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เอกสารสอบเทียบเครื่องมือฯ

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

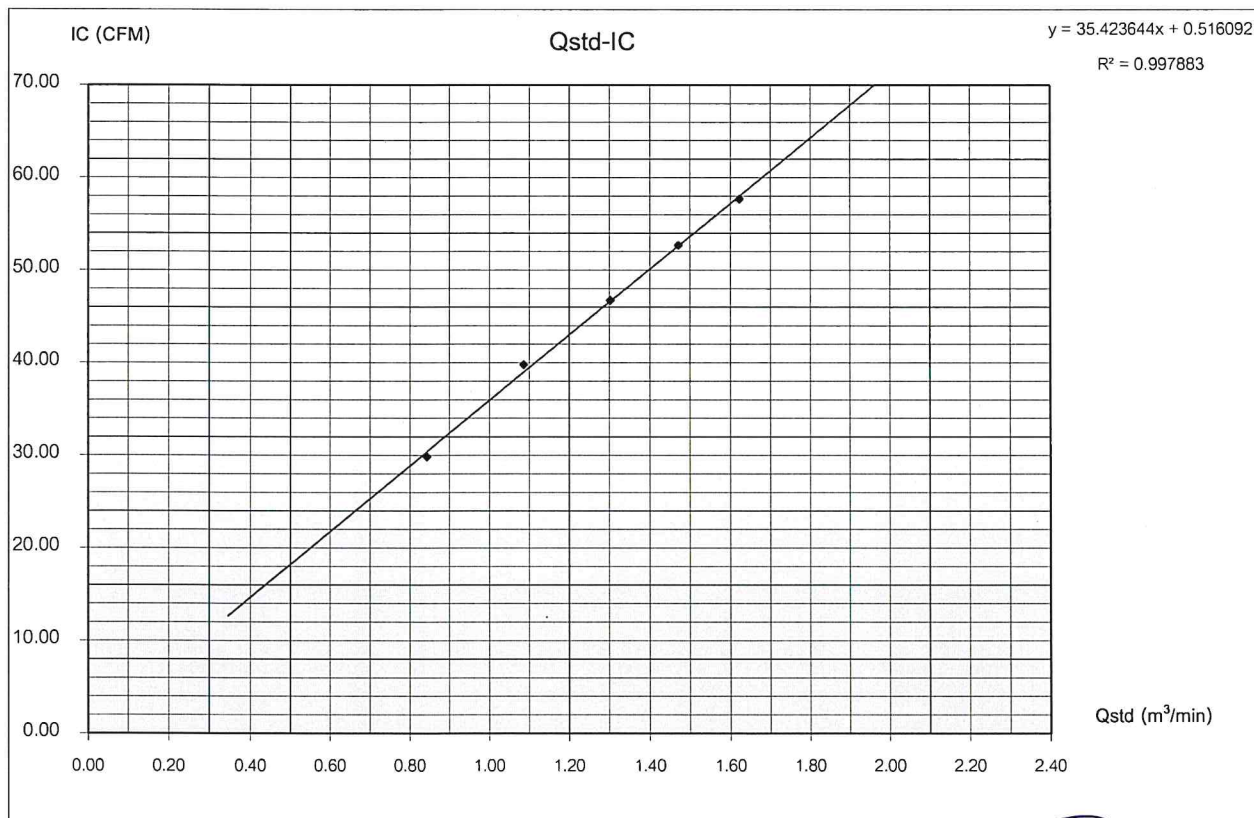
Sampler Location				Date	January 30, 2023
A1 บริเวณหมู่ 6 บ้านดอนไม้เรียง				Start Time	11:31 AM
Sampler Number	TSP No.A7	Transfer Standard Type	Orifice	Stop Time	11:41 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr. Anan Kongngoennok
Motor Serial Number	B-NO.A7	Calibrator Serial Number	2914		
Recorder Serial Number	6167				

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H \cdot O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O		(m ³ /min)	(l ³ /min)					
5	1.5	1.5	3.0	1.72226	0.84350	30.0	29.83	301.0	759.0		
7	2.5	2.5	5.0	2.22343	1.08677	40.0	39.77	301.0	759.0		
10	3.6	3.6	7.2	2.66812	1.30262	47.0	46.73	301.0	759.0		
13	4.6	4.6	9.2	3.01601	1.47149	53.0	52.70	301.0	759.0		
18	5.6	5.6	11.2	3.32773	1.62279	58.0	57.67	301.0	759.0		
Linear Regression Y ON X : Y= mX + b							Average	301.0	759.0		

1	Slope (m)	2.06015	Linear Equation				r^2	0.997883	Pstd(mmHg)	760.0
2	Intercept (b)	-0.01547	Set Point Flow Rate (X) (m ³ /min)			1.133	r	0.9989409	T _{NTP}	298.0
3	Correlation Coefficient (r)	1.00000	Final Set Flow Rate = (I)			0		(Pa/Pstd)*(Tstd/Ta)		0.988730547
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.994349308

COMMENT

Andersen Instruments, Inc.



