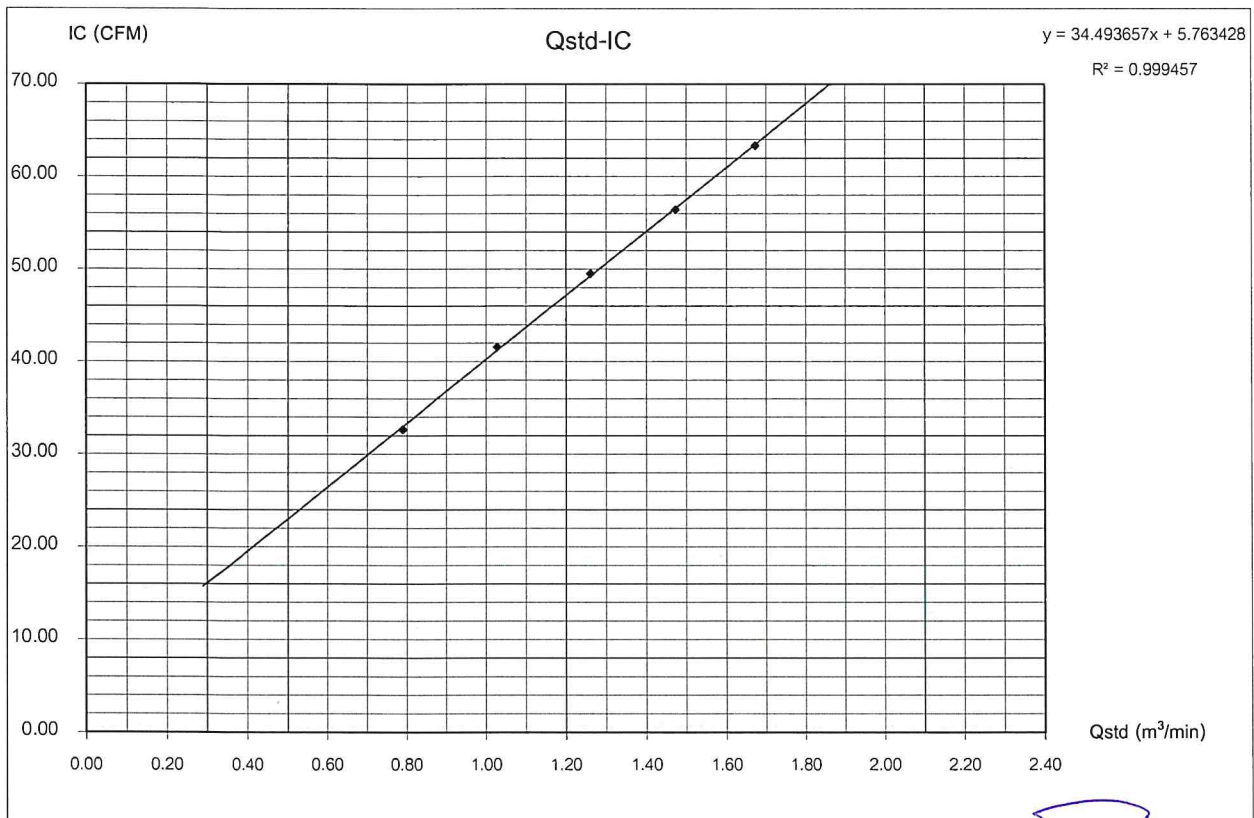
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|--------------------------------------|-------------|--------------------------|----------|---------------|--------------------|
| Sampler Location | | | | Date | June 8, 2020 |
| บ้านเลขที่ 60 บ้านคลองสอง หมู่ที่ 12 | | | | Start Time | 2:20 PM |
| Sampler Number | PM-10 No.30 | Transfer Standard Type | Onfice | Stop Time | 2:30 PM |
| Instrument Model | HIVOL-BMBBE | Calibrator Model | TE-5025A | Calibrated By | Mr.Nigul Phokhamla |
| Motor Serial Number | 2208 | Calibrator Serial Number | 3362 | | |
| Recorder Serial Number | 2616 | | | | |

| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric | Start | Stop | |
|--------------------------------------|---|----------|-------------------|---|---|-----------------------------|--|---------------------|---------------------------|------------------|------------|-------------|
| | Pressure Drop Across Orifice (inH ₂ O) | | | $[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ | sample Flow Rate Indication | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | | Pressure | Meter | Meter | |
| | Positive | Negative | ΔH_{H_2O} | | (m ³ /min) | (ft ³ /min) | | (°K = °C+273) | (mmHg) | | | |
| 5 | 1.3 | 1.3 | 2.6 | 1.59593 | 0.78934 | 33.0 | 32.66 | 303.0 | 757.0 | | | |
| 7 | 2.2 | 2.2 | 4.4 | 2.07613 | 1.02827 | 42.0 | 41.57 | 303.0 | 757.0 | | | |
| 10 | 3.3 | 3.3 | 6.6 | 2.54273 | 1.26043 | 50.0 | 49.49 | 303.0 | 757.0 | | | |
| 13 | 4.5 | 4.5 | 9.0 | 2.96927 | 1.47266 | 57.0 | 56.42 | 303.0 | 757.0 | | | |
| 18 | 5.8 | 5.8 | 11.6 | 3.37099 | 1.67254 | 64.0 | 63.34 | 303.0 | 757.0 | | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 757.0 | | | |
| 1 | Slope (m) | | | 2.00980 | Linear Equation | | | r ² | 0.999457 | Pstd(mmHg) | 760.0 | |
| 2 | Intercept (b) | | | 0.00951 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9997285 | T _{NTP} | 298.0 | |
| 3 | Correlation Coefficient (r) | | | 0.99999 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | | 0.97961612 | |
| Result | | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | | 0.989755586 |

COMMENT

Andersen Instruments, Inc.



Checked By

(Mr. Prayun Detkla)
Technician



Approved By

(Mr. Panupon Podang)
Environmental Scientist



RECALIBRATION

DUE DATE:

July 26, 2022

Certificate of Calibration

Calibration Certification Information

Cal. Date: July 26, 2021 Rootsmeter S/N: 438320 Ta: 297 °K
Operator: Jim Tisch Pa: 749.3 mm Hg
Calibration Model #: TE-5025A Calibrator S/N: 3362

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1 | 1 | 2 | 1 | 1.4180 | 3.2 | 2.00 |
| 2 | 3 | 4 | 1 | 0.9940 | 6.4 | 4.00 |
| 3 | 5 | 6 | 1 | 0.8890 | 8.0 | 5.00 |
| 4 | 7 | 8 | 1 | 0.8460 | 8.8 | 5.50 |
| 5 | 9 | 10 | 1 | 0.6970 | 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) |
|-------------|---------------|--|-----------|-------------|---|
| 0.9850 | 0.6947 | 1.4066 | 0.9957 | 0.7022 | 0.8904 |
| 0.9808 | 0.9867 | 1.9892 | 0.9915 | 0.9974 | 1.2592 |
| 0.9787 | 1.1009 | 2.2240 | 0.9893 | 1.1128 | 1.4078 |
| 0.9776 | 1.1556 | 2.3326 | 0.9883 | 1.1682 | 1.4765 |
| 0.9723 | 1.3950 | 2.8132 | 0.9829 | 1.4102 | 1.7807 |
| QSTD | m= | 2.00980 | QA | m= | 1.25850 |
| | b= | 0.00951 | | b= | 0.00602 |
| | r= | 0.99999 | | r= | 0.99999 |

Calculations

| | | | |
|--|---|-----|--|
| Vstd= | $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$ | Va= | $\Delta Vol((Pa-\Delta P)/Pa)$ |
| Qstd= | Vstd/ΔTime | Qa= | Va/ΔTime |
| 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



