

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|----------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 10:15 AM |
| Sampler Number | TSP No.3 | Transfer Standard Type | Orifice | Stop Time | 10:21 AM |
| Motor Serial Number | BL-3 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

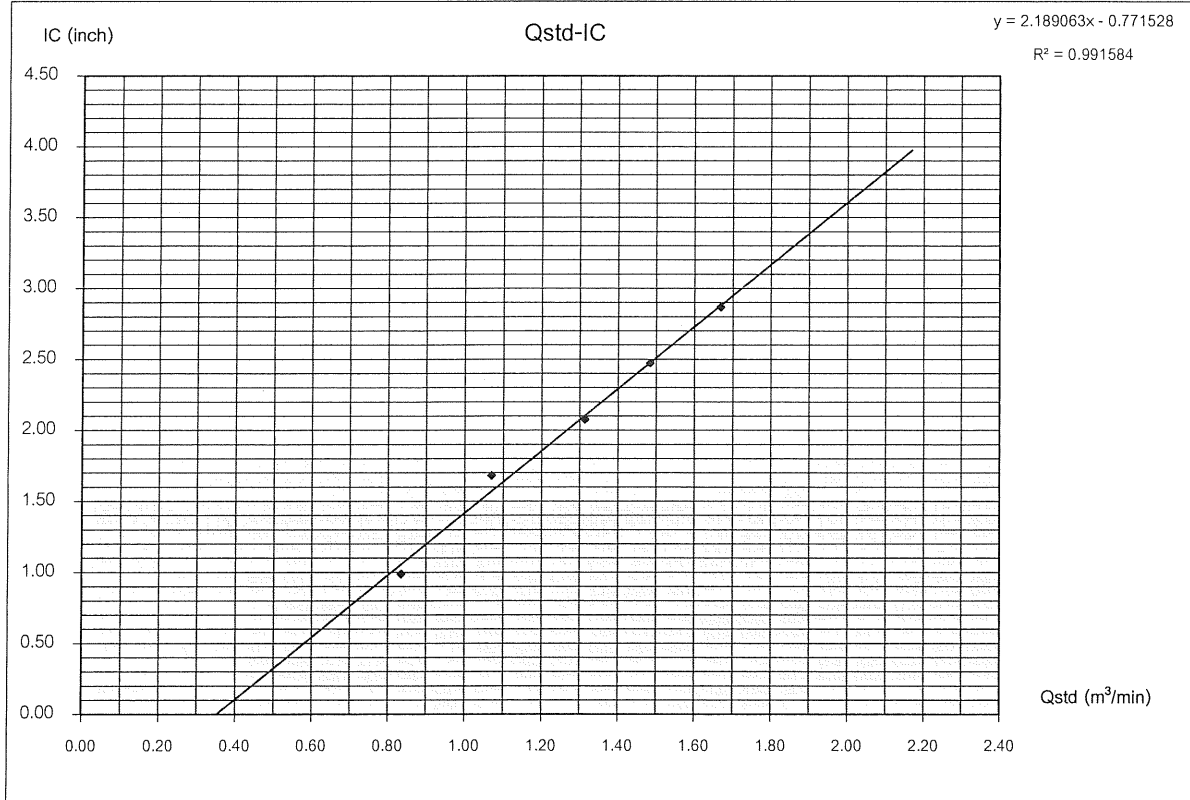
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|-----------|----------|---------------|---|---|--------------------------------------|--|-----------------------------------|---------------------|-------------|------------|
| | Positive | Negative | ΔH_2O | $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ (m^3/min) | Sample Flow Rate Indicator (inch) | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | ($^{\circ}K = ^{\circ}C + 273$) | (mmHg) | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62580 | 0.83518 | 1.0 | 0.99 | 304.0 | 759.0 | | |
| 7 | 2.2 | 2.2 | 4.4 | 2.07545 | 1.07017 | 1.7 | 1.68 | 304.0 | 759.0 | | |
| 10 | 3.3 | 3.3 | 6.6 | 2.54189 | 1.31394 | 2.1 | 2.08 | 304.0 | 759.0 | | |
| 13 | 4.2 | 4.2 | 8.4 | 2.86764 | 1.48418 | 2.5 | 2.47 | 304.0 | 759.0 | | |
| 18 | 5.3 | 5.3 | 10.6 | 3.22135 | 1.66904 | 2.9 | 2.87 | 304.0 | 759.0 | | |

Linear Regression Y ON X : $Y = mX + b$

| | | | | | | | | | |
|--------|-------------------------------|---------|---|-------|---------|-----------|---|-------------|--|
| 1 | Slope (m) | 1.91345 | Linear Equation | | Average | 304.0 | 759.0 | | |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m^3/min) | 1.133 | r^2 | 0.991584 | Pstd(mmHg) | 760.0 | |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | 0 | r | 0.9957831 | T_{NTP} | 298.0 | |
| Result | | | | | | | $C = (Pa/P_{std}) * (T_{std}/Ta)^{0.5}$ | 0.989430815 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By G. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|-----------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 9:37 AM |
| Sampler Number | TSP No.10 | Transfer Standard Type | Orifice | Stop Time | 9:41 AM |
| Motor Serial Number | BL-10 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

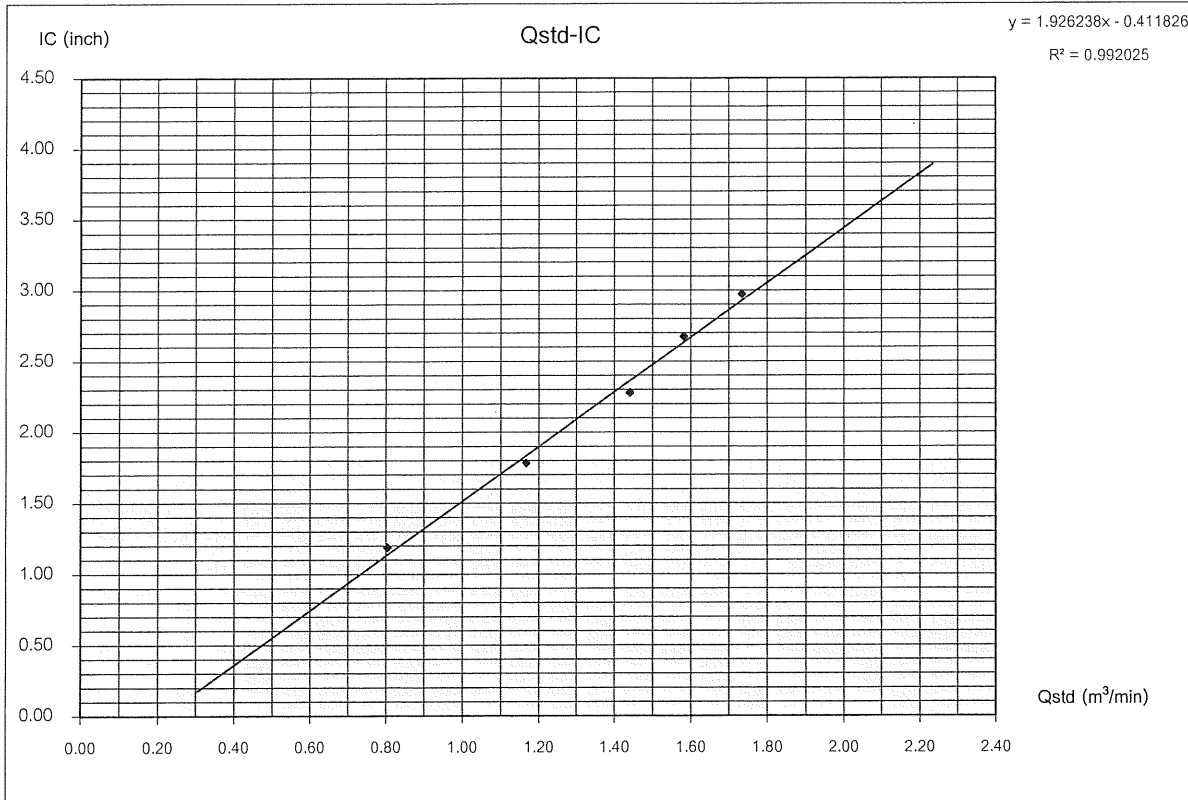
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|-----------|----------|---------------|--|---|--------------------------------------|--|-----------------------------------|---------------------|-------------|------------|
| | Positive | Negative | ΔH_2O | $[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ (m^3/min) | Sample Flow Rate Indicator (inch) | $IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | ($^{\circ}K = ^{\circ}C + 273$) | (mmHg) | | |
| 5 | 1.2 | 1.3 | 2.5 | 1.56701 | 0.80445 | 1.2 | 1.19 | 303.0 | 759.0 | | |
| 7 | 2.6 | 2.6 | 5.2 | 2.25997 | 1.16660 | 1.8 | 1.78 | 303.0 | 759.0 | | |
| 10 | 3.9 | 4.0 | 7.9 | 2.78557 | 1.44129 | 2.3 | 2.28 | 303.0 | 759.0 | | |
| 13 | 4.7 | 4.8 | 9.5 | 3.05466 | 1.58192 | 2.7 | 2.68 | 303.0 | 759.0 | | |
| 18 | 5.6 | 5.8 | 11.4 | 3.34621 | 1.73429 | 3.0 | 2.97 | 303.0 | 759.0 | | |

Linear Regression Y ON X : $Y = mX + b$

| | | | | | | | | | |
|--------|-------------------------------|---------|---|--|---------|---------------------------------------|------------------|-------------|--|
| 1 | Slope (m) | 1.91345 | Linear Equation | | Average | 303.0 | 759.0 | | |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m^3/min) | | r^2 | 0.992025 | Pstd(mmHg) | 760.0 | |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | | r | 0.9960045 | T _{NTP} | 298.0 | |
| Result | | | | | 0 | $(Pa/P_{std})(T_{std}/T_a)$ | | 0.982204273 | |
| | | | | | | $C = (Pa/P_{std})(T_{std}/T_a)^{0.5}$ | | 0.991062194 | |

COMMENT

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|----------------------------|
| Andersen Instruments, Inc. |
|----------------------------|



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Srisuk
(Mr.Jarung Jamnongbut)
Division Manager

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|-----------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 11:14 AM |
| Sampler Number | TSP No.15 | Transfer Standard Type | Orifice | Stop Time | 11:18 AM |
| Motor Serial Number | BL-15 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

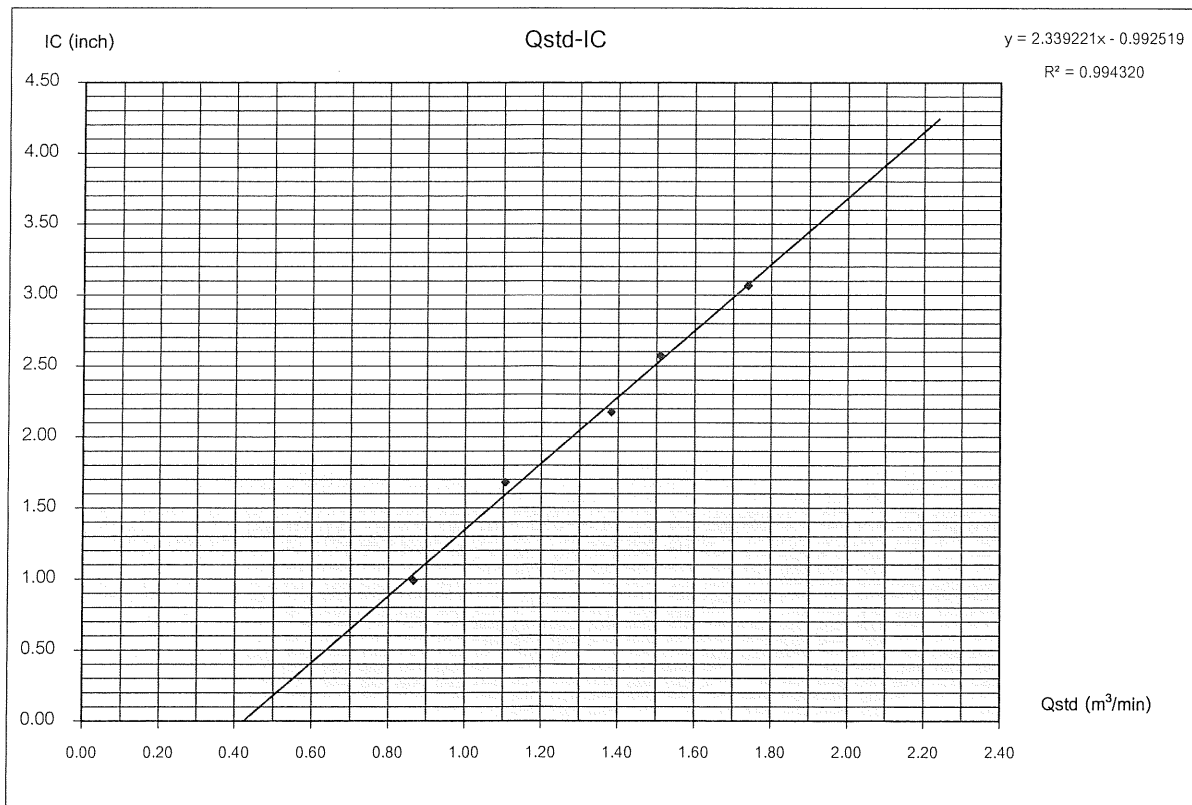
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|-----------|----------|---------------|---|---|---------------------------------------|--|---------------|---------------------|-------------|------------|
| | Positive | Negative | ΔH_2O | $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ (m^3/min) | Sample Flow Rate Indication (inch) | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | (°K = °C+273) | (mmHg) | | |
| 5 | 1.4 | 1.5 | 2.9 | 1.68494 | 0.86608 | 1.0 | 0.99 | 304.0 | 759.0 | | |
| 7 | 2.3 | 2.4 | 4.7 | 2.14503 | 1.10654 | 1.7 | 1.68 | 304.0 | 759.0 | | |
| 10 | 3.6 | 3.7 | 7.3 | 2.67329 | 1.38262 | 2.2 | 2.18 | 304.0 | 759.0 | | |
| 13 | 4.3 | 4.4 | 8.7 | 2.91840 | 1.51071 | 2.6 | 2.57 | 304.0 | 759.0 | | |
| 18 | 5.7 | 5.8 | 11.5 | 3.35532 | 1.73905 | 3.1 | 3.07 | 304.0 | 759.0 | | |

Linear Regression Y ON X: $Y = mX + b$

| | | | | | | | | | |
|--------|-------------------------------|---------|---|-------|---------|---|------------------|-------------|--|
| 1 | Slope (m) | 1.91345 | Linear Equation | | Average | 304.0 | 759.0 | | |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m^3/min) | 1.133 | r^2 | 0.99432 | Pstd(mmHg) | 760.0 | |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | 0 | r | 0.997156 | T _{NTP} | 298.0 | |
| Result | | | | | | $C = (Pa/P_{std}) * (T_{std}/Ta)^{0.5}$ | | 0.978973338 | |
| | | | | | | | | 0.989430815 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
 (Mr.Preecha Srisuk)
 Field Environmental