Checked By

Prayun
(Mr. Prayun Detkla)

Technician



Approved By

Podang
(Mr. Panupon Podang)

Environmental Scientist

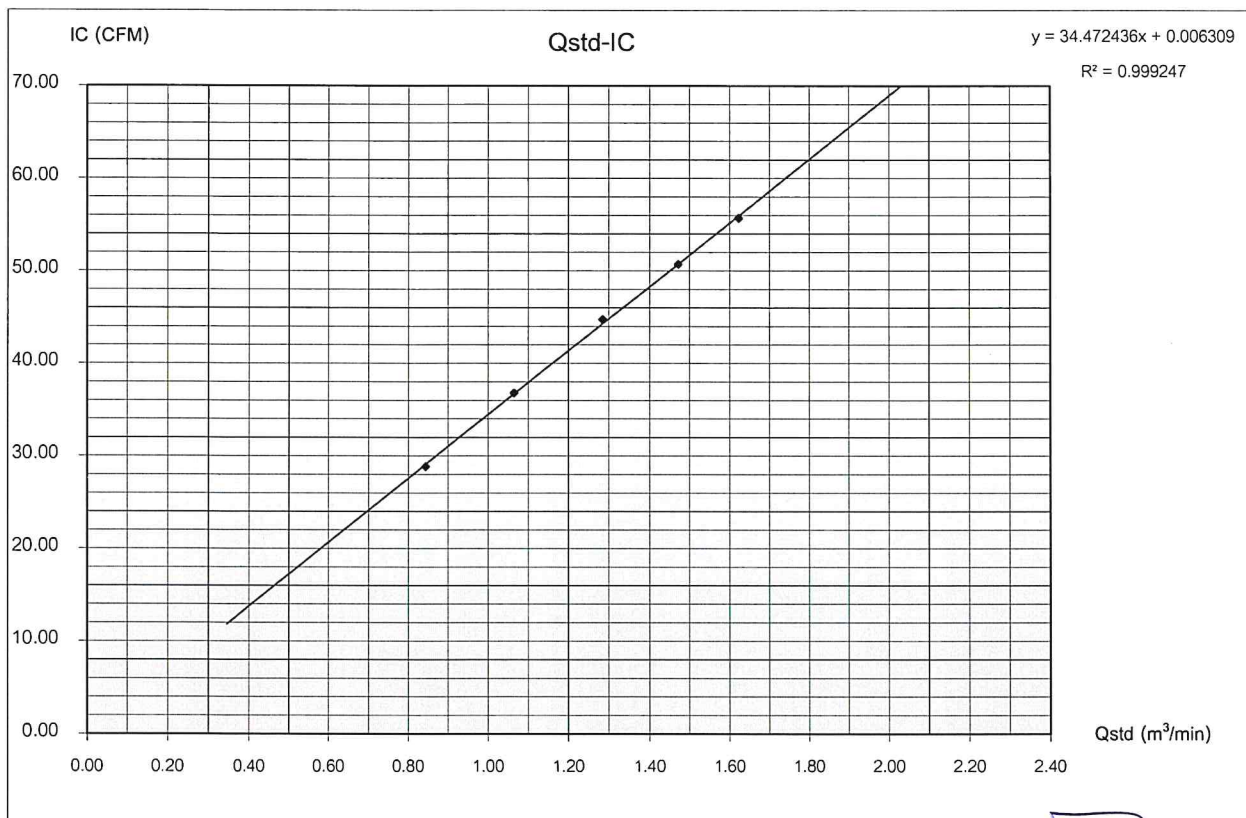
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	January 30, 2023
A1 บริเวณหมู่ 6 บ้านดอนไม้เรียง				Start Time	11:42 PM
Sampler Number	PM-10 No.14	Transfer Standard Type	Orifice	Stop Time	11:52 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr. Anan Kongngoennok
Motor Serial Number	TSP Blower No.3	Calibrator Serial Number	2914		
Recorder Serial Number	102950701				