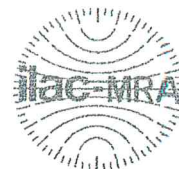
PLAY SOLUTION

PLAY SOLUTION TECHNOLOGY COMPANY LIMITED

179/75 Nawong Pracha Pattana Road, Sikan, Donmuang, Bangkok 10210

Tel.: +66 2 011 0505, Fax: +66 2 010 7700

www.playsotec.com



NSC-TISI-TIS17025
CALIBRATION 0378

CERTIFICATE OF CALIBRATION

Customer

Certificate no. PST-0001-22

Page no. 1 of 3

Company : ENVIRONMENT RESEARCH & TECHNOLOGY CO.,LTD.
Address : 25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road, Toongsonghong,
City / Province : Laksi, Bangkok
Zip/Postal : 10210

Device

Equipment : Electronic Balance Capacity : 220 g
Manufacturer : METTLER TOLEDO Readability : 0.0001 g
Model : AB204-S ID No. : ERTC-L-In-0048
Serial No. : 1123103723

Environment Conditions

Location of Calibration : Calibration Laboratory at Play Solution Technology Co.,Ltd
Ambient Temperature : 25.9 (°C)
Relative Humidity : 53.1 (%RH)
Barometric Pressure : 1011.5 (mba)
Calibration Procedure : This Calibration was conducted by using In-House calibration procedure number CP-M-001 base on "UKAS LAB 14"
Comment :

Date of Receipt : January 4, 2022

Date of Calibration : January 4, 2022

Issue Date : January 4, 2022

Calibrated by : Kittichai R.
(Kittichai Rattanatham)
Calibrator

Approved by : K. R.
(Kittichai Rattanatham)
Approved Signature

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

This Certificate is issued in accordance with the conditions of accreditation granted by Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and is traceability to recognize national standards and to the unit of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval prior written approval of the calibration center, Play Solution Technology Co.,Ltd



PLAY SOLUTION

PLAY SOLUTION TECHNOLOGY COMPANY LIMITED

179/75 Nawong Pracha Pattana Road, Sikan, Donmuang, Bangkok 10210

Tel.: +66 2 011 0505, Fax: +66 2 010 7700

www.playsotec.com



CERTIFICATE OF CALIBRATION

Result of Calibration : Without Adjustment

Certificate no. PST-0001-22

Page no. 2 of 3

1. Repeatability

| Weighing Rang 1 (g) | Norminal Value (g) | Standard Deviation (g) |
|---------------------|--------------------|------------------------|
| Max.capacity 220 | 200 | 0.00005 |

| Weighing Rang 2 (g) | Norminal Value (g) | Standard Deviation (g) |
|---------------------|--------------------|------------------------|
| Max.capacity | | |

2. Linearity, Departure of Indication from nominal value

Weighing Range 1

| Normal Value (g) | Standard Value (g) | Indication (g) | Error of Indication (g) | Expanded Uncertainty (g) | Factor k |
|------------------|--------------------|----------------|-------------------------|--------------------------|----------|
| 0.001 | 0.00100 | 0.0010 | 0.0000 | 0.00011 | 2.07 |
| 0.01 | 0.01000 | 0.0100 | 0.0000 | 0.00011 | 2.07 |
| 0.1 | 0.10001 | 0.1000 | 0.0000 | 0.00011 | 2.07 |
| 1 | 1.00001 | 1.0000 | 0.0000 | 0.00011 | 2.06 |
| 5 | 5.00002 | 5.0000 | 0.0000 | 0.00011 | 2.06 |
| 10 | 10.00001 | 10.0000 | 0.0000 | 0.00011 | 2.05 |
| 50 | 50.00003 | 50.0000 | 0.0000 | 0.00013 | 2.03 |
| 100 | 100.00004 | 100.0001 | 0.0001 | 0.00018 | 2.00 |
| 150 | 150.00007 | 150.0001 | 0.0000 | 0.00024 | 2.00 |
| 200 | 200.00006 | 200.0002 | 0.0001 | 0.00031 | 2.00 |
| | | | | | |
| | | | | | |