Approved By A. Jarung
 (Mr.Jarung Jamnongbut)
 Division Manager

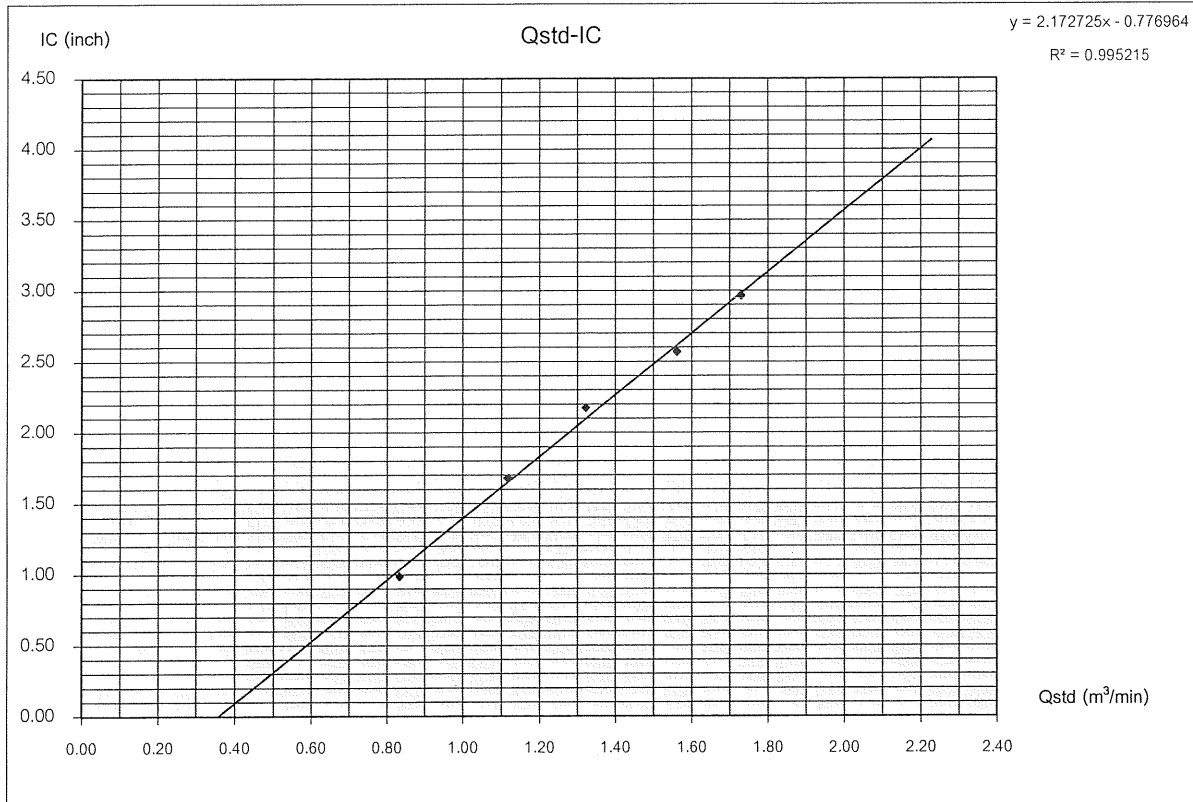
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|-----------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 11:45 AM |
| Sampler Number | TSP No.17 | Transfer Standard Type | Orifice | Stop Time | 11:51 AM |
| Motor Serial Number | BL-17 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|--------------------------------------|---|----------|-------------------|--|---|--|---|---------------------------|---------------------|------------------|------------|
| | 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) | Sample Flow Rate Indicator (inch) | C = [(Pa/P _{std})(T _{std} /Ta)] ^{1/2} | ("K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62420 | 0.83434 | 1.0 | 0.99 | 305.0 | 760.0 | | |
| 7 | 2.4 | 2.4 | 4.8 | 2.16560 | 1.11729 | 1.7 | 1.68 | 305.0 | 760.0 | | |
| 10 | 3.3 | 3.4 | 6.7 | 2.55856 | 1.32265 | 2.2 | 2.17 | 305.0 | 760.0 | | |
| 13 | 4.6 | 4.7 | 9.3 | 3.01439 | 1.56088 | 2.6 | 2.57 | 305.0 | 760.0 | | |
| 18 | 5.7 | 5.7 | 11.4 | 3.33742 | 1.72970 | 3.0 | 2.97 | 305.0 | 760.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 305.0 | 760.0 | | |
| 1 | Slope (m) | | | 1.91345 | Linear Equation | | | r ² | 0.995215 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9976046 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99995 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | 0.97704918 | |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.988457981 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|-----------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 8:45 AM |
| Sampler Number | TSP No.18 | Transfer Standard Type | Orifice | Stop Time | 8:50 AM |
| Motor Serial Number | BL-18 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

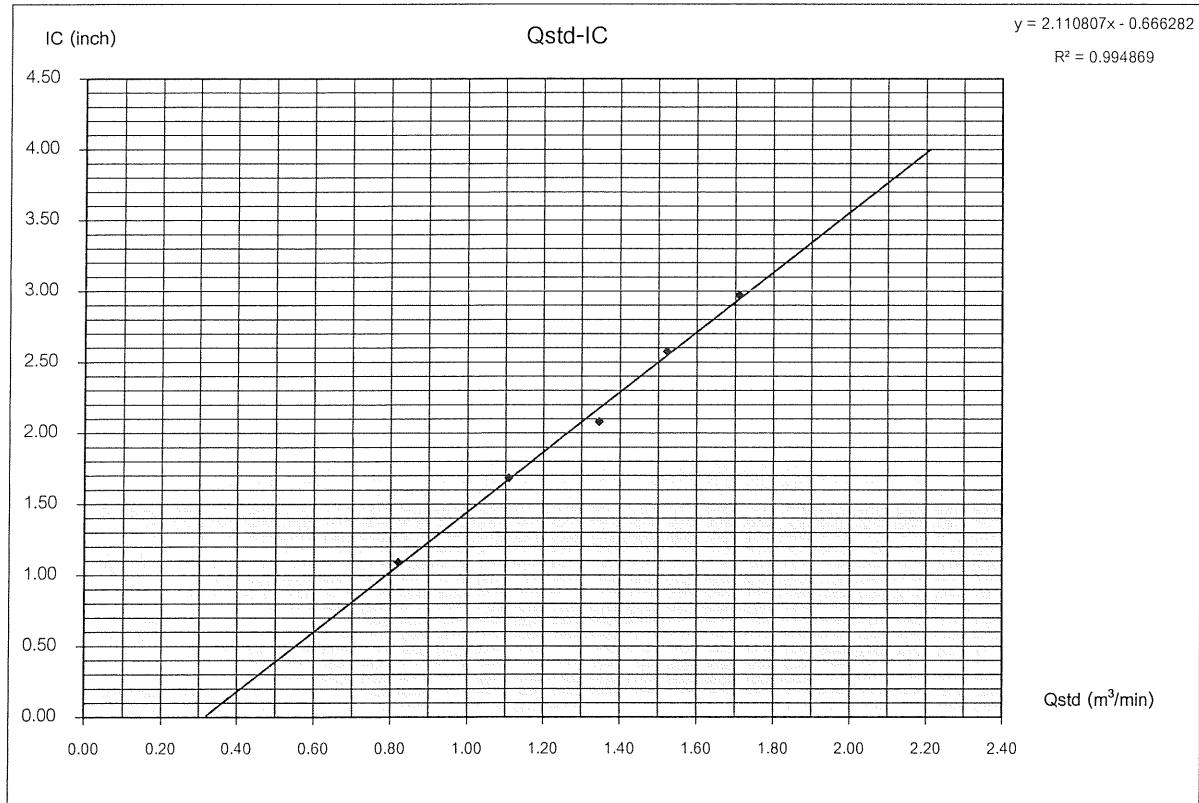
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|-----------|----------|---------------|--|---|---------------------------------------|---|---------------|---------------------|-------------|------------|
| | Positive | Negative | ΔH_2O | $[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ (m ³ /min) | Sample Flow Rate Indication (inch) | $IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | (°K = °C+273) | (mmHg) | | |
| 5 | 1.3 | 1.3 | 2.6 | 1.59804 | 0.82067 | 1.1 | 1.09 | 303.0 | 759.0 | | |
| 7 | 2.3 | 2.4 | 4.7 | 2.14857 | 1.10839 | 1.7 | 1.68 | 303.0 | 759.0 | | |
| 10 | 3.4 | 3.5 | 6.9 | 2.60331 | 1.34604 | 2.1 | 2.08 | 303.0 | 759.0 | | |
| 13 | 4.3 | 4.5 | 8.8 | 2.93997 | 1.52198 | 2.6 | 2.58 | 303.0 | 759.0 | | |
| 18 | 5.5 | 5.6 | 11.1 | 3.30189 | 1.71113 | 3.0 | 2.97 | 303.0 | 759.0 | | |

Linear Regression Y ON X : Y= mX + b

| | | | | | | | | | |
|--------|-------------------------------|---------|---|-------|--|---------------------------|-----------|------------------|-------|
| 1 | Slope (m) | 1.91345 | Linear Equation | | | r^2 | 0.994869 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | 1.133 | | r | 0.9974312 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | 0 | | (Pa/Pstd)*(Tstd/Ta) | | 0.982204273 | |
| Result | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.991062194 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By A. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|------------|--------------------------|----------|----------------|-------------------|
| Sampler Location | | Date | | March 17, 2022 | |
| Project Site | | Start Time | | 10:24 AM | |
| Sampler Number | PM-10 No.1 | Transfer Standard Type | Orifice | Stop Time | 10:28 AM |
| Motor Serial Number | HVL-1 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

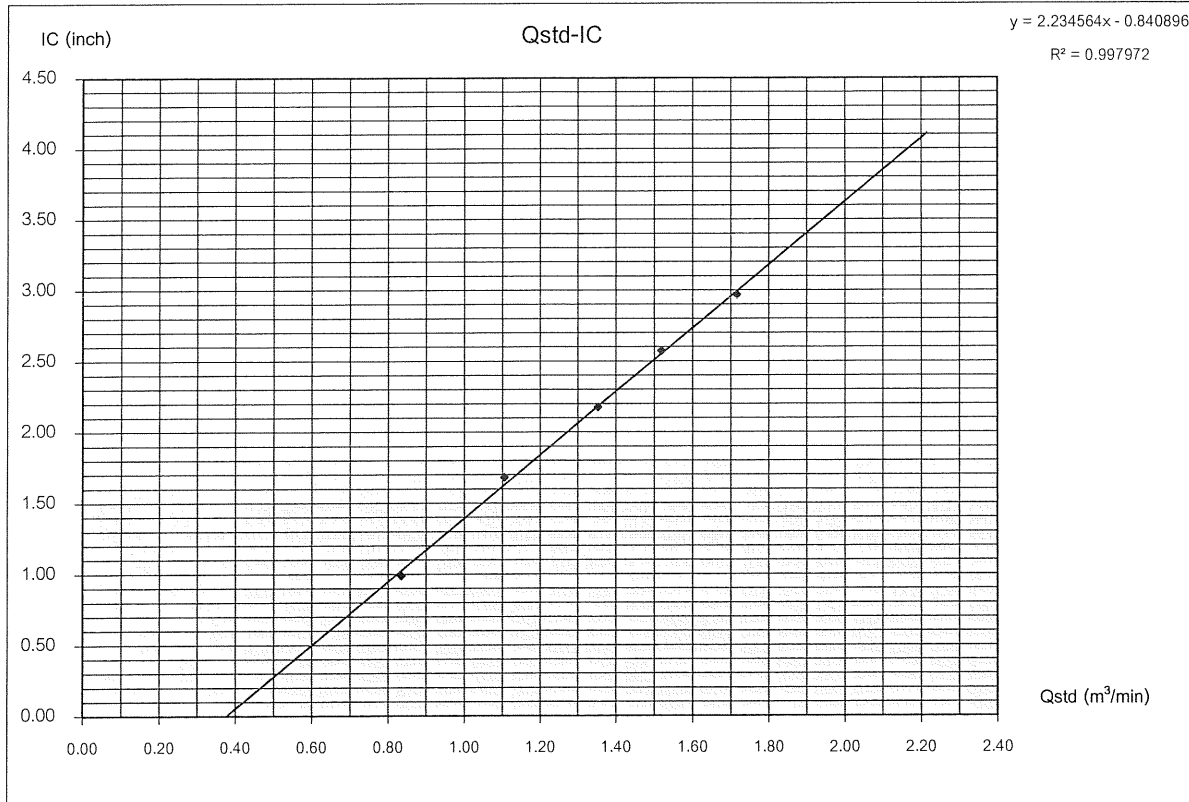
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|---|----------|-------------------|--|--------------------------|---|---|---------------|---------------------|-------------|------------|
| | Pressure Drop Across Orifice (inH ₂ O) | | | $[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ | Sample Flow Rate Indication (m ³ /min) | $IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ | (°K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH ₂ O | | | (inch) | | | | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62580 | 0.83518 | 1.0 | 0.99 | 304.0 | 759.0 | | |
| 7 | 2.3 | 2.4 | 4.7 | 2.14503 | 1.10654 | 1.7 | 1.68 | 304.0 | 759.0 | | |
| 10 | 3.4 | 3.6 | 7.0 | 2.61779 | 1.35361 | 2.2 | 2.18 | 304.0 | 759.0 | | |
| 13 | 4.4 | 4.4 | 8.8 | 2.93513 | 1.51945 | 2.6 | 2.57 | 304.0 | 759.0 | | |
| 18 | 5.6 | 5.6 | 11.2 | 3.31127 | 1.71603 | 3.0 | 2.97 | 304.0 | 759.0 | | |

Linear Regression Y ON X : Y= mX + b

| 1 | Slope (m) | 1.91345 | Linear Equation | | | | | Average | 304.0 | 759.0 | |
|--------|-------------------------------|---------|---|--|--|--|-------|----------------|-----------|------------------|-------|
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | | | | 1.133 | r ² | 0.997972 | Pstd(mmHg) | 760.0 |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | | | | 0 | r | 0.9989855 | T _{NTP} | 298.0 |
| Result | | | | | | | | | | | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By G. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|------------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 11:53 AM |
| Sampler Number | PM-10 No.3 | Transfer Standard Type | Orifice | Stop Time | 11:58 AM |
| Motor Serial Number | HVL-3 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