Plate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (inH ₂ O)			[ΔH ₂ O(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)] (m ³ /min)	Sample Flow Rate Indication (ft ³ /min)	IC = I[(Pa/P _{std})(T _{std} /Ta)] ^{1/2}	("K = °C+273)	Pressure (mmHg)	Meter	Meter	
	Positive	Negative	ΔH ₂ O									
5	1.5	1.5	3.0	1.72226	0.84350	29.0	28.84	301.0	759.0			
7	2.4	2.4	4.8	2.17851	1.06496	37.0	36.79	301.0	759.0			
10	3.5	3.5	7.0	2.63080	1.28450	45.0	44.75	301.0	759.0			
13	4.6	4.6	9.2	3.01601	1.47149	51.0	50.71	301.0	759.0			
18	5.6	5.6	11.2	3.32773	1.62279	56.0	55.68	301.0	759.0			
Linear Regression Y ON X : Y= mX + b							Average	301.0	759.0			
1	Slope (m)			2.06015	Linear Equation			r ²	0.999247	Pstd(mmHg)	760.0	
2	Intercept (b)			-0.01547	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9996234	T _{MTP}	298.0	
3	Correlation Coefficient (r)			1.00000	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.988730547		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.994349308	

COMMENT

Andersen Instruments, Inc.



Checked By

Prayun

(Mr. Prayun Detkla)
Technician



Approved By

Mr. Panupong Podang

(Mr. Panupong Podang)
Environmental Scientist

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	January 30, 2023
A2 บริเวณหมู่ 1 บ้านใหญ่				Start Time	12:13 AM
Sampler Number	TSP No.A6	Transfer Standard Type	Orifice	Stop Time	12:23 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr. Anan Konggoenok
Motor Serial Number	2012-01	Calibrator Serial Number	2914		
Recorder Serial Number	3140				

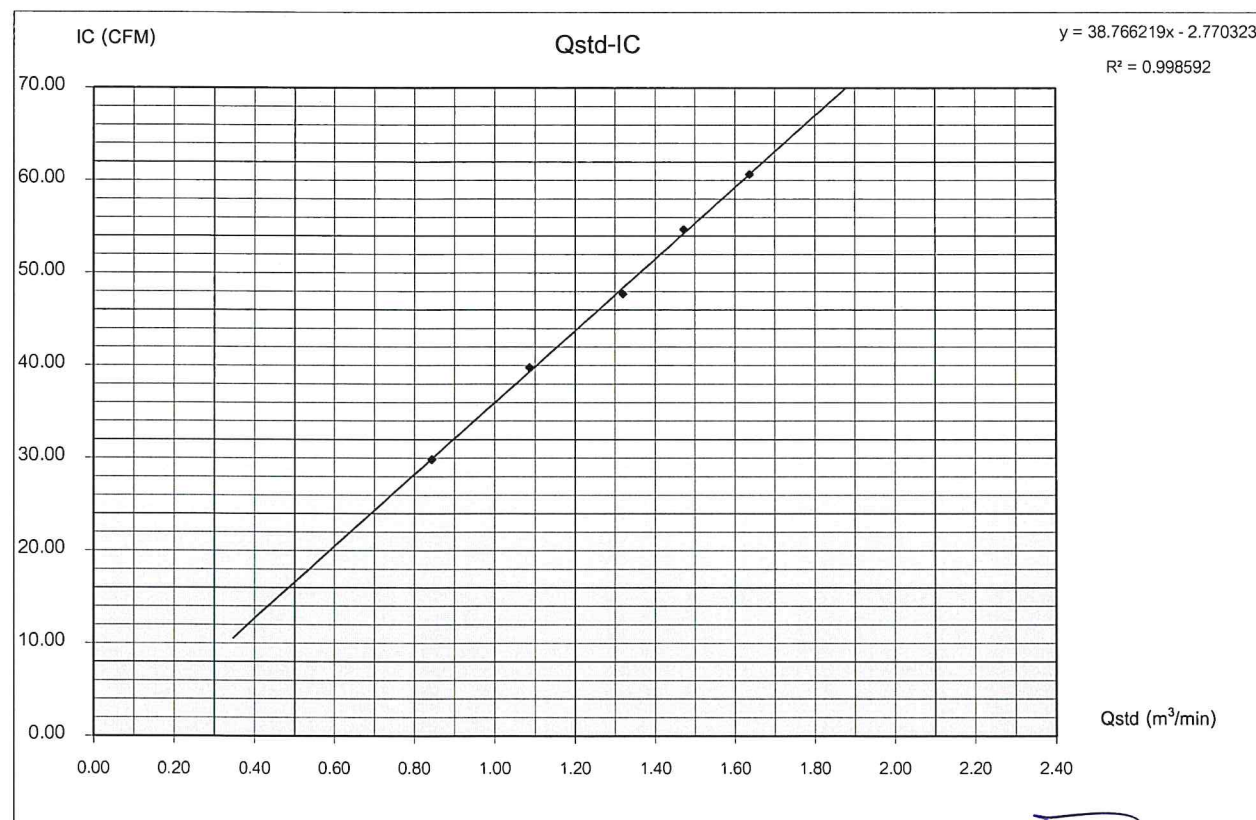
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(ft ³ /min)					
5	1.5	1.5	3.0	1.72226	0.84350	30.0	29.83	301.0	759.0		
7	2.5	2.5	5.0	2.22343	1.08677	40.0	39.77	301.0	759.0		
10	3.7	3.7	7.4	2.70492	1.32048	48.0	47.73	301.0	759.0		
13	4.6	4.6	9.2	3.01601	1.47149	55.0	54.69	301.0	759.0		
18	5.7	5.7	11.4	3.35731	1.63715	61.0	60.66	301.0	759.0		

