

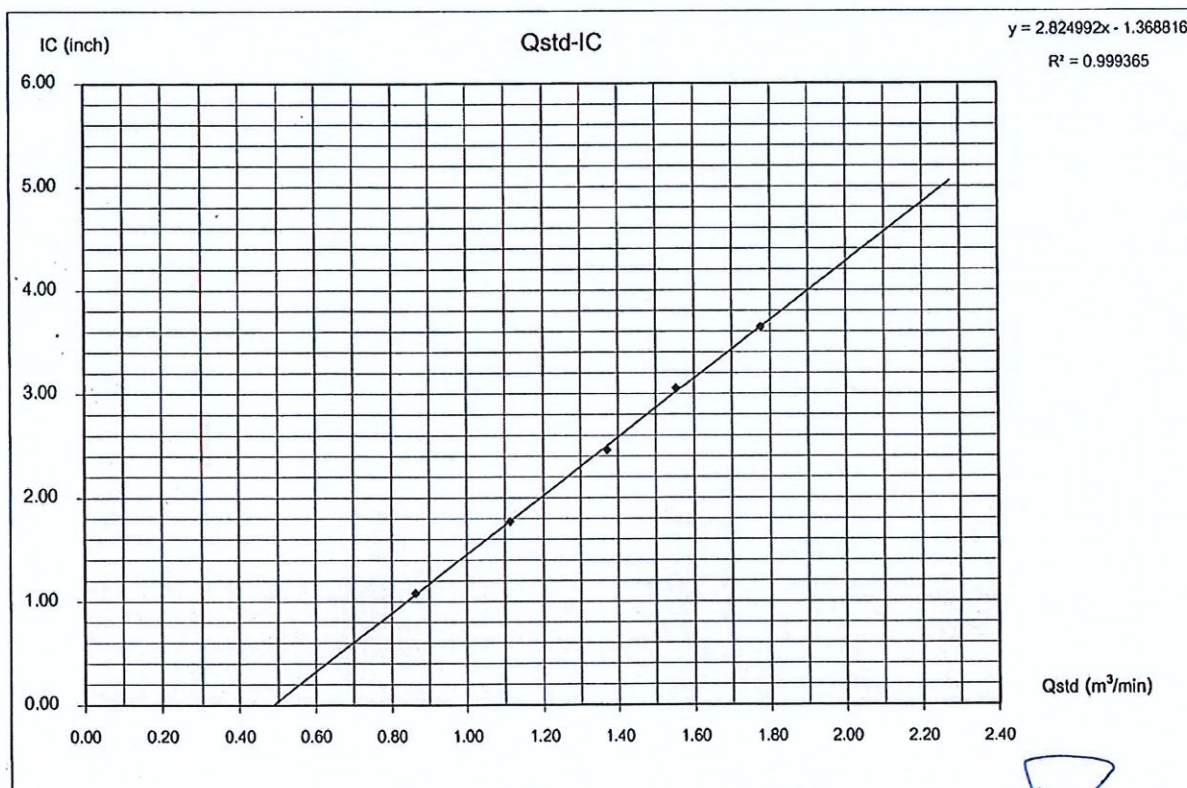
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2025-00875	Date	June 11, 2025
Sampler Location	บ้านพักอาศัยด้านทิศตะวันตก(บ้านเลขที่26)	Start Time	11:05 AM
Sampler Number	TSP No.C16	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	B2012-10	Calibrator Serial Number	3883
Recorder Serial Number		Calibrated By	Mr.Watcharin Charunsilthangkun

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/n)[(A-b)]$ ( m <sup>3</sup> /min )	sample Flow Rate Indicator ( inch )	$IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	( mmHg )		
5	1.5	1.5	3.0	1.70642	0.86418	1.1	1.08	305.0	755.0		
7	2.5	2.5	5.0	2.20298	1.11302	1.8	1.77	305.0	755.0		
10	3.8	3.8	7.6	2.71601	1.37013	2.5	2.46	305.0	755.0		
13	4.9	4.9	9.8	3.08417	1.55462	3.1	3.05	305.0	755.0		
18	6.4	6.4	12.8	3.52476	1.77542	3.7	3.65	305.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	305.0	755.0		
1	Slope ( m )			1.99546	Linear Equation			r <sup>2</sup>	0.997739	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01802	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9988689	T <sub>std</sub>	298.0
3	Correlation Coefficient ( r )			0.99983	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)			0.970621225
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.985201109

## COMMENT

Andersen Instruments, Inc.