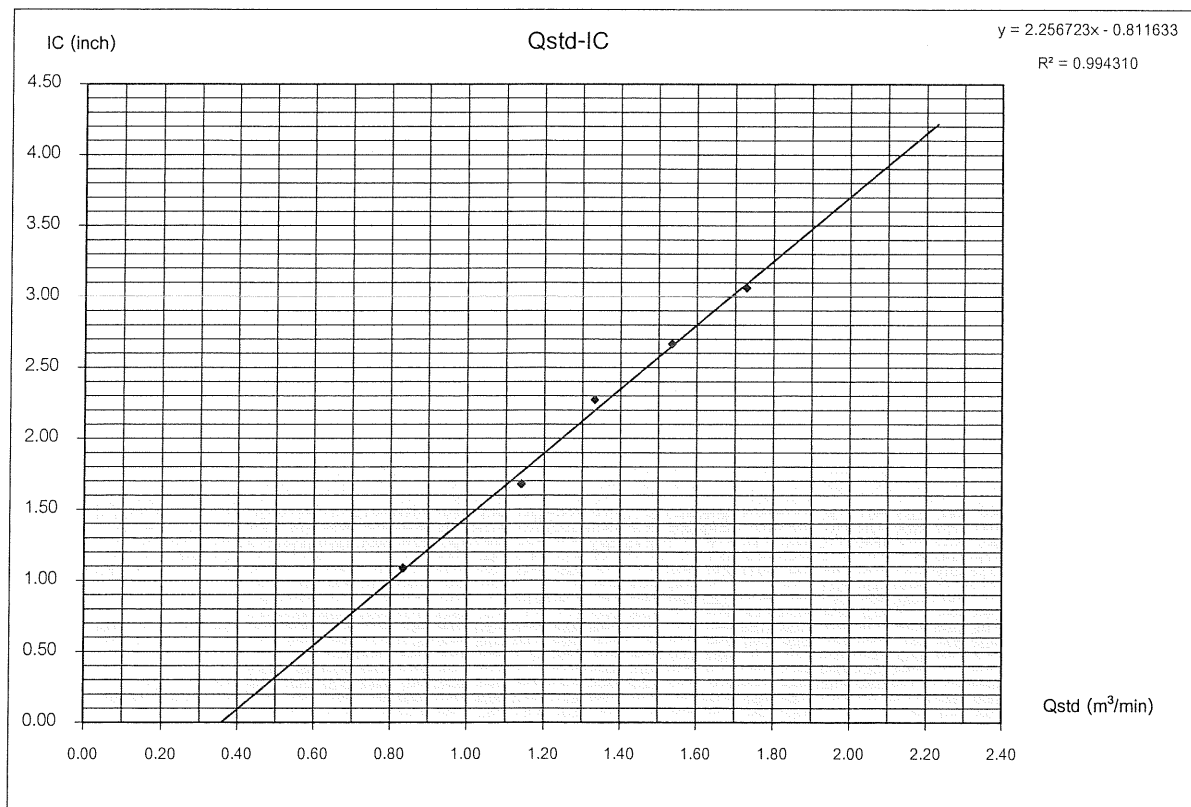
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|---|----------|---------------|---|--------------------------|-----------------------------|--|---------------|---------------------|-------------|------------|
| | Pressure Drop Across Orifice (inH ₂ O) | | | $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ | Sample Flow Rate Indication | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | (°K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH_2O | | (m ³ /min) | (inch) | | | | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62420 | 0.83434 | 1.1 | 1.09 | 305.0 | 760.0 | | |
| 7 | 2.5 | 2.5 | 5.0 | 2.21026 | 1.14063 | 1.7 | 1.68 | 305.0 | 760.0 | | |
| 10 | 3.4 | 3.4 | 6.8 | 2.57758 | 1.33259 | 2.3 | 2.27 | 305.0 | 760.0 | | |
| 13 | 4.5 | 4.5 | 9.0 | 2.96537 | 1.53526 | 2.7 | 2.67 | 305.0 | 760.0 | | |
| 18 | 5.7 | 5.7 | 11.4 | 3.33742 | 1.72970 | 3.1 | 3.06 | 305.0 | 760.0 | | |

Linear Regression Y ON X : Y= mX + b

| | | | Average | | | | |
|--------|-------------------------------|---------|---|-------|-------------------------------|-------------|------------------|
| 1 | Slope (m) | 1.91345 | Linear Equation | | r^2 | 0.99431 | Pstd(mmHg) |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | 1.133 | r | 0.9971509 | T _{NTP} |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | 0 | (Pa/Pstd)*(Tstd/Ta) | 0.97704918 | |
| Result | | | | | $C=(Pa/Pstd)*(Tstd/Ta)^{0.5}$ | 0.988457981 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By A. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

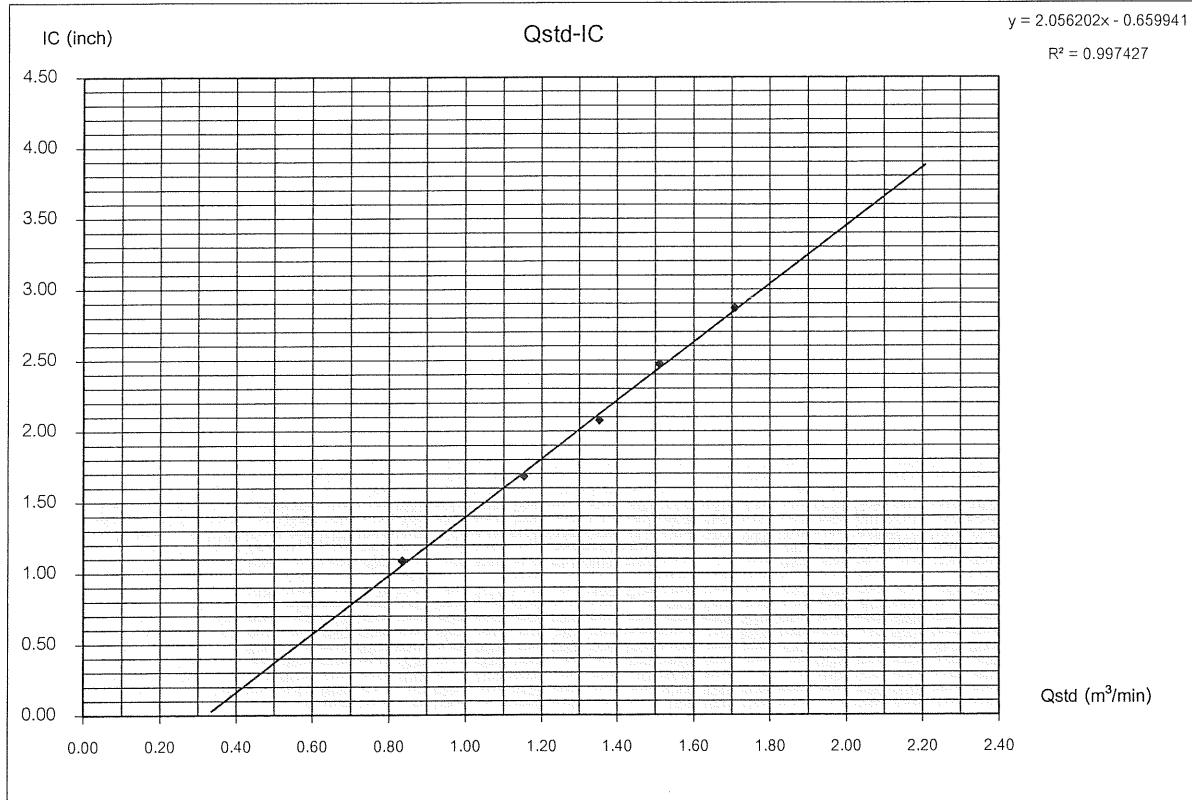
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|------------|--------------------------|----------|-------------------|----------|
| Sampler Location | | Date | | March 17, 2022 | |
| Project Site | | Start Time | | 11:07 AM | |
| Sampler Number | PM-10 No.4 | Transfer Standard Type | Orifice | Stop Time | 11:12 AM |
| Motor Serial Number | HVL-04 | Calibrator Model | TE-5025A | Person | |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |
| | | | | Mr.Preecha Srisuk | |

| 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 Indicator (inch) | $IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | ("K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62580 | 0.83518 | 1.1 | 1.09 | 304.0 | 759.0 | | |
| 7 | 2.5 | 2.6 | 5.1 | 2.23445 | 1.15327 | 1.7 | 1.68 | 304.0 | 759.0 | | |
| 10 | 3.5 | 3.5 | 7.0 | 2.61779 | 1.35361 | 2.1 | 2.08 | 304.0 | 759.0 | | |
| 13 | 4.3 | 4.4 | 8.7 | 2.91840 | 1.51071 | 2.5 | 2.47 | 304.0 | 759.0 | | |
| 18 | 5.5 | 5.6 | 11.1 | 3.29645 | 1.70829 | 2.9 | 2.87 | 304.0 | 759.0 | | |
| Linear Regression Y ON X: Y= mX + b | | | | | | | Average | 304.0 | 759.0 | | |
| 1 | Slope (m) | | | 1.91345 | Linear Equation | | | r ² | 0.997427 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9987127 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99995 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | | 0.978973338 |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | | 0.989430815 |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | | |
|------------------------|------------|--------------------------|----------|-----------|-------------------|----------------|
| Sampler Location | | | | | Date | March 17, 2022 |
| Project Site | | | | | Start Time | 8:52 AM |
| Sampler Number | PM-10 No.7 | Transfer Standard Type | Orifice | Stop Time | 8:57 AM | |
| Motor Serial Number | HVL-7 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk | |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | | |

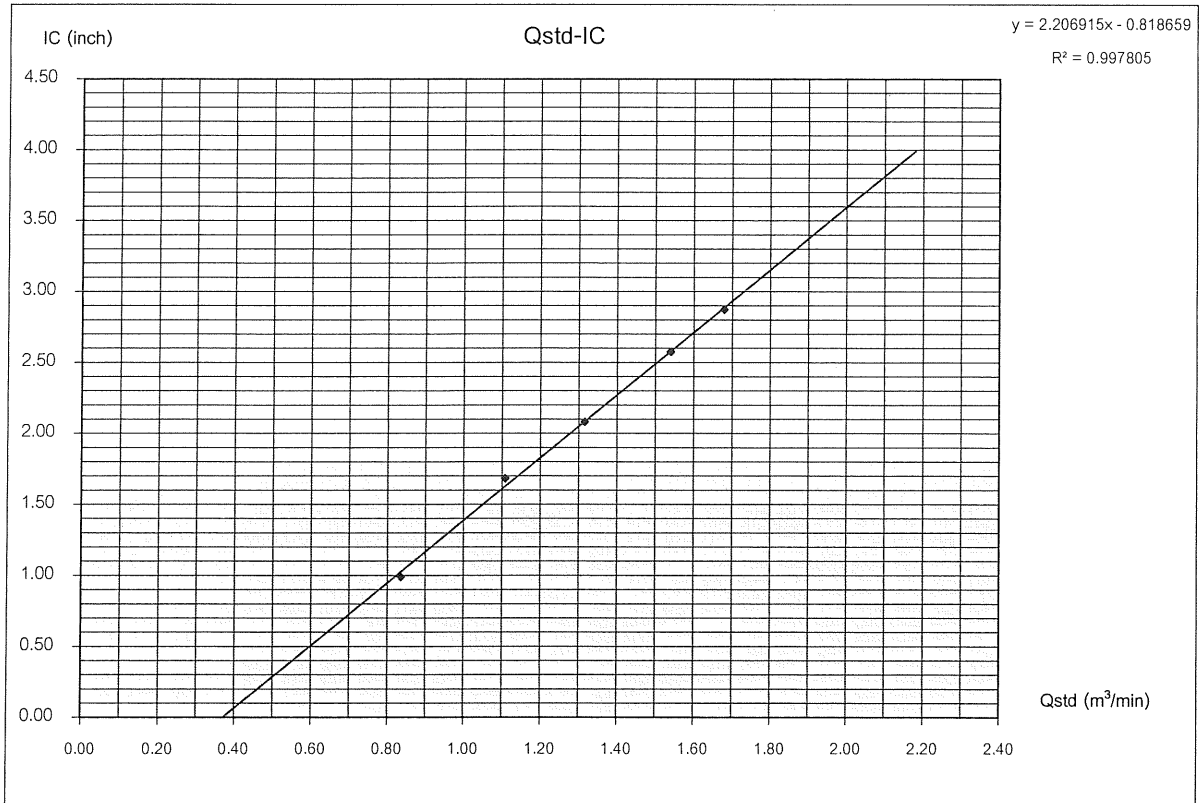
| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|-----------|-----------|----------|---------------|---|---|---------------------------------------|---|---------------|---------------------|-------------|------------|
| | Positive | Negative | ΔH_2O | $[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | $Q_{std} = (1/m)[(A-b)]$ (m^3/min) | Sample Flow Rate Indication (inch) | $IC = \{[(Pa/P_{std})(T_{std}/Ta)]^{1/2}\}$ | (°K = °C+273) | (mmHg) | | |
| 5 | 1.3 | 1.4 | 2.7 | 1.62848 | 0.83658 | 1.0 | 0.99 | 303.0 | 759.0 | | |
| 7 | 2.3 | 2.4 | 4.7 | 2.14857 | 1.10839 | 1.7 | 1.68 | 303.0 | 759.0 | | |
| 10 | 3.3 | 3.3 | 6.6 | 2.54608 | 1.31613 | 2.1 | 2.08 | 303.0 | 759.0 | | |
| 13 | 4.5 | 4.5 | 9.0 | 2.97319 | 1.53934 | 2.6 | 2.58 | 303.0 | 759.0 | | |
| 18 | 5.3 | 5.4 | 10.7 | 3.24185 | 1.67975 | 2.9 | 2.87 | 303.0 | 759.0 | | |

Linear Regression Y ON X: $Y = mX + b$

| | | | | | | | | | |
|--------|-------------------------------|---------|---|--|-------|---------------------|--------------------------------------|------------------|-------|
| 1 | Slope (m) | 1.91345 | Linear Equation | | | r^2 | 0.997805 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | | 1.133 | r | 0.9989019 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | 0.99995 | Final Set Flow Rate = (I) | | 0 | (Pa/Pstd)*(Tstd/Ta) | | 0.982204273 | |
| Result | | | | | | | C=(Pa/Pstd)*(Tstd/Ta) ^{0.5} | 0.991062194 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