Linear Regression Y ON X : Y= mX + b

Linear Regression: Pstd/Ta vs. Tstd/Ta					Average		301.0		759.0	
1	Slope (m)	2.06015	Linear Equation			r^2	0.998592	Pstd(mmHg)	760.0	
2	Intercept (b)	-0.01547	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9992958	T _{NTP}	298.0	
3	Correlation Coefficient (r)	1.00000	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.988730547		
Result						C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.994349308		

COMMENT

Andersen Instruments, Inc.



Checked By

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Technician

Approved By

(Mr. Panupon Podang)
Environmental Scientist

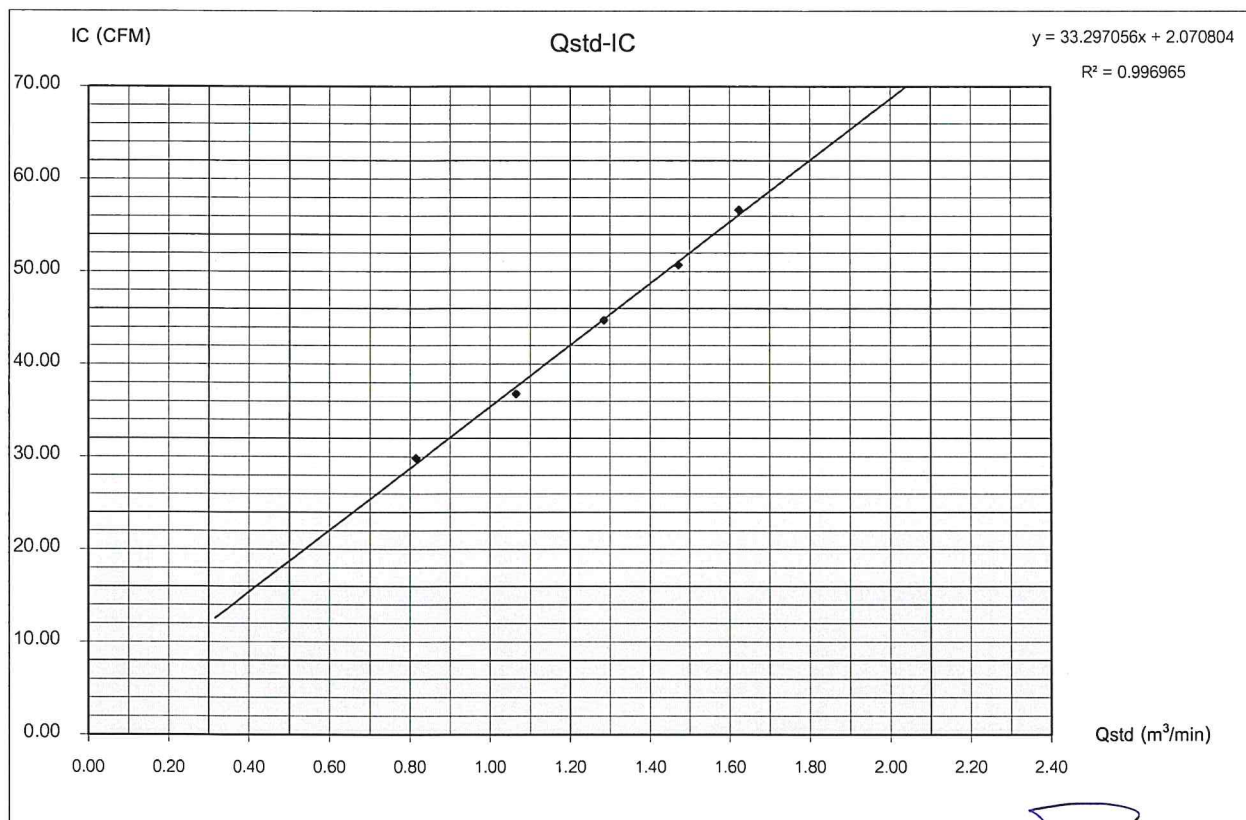
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	January 30, 2023
A2 บริเวณหมู่ 1 บ้านโนนฤๅ				Start Time	12:24 PM
Sampler Number	PM-10 No.2	Transfer Standard Type	Orifice	Stop Time	12:34 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr. Anan Kongngoenok
Motor Serial Number	610-643	Calibrator Serial Number	2914		
Recorder Serial Number	R0411-001				