Checked By

*Prayun Detkla*

( Mr. Prayun Detkla )  
Technician

envi research

ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By

( Mr. Panupon Podang )  
Environmental Scientist



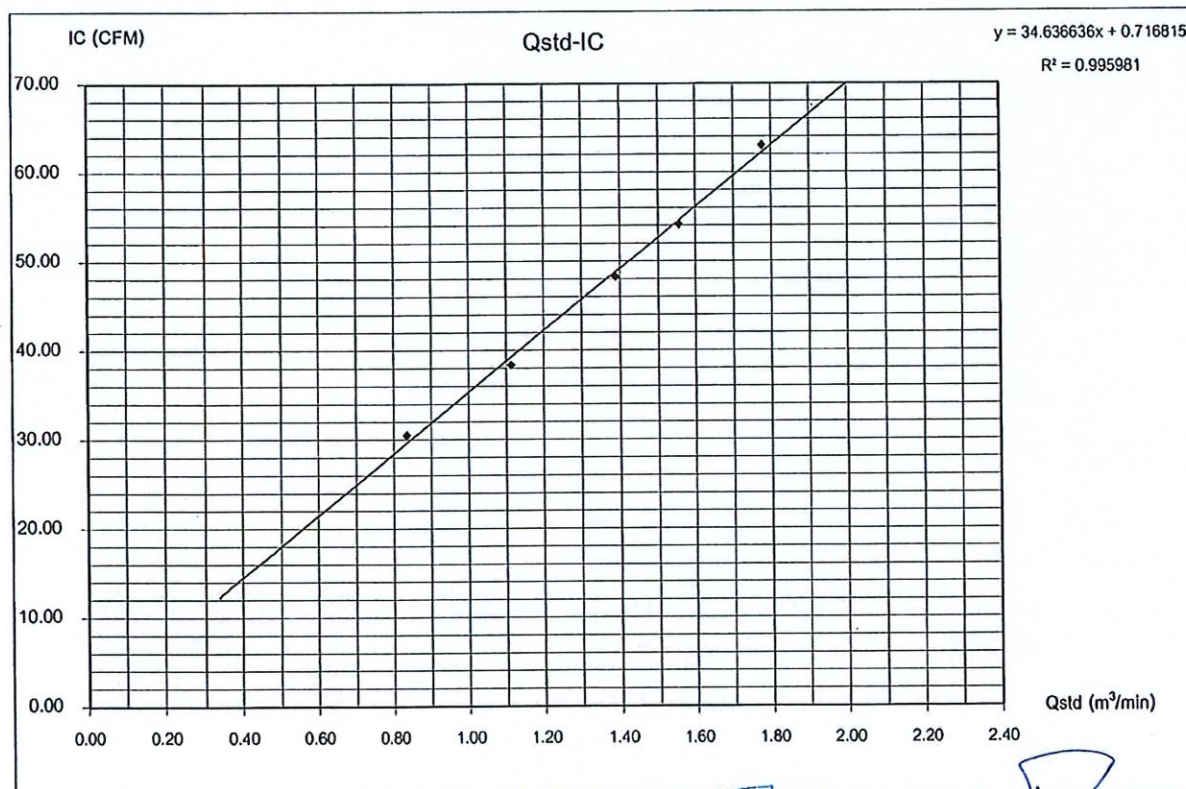
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2025-00875			Date	June 11, 2025
Sampler Location	บ้านพักอาศัยด้านทิศตะวันออก(บ้านเลขที่26)			Start Time	11:15 AM
Sampler Number	PM-10 No.16	Transfer Standard Type	Onifice	Stop Time	11:25 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Walcharin Charunsilthangkun
Motor Serial Number	2066	Calibrator Serial Number	3883		
Recorder Serial Number	2216				