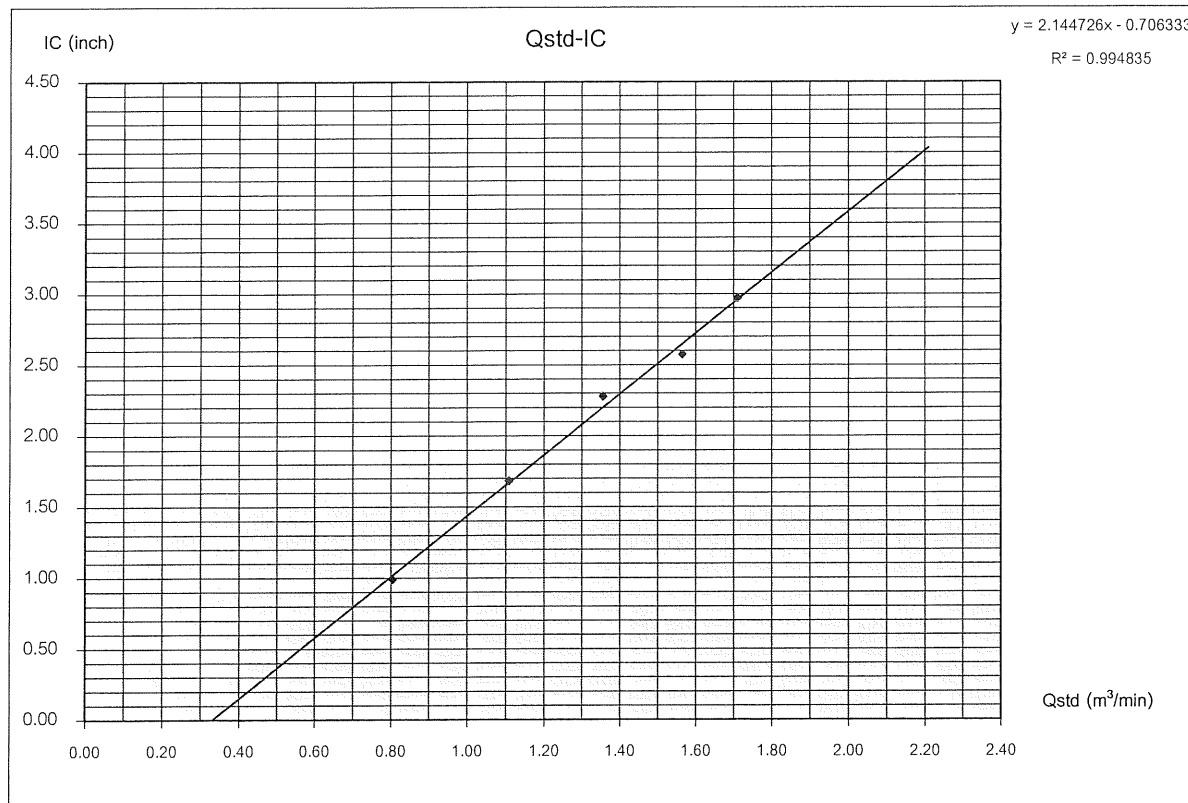
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

| | | | | | |
|------------------------|------------|--------------------------|----------|------------|-------------------|
| Sampler Location | | | | Date | March 17, 2022 |
| Project Site | | | | Start Time | 9:43 AM |
| Sampler Number | PM-10 No.9 | Transfer Standard Type | Orifice | Stop Time | 9:47 AM |
| Motor Serial Number | HVL-9 | Calibrator Model | TE-5025A | Person | Mr.Preecha Srisuk |
| Recorder Serial Number | - | Calibrator Serial Number | 1 | | |

| Plate No. | (Delta H) | | | (A) | (X) | (I) | (Y) | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|--------------------------------------|---|----------|-------------------|---|---|---|---|---------------------------|---------------------|------------------|------------|
| | Pressure Drop Across Orifice (inH ₂ O) | | | $[\Delta H_{2}O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | Qstd = (1/m)[(A-b)] (m ³ /min) | Sample Flow Rate Indication (inch) | IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2} | (°K = °C+273) | (mmHg) | | |
| | Positive | Negative | ΔH ₂ O | | | | | | | | |
| 5 | 1.2 | 1.3 | 2.5 | 1.56701 | 0.80445 | 1.0 | 0.99 | 303.0 | 759.0 | | |
| 7 | 2.3 | 2.4 | 4.7 | 2.14857 | 1.10839 | 1.7 | 1.68 | 303.0 | 759.0 | | |
| 10 | 3.5 | 3.5 | 7.0 | 2.62210 | 1.35586 | 2.3 | 2.28 | 303.0 | 759.0 | | |
| 13 | 4.6 | 4.7 | 9.3 | 3.02233 | 1.56503 | 2.6 | 2.58 | 303.0 | 759.0 | | |
| 18 | 5.5 | 5.6 | 11.1 | 3.30189 | 1.71113 | 3.0 | 2.97 | 303.0 | 759.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 759.0 | | |
| 1 | Slope (m) | | | 1.91345 | Linear Equation | | | r ² | 0.994835 | Pstd(mmHg) | 760.0 |
| 2 | Intercept (b) | | | 0.02773 | Set Point Flow Rate (X) (m ³ /min) | 1.133 | | r | 0.9974142 | T _{NTP} | 298.0 |
| 3 | Correlation Coefficient (r) | | | 0.99995 | Final Set Flow Rate = (I) | 0 | | (Pa/Pstd)*(Tstd/Ta) | | 0.982204273 | |
| Result | | | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.991062194 | |

COMMENT

Andersen Instruments, Inc.



Calibrated By Preecha Sr.
(Mr.Preecha Srisuk)
Field Environmental

Approved By Q. Jarung
(Mr.Jarung Jamnongbut)
Division Manager

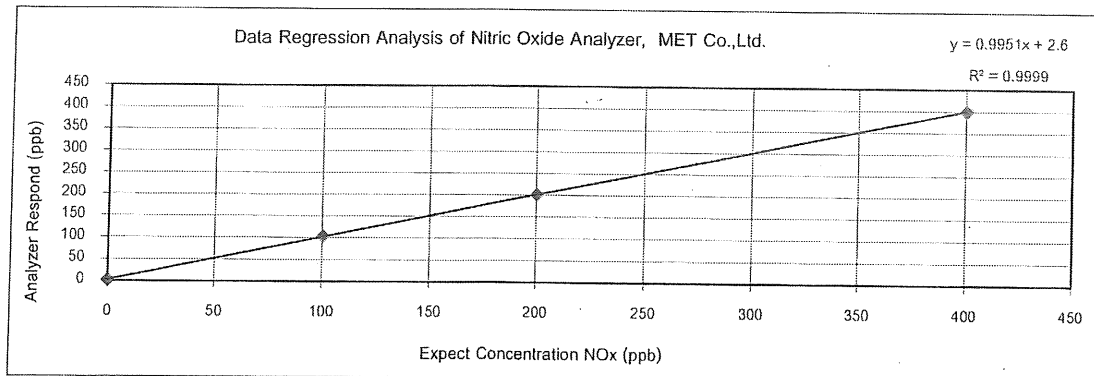
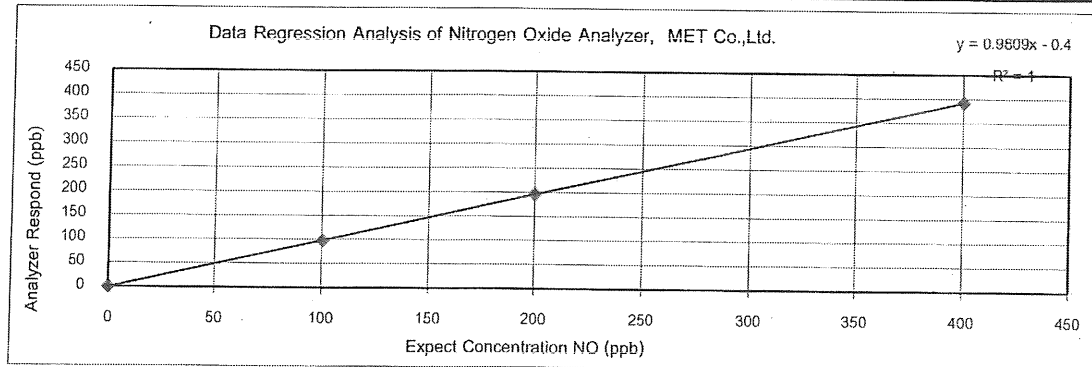
MULTIPOINT CALIBRATION

Nitrogen Oxide Analyzer

| | | | | | |
|---------|-------------|----------------------|-------|---------------|--------------|
| Station | MET CO.,LTD | | | | |
| Brand | ECOTECH | Zero setting | 0 | Station Temp. | 25 °C |
| Model | Serinus 40 | Span Instrument Gain | 2.63 | Date | 5-Jan-22 |
| Range | 500 ppb | Start Time | 13:00 | Span Source | Gas Cal 3000 |
| S/N | 12-1001 | Finish Time | 14:30 | | |

| NO Channel | | | | |
|------------------------|----------------------------|-------------------------|------------------|---------------------------------|
| Span Set Point | Expect Concentration (ppb) | Analyzer Response (ppb) | Difference (ppb) | Percent Diff. |
| Zero | 0 | 0 | 0 | - |
| Point 1 | 400 | 392 | -8 | -2.00 |
| Point 2 | 200 | 196 | -4 | -2.00 |
| Point 3 | 100 | 97 | -3 | -3.00 |
| Average Difference (%) | | | | -2.33 |
| Slope = 1.0055 | | Intercept = 0.5221 | | Correlation Coefficient = 1.000 |

| NO _x Channel | | | | |
|-------------------------|----------------------------|-------------------------|------------------|---------------------------------|
| Span Set Point | Expect Concentration (ppb) | Analyzer Response (ppb) | Difference (ppb) | Percent Diff. |
| Zero | 0 | 1 | 1 | - |
| Point 1 | 400 | 400 | 0 | 0.00 |
| Point 2 | 200 | 202 | 2 | 1.00 |
| Point 3 | 100 | 104 | 4 | 4.00 |
| Average Difference (%) | | | | 1.67 |
| Slope = 0.996 | | Intercept = 2.1211 | | Correlation Coefficient = 1.000 |



Signature

บริษัท สิทิพอร์นแอสโซซิเอต จำกัด

SITHIPHORN ASSOCIATES COMPANY LIMITED

Approved

Don

บริษัท สิทิพอร์น แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสิรินธร แขวงบางบำหรุ เขตบางพลัด กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL:center@sithiporn.com www.sithiporn.com



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แขวง 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|---|---|
| Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C | Manufacturer Thermo Environmental S/N: 42C-33500-371 |
|---|---|

Calibration System

| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924 | NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

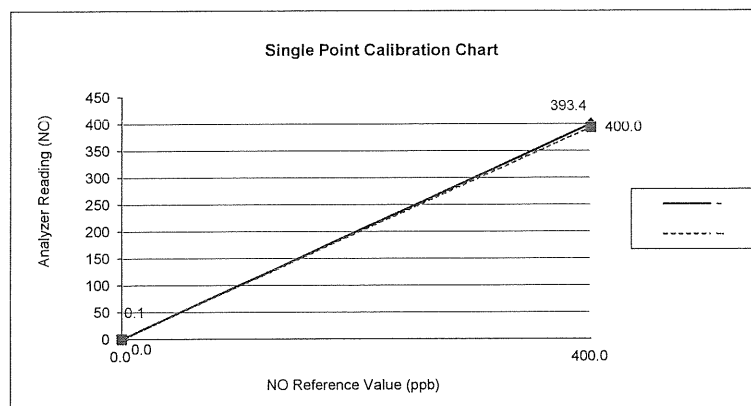
Humidity: 51 %RH

Calibration Check (Before adjust)

| GAS | Zero | | | Span | | |
|-----------------|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.1 | 0.0 | 0.1 | 393.4 | 400.0 | -1.7 |
| NO _x | 0.1 | 0.0 | 0.1 | 396.7 | 400.0 | -0.8 |

Calibration Check (After adjust)

| GAS | Zero | | | Span | | |
|-----------------|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |
| NO _x | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Signature

Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|--|---|
| Analyzer Type: NO/NO2/NOx Analyzer Model: 42C | Manufacturer Thermo Environmental S/N: 42C-601114773 |
|--|---|

Calibration System

| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

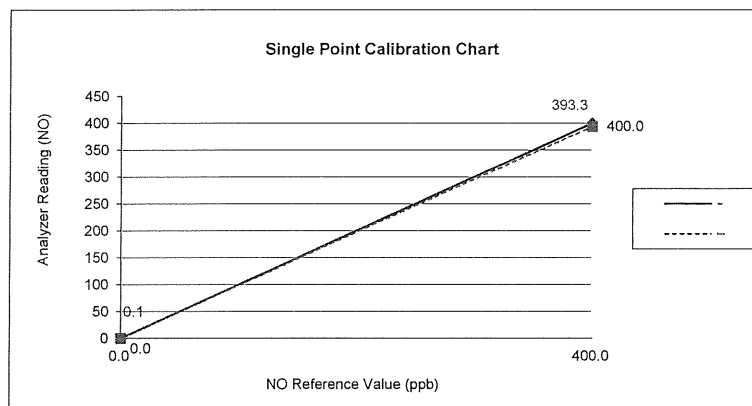
Humidity: 51 %RH

Calibration Check (Before adjust)

| GAS | Zero | | | Span | | |
|-----|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.1 | 0.0 | 0.1 | 393.3 | 400.0 | -1.7 |
| NOx | 0.1 | 0.0 | 0.1 | 396.4 | 400.0 | -0.9 |

Calibration Check (After adjust)

| GAS | Zero | | | Span | | |
|-----|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |
| NOx | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Signature

Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|---|---|
| Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C | Manufacturer Thermo Environmental S/N: 42C-601114783 |
|---|---|

Calibration System

| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924 | NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

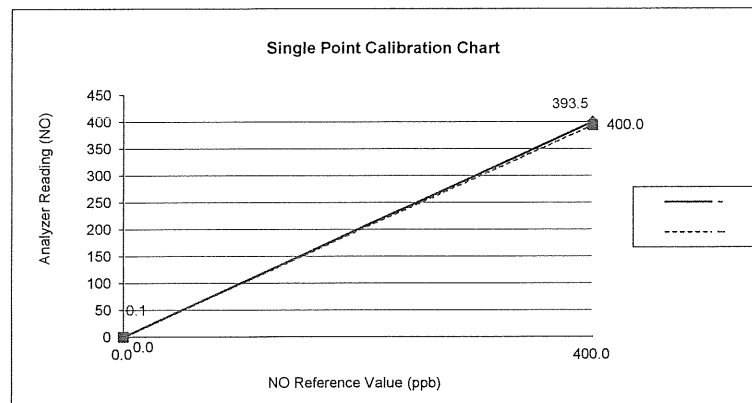
Humidity: 51 %RH

Calibration Check (Before adjust)

| GAS | Zero | | | Span | | |
|-----------------|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.1 | 0.0 | 0.1 | 393.5 | 400.0 | -1.6 |
| NO _x | 0.1 | 0.0 | 0.1 | 396.2 | 400.0 | -1.0 |

Calibration Check (After adjust)

| GAS | Zero | | | Span | | |
|-----------------|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |
| NO _x | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Signature

Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แขวง 9 เขตบางเขน กรุงเทพมหานคร 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|---|---|
| Analyzer Type: NO/NO2/NOx Analyzer Model: 200A | Manufacturer API Environmental S/N: 2789 |
|---|---|

Calibration System

| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4.435 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

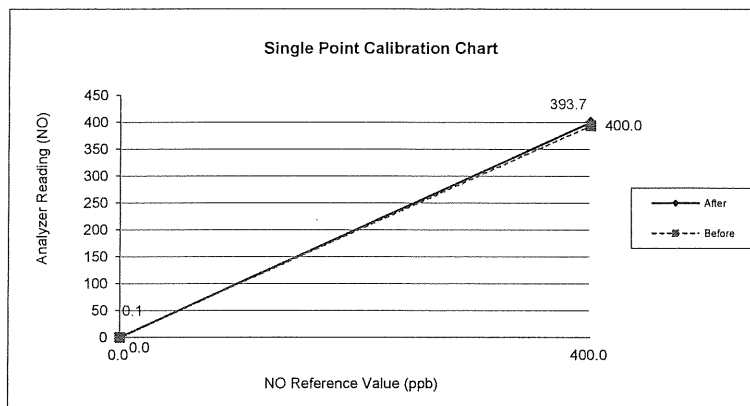
Humidity: 51 %RH

Calibration Check (Before adjust)

| GAS | Zero | | | Span | | |
|-----|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.1 | 0.0 | 0.1 | 393.7 | 400.0 | -1.6 |
| NOx | 0.1 | 0.0 | 0.1 | 400.0 | 400.0 | 0.0 |

Calibration Check (After adjust)

| GAS | Zero | | | Span | | |
|-----|---------------------|----------------------|-------------|---------------------|----------------------|--------|
| | Reading Value (ppb) | Expected Value (ppb) | Drift (ppb) | Reading Value (ppb) | Expected Value (ppb) | Drift% |
| NO | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |
| NOx | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Signature

Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
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ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|---|---|
| Analyzer Type: SO2 Analyzer Model: 43C | Manufacturer Thermo Environmental S/N: 43C-33500-719 |
|---|---|

Calibration System

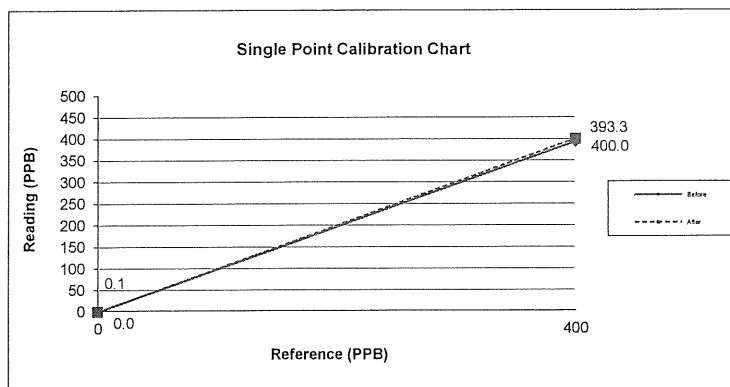
| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

| Status | Zero | | | Span | | |
|--------|-----------------|---------------|-------------|-----------------|---------------|--------|
| | Reference (PPB) | Reading (PPB) | Drift (PPB) | Reference (PPB) | Reading (PPB) | Drift% |
| Before | 0.0 | 0.1 | 0.1 | 400.0 | 393.3 | -1.7 |
| After | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Calibrate By :

Mr.PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
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ENVIR SERVICE CO., LTD. 42 Raminthra 14 yak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|---|---|
| Analyzer Type: SO2 Analyzer Model: 43C | Manufacturer Thermo Environmental S/N: 43C-71354-368 |
|---|---|

Calibration System

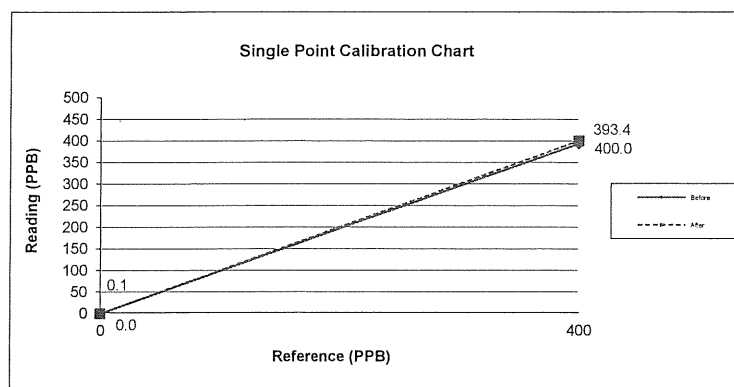
| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

| Status | Zero | | | Span | | |
|--------|-----------------|---------------|-------------|-----------------|---------------|--------|
| | Reference (PPB) | Reading (PPB) | Drift (PPB) | Reference (PPB) | Reading (PPB) | Drift% |
| Before | 0.0 | 0.1 | 0.1 | 400.0 | 393.4 | -1.7 |
| After | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Calibrate By :

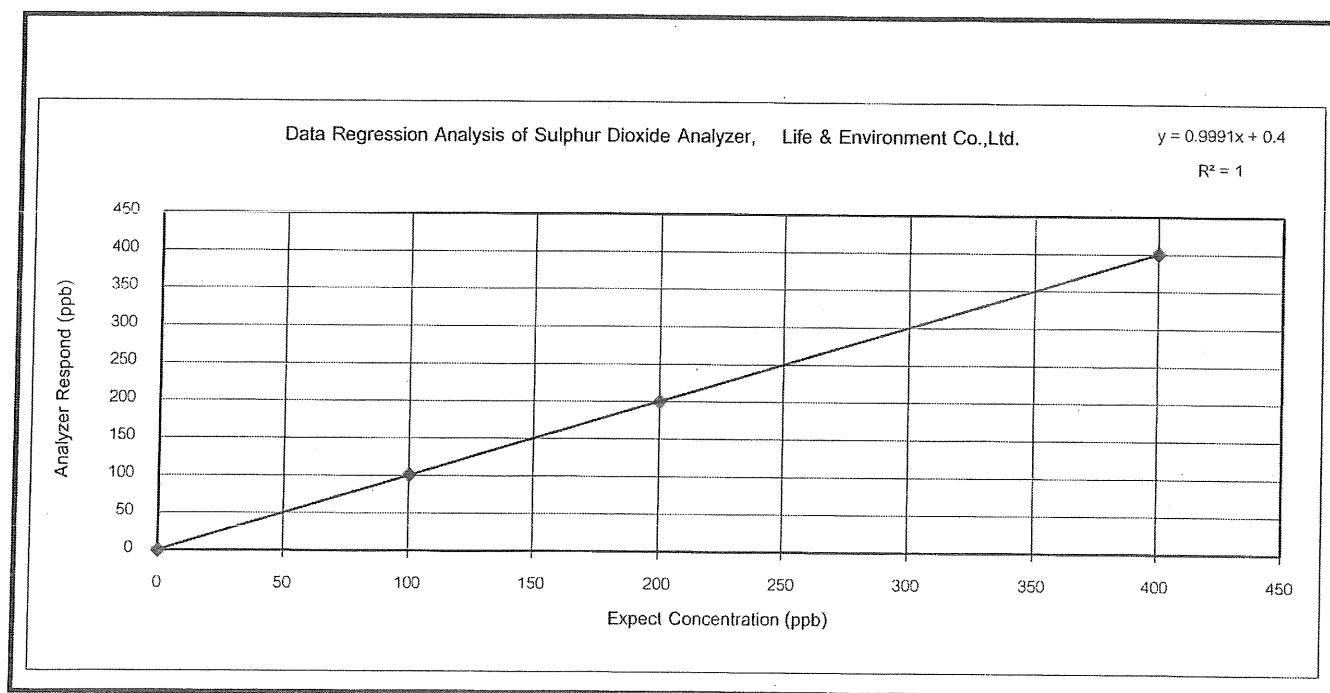
Mr.PASAGORN SAMOL

MULTIPOINT CALIBRATION

Sulphur Dioxide Analyzer

| | | | | | |
|---------|-------------|----------------------|-------|---------------|--------------|
| Station | MET CO.,LTD | | | | |
| Brand | ECOTECH | Zero setting | 0 | Station Temp. | 25 °C |
| Model | Serinus 50 | Span Instrument Gain | 30.57 | Date | 5-Jan-22 |
| Range | 500 ppb | Start Time | 13:00 | Span Source | Gas Cal 3000 |
| S/N | 12-1402 | Finish Time | 14:30 | | |

| Span Set Point | Expect Concentration (ppb) | Analyzer Response (ppb) | Difference (ppb) | Percent Diff. |
|------------------------|----------------------------|-------------------------|------------------|---------------------------------|
| Zero | 0 | 0 | 0 | - |
| Point 1 | 400 | 400 | 0 | 0.00 |
| Point 2 | 200 | 200 | 0 | 0.00 |
| Point 3 | 100 | 101 | 1 | 1.00 |
| Average Difference (%) | | | | 0.33 |
| Slope = 1.0015 | | Intercept = 1.0027 | | Correlation Coefficient = 1.000 |



บริษัท สิทิพรแอสโซซิเอต จำกัด
SITHIPHORN ASSOCIATES COMPANY LIMITED

Signature

[Signature]

Approved

[Signature]



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แขวง 9 เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 year 9, Tha Rang, Bangkok, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|--|------------------------------|
| Analyzer Type: SO2 Analyzer Model: 100A | Manufacturer API S/N: 193 |
|--|------------------------------|

Calibration System

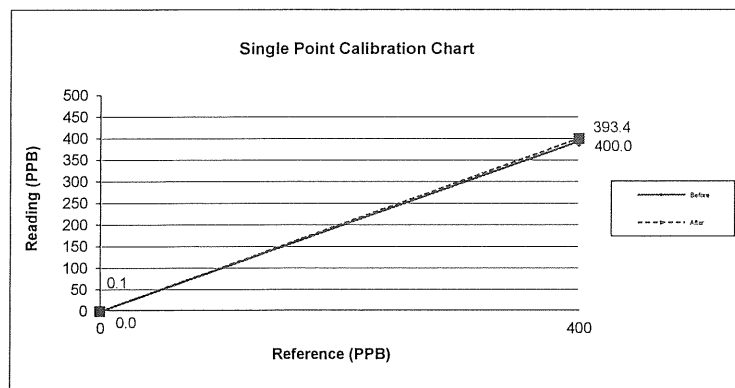
| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

| Status | Zero | | | Span | | |
|--------|-----------------|---------------|-------------|-----------------|---------------|--------|
| | Reference (PPB) | Reading (PPB) | Drift (PPB) | Reference (PPB) | Reading (PPB) | Drift% |
| Before | 0.0 | 0.1 | 0.1 | 400.0 | 393.4 | -1.7 |
| After | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Calibrate By :

Mr.PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

| | |
|--|------------------------------|
| Analyzer Type: SO2 Analyzer Model: 100A | Manufacturer API S/N: 405 |
|--|------------------------------|

Calibration System

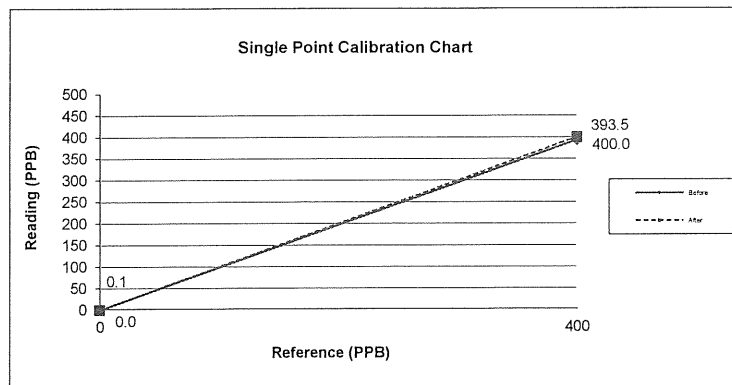
| Calibrator Unit | Standard Gas |
|--|--|
| Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924 | NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027 |

Environment: Temperature 25.5 °C

Humidity: 51 %RH

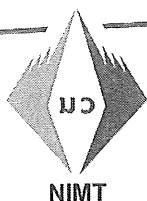
Calibration Report

| Status | Zero | | | Span | | |
|--------|-----------------|---------------|-------------|-----------------|---------------|--------|
| | Reference (PPB) | Reading (PPB) | Drift (PPB) | Reference (PPB) | Reading (PPB) | Drift% |
| Before | 0.0 | 0.1 | 0.1 | 400.0 | 393.5 | -1.6 |
| After | 0.0 | 0.0 | 0.0 | 400.0 | 400.0 | 0.0 |



Calibrate By :

Mr.PASAGORN SAMOL



National Institute of Metrology (Thailand)

Certificate of Calibration

Certificate No. : AA-2013-21
Issued by : Acoustics Laboratory
Acoustics and Vibration Group



Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator
MANUFACTURER : RION
MODEL/TYPE : NC-75
SERIAL NUMBER : 34480442
CUSTOMER : MET Co., Ltd.
36/659 Moo 6, T. Bangrakphatthana,
Bangbuathong, Nonthaburi 11110
MEASUREMENT DATE : 6 September 2021

*The calibration results only marked with an asterisk * in this certificate are not included in Appendix C of the MRA drawn up by the CIPM.*

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 calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference
AUVCO84-01/21

Date
6 September 2021

Authorized Signatory

Person in charge

(Pairoj Rattanangul)

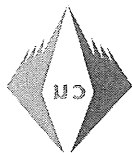
(Yada Juntarapaso)

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation

3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659
75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



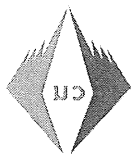
UNCERTAINTY OF MEASUREMENT

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

| Parameter | Uncertainty at SPL94 dB | Maximum-permitted uncertainty of measurement for a coverage probability of 95% |
|------------------------|----------------------------|---|
| 1.Sound Pressure level | 0.08 | 0.15 |
| 2. Frequency | 0.1 | 0.2 |
| 3. THD+N | 0.2 | 0.5 |

TRACEABILITY

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



MEASUREMENT RESULTS

1. Sound pressure level

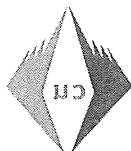
| Specified sound pressure level (dB) | Measured value (dB) | Deviated value ^[1] (dB) | Acceptance Limit (dB) |
|--|---------------------|------------------------------------|-----------------------|
| Microphone 4180 Serial No.1395446 | | | |
| 94 | 94.12 | 0.12 | 0.25 |

Note ^[1] : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

2. Frequency*

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value ^[2] (%) | Acceptance Limit (%) |
|---|---------------------|-----------------------------------|----------------------|
| At the sound pressure level of 94 dB | | | |
| 1000 | 1000.0 | 0.0 | 0.7 |

Note ^[2] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.



ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature : (23.0 ± 1.0) °C
Pressure : (101.325 ± 1.500) kPa
Relative Humidity : (50.0 ± 15.0) %

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

Calibration Condition

Preconditionings : 16 hours at ambient conditions.

Measurement Con : The average values during measurement are
 (100.965 ± 0.013) kPa, (22.3 ± 0.3) °C and (62.2 ± 2.6) %RH

MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

Reference Microphone

B&K Type 4180 serial no.1395446

TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 μ Pa are corrected to the values under the reference environmental conditions.

The microphone volume corrections and the calibrator pressure corrections are excluded in the calibration results.



3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

| Measured value ^[3] (%) | Maximum total distortion + Noise (%) |
|---|---|
| At the sound pressure level of 94 dB | |
| 1.5 | 2.5 |

Note ^[3]: The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz. The measured value must not exceed the maximum total distortion + noise appeared in the table.

End of Certificate of Calibration



บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6503001

Calibrated Date : 16 March 2022

Acoustic Calibrator Data

| | | | | | |
|----------------------|---|------------------|------------------|---|------------------|
| Brand | : | RION | Serial No. | : | 34480442 |
| Model | : | NC-75 | Last Calibration | : | 6 September 2021 |
| Range of Calibration | : | 94.0 dB, 1000 Hz | Due Date | : | 6 September 2022 |

Calibration Data

| Brand | Serial No. | Actual Reading [dB(A)] | |
|------------|------------|------------------------|------------------|
| | | Before Adjustment | After Adjustment |
| RION/NL-21 | 00722042 | 94.5 | 94.0 |
| RION/NL-21 | 00722043 | 94.9 | 94.0 |
| ACO 6236 | 79210 | 94.1 | 94.0 |
| ACO 6236 | 76238 | 94.4 | 94.0 |
| ACO 6236 | 76239 | 94.2 | 94.0 |
| ACO 6236 | 222064 | 94.1 | 94.0 |

Calibrated by :

Satta C.

(Mr. Satta Chaikitrakoon)

Approved by :

Preecha Sr.