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_{2}O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Qstd = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$				
	Positive	Negative	$\Delta H_{2}O$		(m ³ /min)	(ft ³ /min)		(°K = °C+273)	(mmHg)		
5	1.4	1.4	2.8	1.66386	0.81515	30.0	29.83	301.0	759.0		
7	2.4	2.4	4.8	2.17851	1.06496	37.0	36.79	301.0	759.0		
10	3.5	3.5	7.0	2.63080	1.28450	45.0	44.75	301.0	759.0		
13	4.6	4.6	9.2	3.01601	1.47149	51.0	50.71	301.0	759.0		
18	5.6	5.6	11.2	3.32773	1.62279	57.0	56.68	301.0	759.0		
Linear Regression Y ON X : Y= mX + b							Average	301.0	759.0		
1	Slope (m)			2.06015	Linear Equation			r^2	0.998965	Pstd(mmHg)	760.0
2	Intercept (b)			-0.01547	Set Point Flow Rate (X) (m ³ /min)			1.133	r	0.9984813	T _{NTP}
3	Correlation Coefficient (r)			1.00000	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)		0.988730547
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.994349308	

COMMENT

Andersen Instruments, Inc.



Checked By

Prayun
(Mr. Prayun Detkha)
Technician

Approved By

Panupong
(Mr. Panupon Podang)
Environmental Scientist



RECALIBRATION

DUE DATE:

March 8, 2023

Certificate of Calibration

Calibration Certification Information

Cal. Date: March 8, 2022 Rootsmeter S/N: 438320 Ta: 295 °K
Operator: Jim Tisch Pa: 754.4 mm Hg
Calibration Model #: TE-5025A Calibrator S/N: 2914

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4370	3.3	2.00
2	3	4	1	1.0140	6.4	4.00
3	5	6	1	0.9070	7.9	5.00
4	7	8	1	0.8640	8.8	5.50
5	9	10	1	0.7130	12.8	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9983	0.6947	1.4161	0.9956	0.6929	0.8844
0.9942	0.9805	2.0027	0.9915	0.9778	1.2507
0.9922	1.0939	2.2391	0.9895	1.0910	1.3983
0.9910	1.1470	2.3484	0.9883	1.1439	1.4666
0.9857	1.3824	2.8322	0.9830	1.3787	1.7687
QSTD	m=	2.06015	QA	m=	1.29003
	b=	-0.01547		b=	-0.00966
	r=	1.00000		r=	1.00000

Calculations

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

Standard Conditions

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

RECALIBRATION

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

Mettler-Toledo (Thailand) Ltd.

