

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

- เอกสาร 5-1 เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศบริเวณพื้นที่อ่อนไหว
- เอกสาร 5-2 เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศบริเวณอาคารจอดรถ
- เอกสาร 5-3 เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในขบวนและสถานีรถไฟฟ้า
- เอกสาร 5-4 เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียง
- เอกสาร 5-5 เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์น้ำ

เอกสาร 5-1

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศบริเวณพื้นที่อ่อนไหว



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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

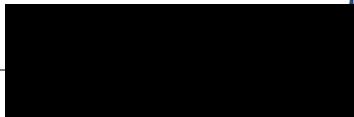
Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	09/02/2022	y = 1.255x-7.443	0.998
B02	B02	02/02/2022	y = 1.075x+1.871	0.999
B03	B03	04/02/2022	y = 1.032x+1.126	0.997
B04	B04	04/02/2022	y = 1.158x-3.770	0.995
B05	B05	02/02/2022	y = 1.199x-5.374	1.000
B06	B06	01/02/2022	y = 1.215x-6.623	0.995
B07	B07	01/02/2022	y = 1.142x-4.465	0.997
B08	B08	02/02/2022	y = 1.241x-8.074	0.999
B09	B09	08/02/2022	y = 1.206x-5.652	0.995
B10	B10	07/02/2022	y = 1.095x+0.184	0.998
B11	B11	10/02/2022	y = 1.099x-2.021	0.996
B12	B12	09/02/2022	y = 1.169x-3.784	1.000
B13	B13	03/02/2022	y = 1.163x-4.662	0.996
B14	B14	07/02/2022	y = 1.169x-3.363	0.998
B15	B15	03/02/2022	y = 1.106x-1.273	0.998
B16	B16	09/02/2022	y = 1.218x-6.757	0.997
B17	B17	07/02/2022	y = 1.132x-1.890	0.998
B18	B18	16/02/2022	y = 1.239x-7.560	0.999
B19	B19	16/02/2022	y = 1.265x-8.934	0.997
B20	B20	03/02/2022	y = 1.199x-6.304	0.998
B21	B21	17/02/2022	y = 1.120x-2.616	0.997
B22	B22	08/02/2022	y = 1.216x-6.597	0.995
B23	B23	03/02/2022	y = 1.139x-3.341	0.999
B24	B24	03/02/2022	y = 1.126x-2.172	1.000
B25	B25	09/02/2022	y = 1.016x+2.185	0.996
B26	B26	04/02/2022	y = 1.122x-2.540	0.997
B27	B27	08/02/2022	y = 1.192x-6.584	0.997
B28	B28	04/02/2022	y = 1.254x-8.360	0.995
B29	B29	02/02/2022	y = 1.217x-6.791	0.996
B30	B30	04/02/2022	y = 1.162x-4.303	0.997
B31	B31	16/02/2022	y = 1.101x-0.556	0.998
B32	B32	04/02/2022	y = 1.208x-5.034	0.997
B33	B33	07/02/2022	y = 1.242x-5.616	0.999
B34	B34	09/02/2022	y = 1.240x-8.273	0.999

Calibrated by :



Approved by :





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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

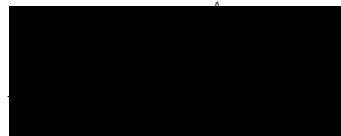
Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/02/2022	y = 1.199x-0.729	0.999
B02	B02	04/02/2022	y = 1.047x+3.100	0.999
B03	B03	07/02/2022	y = 1.212x+3.555	0.997
B04	B04	09/02/2022	y = 1.314x-9.389	1.000
B05	B05	03/02/2022	y = 1.207x-5.472	0.995
B06	B06	04/02/2022	y = 1.260x-8.728	0.997
B07	B07	04/02/2022	y = 1.212x-5.353	0.996
B08	B08	09/02/2022	y = 1.285x-7.356	0.998
B09	B09	08/02/2022	y = 1.243x-6.277	1.000
B10	B10	07/02/2022	y = 1.285x-9.647	0.998
B11	B11	02/02/2022	y = 1.240x-6.135	0.995
B12	B12	01/02/2022	y = 1.285x-9.647	0.998
B13	B13	04/02/2022	y = 1.302x-9.419	0.996
B14	B14	07/02/2022	y = 1.199x+3.376	0.998
B15	B15	04/02/2022	y = 1.118x-0.993	0.995
B16	B16	04/02/2022	y = 1.190x-1.101	0.998
B17	B17	03/02/2022	y = 1.201x-2.953	0.998
B18	B18	07/02/2022	y = 1.143x-1.983	0.998
B19	B19	03/02/2022	y = 1.036x+1.865	0.998
B20	B20	03/02/2022	y = 1.201x-6.181	0.997
B21	B21	04/02/2022	y = 1.158x-0.828	0.998
B22	B22	04/02/2022	y = 1.290x-8.497	0.998
B23	B23	07/02/2022	y = 1.090x-0.542	1.000
B24	B24	01/02/2022	y = 1.218x-6.279	0.998
B25	B25	01/02/2022	y = 1.156x-3.313	0.997
B26	B26	07/02/2022	y = 1.135x+1.438	0.998
B27	B27	02/02/2022	y = 1.260x-8.474	0.998
B28	B28	04/02/2022	y = 1.090x-0.306	0.999
B29	B29	04/02/2022	y = 1.262x-8.639	1.000
B30	B30	03/02/2022	y = 1.219x-6.529	0.996
B31	B31	17/02/2022	y = 1.059x+0.716	0.997
B32	B32	16/02/2022	y = 1.154x-3.610	0.999
B33	B33	03/02/2022	y = 1.258x-8.776	0.999
B34	B34	16/02/2022	y = 1.123x+0.227	0.995

Calibrated by :



Approved by :



**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	XS 105DU
MANUFACTURER	:	METTLER TOLEDO	S/N	:	1126422905
ID No	:	BA 05/50	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar \pm 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° C \pm 1° C	RELATIVE HUMIDITY	:	49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

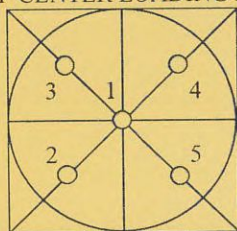
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.000111
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 21 April 2022
NO. CO-B02

BRAND : API

MODEL : 300E
SERIAL NO. 965

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 20 September 2021 Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO) Cylinder No. : D196045
Certified Date : 16 April 2022 Expired Date : 15 April 2024 Cylinder Conc. : 4,570 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	39.93	-0.175	40.00

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4013.5	mV	2500-4800 mV
CO REFERENCE	3947.8	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.3	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	804	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.4	°C	48 ± 4
BENCH TEMPERATURE	48.2	°C	48 ± 2
WHEEL TEMPERATURE	68.3	°C	68 ± 2
BOX TEMPERATURE	30.9	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3064.6	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

Calibrated by :

Approved by :



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 21 April 2022

BRAND : API

MODEL : 300E

NO. CO-B04

SERIAL NO. 3089

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 20 September 2021 Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO) Cylinder No. : D196045
Certified Date : 16 April 2022 Expired Date : 15 April 2024 Cylinder Conc. : 4,570 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	40.09	0.225	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4014.7	mV	2500-4800 mV
CO REFERENCE	3948.2	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.7	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	811	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.5	°C	48 ± 4
BENCH TEMPERATURE	48.2	°C	48 ± 2
WHEEL TEMPERATURE	68.5	°C	68 ± 2
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3021.3	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

Calibrated by :

Approved by :



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CALIBRATION REPORT							
NON-DISPERSIVE INFRARED CO ANALYZER							
DATE :	21 April 2022	BRAND :	API	MODEL :	300E		
NO.	CO-B06	SERIAL NO.	3117				
Calibrator (Dilution System)							
Brand	: API		Model	: 700			
Last Cal. Date	: 20 September 2021		Serial No.	: 421			
Reference Standard Gas							
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045			
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 ppm		
CALIBRATING CONDITION							
Pressure	1011	mmbar	Temp.	24.5	°C	% RH	49
CALIBRATION SETTING							
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM			
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response			
Zero	0	-0.10	-	0			
CO Span	40.00	40.05	0.125	40.00			
API Model 300E CO Analyzer Check list							
Parameter	Observed Value	Units	Nominal Range				
RANGE	50	PPM	0-1000 ppm				
STABILITY	0.10	PPM	< 1 ppm with zero air				
CO MEASURE	4014.1	mV	2500-4800 mV				
CO REFERENCE	3948.9	mV	2500-4800 mV				
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air				
SAMPLE PRESSURE	28.6	In-Hg-A	~2" < ambient absolute pressure				
SAMPLE FLOW	805	cc/min	800 ± 10%				
SAMPLE TEMPERATURE	48.2	°C	48 ± 4				
BENCH TEMPERATURE	48.0	°C	48 ± 2				
WHEEL TEMPERATURE	68.4	°C	68 ± 2				
BOX TEMPERATURE	30.6	°C	Ambient temp + 7 ± 10				
PHOTO-DRIVE	2998.9	mV	250 mV to 4750 mV				
SLOPE	1.017	-	1.0 ± 0.3				
OFFSET	0.2	-	0 ± 0.3				

Calibrated by :

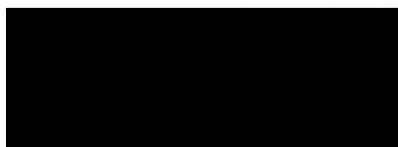
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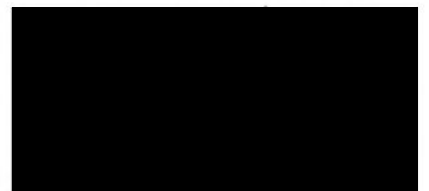
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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	21 April 2022	BRAND :	API	MODEL :	300E
NO.	CO-B10	SERIAL NO.	199-S		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.10	0.250	40.00	
API Model 300E CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4016.1	mV	2500-4800 mV		
CO REFERENCE	3949.8	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.5	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	810	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.3	°C	48 ± 4		
BENCH TEMPERATURE	48.1	°C	48 ± 2		
WHEEL TEMPERATURE	68.2	°C	68 ± 2		
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3035.1	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :





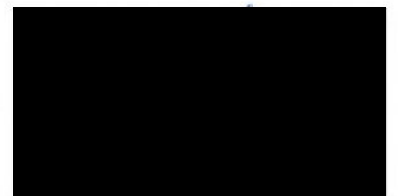
บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	21 April 2022	BRAND :	API	MODEL :	300EU
NO.	CO-B14	SERIAL NO.	131		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	0.10	-	0	
CO Span	40.00	39.97	-0.075	40.00	
API Model 300EU CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4015.5	mV	2500-4800 mV		
CO REFERENCE	3949.3	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.6	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	808	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.2	°C	48 ± 4		
BENCH TEMPERATURE	48.0	°C	48 ± 2		
WHEEL TEMPERATURE	68.3	°C	68 ± 2		
BOX TEMPERATURE	30.6	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3010.9	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spicon.com., www.spicon.com

CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 21 April 2022 BRAND : API MODEL : 300E
NO. CO-B15 SERIAL NO. 226

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 20 September 2021 Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO) Cylinder No. : D196045
Certified Date : 16 April 2022 Expired Date : 15 April 2024 Cylinder Conc. : 4,570 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	39.95	-0.125	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4013.9	mV	2500-4800 mV
CO REFERENCE	3948.7	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.4	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	807	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.3	°C	48 ± 4
BENCH TEMPERATURE	48.2	°C	48 ± 2
WHEEL TEMPERATURE	68.2	°C	68 ± 2
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3007.5	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

Calibrated by :

Approved by :

เอกสาร 5-2

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศบริเวณอาคารจอดรถ

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong Contact: [REDACTED]
Zip / Postal: 10260
State / Province: Bangkok
Order Number: [Barcode] * 0 3 3 2 4 2 3 9 0 6 *

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: AB204-S/FACT Asset Number: UAE.AIR.016/2555
Serial No.: B108115858 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 2 Terminal Asset No.: N/A
Room: Balance Room 2 (206)

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: 22.6 °C	End: 22.1 °C	Start: 56.0 %	End: 51.9 %
As Left	Start: 22.3 °C	End: 22.4 °C	Start: 46.2 %	End: 55.8 %

As Found Calibration Date: 07-Apr-2022 Calibrator: [REDACTED]
As Left Calibration Date: 07-Apr-2022
Issue Date: 08-Apr-2022
Approved Signatory: [REDACTED]
☐ Santi Jitniyom
☐ Surachet Sukkate

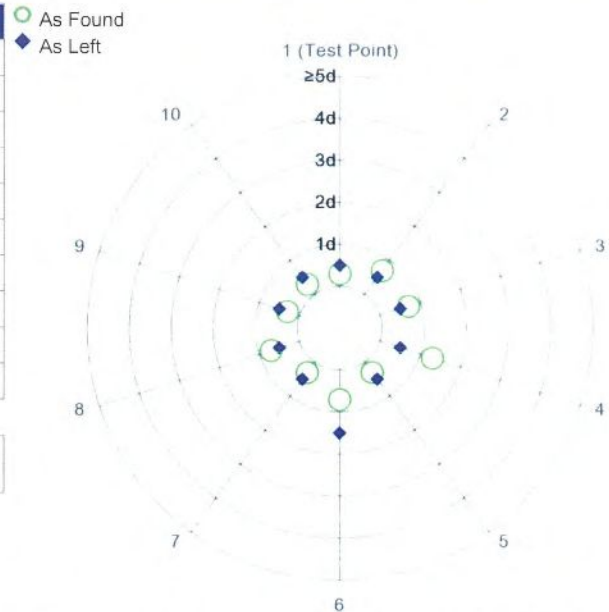
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g

Standard Deviation	0.00007 g	0.00007 g
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

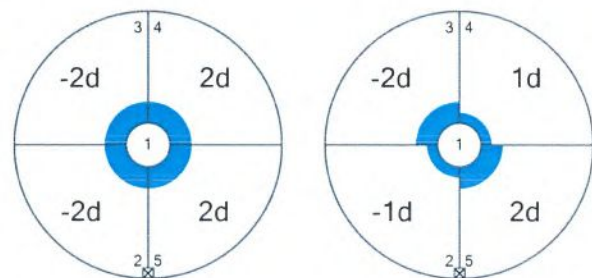
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0005 g	100.0000 g
2	100.0003 g	99.9999 g
3	100.0003 g	99.9998 g
4	100.0007 g	100.0001 g
5	100.0007 g	100.0002 g

Maximum Deviation	0.0002 g	0.0002 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.

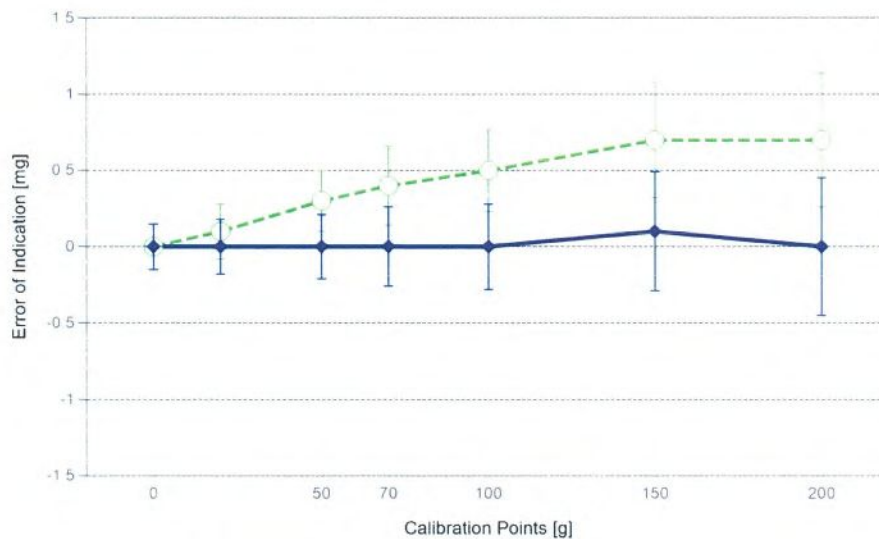
Error of Indication

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	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 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	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 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 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.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated
Value of the built-in weight adjusted
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

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: $2.5 \cdot 10^{-6} / K$

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

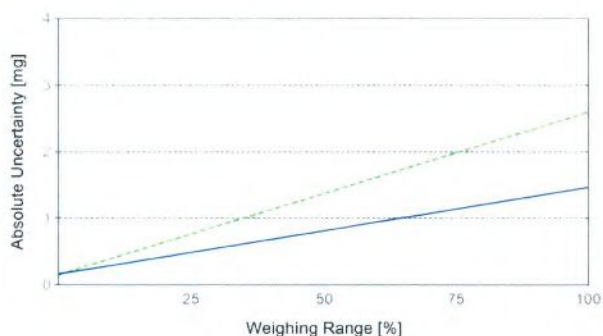
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$	$U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$

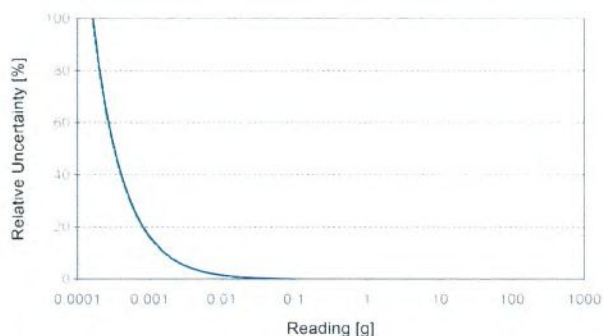
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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%	0.16 mg	0.73%
0.2200 g	0.16 mg	0.074%	0.16 mg	0.073%
2.2000 g	0.18 mg	0.0084%	0.17 mg	0.0079%
22.0000 g	0.40 mg	0.0018%	0.29 mg	0.0013%
220.0000 g	2.6 mg	0.0012%	1.5 mg	0.00066%



As Found



As Left

Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+66 2723 0382

MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong Contact: [REDACTED]
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 
* 0 3 3 2 4 2 3 9 0 6 *

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: AB204-S Asset Number: UAE.AIR.019/2550
Serial No.: 1128312528 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 2 Terminal Asset No.: N/A
Room: Balance Room 2 (206)

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 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: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %

As Found Calibration Date: 07-Apr-2022 Calibrator: [REDACTED]
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022
Approved Signatory: [REDACTED]
☐ Santi Jitniyom
☐ Surachet Sukkate

Measurement Results

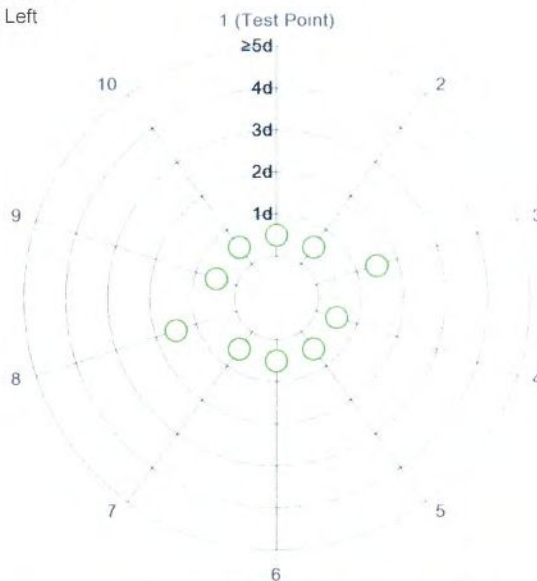
Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00008 g	N/A
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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.

