

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

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ลำดับที่ 1

คุณภาพอากาศในบรรยากาศ



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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 : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	02/02/2024	y = 1.188x-3.435	0.996
B36	B36	01/02/2024	y = 1.201x-4.036	0.999
B37	B37	01/02/2024	y = 1.196x-2.671	0.998
B38	B38	02/02/2024	y = 1.232x-6.552	0.997
B39	B39	03/02/2024	y = 1.164x-0.902	0.997
B40	B40	01/02/2024	y = 1.225x-6.117	0.999
B41	B41	02/02/2024	y = 1.265x-6.140	0.999
B42	B42	02/02/2024	y = 1.187x-3.625	0.999
B43	B43	01/02/2024	y = 1.233x-2.707	0.997
B44	B44	01/02/2024	y = 1.202x-3.263	0.996
R01	R01	01/02/2024	y = 1.214x-4.512	0.999
R02	R02	02/02/2024	y = 1.222x-5.522	0.999
R03	R03	03/02/2024	y = 1.204x-5.785	0.999
R04	R04	01/02/2024	y = 1.220x-5.355	0.999
R05	R05	01/02/2024	y = 1.190x-5.262	0.997
R06	R06	02/02/2024	y = 1.223x-6.383	0.998
R07	R07	02/02/2024	y = 1.084x+0.577	0.999
R08	R08	01/02/2024	y = 1.157x-2.531	0.999
R09	R09	01/02/2024	y = 1.194x-3.227	0.998
R10	R10	02/02/2024	y = 1.198x-4.625	0.998
R11	R11	02/02/2024	y = 1.143x-2.176	1.000
R12	R12	02/02/2024	y = 1.165x-4.124	0.998
R13	R13	03/02/2024	y = 1.133x-1.833	0.997
R14	R14	01/02/2024	y = 1.216x-3.559	0.995
R15	R15	01/02/2024	y = 1.183x-5.143	0.999
R16	R16	01/02/2024	y = 1.227x-7.151	0.999
R17	R17	02/02/2024	y = 1.181x-3.964	0.996
R18	R18	02/02/2024	y = 1.195x-3.915	0.997
R19	R19	03/02/2024	y = 1.215x-6.609	1.000
R20	R20	03/02/2024	y = 1.208x-5.309	0.998



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/02/2024	$y = 1.147x - 0.194$	0.996
B02	B02	01/02/2024	$y = 1.060x + 2.506$	1.000
B03	B03	01/02/2024	$y = 1.216x - 3.895$	0.996
B04	B04	01/02/2024	$y = 1.224x - 5.960$	0.999
B05	B05	02/02/2024	$y = 1.220x - 5.384$	0.999
B06	B06	02/02/2024	$y = 1.197x - 4.228$	0.998
B07	B07	03/02/2024	$y = 1.208x - 4.865$	0.996
B08	B08	01/02/2024	$y = 1.171x - 1.266$	0.998
B09	B09	01/02/2024	$y = 1.198x - 5.197$	0.997
B10	B10	01/02/2024	$y = 1.219x - 5.339$	0.997
B11	B11	03/02/2024	$y = 1.211x - 3.765$	0.999
B12	B12	05/02/2024	$y = 1.203x - 3.968$	0.997
B13	B13	05/02/2024	$y = 1.158x - 1.909$	0.996
B14	B14	03/02/2024	$y = 1.190x - 3.316$	0.999
B15	B15	01/02/2024	$y = 1.163x - 1.150$	0.999
B16	B16	01/02/2024	$y = 1.170x + 0.508$	0.999
B17	B17	01/02/2024	$y = 1.186x - 2.843$	0.997
B18	B18	01/02/2024	$y = 1.207x - 1.821$	1.000
B19	B19	03/02/2024	$y = 1.178x - 2.990$	0.999
B20	B20	02/02/2024	$y = 1.206x - 5.507$	0.997
B21	B21	03/02/2024	$y = 1.172x - 0.702$	0.999
B22	B22	02/02/2024	$y = 1.175x - 1.992$	0.996
B23	B23	02/02/2024	$y = 1.196x - 3.382$	0.998
B24	B24	01/02/2024	$y = 1.181x - 2.463$	0.999
B25	B25	01/02/2024	$y = 1.204x - 3.960$	0.997
B26	B26	01/02/2024	$y = 1.218x - 5.354$	0.998
B27	B27	03/02/2024	$y = 1.178x - 4.891$	0.997
B28	B28	02/02/2024	$y = 1.226x - 6.323$	0.999
B29	B29	05/02/2024	$y = 1.174x - 3.753$	0.997
B30	B30	03/02/2024	$y = 1.179x - 3.207$	0.998
B31	B31	03/02/2024	$y = 1.189x - 1.040$	0.997
B32	B32	01/02/2024	$y = 1.222x - 3.815$	0.999
B33	B33	01/02/2024	$y = 1.159x - 1.689$	0.996
B34	B34	01/02/2024	$y = 1.191x - 1.278$	0.995