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (mH <sub>2</sub> O)			$[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ ( m <sup>3</sup> /min )	Sample Flow Rate Indicator ( ft <sup>3</sup> /min )	$IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	( mmHg )			
5	1.4	1.4	2.8	1.64856	0.83518	31.0	30.54	305.0	755.0			
7	2.5	2.5	5.0	2.20298	1.11302	39.0	38.42	305.0	755.0			
10	3.9	3.9	7.8	2.75152	1.38792	49.0	48.27	305.0	755.0			
13	4.9	4.9	9.8	3.08417	1.55462	55.0	54.19	305.0	755.0			
18	6.4	6.4	12.8	3.52476	1.77542	64.0	63.05	305.0	755.0			
Linear Regression Y ON X : Y= mX + b							Average	305.0	755.0			
1	Slope ( m )			1.99546	Linear Equation			r <sup>2</sup>	0.995981	Pstd(mmHg)	760.0	
2	Intercept ( b )			-0.01802	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)			1.133	r	0.9979885	T <sub>std</sub>	298.15
3	Correlation Coefficient ( r )			0.99983	Final Set Flow Rate = ( I )			0	(Pa/Pstd)*(Tstd/Ta)		0.970621225	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.985201109		

## COMMENT

Andersen Instruments, Inc.



Checked By

*Prayun Detkla*  
(Mr. Prayun Detkla)  
Technician

Approved By

*Panupon Podang*  
( Mr.Panupon Podang )  
Environmental Scientist



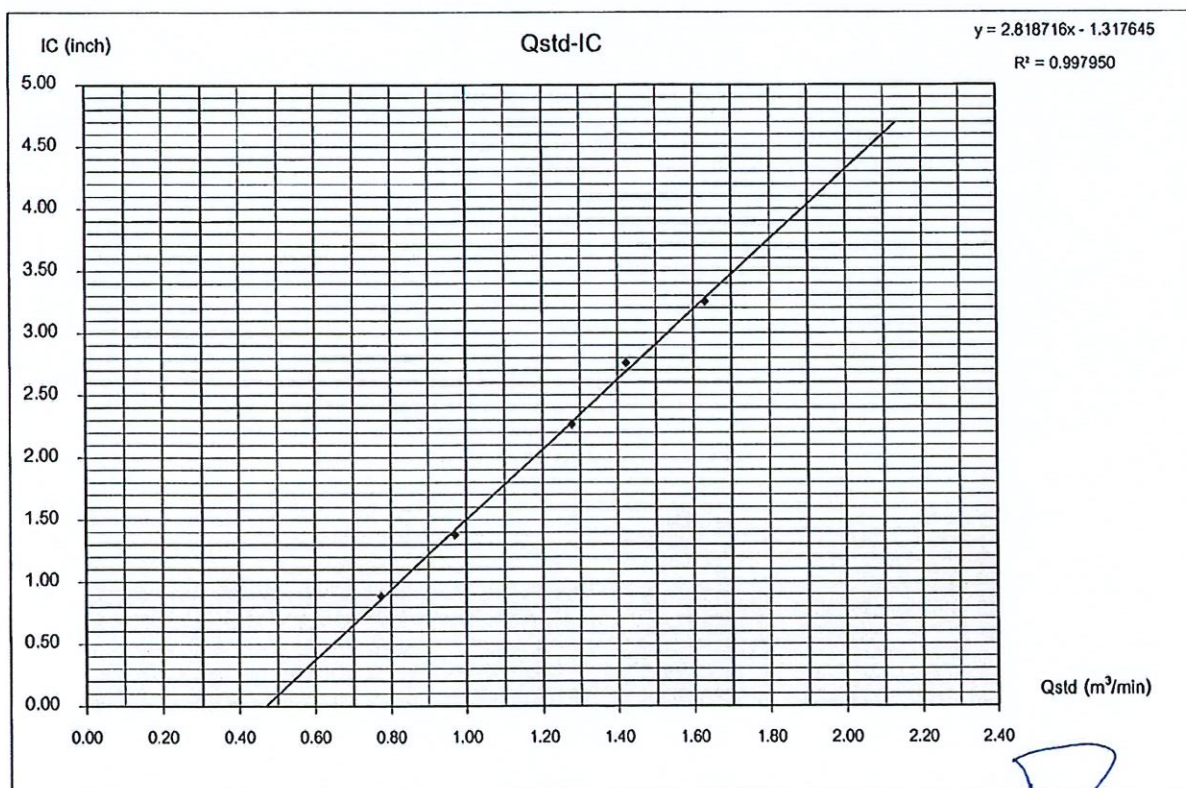
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2025-00975	Date	June 11, 2025
Sampler Location	บ้านพักอาศัยด้านทิศเหนือ(บ้านเลขที่32)	Start Time	10:18 AM
Sampler Number	TSP No.C21	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	610-650	Calibrator Serial Number	3883
Recorder Serial Number		Calibrated By	Mr. Watcharin Charunsithangkun