Weighing Range 2

| Normal Value (g) | Standard Value (g) | Indication (g) | Error of Indication (g) | Expanded Uncertainty (g) | Factor k |
|------------------|--------------------|----------------|-------------------------|--------------------------|----------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

The given extended measurement uncertainty is the standard uncertainty of the measurement multiplied by cover factor ,k as per listed in table above, which corresponds to a confidene level of about 95%



PLAY SOLUTION

PLAY SOLUTION TECHNOLOGY COMPANY LIMITED

179/75 Nawong Pracha Pattana Road, Sikan, Donmuang, Bangkok 10210

Tel.: +66 2 011 0505, Fax: +66 2 010 7700

www.playsotec.com



CERTIFICATE OF CALIBRATION

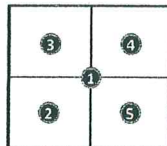
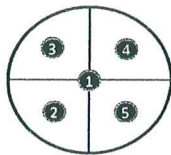
Result of Calibration

Certificate no. PST-0001-22

Page no. 3 of 3

3. Eccentricity

Test load at least 1/3 of the maximum capacity, typically placed between 1/2 and 1/3 of the distance from the centre of the load receptor to the edge.



Weighing Range 1

Test Load : 100 (g)

| Position | Indication (g) |
|---------------|----------------|
| 1 | 100.0001 |
| 2 | 100.0001 |
| 3 | 100.0002 |
| 4 | 100.0001 |
| 5 | 100.0002 |
| Max.Deviation | 0.0001 |

Weighing Range 2

Test Load : (g)

| Position | Indication (g) |
|---------------|----------------|
| | |
| | |
| | |
| | |
| | |
| Max.Deviation | |

Standard methode

The calibration was performed by using calibration laboratory's in-house calibration methode : CP-M-001 based on "UKAS LAB 14 : Calibration of weighing machine" : edition 6 | October 2019

Reference standards instrument

| Instrument | OIML Class | S/N | Certificate No. | Due Date |
|---------------------|------------|------------|-----------------|------------------|
| Standard Weight Set | E2 | 4000021952 | MM-0183-20 | December 8, 2022 |
| Standard Weight Set | - | - | - | - |
| Standard Weight Set | - | - | - | - |
| Standard Weight Set | - | - | - | - |

Measurement Uncertainty

The given measurement uncertainty is the standard of the measurement multiplied by an extension factor k which corresponds to a confidence level of about 95% for a normal distribution. The standard uncertainty was calculated according to M3003

Traceability : The measurement is traceable to national standard, which realize the physical unit of measurement (SI)

- National institute of Metrology (Thailand) through Calibration Laboratory

END OF REPORT



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 6 August, 2021

Certification No. 370/21

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC90504A18 ID No. : No.14

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :

Watcharapol Subwat

Signed :

Pisood Promsut

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 370/21

6 August, 2021

Page : 2 of 2

| Standard Ultrasonic Anemometer | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|-----------------------------------|--------------------|--------|----------|-------------------|------------|
| | Pressure | Vacumm | Pressure | Velocity | Correction |
| m/sec | inches | inches | hPa | m/sec | m/sec |
| 1.00 | - | - | - | 0.9 | 0.10 |
| 3.02 | - | - | - | 2.7 | 0.32 |
| 5.00 | - | - | - | 4.5 | 0.50 |
| 7.04 | - | - | - | 6.3 | 0.74 |
| 9.02 | - | - | - | 8.5 | 0.52 |
| 11.01 | - | - | - | 10.3 | 0.71 |
| 13.01 | - | - | - | 12.5 | 0.51 |
| 15.01 | - | - | - | 14.3 | 0.71 |
| 17.02 | - | - | - | 16.5 | 0.52 |
| 20.02 | - | - | - | 19.3 | 0.72 |

| Wind Aloft Plotting Board. | |
|--|-----------------------|
| US.DEPARTMENT OF COMMERCE WEATHER BUREAU | |
| WIND DIRETION | TESTED WIND DIRECTION |
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by :