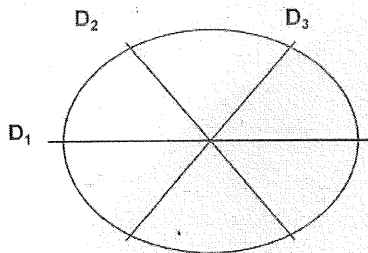
(Mr. Preecha Srisuk)

NOZZLE CALIBRATION

| Sampling System Equipment Information | | Inspection Conditions | | | |
|--|---------|---------------------------|------|------------------|--------------------|
| Console Model Number | XC572V | Date | Time | 24-Feb-22 | 8:30 AM |
| Console Serial Number | 0509047 | Calibration Reference No. | | HC65APE0023 | |
| DGM Model Number | SK25 | Barometric Pressure | | 758 | mm Hg |
| DGM Serial Number | 8001032 | Calibration | | Vernier ,0-150mm | 0.01 mm increments |
| | | Method Reference | | US.EPA Method | |

| Inspection Data | | | | | Results | |
|-----------------|-----------------|----------------|----------------|----------------|-----------|--|
| Nozzle ID | Nozzle Diameter | | | | Different | (D ₁ + D ₂ + D ₃) / 3 |
| Sizes | | D ₁ | D ₂ | D ₃ | ΔD | Davg |
| | mm | mm | mm | mm | mm | mm |
| 4 | 3.2 | 3.04 | 3.04 | 3.03 | 0.006 | 3.037 |
| 5 | 4.0 | 4.01 | 4.01 | 4.00 | 0.006 | 4.007 |
| 8 | 6.4 | 5.99 | 5.89 | 6.04 | 0.076 | 5.973 |
| 10 | 8.0 | 7.58 | 7.53 | 7.50 | 0.040 | 7.537 |
| 12 | 9.5 | 9.38 | 9.37 | 9.46 | 0.049 | 9.403 |
| 14 | 11.1 | 11.01 | 11.02 | 11.12 | 0.061 | 11.050 |
| 16 | 12.7 | 12.43 | 12.49 | 12.52 | 0.046 | 12.480 |

- D1, D2, D3 = There difference nozzle diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm
- ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm
- Davg = (D₁ + D₂ + D₃) / 3



Signature _____

(Surachai Chaisana)
Service Engineer

บริษัท สกทิพแอสโซซิเอตส์ จำกัด
SITHIPORN ASSOCIATES COMPANY

บริษัท สกทิพ แอสโซซิเอตส์ จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสิรินธร แขวงบางบำหรุ เขตบางพลี กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL:center@sithiporn.com www.sithiporn.com

THERMOCOUPLES SYSTEM CALIBRATION

| Sampling System Equipment Information | |
|---------------------------------------|-----------|
| Console Model Number | XC572V |
| Console Serial Number | 0509047 |
| DGM Model Number | SK25 |
| DGM Serial Number | 8001032 |
| Meter Box Model Number | JENCO 765 |
| Meter Box Model Number | REX-C100 |

| Calibration Conditions | | | |
|---------------------------|-------------|-----------|---------|
| Date | Time | 24-Feb-22 | 8:30 AM |
| Calibration Reference No. | HC65APE0023 | | |
| Barometric Pressure | 758 | mm Hg | |
| Reference Thermometer | FLUKE 714 | | |
| Serial Number | 9038005 | | |

| Results | | | | | | | | | | | | |
|--------------------------------|--|------|------|------|-------|-------|-------|-------|-------|-------|--------|--|
| Console Thermocouple Simulator | | | | | | | | | | | | |
| Channel and test point | Meter Box Channal Temperature Reading (°C) | | | | | | | | | | | |
| | 0.0 | 25.0 | 38.0 | 93.0 | 149.0 | 260.0 | 371.0 | 482.0 | 593.0 | 816.0 | 1038.0 | |
| Stack | 0 | 25 | 38 | 94 | 152 | 260 | 371 | 485 | 596 | 818 | 1041 | |
| Probe | 0 | 25 | 38 | 94 | 151 | | | | | | | |
| Filter | 0 | 25 | 38 | 94 | 151 | | | | | | | |
| Aux | 0 | 25 | 38 | 94 | 152 | | | | | | | |
| Exit | 0 | 25 | 38 | | | | | | | | | |
| Meter | 0 | 25 | 38 | | | | | | | | | |

Tolerance Range

Stack ± 1.50% Absolute
Probe ± 3.0 °C
Filter ± 3.0 °C

Aux ± 3.0 °C
Exit ± 2.0 °C
Meter ± 2.0 °C

Note. Cabel socket temp probe wrong + -

Signature _____

(Surachai Chaisana)
Service Engineer

บริษัท สกทิพพร แอสโซซิเอต จำกัด
SITHIPHORN ASSOCIATES COMPANY LIMITED

บริษัท สกทิพพร แอสโซซิเอต จำกัด

Sithiphorn Associates Co., Ltd.

451-451/1 ถนนสิรินธร แขวงบางบำหรุ เขตบางพลัด กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL: center@sithiphorn.com

www.sithiphorn.com

HEATER SYSTEM CALIBRATION

| Sampling System Equipment Information | |
|---------------------------------------|------------------------------|
| Console Model Number | XC572V |
| Console Serial Number | 0509047 |
| DGM Model Number | SK25 |
| DGM Serial Number | 8001032 |
| Probe Heater | Standard Method 5 Assemblies |
| Heated Filter Box | SB-2-V |

| Calibration Conditions | | | |
|---------------------------|-------------|-----------|---------|
| Date | Time | 24-Feb-22 | 8:30 AM |
| Calibration Reference No. | HC65APE0023 | | |
| Barometric Pressure | 758 | mm Hg | |

| Results | | | | |
|------------------------------------|--------------------|-----------------------------------|--|------------------------|
| System Heat | Control Acceptance | Reference thermometer temperature | Thermocouple potentiometer temperature | Temperature difference |
| | °C | °C | °C | °C |
| Probe Heater System for 5ft. Probe | 120 °C ± 14 °C | 121 | 120.5 | 0.13 |
| Heated Filter Box | 120 °C ± 14 °C | 121 | 120 | 0.25 |

Note: Check Acceptance Limits, capable of maintaining 120 °C ± 14 °C at 20-lpm flow rate

Signature _____

(Surachai Chaisana)
Service Engineer

บริษัท สกทิพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY (Public)

บริษัท สกทิพร แอสโซซิเอต จำกัด

Sithiporn Associates Co., Ltd.

451-451/1 ถนนสีรินธร แขวงบางปทุม เขตบางพลัด กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510

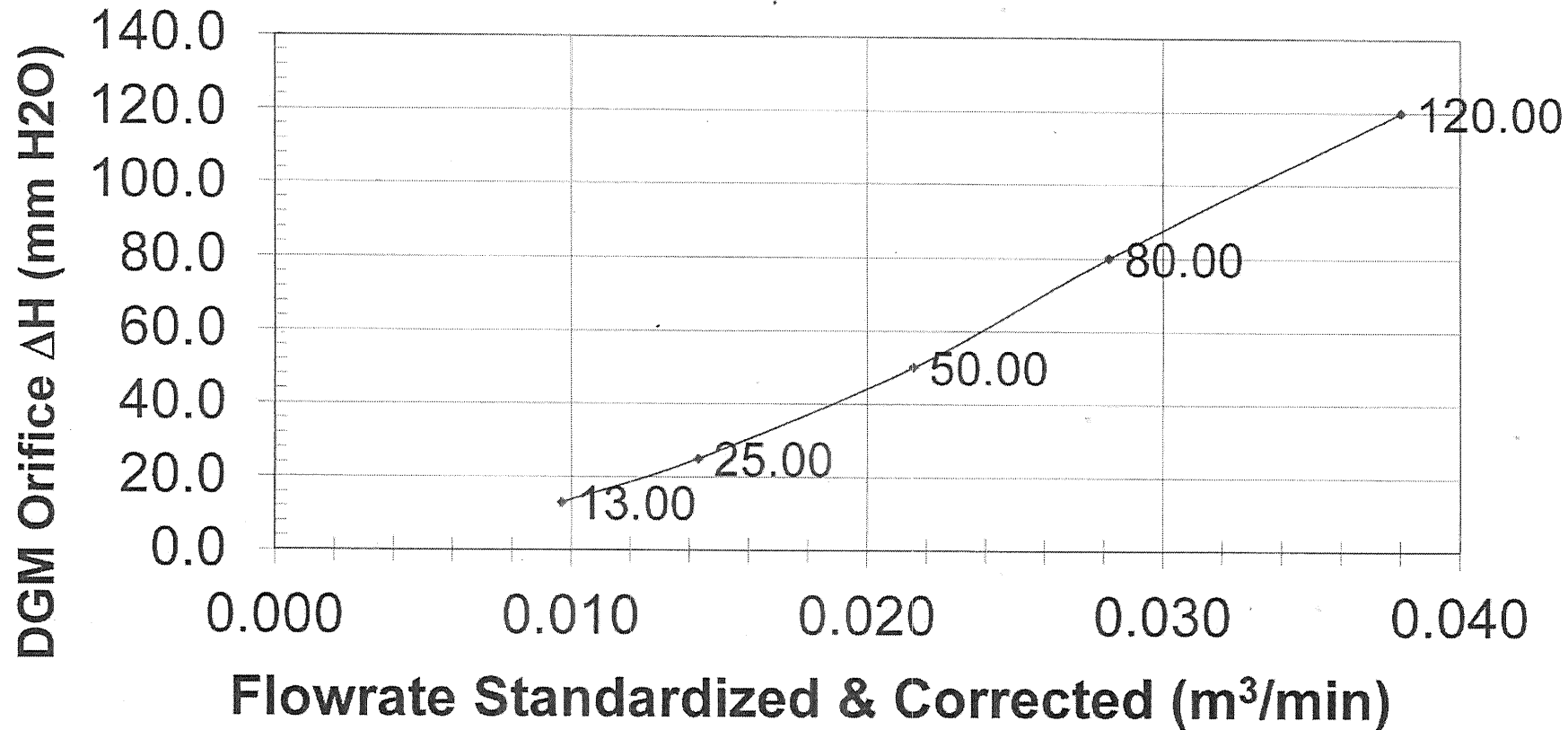
451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL: center@sithiporn.com www.sithiporn.com

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023

Meter Pressure vs Flowrate



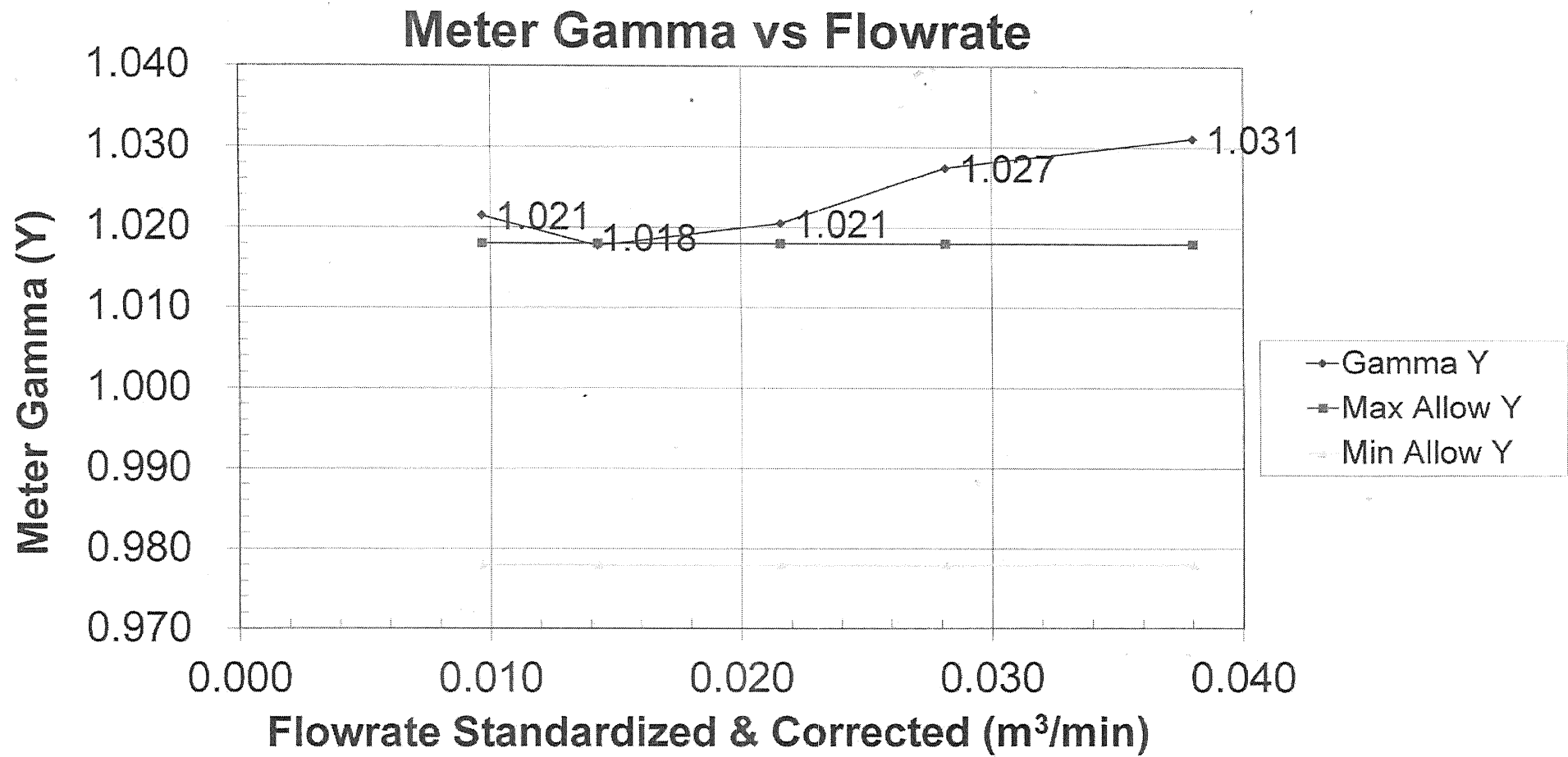
Console Serial: 0509047

บริษัท สหกิจพาณิชยกิจ จำกัด
SITHIPORN ASSOCIATES COMPANY

Console Model: XC572V

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023



Console Serial: 0509047

บริษัท สกซิพรแอสโซซิเอตส์ จำกัด
SITIPORN ASSOCIATES COMPANY LIMITED

Console Model: XC572V

METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING REFERENCE METER # WET TEST METER W-NK5A No. 540961
5-POINT METRIC UNIT

| Meter Console Information | |
|---------------------------|---------|
| Console Model Number | XC572V |
| Console Serial Number | 0509047 |
| DGM Model Number | SK25 |
| DGM Serial Number | 8001032 |

| Calibration Conditions | | | |
|---------------------------|-------------|-----------|---------|
| Date | Time | 24-Feb-22 | 8:30 AM |
| Calibration Reference No. | HC35APE0023 | | |
| Barometric Pressure | 758 | mm Hg | |
| Calibration Meter Gamma | 0.9980 | unitless | |

| Factors/Conversions | | |
|---------------------|-------|-------|
| Std Temp | 293 | K |
| Std Press | 760 | mm Hg |
| K ₁ | 0.386 | |
| Console Leak Check | PASS | |