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Bangna District, Bangkok 10260

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MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: Environment Research & Technology Co., Ltd.
Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong
City: Laksi **Contact:** Ramita Taengthai
Zip / Postal: 10210
State / Province: Bangkok
Order Number: 
* 0 3 3 2 6 1 7 8 5 6 *

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: AB204-S **Asset Number:** ERTC-L-IN-0048
Serial No.: 1123103723 **Terminal Model:** N/A
Building: N/A **Terminal Serial No.:** N/A
Floor: 4 **Terminal Asset No.:** N/A
Room: 406

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20


This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 23.6 °C	End: 23.5 °C	Start: 34.6 %	End: 35.1 %
As Left	Start: 23.6 °C	End: 23.5 °C	Start: 35.0 %	End: 35.7 %

As Found Calibration Date: 17-Jan-2023
As Left Calibration Date: 17-Jan-2023
Issue Date: 19-Jan-2023

Calibrator: 
Chawalit Martsuloke

Approved Signatory: 
Technical Manager / Head of Calibration Center

Measurement Results

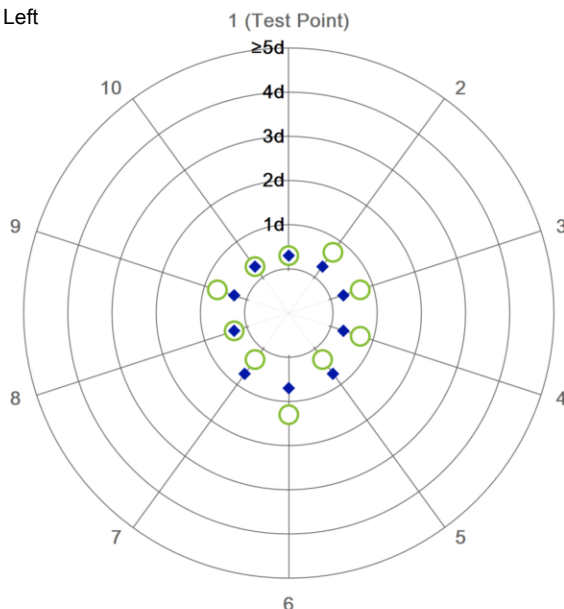
Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9992 g	100.0001 g
2	99.9991 g	100.0001 g
3	99.9991 g	100.0001 g
4	99.9991 g	100.0001 g
5	99.9992 g	100.0002 g
6	99.9993 g	100.0002 g
7	99.9992 g	100.0002 g
8	99.9992 g	100.0001 g
9	99.9991 g	100.0001 g
10	99.9992 g	100.0001 g

Standard Deviation	0.00007 g	0.00005 g
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○ As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

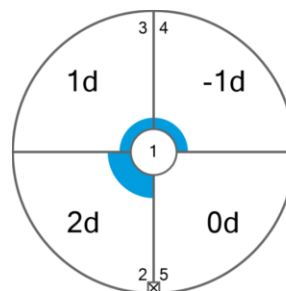
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

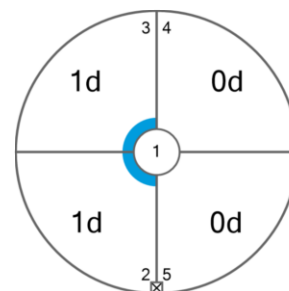
Test Load: 100 g

Position	As Found	As Left
1	99.9991 g	100.0001 g
2	99.9993 g	100.0002 g
3	99.9992 g	100.0002 g
4	99.9990 g	100.0001 g
5	99.9991 g	100.0001 g

Maximum Deviation	0.0002 g	0.0001 g
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As Found