Wacharapol

Mr. Wacharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 16 August, 2021

Certification No. 383/21

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC60110A03 ID No. : No.11

Customer : Environment Research & Technology Company Limited.
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 383/21

16 August, 2021

Page : 2 of 2

| Standard Ultrasonic Anemometer m/sec | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|--|--------------------|------------------|-----------------|-------------------|---------------------|
| | Pressure inches | Vacumm inches | Pressure hPa | Velocity m/sec | Correction m/sec |
| 1.00 | - | - | - | 0.4 | 0.60 |
| 3.02 | - | - | - | 2.2 | 0.82 |
| 5.00 | - | - | - | 4.5 | 0.50 |
| 7.04 | - | - | - | 6.7 | 0.34 |
| 9.02 | - | - | - | 8.5 | 0.52 |
| 11.01 | - | - | - | 10.3 | 0.71 |
| 13.01 | - | - | - | 12.5 | 0.51 |
| 15.01 | - | - | - | 14.3 | 0.71 |
| 17.02 | - | - | - | 16.5 | 0.52 |
| 20.02 | - | - | - | 19.3 | 0.72 |

| Wind Aloft Plotting Board. | |
|--|-----------------------|
| US.DEPARTMENT OF COMMERCE WEATHER BUREAU | |
| WIND DIRETION | TESTED WIND DIRECTION |
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer



Meteorological Instruments Bureau

Sound Level Meter Calibration Report

Support Equipment Type : Sound Level Calibrator

Manufacture : Larson Davis

Model : CAL150

Serial No. : 2197

Range of Calibrator

- Sound Pressure Level : 94.0 dB.

- Frequency : 1,000 Hz.

Calibrated By : Mr.Akarawat Kochabog

Calibration Date : June 8, 2022

Customer Name : บริษัท โฟรเทียร์ คอนซัลแตนต์ จำกัด: นิคมอุตสาหกรรมเอเพ็กซ์กรีน อินดัสเทรียล เอสเตท ของบริษัท
เอเพ็กซ์ ปาร์ค จำกัด

[illegible]

Checked By

Mr. Prayun Detkla
Technician

Approved By

Ms.Sutatip Im-noi
Environmental Scientist



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0733

MTC No. EEL. BP. 89/0764

CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co.,Ltd.

Address : 25/114 Moo 6, Soi Chinnaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.

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 : Precision Acoustic Calibrator

Manufacturer : Larson Davis

Model : CAL150

Serial No. : 2197

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 Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone B&K 4180 S/N 2633526.

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 : 21 Jul. 2021

Date of Calibration : 28 Jul. 2021

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.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

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)

Request No. 21-64/0733

MTC No. EEL. BP. 89/0764

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

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

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 2 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer4180 | 93.96 | -0.04 | ± 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&Kjaer4180 | 999.7 | -0.3 | ± 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&Kjaer4180 | 1.44 | ± 0.50 | $\pm 4.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Date of Calibration : 28 Jul. 2021

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.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
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)

Request No. 21-64/0733

MTC No. EEL. BP. 89/0764

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 2 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 113.96 | -0.04 | ± 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 | 999.6 | -0.4 | ± 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 | 0.38 | ± 0.50 | $\pm 4.0\%$ |

Note : 1. No adjustment.


2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual

Calibrated by :


.....
(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Kluaypa)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Jul. 2021

Date of Issue : 30 Jul. 2021

Ref : 2011264072103155001

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.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
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