| Calibration Data | | | | | | | | | |
|------------------|---------------------------|-------------------|-----------------|------------------------|----------------------|-------------------|-----------------|------------------------|----------------------|
| Run Time | Metering Console | | | | | Calibration Meter | | | |
| Elapsed | DGM Orifice ΔH | Volume Initial | Volume Final | Outlet Temp Initial | Outlet Temp Final | Volume Initial | Volume Final | Outlet Temp Initial | Outlet Temp Final |
| (Θ) | (P_m) | (V_{mi}) | (V_{mf}) | (t_{mi}) | (t_{mf}) | (V_{wi}) | (V_{wf}) | (t_{wi}) | (t_{wf}) |
| min | mm H ₂ O | m ³ | m ³ | °C | °C | m ³ | m ³ | °C | °C |
| 15.00 | 13.0 | 3826.4749 | 3826.6201 | 26 | 26 | 268.44500 | 268.59380 | 26 | 26 |
| 10.00 | 25.0 | 3826.6500 | 3826.7934 | 26 | 26 | 268.61426 | 268.76088 | 26 | 26 |
| 8.00 | 50.0 | 3826.8148 | 3826.9870 | 26 | 26 | 268.77850 | 268.95544 | 26 | 26 |
| 7.00 | 80.0 | 3827.0198 | 3827.2147 | 26 | 26 | 268.98871 | 269.19091 | 26 | 26 |
| 5.00 | 120.0 | 3827.5000 | 3827.6865 | 26 | 26 | 269.19122 | 269.38615 | 26 | 26 |

| Results | | | | | | | | |
|-------------------|---------------------|-------------------|---------------------|--------------------|----------------|------------------------|--|------------------------|
| Standardized Data | | | | Dry Gas Meter | | | | |
| Dry Gas Meter | | Calibration Meter | | Calibration Factor | | Flowrate | ΔH @ | |
| ($V_{m(std)}$) | ($Q_{m(std)}$) | ($V_{w(std)}$) | ($Q_{w(std)}$) | Value | Variation | Std & Corr | .0212 m ³ _{std} /min | Variation |
| m ³ | m ³ /min | m ³ | m ³ /min | (Y) | (ΔY) | ($Q_{m(std)(corr)}$) | (ΔH @) | ($\Delta \Delta H$ @) |
| | | | | | | m ³ /min | mm H ₂ O | |
| 0.142 | 0.009 | 0.145 | 0.010 | 1.021 | -0.002 | 0.010 | 61.378 | 12.190 |
| 0.140 | 0.014 | 0.143 | 0.014 | 1.018 | -0.006 | 0.014 | 54.157 | 4.969 |
| 0.169 | 0.021 | 0.173 | 0.022 | 1.021 | -0.003 | 0.022 | 47.830 | -1.358 |
| 0.192 | 0.027 | 0.197 | 0.028 | 1.027 | 0.004 | 0.028 | 45.127 | -4.061 |
| 0.184 | 0.037 | 0.190 | 0.038 | 1.031 | 0.007 | 0.038 | 37.447 | -11.741 |
| | | | | 1.024 | Y Average | | 49.188 | ΔH @ Average |

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

Note: For ΔH_{std} , orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Signature

(Surachai Chaisana)
Service Engineer

SITHIPHORN ASSOCIATES COMPANY

Date

24 / 02 / 2022

Certificate of Calibration

Certificate No. : 64-200244-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.2 to 26.5) °C
Relative Humidity : (45.2 to 45.8) %
Air Pressure : 1007.0 mbar

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 24 August 2021

Calibrated by : Wutthiporn Woraphan

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

| ID No. | Cert. No. | Due Date | Traceability |
|------------|-----------|-------------|--|
| E261-E2624 | C02204101 | 17 Nov 2021 | National Institute of Metrology (Thailand), (NIMT) |

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 64-200244-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

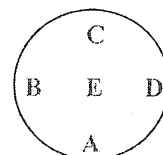
| Nominal Value (g) | Correction (g) | Uncertainty \pm (g) |
|----------------------|-------------------|--------------------------|
| 0.05 | 0.0000 | 0.00011 |
| 0.1 | 0.0000 | 0.00011 |
| 0.5 | -0.0001 | 0.00011 |
| 1 | -0.0001 | 0.00011 |
| 5 | 0.0000 | 0.00011 |
| 10 | 0.0001 | 0.00012 |
| 50 | 0.0000 | 0.00014 |
| 100 | 0.0000 | 0.00020 |
| 150 | 0.0001 | 0.00038 |
| 200 | 0.0000 | 0.00038 |

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.11$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g

| | | | | | |
|---------|---------|--------|--------|--------|---|
| A | B | C | D | E | |
| -0.0001 | -0.0001 | 0.0001 | 0.0001 | 0.0000 | g |



Repeatability Load test : 200 g

Stdev. : 0.00005 g

- o0o -

Handwritten signature



EMEX

EMEX

EMEX

ใบรับรองการสอบเทียบ “เครื่องวัดก๊าซคาร์บอนมอนอกไซด์”

(Calibration Certificate of CO Analyzer)

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.

ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

EMEX

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : เอ็มเม็กซ์ แอสโซซิเอชั่น จำกัด

วันที่ : 20 กันยายน 2564

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 92

| TEST VALUES | | | |
|----------------|-----------------------------------|-------------------------------|-------------------------------|
| API MODEL T300 | | BEFORE | AFTER |
| 1 | RANGE PPM | 50 | 50 |
| 2 | STABILITY < 1 PPM | 0.0 | 0.0 |
| 3 | CO MEAS (Zero Air) 3600 - 4800 Mv | 3276.0 | 3656.8 |
| 4 | CO REF (Zero Air) 3000 - 4000 mV | 2706.0 | 3036.8 |
| 5 | MR RATION (Zero Air) 1.2 ± 0.05 | 1.221 | 1.220 |
| 6 | PRES IN-HG-A | 30.6 | 29.9 |
| 7 | SAMP FL 800 ± 10% cc/min | 740 | 819 |
| 8 | SAMPLE TEMP 48 ± 4 °C | 46.6 | 46.8 |
| 9 | BENCH TEMP 48 ± 1 °C | 48.0 | 48.0 |
| 10 | WHEEL TEMP 68 ± 2 °C | 68.0 | 68.0 |
| 11 | BOX TEMP AMBIENT ± 10 °C | 33.8 | 33.5 |
| 12 | PHT DRIVE 250 - 4750 Mv | 2922.6 | 2928.8 |
| 13 | SLOPE 1.0 ± 0.2 | 0.947 | 0.915 |
| 14 | OFFSET 0.05 ± 0.2 | 0.011 | 0.012 |
| 15 | SLOPE H 1.0 ± 0.2 | 2.765 | 0.904 |
| 16 | OFFSET H 0.05 ± 0.2 | 0.0012 | 0.011 |
| 17 | CO READING (Ambient) PPM | -0.5 | 0.3 |
| 18 | ELECTRICAL TEST 40.0 ± 2 PPM | 36.9 | 39.8 |
| 19 | VOLTAGE TEST +5V +12V +15V -15V | 5.23 / 12.12 / 16.67 / -15.09 | 5.24 / 12.10 / 15.67 / -15.01 |
| 20 | Zero GAS 0.00 PPM | 0 | 0.0 |
| 21 | Span GAS 0.00 PPM | 40 | 39.8 |

หมายเหตุ

- ทำการ Calibrate Sample Flow
- ทำการ Calibrate Sample Pressure
- ทำการ Calibrate ค่า Co MEAS และ Co REF ใหม่เนื่องจากค่าเดิมมีค่าต่ำ

รายการอะไหล่ที่เปลี่ยน

- เปลี่ยน Sintared Filter 1 ชิ้น
- เปลี่ยน Sample Filter 47 mm 1 ชิ้น
- เปลี่ยน O-Ring 2 ชิ้น
- เปลี่ยน Spring Flowed 1 ชิ้น

EMEX Environmental and Medical Expert
EMEX ASSOCIATION CO., LTD.

ห้องปฏิบัติการวิเคราะห์เอกชน

เลขที่ใบรับแจ้ง 1414
KINETICS

บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

(นายสันหรีฐา พัฒนภิรมย์กุล)

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณสันหรีฐา พัฒนภิรมย์กุล

โทรศัพท์ : 0-2515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : Info@kinetics.co.th

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : เอ็มเม็กซ์ แอสโซซิเอชัน จำกัด

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API

MODEL : T300

SERIAL NO : 92

STANDARD GAS CONCENTRATION (PPM) : 4448

CYLINDER NO : CC715528

CYLINDER PRESSURE (psig) : 1000

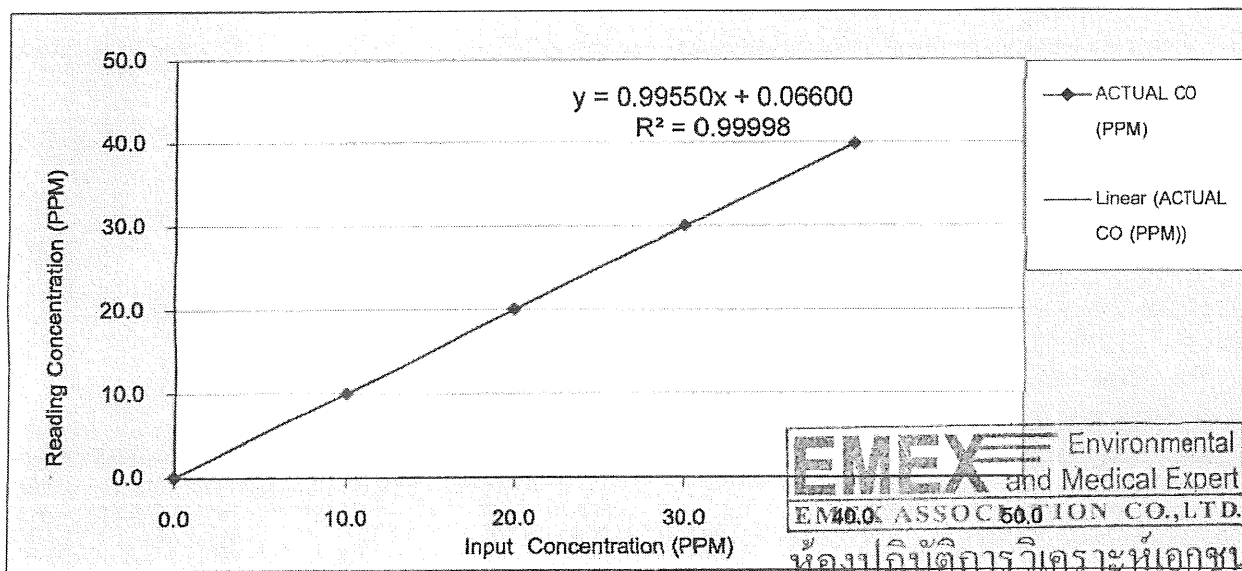
CERTIFIED DATE : Feb 13, 2019

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Feb 13, 2022

CALIBRATION RESULTS

| POINT NO | CALIBRATION RESULTS | | | |
|-------------|---------------------|-----------------|----------------|------------|
| | IDEAL (PPM) | ACTUAL CO (PPM) | ERROR CO (PPM) | % ERROR CO |
| ZERO | 0.00 | 0.00 | 0.00 | - |
| 1 | 10.00 | 10.05 | 0.05 | 0.50 |
| 2 | 20.00 | 20.03 | 0.03 | 0.15 |
| 3 | 30.00 | 30.00 | 0.00 | 0.00 |
| 4 | 40.00 | 39.80 | -0.20 | -0.50 |
| AVERAGE (%) | | | | 0.29 |



CALIBRATED BY : คุณสัณห์จุฑา พัฒนภิรมย์กุล

DATE : 20 กันยายน 2564

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณสัณห์จุฑา พัฒนภิรมย์กุล โทรศัพท์ : 02-515-8987

บริษัท เอ็มเม็กซ์ แอสโซซิเอชัน จำกัด

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : Info@kinetics.co.th

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-420003-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : pH 150

Range : N/A pH Resolution : 0.01 pH

Serial No. : 2913288 ID No. : MET-PH05/63

Electrode

Model : N/A Serial No. : 48393

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$

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

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-----------|-------------|---|
| 440001 | 21E997 | 17 Mar 2023 | National Institute of Metrology Thailand (NIMT) |

2. Standard Buffer Solution

| pH | Cert. No. | Lot No. | Exp. Date | Traceability |
|-------|-----------|---------|-------------|---|
| 4.004 | 61218215 | 769926 | 15 May 2022 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 6.985 | 61223875 | 769927 | 15 May 2022 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 9.963 | 61208865 | 769928 | 15 May 2022 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420003-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

| Adjustment Curve at nominal pH | Applied Voltage (mV) | Nominal Value (pH) | UUC Reading | | Correction (mV) | Uncertainty (± mV) |
|-----------------------------------|---------------------------|-------------------------|-------------|--------|----------------------|-------------------------|
| | | | (pH) | (mV) | | |
| 4, 7, 10 | 177.4800 | 4 | 4.00 | 177.5 | 0.0 | 0.060 |
| | 0.0000 | 7 | 7.00 | 0.2 | -0.2 | 0.058 |
| | -177.4800 | 10 | 10.00 | -177.2 | -0.3 | 0.060 |

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

| Adjustment Curve at nominal pH | Standard Buffer (pH) | UUC Reading (pH) | Correction (pH) | Uncertainty (± pH) |
|-----------------------------------|---------------------------|-----------------------|----------------------|-------------------------|
| 4, 7, 10 | 4.004 | 4.01 | 0.00 | 0.011 |
| | 6.985 | 7.00 | -0.01 | 0.011 |
| | 9.963 | 10.01 | -0.04 | 0.016 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- 000 -

B



Certificate of Calibration

Certificate No. : 65-400021-2

Page : 1 of 2

Submitted by : M E T Company Limited

6/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Digital Thermometer with Thermistor Probe
Temperature Indicator

Manufacturer : Thermo Scientific

Model : pH 150

Range : N/A

Resolution : 0.1 °C

Serial No. : 2913288

ID No. : MET-PH05/63

Thermistor Probe

Model : PHWPTEM01W

Sheath Material : Stainless

Diameter : 3 mm.

Length : 85 mm.