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	02/02/2024	y = 1.206x-5.952	0.998
R02	R02	02/02/2024	y = 1.219x-3.961	0.997
R03	R03	01/02/2024	y = 1.203x-5.426	0.998
R04	R04	01/02/2024	y = 1.191x-6.027	0.997
R05	R05	01/02/2024	y = 1.199x-5.883	1.000
R06	R06	01/02/2024	y = 1.192x-3.038	0.998
R07	R07	02/02/2024	y = 1.169x-2.670	0.996
R08	R08	02/02/2024	y = 1.186x-4.195	0.997
R09	R09	03/02/2024	y = 1.184x-3.512	1.000
R10	R10	03/02/2024	y = 1.179x-3.695	0.999
R11	R11	03/02/2024	y = 1.202x-2.389	0.997
R12	R12	01/02/2024	y = 1.194x-5.194	0.998
R13	R13	01/02/2024	y = 1.173x-2.754	0.999
R14	R14	01/02/2024	y = 1.176x-2.231	0.997
R15	R15	02/02/2024	y = 1.188x-3.910	0.998
R16	R16	02/02/2024	y = 1.180x-3.568	0.998
R17	R17	02/02/2024	y = 1.195x-3.126	0.996
R18	R18	03/02/2024	y = 1.143x-2.749	1.000
R19	R19	01/02/2024	y = 1.154x-2.002	0.996
R20	R20	01/02/2024	y = 1.161x-4.362	0.998



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 21 April 2024 BRAND : API MODEL : 200E
NO. NOX-B05 SERIAL NO. 2284

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 08 August 2023 Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A00726SV
Certified Date : 05 January 2023 Expired Date : 05 January 2026 Cylinder Conc. : 48.8 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.003
NO _x Span	400	400.3	0.075	400.0	1.007

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	506	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.0	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.003	-	1.0 ± 0.3
NO _x Slope	1.007	-	1.0 ± 0.3
NO Offset	0.8	mV	-20 to +150
NO _x Offset	0.3	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 21 April 2024

BRAND : API

MODEL : 200A

NO. NOX-B15

SERIAL NO. 213

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00726SV

Certified Date : 05 January 2023

Expired Date : 05 January 2026

Cylinder Conc. : 48.8 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.7	-0.075	400.0	1.005
NO _x Span	400	400.1	0.025	400.0	1.010

API Model 200A NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	5.4	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	102.7	mV	-20 - 150
AZERO	93.5	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.3	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.005	-	1.0 ± 0.3
NO _x Slope	1.010	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.5	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	21 April 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B06	SERIAL NO.	2286		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
			Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.007
NO _x Span	400	400.1	0.025	400.0	1.009
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.7	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO _x Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO _x Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 21 April 2024 BRAND : API MODEL : 200E
NO. NOX-B10 SERIAL NO. 4465

Calibrator (Dilution System)

Brand : Teledyne Model : 700
Last Cal. Date : 30 October 2023 Serial No. : 421

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A00726SV
Certified Date : 05 January 2023 Expired Date : 05 January 2026 Cylinder Conc. : 48.8 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.005
NO _x Span	400	400.2	0.050	400.0	1.008