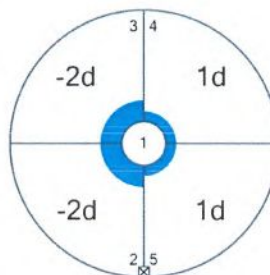
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
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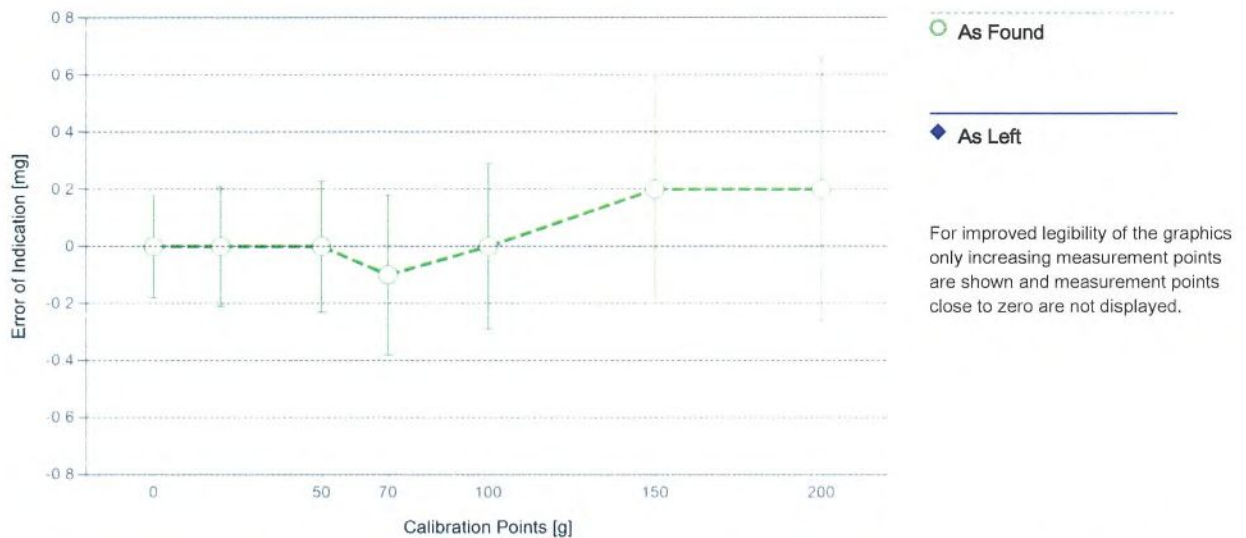
As Found

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	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 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.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

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

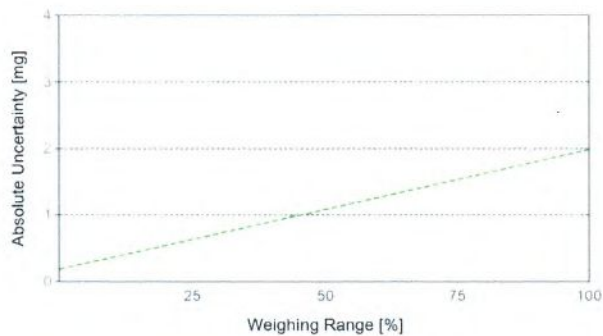
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

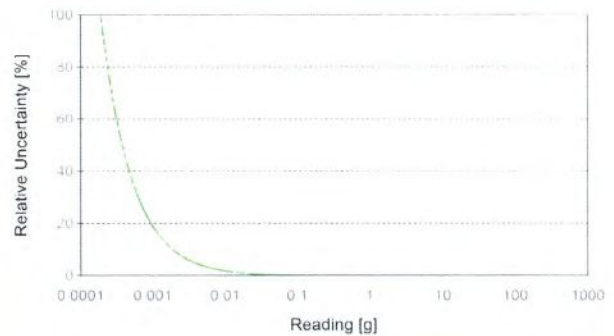
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.19 mg	0.86%	N/A	N/A
0.2200 g	0.19 mg	0.087%	N/A	N/A
2.2000 g	0.21 mg	0.0095%	N/A	N/A
22.0000 g	0.37 mg	0.0017%	N/A	N/A
220.0000 g	2.0 mg	0.00090%	N/A	N/A



As Found



As Left

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01QC	Reference Number:	160-401526192-1
Cylinder Number:	CC159599	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	+/- 1% NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	+/- 0.4% NIST Traceable	07/23/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	18060121	KAL004215	250.0 PPM NOx/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOx/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	072508	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000929062	FTIR	Jul 19, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
SO2 MKS FTIR 000929062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES:RAN# 51319-CM03
PO# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 16 August, 2021

Certification No. 385/21

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827
Thermoigrometers DMA875 Barometer DQA 801
Mfg Code : Dato Logger 19040308 wind speed and wind direction 19020211
Thermoigrometers 19010187 Barometer 19040219
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

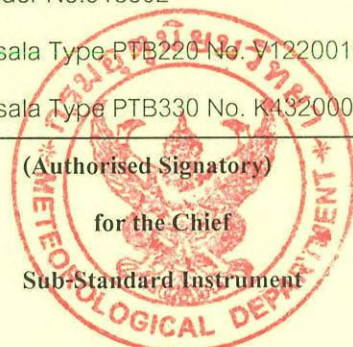
Signed

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 385/21

16 August, 2021 Model DNA821 S/N 19020211

Page : 2 of 7

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacumm inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.7	0.32
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.7	0.34
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.7	0.32
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.7	0.32

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

Calibrated by :

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 20 July, 2021

Certification No. 354/21

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุณหภูมิมหาวิทยาลัย

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827
Thermoigrometers DMA875 Barometer DQA 801

Mfg Code : Dato Logger 19040406 wind speed and wind direction 19020214
Thermoigrometers 19050007 Barometer 19040190

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Signe

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 354/21

20 July, 2021

Model DNA821 S/N

19020214

Page : 2 of 7

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.02	-	-	-	10.7	0.32
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.7	0.32

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

Calibrated by :

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





SCARLET | TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0004

Calibration Date: 2022/2/22

Calibration Expiry Date: 2023/2/21

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.1	0.9 – 1.1	Pass
2.0	2	0	1.8 – 2.2	Pass
5.0	4.8	0.2	4.7 – 5.3	Pass
7.0	7.1	0.1	6.0 – 8.0	Pass
10.0	9.7	0.3	9.5 – 10.5	Pass
20.0	20	0	19.0 – 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	48	3	42 – 48	Pass
135°	134	1	132 – 138	Pass
225°	227	2	222 – 228	Pass
315°	315	0	312 – 318	Pass
0°	1	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.5°C	22.1	0.4	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 24 °C

Relative humidity: 58 %

Static pressure: 118.3 kPa

Performed by:



Certified by
Head of Engineering department

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan



SCARLET | TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0041

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1	0	0.9 – 1.1	Pass
2.0	1.8	0.2	1.8 – 2.2	Pass
5.0	5	0	4.7 – 5.3	Pass
7.0	7.2	0.2	6.0 – 8.0	Pass
10.0	9.9	0.1	9.5 – 10.5	Pass
20.0	20	0	19.0 – 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	43	2	42 – 48	Pass
135°	135	0	132 – 138	Pass
225°	227	2	222 – 228	Pass
315°	318	3	312 – 318	Pass
0°	0	0	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.8	0.6	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1001	3	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:



Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0052

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.1	0.9 – 1.1	Pass
2.0	1.9	0.1	1.8 – 2.2	Pass
5.0	4.8	0.2	4.7 – 5.3	Pass
7.0	7.0	0	6.0 – 8.0	Pass
10.0	9.9	0.1	9.5 – 10.5	Pass
20.0	20.0	0	19.0 – 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	0	42 – 48	Pass
135°	137	2	132 – 138	Pass
225°	223	2	222 – 228	Pass
315°	316	2	312 – 318	Pass
0°	1	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.0	0.2	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

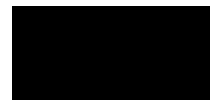
Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:



Certified by
Head of Engineering department

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SCARLET | TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0058

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9 – 1.1	Pass
2.0	1.9	0.1	1.8 – 2.2	Pass
5.0	5.0	0.0	4.7 – 5.3	Pass
7.0	7.2	0.2	6.0 – 8.0	Pass
10.0	9.8	0.2	9.5 – 10.5	Pass
20.0	20.0	0	19.0 – 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	47	2	42 – 48	Pass
135°	135	0	132 – 138	Pass
225°	224	1	222 – 228	Pass
315°	315	0	312 – 318	Pass
0°	359	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.5	0.3	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by: _____

Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0065

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9 - 1.1	Pass
2.0	2.0	0.0	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.1	0.1	6.0 - 8.0	Pass
10.0	9.8	0.2	9.5 - 10.5	Pass
20.0	19.8	0.2	19.0 - 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	43	2	42 - 48	Pass
135°	136	1	132 - 138	Pass
225°	225	0	222 - 228	Pass
315°	315	0	312 - 318	Pass
0°	2	2	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.2	0.0	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	997	1	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:



Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0072

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.1	0.1	0.9 – 1.1	Pass
2.0	2.0	0.0	1.8 – 2.2	Pass
5.0	4.8	0.2	4.7 – 5.3	Pass
7.0	7.0	0.0	6.0 – 8.0	Pass
10.0	9.9	0.1	9.5 – 10.5	Pass
20.0	20.2	0.2	19.0 – 21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	0	42 – 48	Pass
135°	135	0	132 – 138	Pass
225°	227	2	222 – 228	Pass
315°	314	1	312 – 318	Pass
0°	359	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.2	0.0	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by:



Certified by
Head of Engineering department

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Certificate of Calibration

Calibration Certification Information

Cal. Date: June 22, 2020 Rootsmeter S/N: 438320 Ta: 296 °K
Operator: [REDACTED] Pa: 748.0 mm Hg
Calibration Model #: G25A Calibrator S/N: 1901

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3620	3.2	2.00
2	3	4	1	0.9580	6.4	4.00
3	5	6	1	0.8590	7.9	5.00
4	7	8	1	0.8160	8.8	5.50
5	9	10	1	0.6750	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)
0.9867	0.7244	1.4078	0.9957	0.7311	0.8896
0.9824	1.0255	1.9909	0.9914	1.0349	1.2581
0.9804	1.1414	2.2259	0.9894	1.1518	1.4066
0.9792	1.2001	2.3345	0.9882	1.2111	1.4753
0.9739	1.4429	2.8155	0.9829	1.4561	1.7792
QSTD	m=	1.95981	QA	m=	1.22720
	b=	-0.01429		b=	-0.00903
	r=	0.99998		r=	0.99998

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 22P800

Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.022/2560

Condition As-Received: Used Item

Received Date: 03 March 2022

Calibration Date: 12 March 2022

Reference: 2203-0131WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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Corporate Services 3: Equipment Calibration and Testing Services.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

2.This result of calibration was made on requested at the point specified by customer.

3.Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4.This instrument was used clean air as pressure media.