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mmH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{133})(T_{133}/Ta)]^{1/2}$	$Q_{std} = (I/m)[(A-b)]$ ( m <sup>3</sup> /min )	Sample Flow Rate Indicator ( inch )	$IC = I[(Pa/P_{133})(T_{133}/Ta)]^{1/2}$ (°K = °C+273)	( mmHg )			
5	1.2	1.2	2.4	1.52627	0.77390	0.9	0.89	305.0	755.0		
7	1.9	1.9	3.8	1.92051	0.97147	1.4	1.38	305.0	755.0		
10	3.3	3.3	6.6	2.53103	1.27742	2.3	2.27	305.0	755.0		
13	4.1	4.1	8.2	2.82119	1.42283	2.8	2.76	305.0	755.0		
18	5.4	5.4	10.8	3.23770	1.63156	3.3	3.25	305.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	305.0	755.0		
1	Slope ( m )			1.99546	Linear Equation			r <sup>2</sup>	0.99795	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01802	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9989745	Tstd	298.0
3	Correlation Coefficient ( r )			0.99983	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.970621225	
Result								C=(Pa/Pstd)*(Tstd/Ta)*0.5		0.985201109	

## COMMENT

Andersen Instruments, Inc.



Checked By

Prayun Detkla

( Mr. Prayun Detkla )  
Technician

Approved By

( Mr. Panupon Podang )  
Environmental Scientist



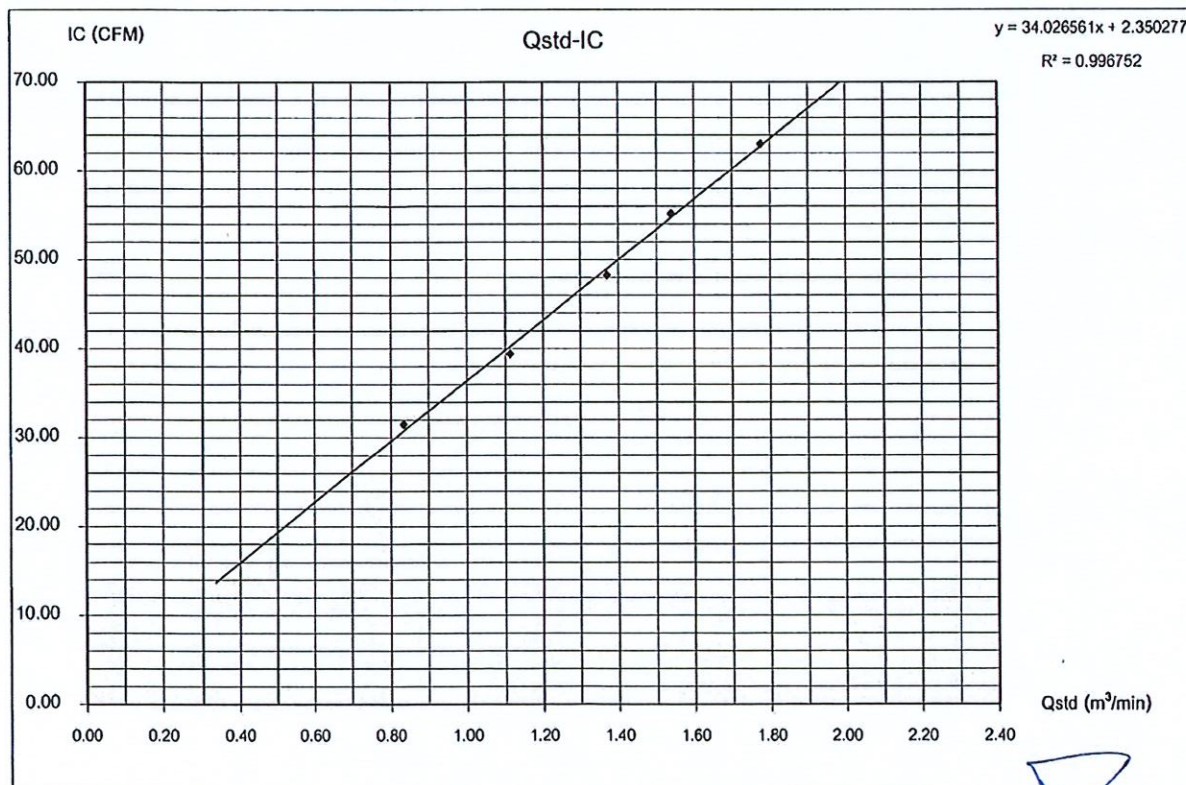
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2025-00875			Date	June 11, 2025
Sampler Location	บ้านพักอาศัยย่านทิวทอง(บ้านเลขที่32)			Start Time	10:08 AM
Sampler Number	PM-10 No.14	Transfer Standard Type	Orifice	Stop Time	10:18 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr. Watcharin Charunsilthangkun
Motor Serial Number	14	Calibrator Serial Number	3883		
Recorder Serial Number	102950701				