Serial No. : 459

ID No. : MET-PH05/63

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90


Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No. | Due Date | Traceability |
|--------|------------|-------------|---|
| 400001 | TT-0016-20 | 04 Mar 2022 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-----------|-------------|---|
| 400003 | 21E1850 | 14 Jun 2023 | National Institute of Metrology Thailand (NIMT) |
| 400004 | 21E1850 | 14 Jun 2023 | National Institute of Metrology Thailand (NIMT) |

Approved by : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400021-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

| Immersion Depth (mm.) | Standard Reading (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|----------------------------|----------------------------|-----------------------|----------------------|-------------------------|
| 85 | 10.0024 | 10.1 | -0.1 | 0.11 |
| 85 | 50.0038 | 50.4 | -0.4 | 0.11 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- oOo -

B



Certificate of Calibration

Certificate No. : 64-400425-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

| ID No. | Cert. No. | Due Date | Traceability |
|-----------------|-------------|-------------|---|
| 400029 & 400032 | 64-400106-1 | 30 Sep 2021 | National Institute of Metrology Thailand (NIMT) |

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-5

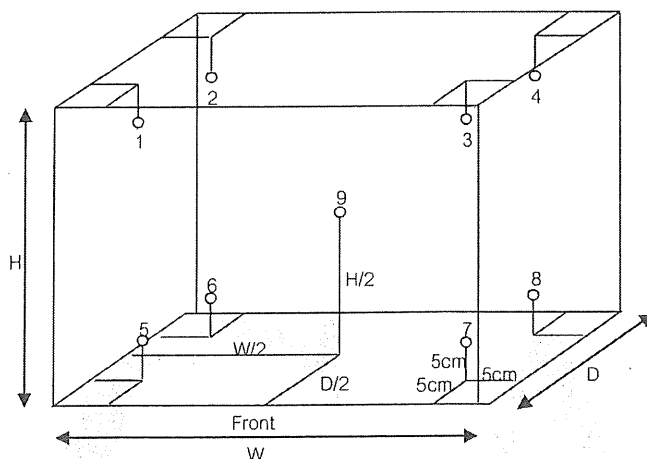
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|--------------------|-----------------------------|--------------------------------|--|------|------|------|------|------|------|------|------|-----------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 20.0 | 20.0 | 20.0 | 19.9 | 19.8 | 19.7 | 19.5 | 20.4 | 20.4 | 20.3 | 20.1 | 20.4 | 0.57 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 20.0 | 20.0 | 20.0 | 1.0 | 0.1 | 1.0 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

- o o o -

Signature



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-07419

ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030 64-400104-1

29 Sep 2021

National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-2

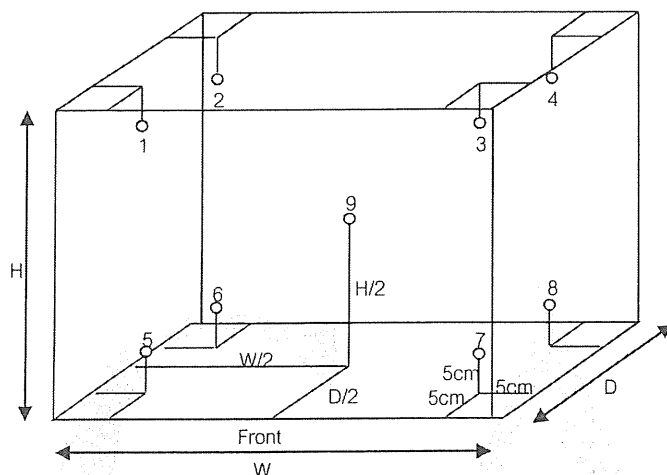
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|--------------------|-----------------------------|--------------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-----------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 104 | 109 | 109 | 104.8 | 105.0 | 104.4 | 104.6 | 103.4 | 103.5 | 103.6 | 103.7 | 103.7 | 0.96 |
| 180 | 184 | 184 | 180.8 | 181.8 | 179.9 | 180.6 | 180.6 | 180.8 | 180.6 | 180.9 | 180.5 | 1.1 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 104 | 109 | 109 | 1.5 | 0.2 | 1.8 |
| 180 | 184 | 184 | 1.6 | 0.2 | 2.3 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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B



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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UM 100

Range : N/A °C

Resolution : 0.1 °C

Serial No. : b197.0985

ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

| <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> | <u>Traceability</u> |
|-----------------|------------------|-----------------|---|
| 400029 & 400032 | 64-400106-1 | 30 Sep 2021 | National Institute of Metrology Thailand (NIMT) |

Approved by :

(Bunjerd Masri)

Supervisor

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Certificate of Calibration

Certificate No. : 64-400425-1

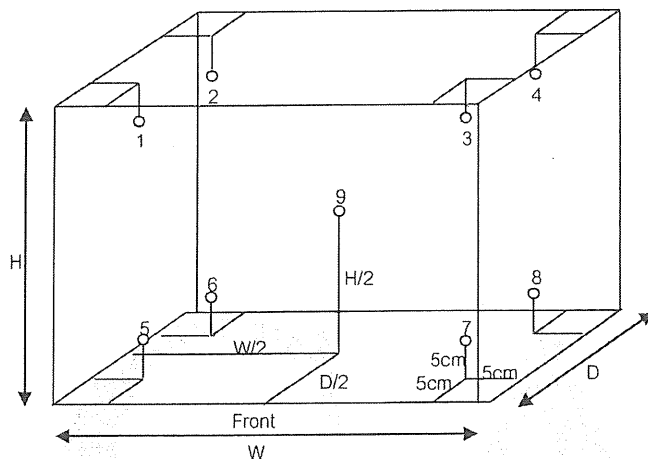
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.32 m

D = 0.18 m

H = 0.24 m

Capacity = 0.01 m³

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|-----------------|--------------------------|-----------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 180.0 | 180.0 | 180.0 | 180.9 | 181.2 | 180.7 | 181.0 | 181.1 | 181.3 | 180.6 | 180.7 | 179.6 | 0.95 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|-----------------|--------------------------|-----------------------------|--------------------------|-------------------------|------------------------|
| 180.0 | 180.0 | 180.0 | 1.9 | 0.2 | 2.0 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-3

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : YPR-068S

Range : N/A °C

Resolution : 1 °C

Serial No. : YPR0659S-141200060R

ID No. : MET-RE03/59

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (28.6 to 30.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.0 to 220.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400022 & 400023 64-400101-1

01 Sep 2021

National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-3

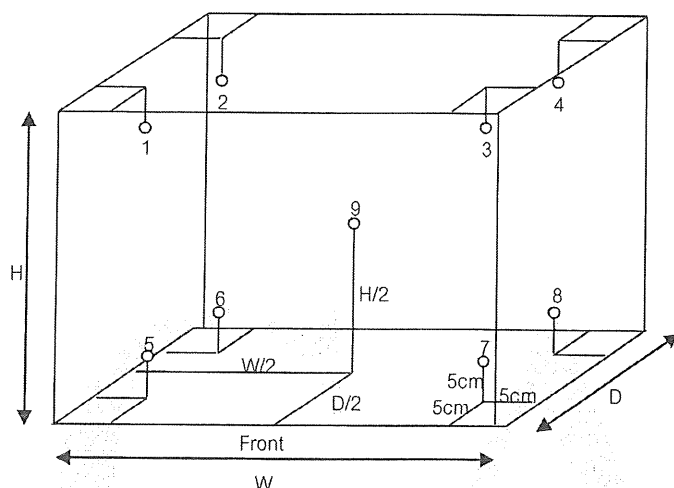
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|--------------------|-----------------------------|--------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 3 | 2 | 2 | 3.6 | 3.6 | 3.8 | 3.5 | 2.9 | 3.5 | 2.9 | 3.2 | 3.0 | 0.83 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 3 | 2 | 2 | 0.8 | 0.2 | 1.1 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- o0o -





Certificate of Calibration

Certificate Number : SPR21120189-2

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial Number : 00722043

ID. Number : SLM-45

Environmental Conditions

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

Received Date : 13 Dec 2021

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

Calibration Date : 13 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : 13 Dec 2022

Calibration Procedure : SP-CPE-04-01

Date of Issue : 14 Dec 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

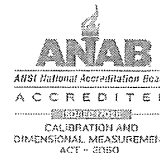
Calibrated by : Mr. Surasak Vakjan

Approved by :

Calibration Officer

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21120189-2

Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|------------------------|--------|------------|-----------------|-------------|
| Sound Level Calibrator | SC-942 | B014059 | EEL.BP.19/1063 | 15 Oct 2022 |

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR21120189-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.1 | 114.1 | 0.1 | 0.1 | 0.15 |

Select C

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.1 | 114.1 | 0.1 | 0.1 | 0.15 |

Select F

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.1 | 94.1 | 0.1 | 0.1 | 0.15 |
| 114 | 114.1 | 114.1 | 0.1 | 0.1 | 0.15 |

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR21120189- 1

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial Number : 00722042

ID. Number : SLM-46

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 13 Dec 2021

Calibration Date : 13 Dec 2021

Recommend Due Date : 13 Dec 2022

Date of Issue : 14 Dec 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Surasak Vakjan

Calibration Officer

Approved by :

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21120189- 1

Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|------------------------|--------|------------|-----------------|-------------|
| Sound Level Calibrator | SC-942 | B014059 | EEL.BP.19/1063 | 15 Oct 2022 |

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR21120189-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 113.9 | 113.9 | -0.1 | -0.1 | 0.15 |

Select C

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.0 | 114.0 | 0.0 | 0.0 | 0.15 |

Select F

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.0 | 114.0 | 0.0 | 0.0 | 0.15 |

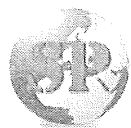
Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR21120189-4

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 79210

ID. Number : N/A

Environmental Conditions

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

Received Date : 13 Dec 2021

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

Calibration Date : 13 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : 13 Dec 2022

Calibration Procedure : SP-CPE-04-01

Date of Issue : 14 Dec 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Surasak Vakjan

Approved by :

Calibration Officer

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21120189-4

Page : 2 of 3

Reference Standards

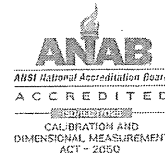
| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|------------------------|--------|------------|-----------------|-------------|
| Sound Level Calibrator | SC-942 | B014059 | EEL.BP.19/1063 | 15 Oct 2022 |

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research





Certificate of Calibration

Certificate Number : SPR21120189-3

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 76239

ID. Number : N/A

Environmental Conditions

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

Received Date : 13 Dec 2021

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

Calibration Date : 13 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : 13 Dec 2022

Calibration Procedure : SP-CPE-04-01

Date of Issue : 14 Dec 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Surasak Vakjan

Approved by :

Calibration Officer

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21120189-3

Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|------------------------|--------|------------|-----------------|-------------|
| Sound Level Calibrator | SC-942 | B014059 | EEL.BP.19/1063 | 15 Oct 2022 |

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR21120189-3

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 93.9 | 93.9 | -0.1 | -0.1 | 0.15 |
| 114 | 113.9 | 113.9 | -0.1 | -0.1 | 0.15 |

Select C

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.0 | 114.0 | 0.0 | 0.0 | 0.15 |

Select Z

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 94.0 | 94.0 | 0.0 | 0.0 | 0.15 |
| 114 | 114.0 | 114.0 | 0.0 | 0.0 | 0.15 |

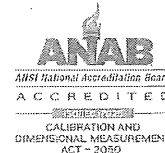
Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR21120189-5

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 76238

ID. Number : N/A

Environmental Conditions

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

Received Date : 13 Dec 2021

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

Calibration Date : 13 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : 13 Dec 2022

Calibration Procedure : SP-CPE-04-01

Date of Issue : 14 Dec 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

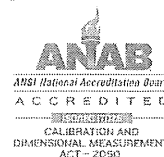
Calibrated by : Mr. Surasak Vakjan

Approved by :

Calibration Officer

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21120189-5

Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|------------------------|--------|------------|-----------------|-------------|
| Sound Level Calibrator | SC-942 | B014059 | EEL.BP.19/1063 | 15 Oct 2022 |

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR21120189-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 93.8 | 93.8 | -0.2 | -0.2 | 0.15 |
| 114 | 113.8 | 113.8 | -0.2 | -0.2 | 0.15 |

Select C

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 93.8 | 93.8 | -0.2 | -0.2 | 0.15 |
| 114 | 113.8 | 113.8 | -0.2 | -0.2 | 0.15 |

Select Z

Unit : dB

| Standard Setting | UUC Reading | | Error | | Uncertainty (±) |
|------------------|-------------|-------|-------|------|-------------------|
| | Fast | Slow | Fast | Slow | |
| 94 | 93.9 | 93.9 | -0.1 | -0.1 | 0.15 |
| 114 | 113.9 | 113.9 | -0.1 | -0.1 | 0.15 |

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkoe Bangkok 10160

Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2111-099-0002

Date Issued : 15-Nov-21

Customer : MET CO.,LTD.
36/659 Moo 6 T. Bangrakpattana A.Bangbuatong Nonthaburi 11110

Equipment : Heat Stress Meter

Manufacturer : METROSONIC

Model : hs-32

Serial No. : MCE010018

ID No./Tag No. : HT-02

Date Received : 09-Nov-21

Date Calibrated : 12-Nov-21

Calibrated by : Ms. Yaowanuch Jirakiattikul

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :

K. Nathong

(Mr. Nathapong Krudaum)



Page 1 of 2

Certificate No. : AD2111-099-0002

Environment : Ambient Temperature : $(25 \pm 2)^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\%\text{RH}$

| STD Reading ($^\circ\text{C}$) | UUC Reading ($^\circ\text{C}$) | | UUC Error ($^\circ\text{C}$) | Measurement Uncertainty ($\pm^\circ\text{C}$) |
|-------------------------------------|----------------------------------|----------------|-----------------------------------|--|
| | Before Adjusted | After Adjusted | | |
| 23.99 | WET 24.0 | - | 0.01 | 0.35 |
| 27.99 | DRY 27.9 | - | -0.09 | 0.35 |
| 30.01 | GLOBE 29.7 | - | -0.31 | 0.35 |
| 26.99 | WET 27.0 | - | 0.01 | 0.35 |
| 32.00 | DRY 31.9 | - | -0.10 | 0.35 |
| 35.01 | GLOBE 34.8 | - | -0.21 | 0.35 |
| 30.01 | WET 29.8 | - | -0.21 | 0.35 |
| 36.01 | DRY 35.7 | - | -0.31 | 0.35 |
| 39.99 | GLOBE 39.7 | - | -0.29 | 0.35 |

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 100 $^\circ\text{C}$
Resolution 0.1 $^\circ\text{C}$

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkoe Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2111-091-0001

Date Issued : 11-Nov-21

Customer : MET CO.,LTD.
36/659 Moo 6 T. Bangrakpattana A.Bangbuatong Nonthaburi 11110

Equipment : Heat Stress Meter

Manufacturer : QUEST TECHNOLOGY

Model : QUESTemp 34

Serial No. : TFB060016

ID No./Tag No. : HT-11

Date Received : 09-Nov-21

Date Calibrated : 10-Nov-21

Calibrated by : Ms. Yaowanuch Jirakiattikul

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :

K. Nathong

(Mr. Nathapong Krudaum)



Certificate No. : AD2111-091-0001

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\% \text{RH}$

| STD Reading ($^\circ\text{C}$) | UUC Reading ($^\circ\text{C}$) | | UUC Error ($^\circ\text{C}$) | Measurement Uncertainty ($\pm^\circ\text{C}$) |
|-------------------------------------|----------------------------------|----------------|-----------------------------------|--|
| | Before Adjusted | After Adjusted | | |
| 23.99 | WET 24.1 | - | 0.11 | 0.40 |
| 27.99 | DRY 28.1 | - | 0.11 | 0.35 |
| 30.01 | GLOBE 30.1 | - | 0.09 | 0.35 |
| 26.99 | WET 26.9 | - | -0.09 | 0.40 |
| 32.00 | DRY 32.1 | - | 0.10 | 0.35 |
| 35.01 | GLOBE 35.1 | - | 0.09 | 0.35 |
| 30.01 | WET 30.0 | - | -0.01 | 0.40 |
| 36.00 | DRY 36.0 | - | 0.00 | 0.35 |
| 40.03 | GLOBE 40.0 | - | -0.03 | 0.35 |

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 100 $^\circ\text{C}$
Resolution 0.1 $^\circ\text{C}$

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2011-059-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 13-Nov-21

End of Certificate