As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

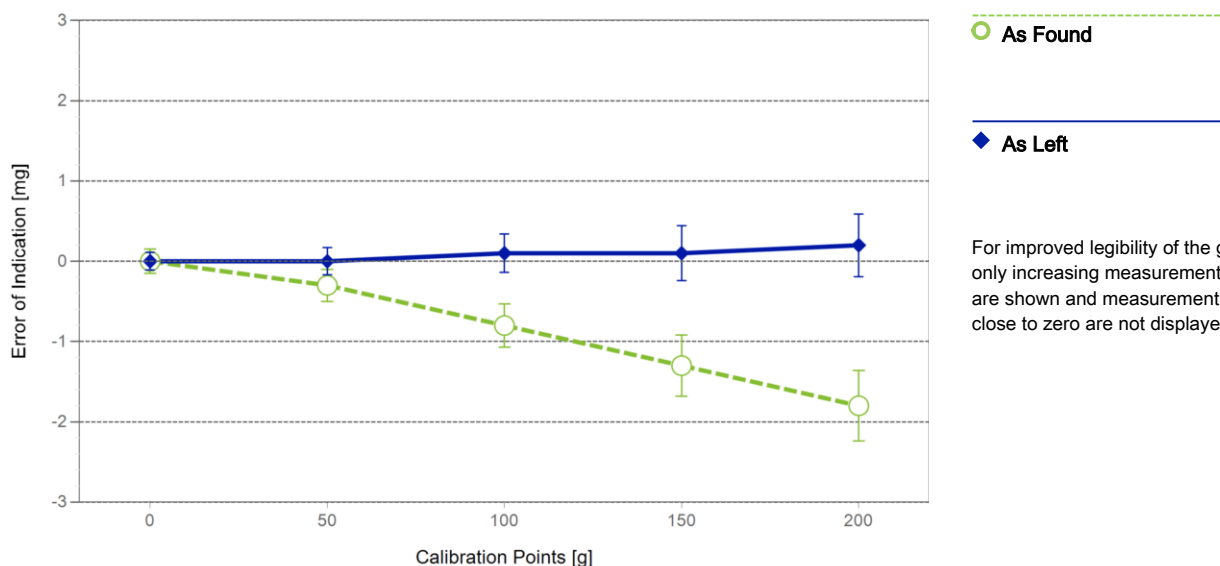
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.16 mg	2
3	0.1000 g	0.0999 g	-0.0001 g	0.16 mg	2
4	0.5000 g	0.4999 g	-0.0001 g	0.16 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.16 mg	2
6	5.0000 g	5.0001 g	0.0001 g	0.16 mg	2
7	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
8	50.0000 g	49.9997 g	-0.0003 g	0.20 mg	2
9	100.0000 g	99.9992 g	-0.0008 g	0.27 mg	2
10	150.0000 g	149.9987 g	-0.0013 g	0.38 mg	2
11	200.0000 g	199.9982 g	-0.0018 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.13 mg	2
6	5.0000 g	5.0001 g	0.0001 g	0.13 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.14 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.17 mg	2
9	100.0000 g	100.0001 g	0.0001 g	0.24 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.34 mg	2
11	200.0000 g	200.0002 g	0.0002 g	0.39 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS57	Date of Issue:	06-Jan-2022
Certificate Number:	177037	Calibration Due Date:	03-Jul-2023

Thermo Hygrometer

Equipment No.:	IN255	Date of Issue:	20-Jul-2022
Certificate Number:	22H1503	Calibration Due Date:	04-Jul-2023

Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

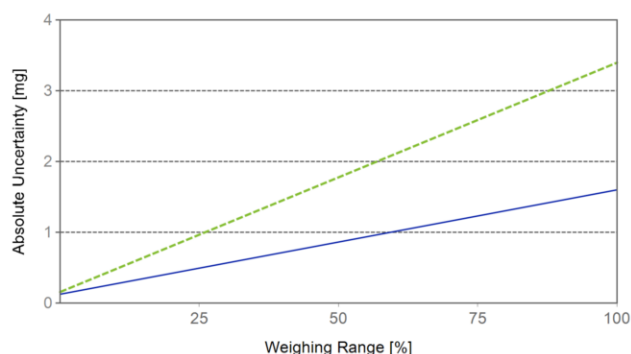
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0147 \text{ mg/g} \cdot R$	$U_1 = 0.13 \text{ mg} + 0.00671 \text{ mg/g} \cdot R$

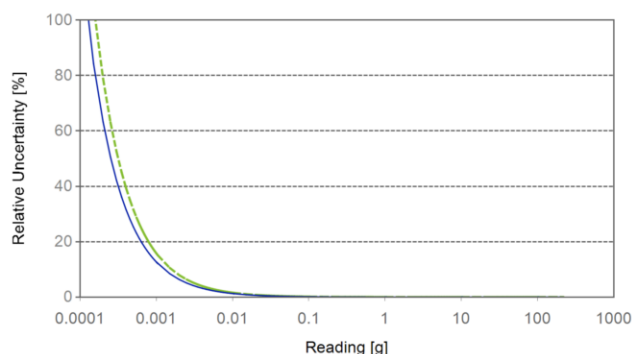
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.16 mg	0.73%	0.13 mg	0.59%
0.2200 g	0.16 mg	0.074%	0.13 mg	0.060%
2.2000 g	0.19 mg	0.0087%	0.14 mg	0.0066%
22.0000 g	0.48 mg	0.0022%	0.28 mg	0.0013%
220.0000 g	3.4 mg	0.0015%	1.6 mg	0.00073%