Plate No.	(Delta H)			( A ) $[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	( X ) $Q_{std} = (1/m)[(A-b)]$ ( m <sup>3</sup> /min )	( I ) sample Flow Rate Indicator ( ft <sup>3</sup> /min )	( Y ) $IC = \{[(Pa/P_{std})(T_{std}/T_a)]^{1/2}\}$ (°K = °C+273)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH <sub>2</sub> O					Pressure ( mmHg )	Meter	Meter	
5	1.4	1.4	2.8	1.64856	0.83518	32.0	31.53	305.0	755.0		
7	2.5	2.5	5.0	2.20298	1.11302	40.0	39.41	305.0	755.0		
10	3.8	3.8	7.6	2.71601	1.37013	49.0	48.27	305.0	755.0		
13	4.8	4.8	9.6	3.05253	1.53877	56.0	55.17	305.0	755.0		
18	6.4	6.4	12.8	3.52476	1.77542	64.0	63.05	305.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	305.0	755.0		
1	Slope ( m )			1.99546	Linear Equation			r <sup>2</sup>	0.996752	Pstd(mmHg)	760.
2	Intercept ( b )			-0.01802	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min )		1.133	r	0.9983747	T <sub>NTP</sub>	298.
3	Correlation Coefficient ( r )			0.99983	Final Set Flow Rate = ( I )		0	( Pa/Pstd )( Tstd/Ta )		0.970621225	
Result								C=( Pa/Pstd )*( Tstd/Ta )^0.5		0.985201109	

## COMMENT

Andersen Instruments, Inc.



Checked By

*Pangsan*  
(Mr. Prayun Detkla)  
Technician

envi research  
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.  
Approved By

*Panupon*  
(Mr. Panupon Podang)  
Environmental Scientist





JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyal,  
Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : COF-022-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-5025A  
SERIAL NUMBER : 3883  
ID NUMBER : -  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : Environment Research & Technology Co., Ltd.  
25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

RECEIVED DATE : 26 Jun 2024  
MEASUREMENT DATE : 26 Jun 2024  
ISSUE DATE : 27 Jun 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.3 °C and 53.0 %RH.