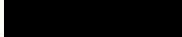
5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.


6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : 
Issue Date : 14 March 2022

Approved Signatory 

B 0282413



Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range : 0 inH₂O to 36 inH₂O

Scale Interval : 0.1 inH₂O(The Fifth Estimate)

<u>Applied Pressure</u> (inH ₂ O)	<u>UUC Indication</u>		<u>ΔP</u> (inH ₂ O)	<u>Error</u> (inH ₂ O)
	<u>High-port side</u> (inH ₂ O)	<u>Low-port side</u> (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.04	14.04	0.04
16.00	8.00	-8.04	16.04	0.04
18.00	9.00	-9.04	18.04	0.04
20.00	10.00	-10.04	20.04	0.04
22.00	11.00	-11.02	22.02	0.02
24.00	12.00	-12.02	24.02	0.02
26.00	13.00	-13.02	26.02	0.02
28.00	14.00	-14.04	28.04	0.04
30.00	15.00	-15.04	30.04	0.04
32.00	16.00	-16.04	32.04	0.04
34.00	16.98	-17.06	34.04	0.04
35.80	17.98	-18.00	35.98	0.18

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

The 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-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 21P2501

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WSC

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1009 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0053-21	08 Apr 2022

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.This instrument was used clean air as pressure media.

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

6.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by :

Issue Date : 22 July 2021

Approved Signatory

B 0264464



Cert.No.: 21P2501

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa(The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	958.69	969.60	980.32	990.60	1000.69	1010.73	1020.58	1030.55
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	1.31	0.40	-0.32	-0.60	-0.69	-0.73	-0.58	-0.55

Decreasing Pressure

Applied Pressure (hPa)	1030.66	1020.50	1010.63	1000.57	990.45	980.19	969.47	958.54
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.66	-0.50	-0.63	-0.57	-0.45	-0.19	0.53	1.46

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

The 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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Attapol P.

a 1062242



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 22H772
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.001/2548

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022
to 05 April 2022

Reference: 2203-1124WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10203027	TH-0063-21	01 Jul 2022

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

3.This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by :

Issue Date : 08 April 2022

Approved Signatory :

B 0285424



Cert. No.: 22H772

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	40	-0.1	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	76	-4.0	2.0

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.02	21.5	1.48	0.72
29.98	30.0	0.02	0.72
40.03	39.5	-0.53	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

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MULTI-POINT GAS TEST REPORT

Test Date : Nov 4, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503038

Standard Gas Concentration

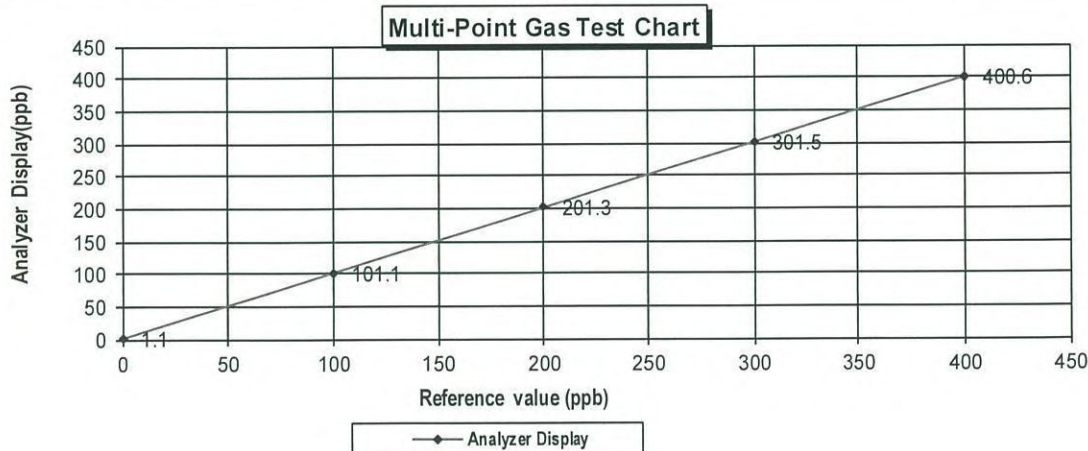
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.1	1.10	1.10	1.10
Level 2	20.00%	100.0	101.1	1.10	1.09	1.09
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.5	1.50	0.50	0.50
Level 5	80.00%	400.0	400.6	0.60	0.15	0.15
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.70



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4 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 10, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201497724

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

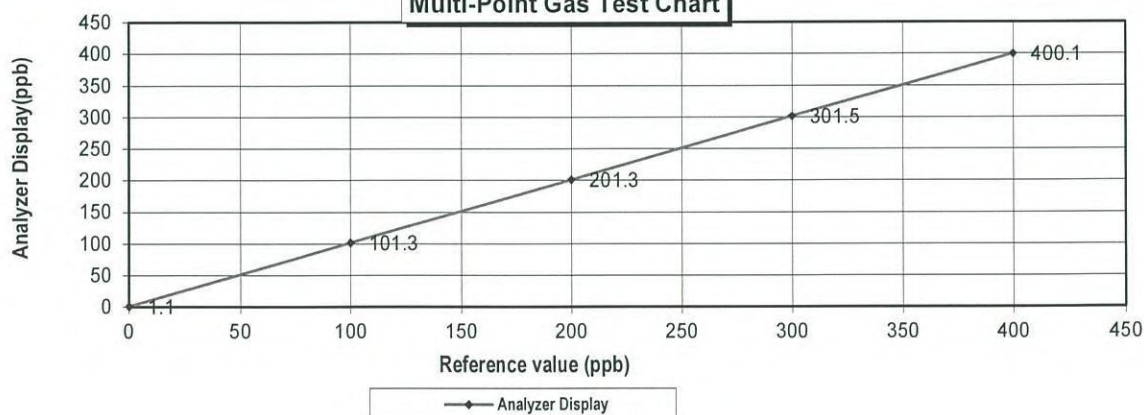
Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.1	1.10	1.10	1.10
Level 2	20.00%	100.0	101.3	1.30	1.28	1.28
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.5	1.50	0.50	0.50
Level 5	80.00%	400.0	400.1	0.10	0.02	0.02

Remark : Measuring Range 500.0 ppb
: Acceptable Limit $\pm 5\%$

Average Difference (%) 0.71

Multi-Point Gas Test Chart



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10 / 11 / 64

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10 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 10, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201497725

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

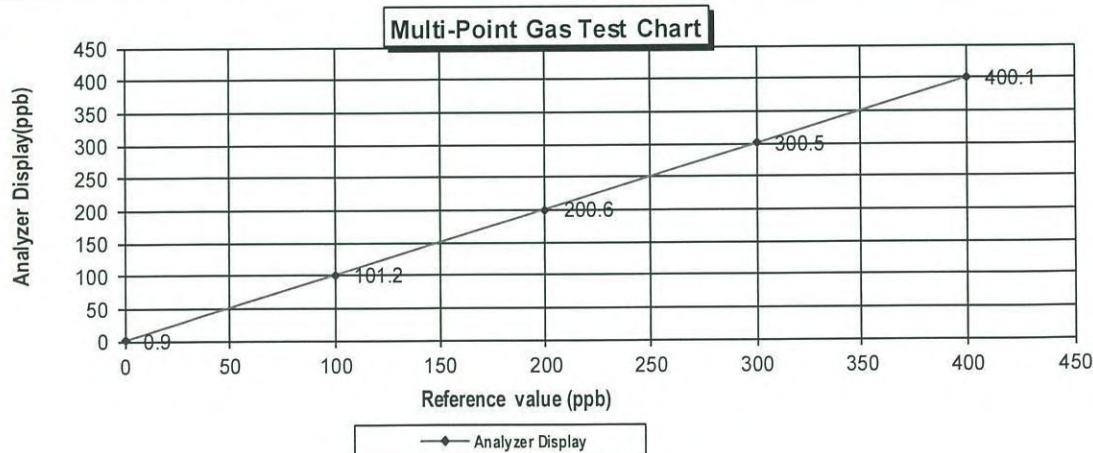
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	101.2	1.20	1.19	1.19
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.1	0.10	0.02	0.02
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.52

:Acceptable Limit $\pm 5\%$



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10 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 17, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201497726

Standard Gas Concentration

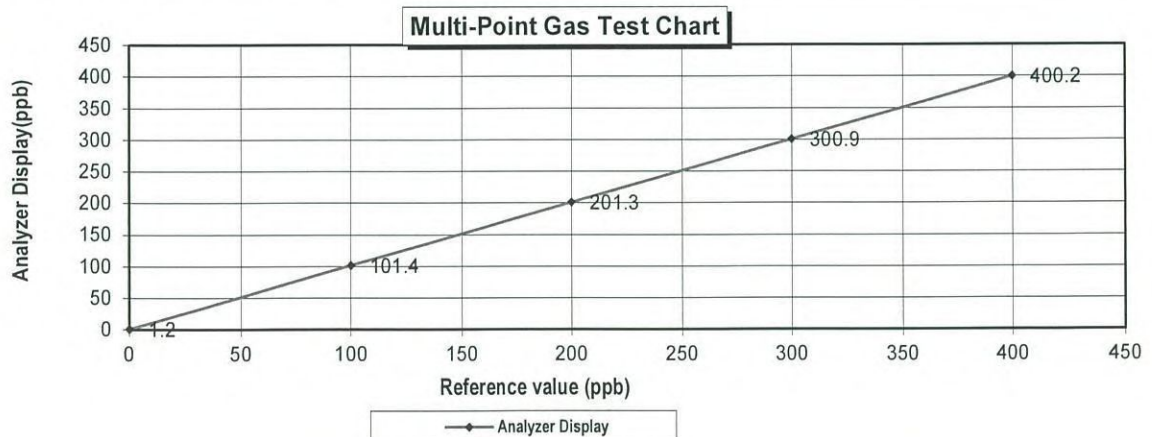
Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.20	1.20	1.20
Level 2	20.00%	100.0	101.4	1.40	1.38	1.38
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.2	0.20	0.05	0.05
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.72
: Acceptable Limit $\pm 5\%$						



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17 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 17,2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201778105

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	
Cylinder No. :	CC159599	
Expiration Date :	Jul 30,2022	