As Found



As Left

GWP® Certificate



As
Found



As
Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left

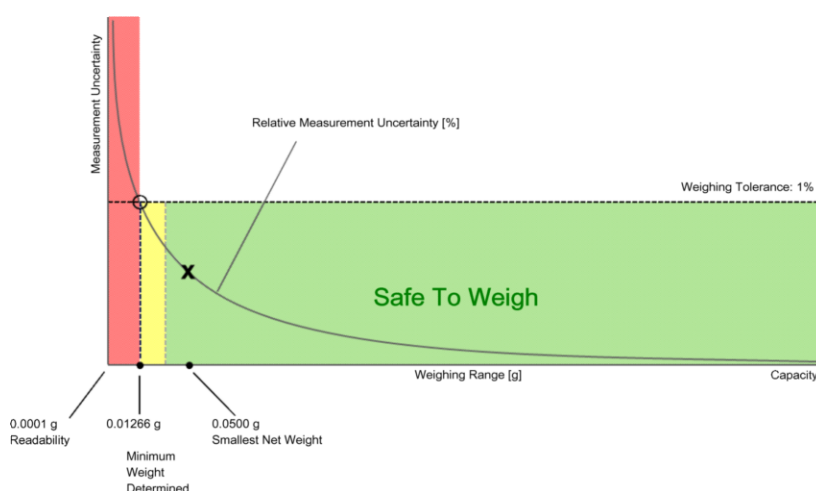
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.16012 g	0.32511 g	0.49518 g	0.85155 g	1.85026 g
0.2%	0.07947 g	0.16012 g	0.24199 g	0.40949 g	0.85155 g
0.5%	0.03165 g	0.06348 g	0.09550 g	0.16012 g	0.32511 g
1%	0.01580 g	0.03165 g	0.04754 g	0.07947 g	0.16012 g
2%	0.00789 g	0.01580 g	0.02372 g	0.03959 g	0.07947 g
5%	0.00316 g	0.00631 g	0.00947 g	0.01580 g	0.03165 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.12735 g	0.25642 g	0.38726 g	0.65440 g	1.35584 g
0.2%	0.06346 g	0.12735 g	0.19166 g	0.32162 g	0.65440 g
0.5%	0.02533 g	0.05073 g	0.07620 g	0.12735 g	0.25642 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06346 g	0.12735 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03168 g	0.06346 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0.00007 g*	N/A	0.00005 g*	N/A
0.2%	0.00005 g		✗		⚠
0.5%	0.00013 g		✓		✓
1%	0.00025 g		✓		✓
2%	0.00050 g		✓		✓
5%	0.00125 g		✓		✓

*The calculated standard deviation value is below the rounding error of the balance. The $0.41 \cdot d$ rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0002 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

Error of Indication**As Found**

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	-0.0003 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0000 g	-0.0008 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0013 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0018 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0000 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Sound Level Meter Calibration Report

Support Equipment Type : Sound Level Calibrator

Manufacture : BSWA TECH

Model : CA114

Serial No. : 590040

Range of Calibrator

- Sound Pressure Level : 93.9 dB.

- **Frequency** : 1,000 Hz.

Calibrated By : Mr.Nuttapon Juisup

Calibration Date : January 30, 2023

Customer Name : บริษัท ไฟร์เทียร์ คอนซัลแตนต์ จำกัด : โครงการผลิตขดลวดเสริมแรง ของบริษัท ราชรัตน์ ไทย ไวร์ จำกัด

[illegible]

Checked By

Mr. Prayun Detkla
Technician

Approved By

Ms.Sutatip Im-noi
Environmental Scientist

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0605

MTC No. EEL. BP. 96/0665

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : BSWA TECH

Model : CA114

Serial No. : 590040

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

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

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

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

Date of Receipt : 29 Jun. 2022

Date of Calibration : 4 Jul. 2022

1/2
N. N. N.

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

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

FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0605

MTC No. EEL. BP. 96/0665

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.90	-0.10	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.8	0.8	± 1.5	± 2.0 %


3. Total Distortion


Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.26	± 0.50	± 4.0 %

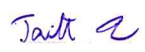
- Note :
1. No adjustment.
 2. The calibrator pressure correction was not included.
 3. The microphone volume correction was not included.

Calibrated by :

Approved by :


(Mr. Nuttapong Niljrusvanit)


(Mr. Prawate Kluaypa)


(Mr. Tawikiat Iamsamran)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Jul. 2022

Date of Issue : 6 Jul. 2022

Ref : 2011265062902932001

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End of Certificate

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

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