**NOTED:** The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

**MEASUREMENT RESULTS:**

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

**Table 1: The results of  $Q$  Standard calibration data**

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.699	751.705	23.36	22.60	55.738	1.627	1.272	0.645
2	1.005	751.676	23.49	22.82	61.668	3.315	1.815	0.919
3	1.117	751.621	23.73	23.21	41.170	4.339	2.076	1.050
4	1.163	751.557	23.90	23.37	29.781	4.860	2.196	1.111
5	1.421	751.550	23.97	23.50	29.382	7.313	2.694	1.357

Slope ( $m$ ): 1.99546  
 Intercept ( $b$ ): -0.01802  
 Correlation coefficient ( $r$ ): 0.99983  
 Uncertainty ( $k=2$ ): 0.015  $m^3/min$

**Table 2: The results of  $Q$  actual calibration data**

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.699	751.705	23.36	22.60	55.738	1.627	0.801	0.649
2	1.005	751.676	23.49	22.82	61.668	3.315	1.144	0.925
3	1.117	751.621	23.73	23.21	41.170	4.339	1.309	1.057
4	1.163	751.557	23.90	23.37	29.781	4.860	1.386	1.119
5	1.421	751.550	23.97	23.50	29.382	7.313	1.700	1.368

Slope ( $m$ ): 1.24981  
 Intercept ( $b$ ): -0.01133  
 Correlation coefficient ( $r$ ): 0.99984  
 Uncertainty ( $k=2$ ): 0.015  $m^3/min$

\*\*\*End of Certificate of Calibration\*\*\*





Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+662 723 0382  
MT-TH.ServiceSupport@mt.com



## 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 3 3 6 1 0 1 9

### 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: CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration 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: 23.1 °C	End: 23.3 °C	Start: 35.7 %	End: 35.2 %

As Found Calibration Date: 16-Jan-2025 Calibrator:   
As Left Calibration Date: N/A  
Issue Date: 18-Jan-2025  
Approved Signatory:   
Technical Manager / Head of Calibration Center

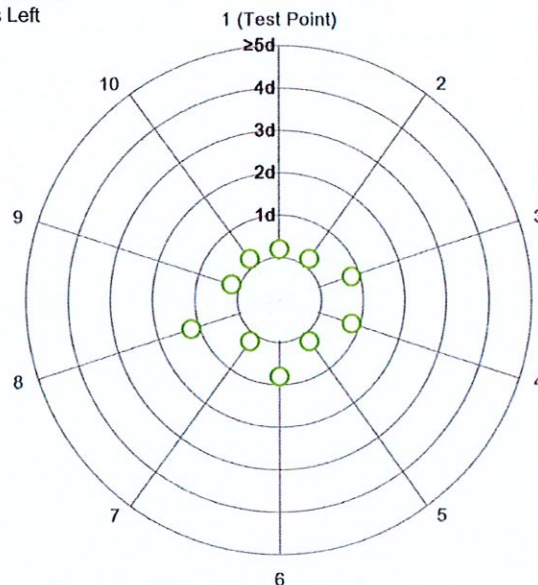
## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0001 g	N/A
5	100.0000 g	N/A
6	100.0001 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00006 g	N/A

○ As Found  
◆ As Left



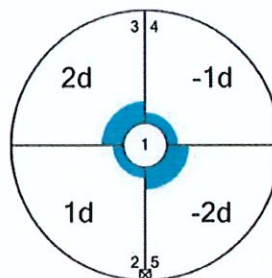
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0002 g	N/A
4	99.9999 g	N/A
5	99.9998 g	N/A
Maximum Deviation	0.0002 g	N/A