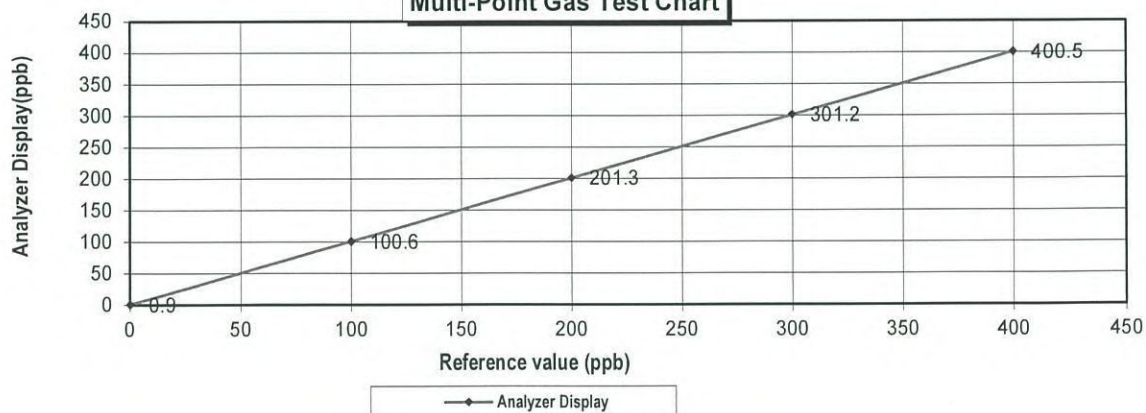
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.2	1.20	0.40	0.40
Level 5	80.00%	400.0	400.5	0.50	0.12	0.12
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.53

Multi-Point Gas Test Chart



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17 / 11 / 64

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MULTI-POINT GAS TEST REPORT

Test Date : Nov 17,2021

Equipment :	Gas Analyzer (NO ₂)	Model :	42i
Manufacturer :	Thermo Scientific	Serial Number :	1201778106

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30,2022

Dilutor Detail

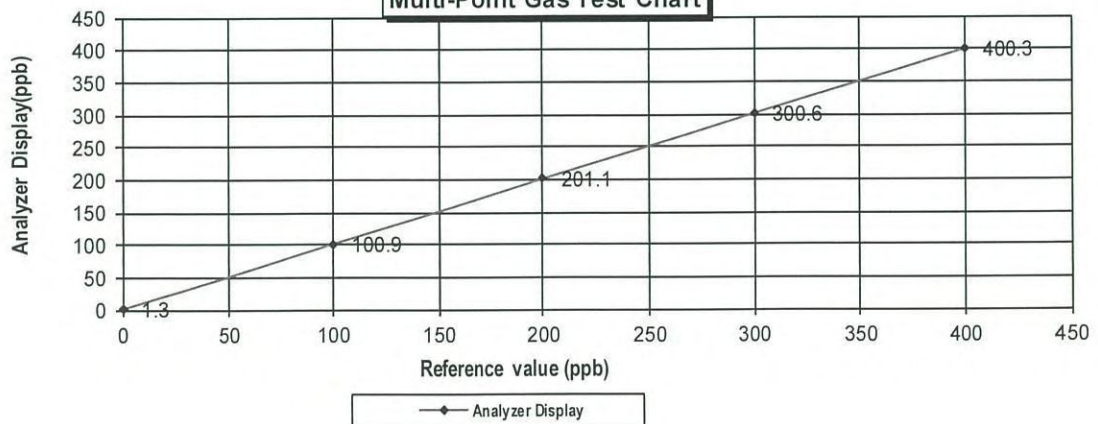
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.3	1.30	1.30	1.30
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	201.1	1.10	0.55	0.55
Level 4	60.00%	300.0	300.6	0.60	0.20	0.20
Level 5	80.00%	400.0	400.3	0.30	0.07	0.07
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.60

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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17 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 17, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201778107

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

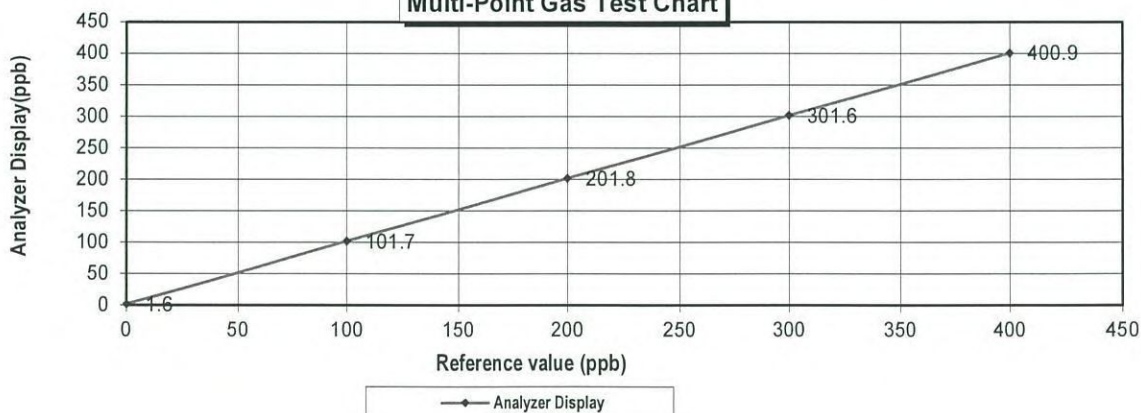
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.6	1.60	1.60	1.60
Level 2	20.00%	100.0	101.7	1.70	1.67	1.67
Level 3	40.00%	200.0	201.8	1.80	0.89	0.89
Level 4	60.00%	300.0	301.6	1.60	0.53	0.53
Level 5	80.00%	400.0	400.9	0.90	0.22	0.22
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.98

Multi-Point Gas Test Chart



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17 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201778108

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

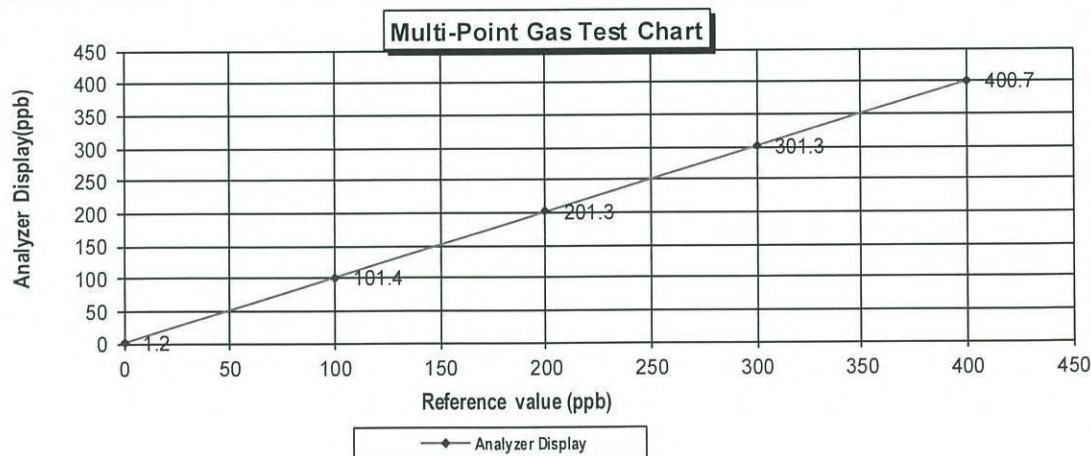
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.20	1.20	1.20
Level 2	20.00%	100.0	101.4	1.40	1.38	1.38
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.3	1.30	0.43	0.43
Level 5	80.00%	400.0	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.77

:Acceptable Limit $\pm 5\%$



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8, Dec, 2021

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01QC	Reference Number:	160-401526192-1
Cylinder Number:	CC159599	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	+/- 1% NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	+/- 0.4% NIST Traceable	07/23/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	18060121	KAL004215	250.0 PPM NOx/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOx/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	072508	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000929062	FTIR	Jul 19, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
SO2 MKS FTIR 000929062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES:RAN# 51319-CM03
PO# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1200636464

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

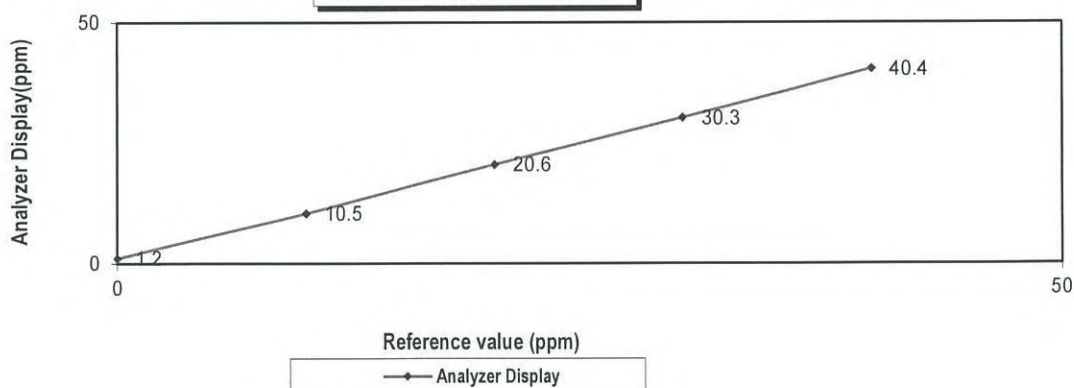
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.2	1.2	1.2
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.6	0.6	2.9	2.9
Level 4	60.00%	30.0	30.3	0.3	1.0	1.0
Level 5	80.00%	40.0	40.4	0.4	1.0	1.0
Remark : Measuring Range 50.0 ppm			Average Difference (%)		2.17	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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24, 11, 2021

Approve by

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24, Nov, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1200636465