As Found

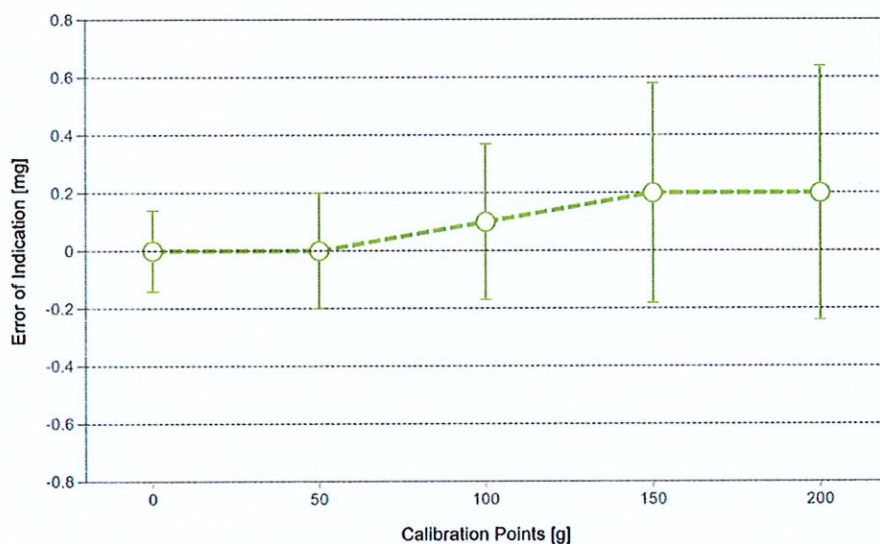
The "d" in the graph represents the readability of the range/interval in which the test was performed.



## Error of Indication

### As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.14 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.15 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.15 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.16 mg	2
8	50.0001 g	50.0001 g	0.0000 g	0.20 mg	2
9	99.9999 g	100.0000 g	0.0001 g	0.27 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.38 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.44 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor  $k$  such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.  
The results of this calibration certificate relate only to the calibrated item.

## 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.:	WS52	Date of Issue:	17-Apr-2024
Certificate Number:	191753	Calibration Due Date:	15-Oct-2025

### Weight Set 2: OIML E2

Weight Set No.:	WS52-1	Date of Issue:	17-May-2024
Certificate Number:	C420107128	Calibration Due Date:	17-Oct-2025

### Weight Set 3: OIML E2

Weight Set No.:	WS52-2	Date of Issue:	17-May-2024
Certificate Number:	C420107129	Calibration Due Date:	28-Oct-2025

### Thermo Hygrometer

Equipment No.:	IN302	Date of Issue:	31-Oct-2024
Certificate Number:	SG-H-00908/67	Calibration Due Date:	17-Oct-2025

## 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

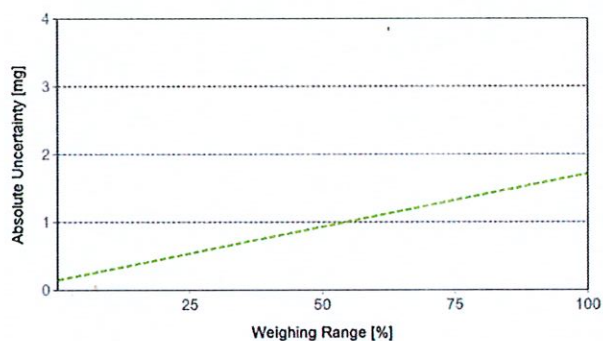
### Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00712 \text{ mg/g} \cdot R$	N/A

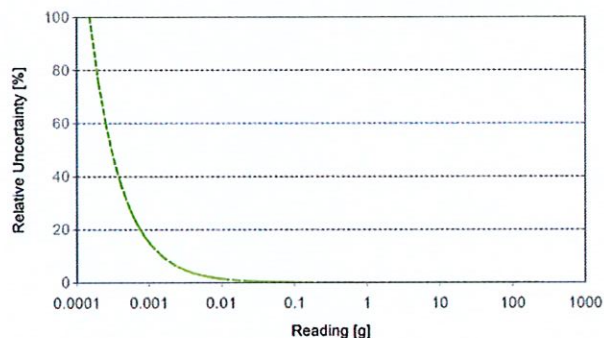
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.17 mg	0.0075%	N/A	N/A
22.0000 g	0.31 mg	0.0014%	N/A	N/A
220.0000 g	1.7 mg	0.00078%	N/A	N/A



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



No adjustments/modifications made. As Left results correspond to As Found.