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

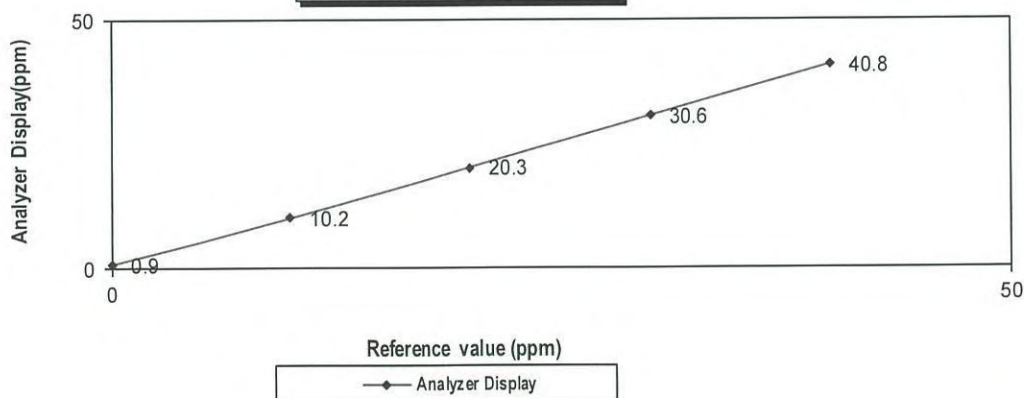
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.2	2.0	2.0
Level 3	40.00%	20.0	20.3	1.5	1.5
Level 4	60.00%	30.0	30.6	2.0	2.0
Level 5	80.00%	40.0	40.8	2.0	2.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)		1.65

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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24/Nov/2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1200636466

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

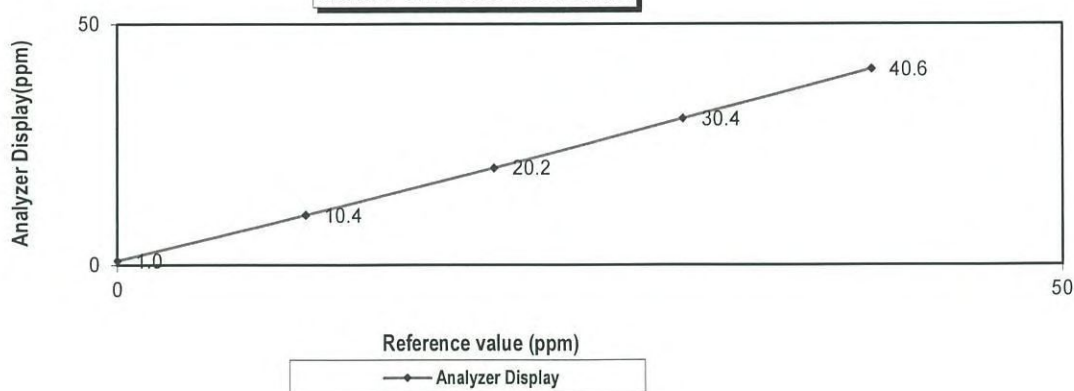
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.0	1.0	1.0	1.0
Level 2	20.00%	10.0	10.4	0.4	3.8	3.8
Level 3	40.00%	20.0	20.2	0.2	1.0	1.0
Level 4	60.00%	30.0	30.4	0.4	1.3	1.3
Level 5	80.00%	40.0	40.6	0.6	1.5	1.5
Remark : Measuring Range			50.0 ppm	Average Difference (%)		1.73
			:Acceptable Limit $\pm 5\%$			

Multi-Point Gas Test Chart



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24 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1200636467

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

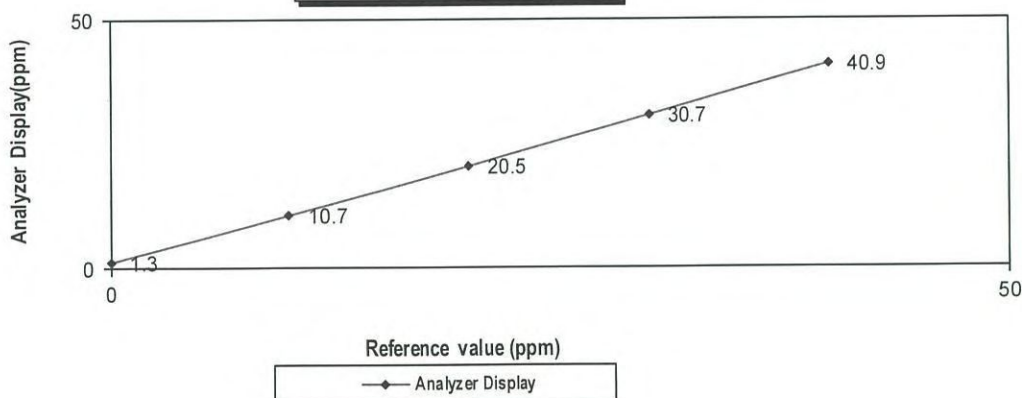
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.3	1.3	1.3	1.3
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.9	0.9	2.2	2.2
Remark : Measuring Range 50.0 ppm				Average Difference (%)		2.95

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

24 / 11 / 64

Approve by

24 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 30,2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1200906880

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30,2022

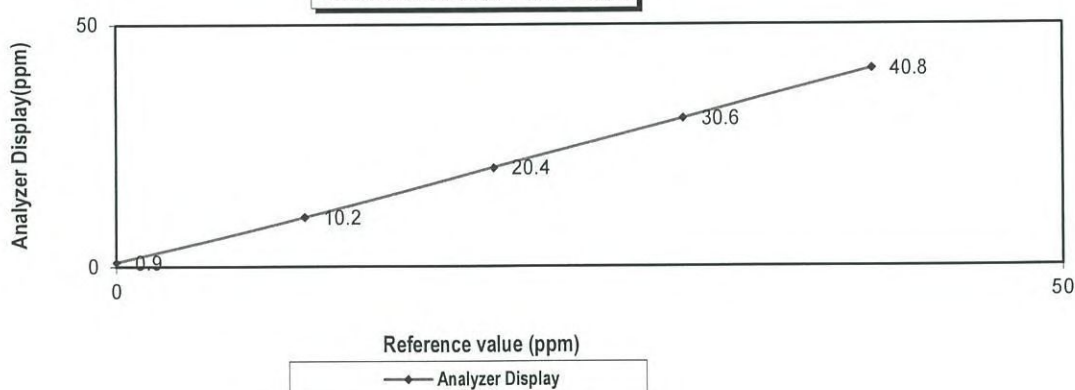
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9	0.9
Level 2	20.00%	10.0	10.2	0.2	2.0	2.0
Level 3	40.00%	20.0	20.4	0.4	2.0	2.0
Level 4	60.00%	30.0	30.6	0.6	2.0	2.0
Level 5	80.00%	40.0	40.8	0.8	2.0	2.0
Remark : Measuring Range 50.0 ppm				Average Difference (%)		1.75

Multi-Point Gas Test Chart



Calculate by

30 / 11 / 64

Approve by

30 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 30,2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1201497730

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30,2022

Dilutor Detail

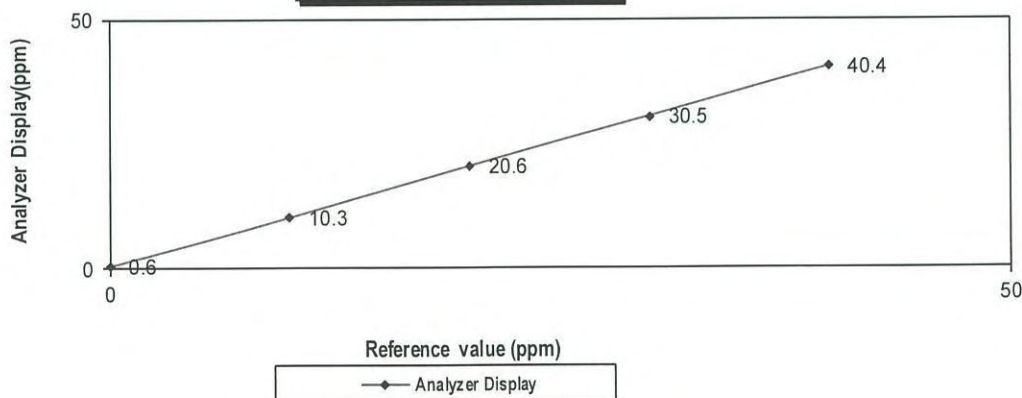
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.6	0.6	0.6
Level 2	20.00%	10.0	10.3	0.3	2.9	2.9
Level 3	40.00%	20.0	20.6	0.6	2.9	2.9
Level 4	60.00%	30.0	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	40.4	0.4	1.0	1.0
Remark : Measuring Range 50.0 ppm				Average Difference (%)		1.81

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

[Signature]

30 / 11 / 21

Approve by

[Signature]

30 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 30,2021

Equipment : Gas Analyzer (CO) **Model :** 48i
Manufacturer : Thermo Scientific **Serial Number :** 1201497732

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30,2022

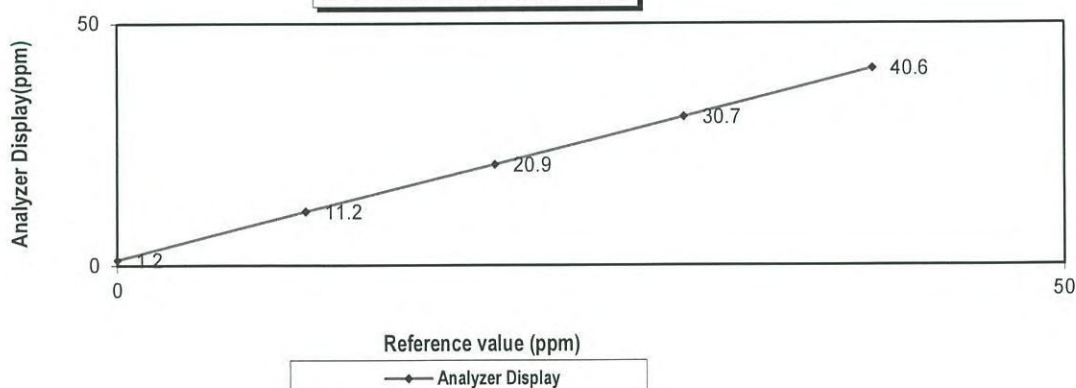
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.2	1.2	1.2
Level 2	20.00%	10.0	11.2	1.2	10.7	10.7
Level 3	40.00%	20.0	20.9	0.9	4.3	4.3
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.6	0.6	1.5	1.5
Remark : Measuring Range 50.0 ppm				Average Difference (%)		4.00