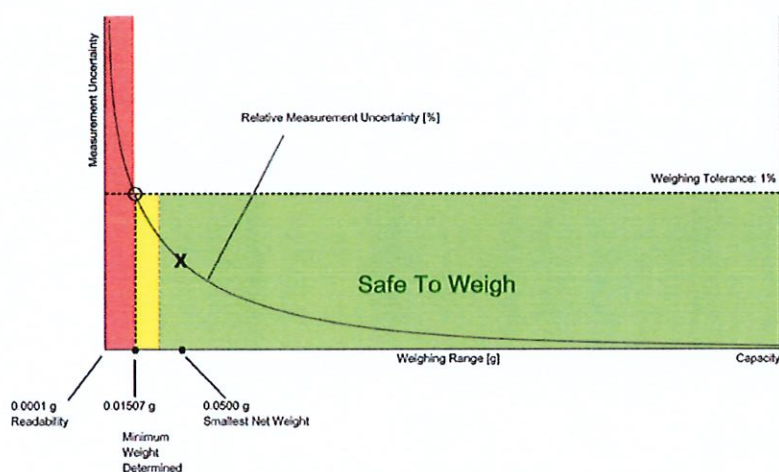
## Process Requirements

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					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15163 g	0.30546 g	0.46152 g	0.78056 g	1.62097 g
0.2%	0.07555 g	0.15163 g	0.22827 g	0.38321 g	0.78056 g
0.5%	0.03015 g	0.06039 g	0.09072 g	0.15163 g	0.30546 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07555 g	0.15163 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03771 g	0.07555 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 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					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15163 g	0.30546 g	0.46152 g	0.78056 g	1.62097 g
0.2%	0.07555 g	0.15163 g	0.22827 g	0.38321 g	0.78056 g
0.5%	0.03015 g	0.06039 g	0.09072 g	0.15163 g	0.30546 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07555 g	0.15163 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03771 g	0.07555 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 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	0.00006 g*	N/A	0.00006 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\*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	✓	0.0002 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
50.0001 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 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	0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0002 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
50.0001 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
99.9999 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	0.0002 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 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.







THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0279

MTC No. EEL. BP. 54/0368

## CALIBRATION CERTIFICATE

**Submitted by** : Environment Research & Technology Co.,Ltd.  
**Address** : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Acoustic Calibrator  
Manufacturer : BSWA  
Model : CA111  
Serial No. : 590338

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

**Standards used :**

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N4106495.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

**Date of Receipt** : 18 Mar. 2025

**Date of Calibration** : 1 Apr. 2025

1 / 3

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

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

FM.BLMTC.002 Rev.5

**Head Office**  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9036  
Fax. (66) 0 2577 9009

**Office/Laboratory**  
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,  
Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
(66) 08 3219 9440  
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

**Office**  
196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0279

MTC No. EEL. BP. 54/0368

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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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 1
1/2 inch Bruel&Kjaer 4180	94.35	0.35	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1002.3	2.3	$\pm 1.5$	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.30	$\pm 0.60$	$\pm 3.0\%$

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

Date of Calibration : 1 Apr. 2025

2 / 3  
↓

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9036  
Fax. (66) 0 2577 9009

Office/Laboratory  
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,  
Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
(66) 08 3219 9440  
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office  
196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 521  
(66) 08 1889 6827





## THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0279

MTC No. EEL. BP. 54/0368

Nominal Output of Unit Under Test = 114 dB re 20 $\mu$ Pa at 1000 HzAcoustic Output in dB re 20 $\mu$ 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 1
1/2 inch Bruel&Kjaer 4180	114.33	0.33	$\pm 0.10$	$\pm 0.40$ dB

## 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1002.3	2.3	$\pm 1.5$	$\pm 1.0\%$

## 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.68	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

.....  
(Mr. Weerachai Deechaiyae)

Approved by :

.....  
(Mr. Prawate Klunaypa)  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 1 Apr. 2025

Date of Issue : 1 Apr. 2025

Ref : 2011268031801147001

End of Certificate

3 / 3

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

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

FM.BL.MTC.002 Rev.5

## Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9036  
Fax. (66) 0 2577 9009

## Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,  
Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
(66) 08 3219 9440  
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

## Office

196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827