Multi-Point Gas Test Chart



Calculate by

30. / 11 / 64

Approve by

30. / Nov, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1201497733

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

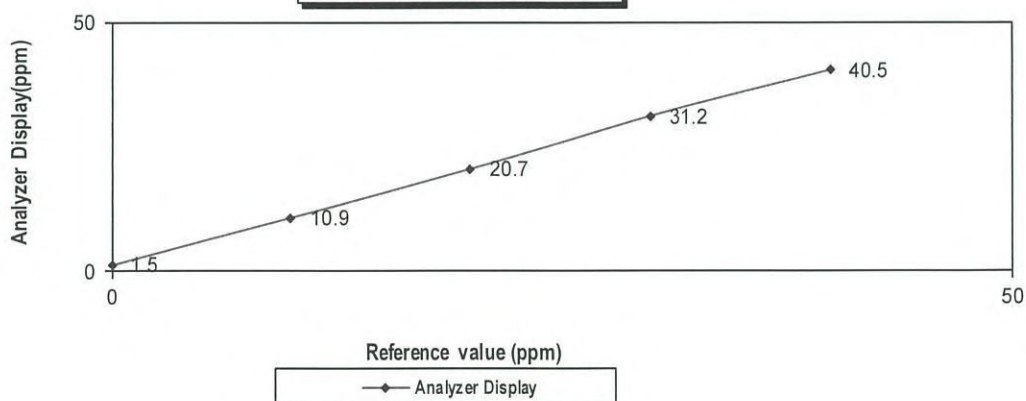
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.5	1.5	1.5	1.5
Level 2	20.00%	10.0	10.9	0.9	8.3	8.3
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
Level 4	60.00%	30.0	31.2	1.2	3.8	3.8
Level 5	80.00%	40.0	40.5	0.5	1.2	1.2
Remark : Measuring Range 50.0 ppm				Average Difference (%)		3.64

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

30 / 11 / 64

Approve by

30 / Nov / 2021

เอกสาร 5-3

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในชุมชน
และสถานีรถไฟฟ้า



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
 7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
 Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

การเปรียบเทียบความถูกต้องของอุปกรณ์ Microbiological air sampler
(โดยเปรียบเทียบกับ Dry Cal Primary Flowmeter(Defender 510 High Flow) : S/N 136164)

ข้อมูลการเปรียบเทียบ			
เบอร์เครื่อง	: Microflowα 90C (No.B02)	วันที่ทำการเปรียบเทียบ	: 31/03/2022
Serial number	: G9CP M2861	อุณหภูมิ	: 24.5 °C
ยี่ห้อ	: AQUARIA	ความดันบรรยากาศ	: 1011 mmbar
รุ่น	: Microflowα 90C	ความชื้นสัมพัทธ์	: 50 %

แสดงการคำนวณ

$$Q(\text{std.}) = Q \times \frac{P}{(1.333224 \times 760) \times 10^3} \times \frac{298}{(T+273)}$$

Q = อัตราการไหลที่แท้จริงของอากาศขณะเปรียบเทียบ (ml/min)
 Q (std.) = อัตราการไหลที่แท้จริงของอากาศที่สภาวะมาตรฐาน (lit/min)
 P = ความดันบรรยากาศขณะเปรียบเทียบ (มิลลิบาร์)
 T = อุณหภูมิอากาศขณะเปรียบเทียบ (องศาเซลเซียส)

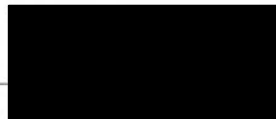
ตารางแสดงค่าที่เปรียบเทียบ

DATA	Flow rate ที่อ่านได้ จากเครื่อง Microflowα 90C (lit/min)	Actual flow rate (ml/min)						Actual flow rate ที่อุณหภูมิและความดัน มาตรฐาน(Qstd.) (lit/min)
		ที่อุณหภูมิและความดันขณะปรับเทียบ (Q)						
		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3	ครั้งที่ 4	ครั้งที่ 5	เฉลี่ย	
1	30	29885	29879	29872	29876	29883	29879.00	29.86

ผู้ทำการเปรียบเทียบ

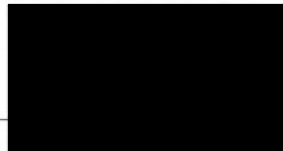


ผู้ตรวจสอบ



หัวหน้าส่วนงานเก็บตัวอย่าง

ผู้รับรองผล



ผู้จัดการวิชาการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72. Fax : (662) 513-4221. E-mail : sale@spscon.com., www.spscon.com

การเปรียบเทียบความถูกต้องของอุปกรณ์ Microbiological air sampler
(โดยเปรียบเทียบกับ Dry Cal Primary Flowmeter(Defender 510 High Flow) : S/N 136164)

ข้อมูลการเปรียบเทียบ			
เบอร์เครื่อง	: Microflowα 90C (No.B04)	วันที่ทำการเปรียบเทียบ	: 31/03/2022
Serial number	: G9ER M3095	อุณหภูมิ	: 24.5 °C
ยี่ห้อ	: AQUARIA	ความดันบรรยากาศ	: 1011 mmbar
รุ่น	: Microflowα 90C	ความชื้นสัมพัทธ์	: 50 %

แสดงการคำนวณ

$$Q(\text{std.}) = Q \times \frac{P}{(1.333224 \times 760) \times 10^3} \times \frac{298}{(T+273)}$$

Q = อัตราการไหลที่แท้จริงของอากาศขณะเปรียบเทียบ (ml/min)
Q (std.) = อัตราการไหลที่แท้จริงของอากาศที่สภาวะมาตรฐาน (lit/min)
P = ความดันบรรยากาศขณะเปรียบเทียบ (มิลลิบาร์)
T = อุณหภูมิอากาศขณะเปรียบเทียบ (องศาเซลเซียส)

ตารางแสดงค่าที่เปรียบเทียบ

DATA	Flow rate ที่อ่านได้ จากเครื่อง Microflowα 90C (lit/min)	Actual flow rate (ml/min)						Actual flow rate ที่อุณหภูมิและความดัน มาตรฐาน(Qstd.) (lit/min)
		ที่อุณหภูมิและความดันขณะปรับเทียบ (Q)						
		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3	ครั้งที่ 4	ครั้งที่ 5	เฉลี่ย	
1	30	29872	29883	29895	29882	29890	29884.40	29.87

ผู้ทำการเปรียบเทียบ

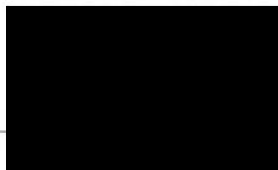


ผู้ตรวจสอบ



หัวหน้าส่วนงานเก็บตัวอย่าง

ผู้รับรองผล



ผู้จัดการวิชาการ



CERT NO.: E22/0168B

PAGE : 1 OF 3

**ISOCAL TECHNOLOGY CO.,LTD.
INDUSTRIAL INSTRUMENT CALIBRATION CENTER**

170/405 Moo 3 Serithai Rd., Kannayao Kannayao Bangkok 10230

Tel. 0-2906-3040-1 Fax. 0-2919-9948

Certificate of Calibration

EQUIPMENT :	ANEMOMETER
MODEL :	425
SERIAL NO. :	03053644
ID NO. :	NO.B03
MANUFACTURER :	TESTO
MADE IN :	GERMAANY
SUBMITTED BY :	S.P.S. CONSULTING SERVICE CO.,LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,JOMPOL, CHATUCHAK , BANGKOK
AMBIENT TEMPERATURE :	(23 \pm 2) °C
RELATIVE HUMIDITY :	(50 \pm 15) %
CALIBRATED BY:	
APPROVED BY :	
ISSUE DATE :	23-Mar-2022

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL, EXCEPT WITH THE PRIOR
WRITTEN APPROVAL OF THE HEAD OF THE INDUSTRIAL INSTRUMENTS CALIBRATION CENTER.



ISOCAL TECHNOLOGY CO., LTD.

CALIBRATION REPORT

CERT NO.: E22/0168B

PAGE : 2 OF 3

EQUIPMENT : ANEMOMETER
MANUFACTURER : TESTO
MODEL : 425
SERIAL NO. : 03053644
ID NO. : NO.B03
CALIBRATION DATE : 19-Mar-2022
RECEIVED DATE : 17-Mar-2022
PROCEDURE USED :

THIS INSTRUMENT WAS CALIBRATED BY COMPARISON WITH STANDARD THERMAL ANEMOMETER.

CONDITION OF THIS RESULT OF CALIBRATION

1. THIS RESULT OF CALIBRATION WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
2. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL OF THIS RESULT OF CALIBRATION.
3. REFERENCE STANDARDS INSTRUMENTS :-

ANEMOMETER MODEL DA-45 SERIAL NO. Q431637 CERT. NO L2003-577 DUE DATE 09-APR-2022
-THE INTERNATIONAL SYSTEM OF UNITS (SI).

THROUGH THE REFERENCE STANDARDS LABORATORY OF MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD.



ISOCAL TECHNOLOGY CO., LTD.

CALIBRATION REPORT

CERT.NO.: E22/0168B

PAGE : 3 OF 3

RESULT OF CALIBRATION: ADJUSTMENT (NO)
FUNCTION: AIR VELOCITY MEASUREMENT
RESOLUTION : 0.01 m/S

STANDARD READING (m/S)	UUC READING (m/S)	ERROR (m/S)	UNCERTAINTY (m/S)
0.00	0.00	0.00	0.08
2.09	2.18	0.09	0.15
4.05	4.15	0.10	0.20
6.13	6.19	0.06	0.20
8.15	8.23	0.08	0.20
10.09	10.19	0.10	0.20

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k = 2$, PROVIDING A LEVEL OF CONFIDENCE OF APPROXIMATELY 95%

UUC = UNIT UNDER CALIBRATE

- oOo -

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : HUMIDITY/TEMPERATURE DATA LOGGER
MANUFACTURER : HTI
MODEL / TYPE : HT-2000
SERIAL NO. : 2021020002298
CLID. NO. : 232100961
JOB CONTROL NO. : 210403031519

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 03 April 2021

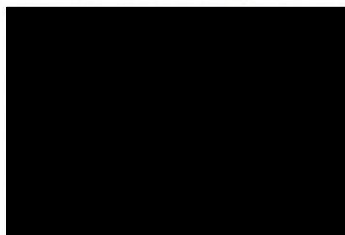
DATE OF ISSUED : 17 April 2021

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Calibration Engineer



Approved By :

Authorized Signatory

17 April 2021



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

Certificate No. Q21031519

F3-011-04/01-12

page 1 of 3



@clccalibration



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yeak 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

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



NSC-TISI-TIS 17025
CALIBRATION 0059
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	HUMIDITY/TEMPERATURE DATA LOGGER
MANUFACTURER	:	HTI
MODEL / TYPE	:	HT-2000
SERIAL NO.	:	2021020002298
DATE OF CALIBRATION	:	06 April 2021

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No.18815, Due Date 11 November 2021.

UNCERTAINTY :

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

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. **Q21031519**

F3-011-04/01-12

page 2 of 3



@clccalibration



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yeak 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

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



NSC-TISI-TIS 17025
CALIBRATION 0059
CLC

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring humidity/temperature data logger.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	19.99	20.1	-0.11	0.40
25.0	24.99	25.1	-0.11	
30.0	29.98	30.1	-0.12	

2. CORRECTION OF HUMIDITY

STD Temperature (° C)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
25	35.03	38.3	-3.27	1.20
25	50.03	52.5	-2.47	1.20
25	64.99	67.2	-2.21	1.42

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q21031519

F3-011-04/01-12

page 3 of 3



@clccalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : HUMIDITY/TEMPERATURE DATA LOGGER
MANUFACTURER : HTI
MODEL / TYPE : HT-2000
SERIAL NO. : 2021020002299
CLID. NO. : 232100960
JOB CONTROL NO. : 210403031518

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 03 April 2021

DATE OF ISSUED : 17 April 2021

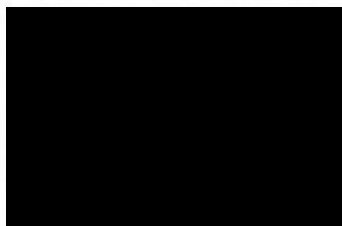
Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Calibration Engineer

Approved By :



Authorized Signatory

17 April 2021



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

Certificate No. Q21031518

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : **HUMIDITY/TEMPERATURE DATA LOGGER**
MANUFACTURER : **HTI**
MODEL / TYPE : **HT-2000**
SERIAL NO. : **2021020002299**
DATE OF CALIBRATION : **06 April 2021**

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No.18815, Due Date 11 November 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21031518

F3-011-04/01-12



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring humidity/temperature data logger.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	19.99	20.0	-0.01	0.40
25.0	24.99	25.0	-0.01	
30.0	29.98	30.0	-0.02	

2. CORRECTION OF HUMIDITY

STD Temperature (° C)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
25	35.03	38.2	-3.17	1.20
25	50.03	52.4	-2.37	1.20
25	64.99	67.0	-2.01	1.42

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q21031518

F3-011-04/01-12

page 3 of 3



เอกสาร 5-4

เอกสารการสอบเทียบเครื่องมือตรวจวัดระดับเสียง

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

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 : ACO

Model : 2127

Serial No. : 130006

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/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be 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 : 6 May 2021

Date of Calibration : 15 May 2021

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.

Head Office

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

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

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

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

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

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

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

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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 1
1/2 inch Bruel&Kjaer 4180	93.96	-0.04	± 0.10	± 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	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total Distortion

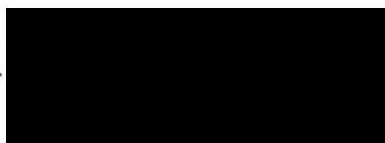
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.26	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise B_192/22

Sound Level Meter Calibration Report

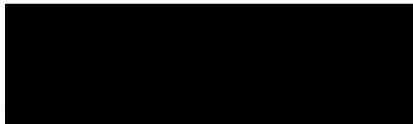
Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	15 May 2021
		Due Date	15 May 2022

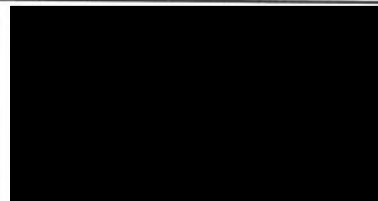
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B02	ACO	6236	00090370	07 April 2022	93.9	94.0
ACO-B08	ACO	6236	00142008	07 April 2022	94.0	94.0
ACO-B09	ACO	6236	00152004	07 April 2022	94.0	94.0
ACO-B16	ACO	6236	00172039	07 April 2022	94.1	94.0
ACO-B17	ACO	6236	00172042	07 April 2022	94.1	94.0
ACO-B32	ACO	6236	00182014	07 April 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 \pm 0.40 dB	

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Noise B_193/22

Sound Level Meter Calibration Report

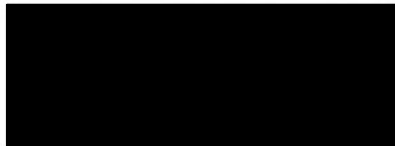
Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	15 May 2021
		Due Date	15 May 2022

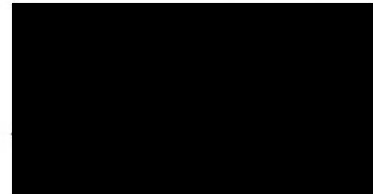
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B06	ACO	6236	00142003	07 April 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Calibrated by :



Approved by :



เอกสาร 5-5

เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์น้ำ



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

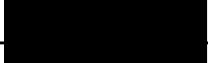



CERTIFICATE No : 22E0980
REFERENCE No : 63904-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : DKK-TOA
MODEL : HM-25R
SERIAL No : 760205
ID No : EQL-183
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : 
CALIBRATION DATE : 02-Feb-22

APPROVED BY : 
ISSUED DATE : 02-Feb-22
RECEIVED DATE : 02-Feb-22



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22E0980

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : DKK-TOA
ID No : EQL-183
RECEIVED DATE : 02-Feb-22
AMBIENT TEMPERATURE : 25° C ± 1° C
MODEL : HM-25R
SERIAL NUMBER : 760205
CALIBRATION DATE : 02-Feb-22
RELATIVE HUMIDITY : 57 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.
- REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	744	7514008	21E1392	29-Apr-22
5) BATH	260014	1247 48074	21T9121	10-Sep-22
6) THERMOMETER WITH PROBE	421504	55000379	21T9129	14-Sep-22
7) STANDARD THERMOMETER	2560	A14546	PSL-T0049/64	23-Nov-22

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
 - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH pH ELECTRODE S/N: 002F0035MK

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	ACTUAL READING (mV)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.01	-0.003	174	0.013	2.0
7.003	7.00	0.003	0.0	0.013	2.0
10.014	10.01	0.004	-172	0.014	2.0

2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
25.003	25.1	80	-0.097	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



CERTIFICATE No : 21E11277
REFERENCE No : 63049-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : TOA DKK
MODEL : HM-41X
SERIAL No : 784787
ID No : EQL-199
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY :

CALIBRATION DATE :

15-Oct-21

APPROVED BY :

ISSUED DATE :

15-Oct-21

RECEIVED DATE :

15-Oct-21



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 21E11277

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : TOA DKK
ID No : EQL-199
RECEIVED DATE : 15-Oct-21
AMBIENT TEMPERATURE : 25° C ± 1° C
MODEL : HM-41X
SERIAL NUMBER : 784787
CALIBRATION DATE : 15-Oct-21
RELATIVE HUMIDITY : 51 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	744	7514008	21E1392	29-Apr-22
5) BATH	260014	1247 48074	21T9121	10-Sep-22
6) THERMOMETER WITH PROBE	421504	55000379	21T9129	14-Sep-22
7) STANDARD THERMOMETER	2560	A14546	PSL-T0049/64	23-Nov-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
 - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT WITH pH ELECTRODE S/N: 903F0008MK

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	ACTUAL READING (mV)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.01	-0.003	177	0.013	2.00
7.003	7.00	0.003	0	0.013	2.00
10.014	10.01	0.004	-177	0.014	2.00

2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
25.008	25.0	80	0.008	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



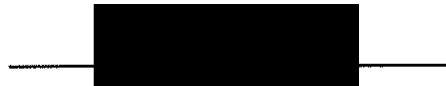
CERTIFICATE No : 21M9564
REFERENCE No : 62575-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BP210S
SERIAL No : S0736477
ID No : EQL-008
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD.,
SAMAEDAM, BANGKHUNTHIAN, BANGKOK
10150

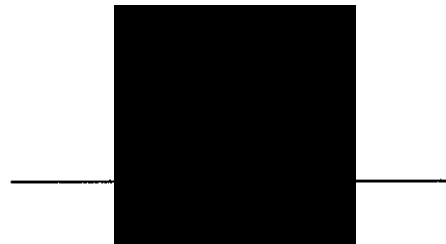
CALIBRATED BY :



CALIBRATION DATE :

23-Sep-21

APPROVED BY :



ISSUED DATE :

27-Sep-21

RECEIVED DATE :

23-Sep-21



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 21M9564

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BP210S
MANUFACTURER : SARTORIUS S/N : S0736477
ID No : EQL-008 RECEIVED DATE : 23-Sep-21
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 23-Sep-21
AMBIENT TEMPERATURE : 25°C \pm 1°C RELATIVE HUMIDITY : 51 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

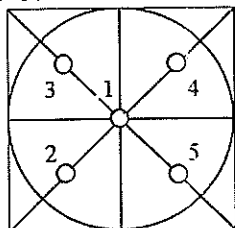
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.000	0.0000	0.0000	0.000078
0.100	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
1.0	1.0000	0.0000	0.000079
2.0	2.0000	0.0000	0.000080
20.0	19.9999	0.0001	0.000089
45.0	44.9999	0.0001	0.00014
65.0	64.9999	0.0001	0.00016
80.0	79.9999	0.0001	0.00019
100.0	99.9998	0.0002	0.00019
120.0	119.9998	0.0002	0.00022
140.0	139.9998	0.0002	0.00025
160.0	159.9998	0.0002	0.00027
180.0	179.9999	0.0001	0.00030
200.0	199.9995	0.0005	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9997
2	99.9996
3	99.9994
4	99.9998
5	99.9997
OFF-CENTER LOADING	0.0003

6. INTERNAL WEIGHT ERROR : 0.000400000000013279 g

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-0