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	504	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	102.9	mV	-20 - 150
AZERO	93.8	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.0	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.005	-	1.0 ± 0.3
NO _x Slope	1.008	-	1.0 ± 0.3
NO Offset	1.3	mV	-20 to +150
NO _x Offset	0.7	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 21 April 2024

BRAND : API

MODEL : 200E

NO. NOX-B07

SERIAL NO. 4338

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00726SV

Certified Date : 05 January 2023

Expired Date : 05 January 2026

Cylinder Conc. : 48.8 ppm

CALIBRATING CONDITION

Pressure : 1011 mmbar

Temp. : 24.5 °C

% RH : 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.006
NO _x Span	400	400.2	0.050	400.0	1.010

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	505	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	102.9	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.0	°C	7 ± 2
MOLY TEMP	314.8	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO _x Slope	1.010	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO _x Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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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					
SO ₂ FLUORESCENT ANALYZER					
DATE :	21 April 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B12	SERIAL NO.	1886		
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	399.6	-0.100	400.0	1.008
API Model TML-50 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3007	mV	1000-4900		
STR. LGT	60.9	PPB	<100		
DRK PMT	62.8	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2523	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.008	-	1.0 ± 0.3		
SO ₂ Offset	22.1	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	21 April 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -B05			SERIAL NO.	3270
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.007
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	658	cc/min	650 ± 10%		
PMT	103.4	mV	-20-150 with Zero Air		
UV LAMP	2997	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	58.4	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2516	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	28.9	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.007	-	1.0 ± 0.3		
SO ₂ Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	21 April 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -803			SERIAL NO.	1846
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 08 August 2023			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	0.998
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	652	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3035	mV	1000-4900		
STR. LGT	60.9	PPB	<100		
DRK PMT	62.7	mV	-50 - 200		
DRK LMP	57.5	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2523	mV	2500 ± 200		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	0.998	-	1.0 ± 0.3		
SO ₂ Offset	21.6	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	21 April 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B02			SERIAL NO.	1847
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.6	-0.100	400.0	1.008
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	652	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	3017	mV	1000-4900		
STR. LGT	61.2	PPB	<100		
DRK PMT	62.8	mV	-50 - 200		
DRK LMP	58.2	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2519	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.008	-	1.0 ± 0.3		
SO ₂ Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	21 April 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R01			SERIAL NO.	3415
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	399.5	-0.125	400.0	1.002
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.3	in-Hg	25-35		
SAMPLE FLOW	657	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3025	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	58.4	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2523	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.002	-	1.0 ± 0.3		
SO ₂ Offset	21.8	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		



CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA05/50

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 : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :

ISSUED DATE :

RECEIVED DATE :



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

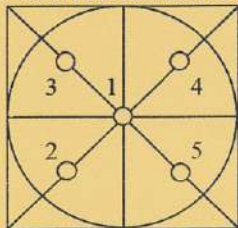
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) 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 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

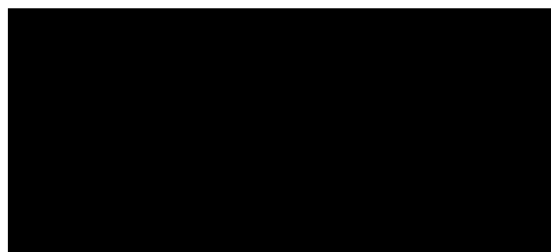
Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by :

Approved by :



This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

Resolution of Wavelength Mode 0.1 nm
Resolution of Photometric Mode 0.0001 A
Parameter Setting
Measurement Mode Wavelength, Absorbance
Wavelength Scan 1100 nm-190 nm
Scanning Speed 7.5 nm/min
Data Pitch 0.1 nm
Band width(Wavelength) 1.0 nm
Band width(Vis) 1.0 nm
Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0111	3.9564

**Specific Acceptance :

Transmission \leq 1.0 T(%), Absorbance \geq 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate

ลำดับที่ 2

คุณภาพอากาศจากปล่อง



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S.P.S. CONSULTING SERVICE CO., LTD.
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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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH _g (mmH ₂ O)
B01	1563	04/09/2023	0.997	50.11
B02	8002514	06/09/2023	1.002	49.25
B03	1503016	05/09/2023	0.998	50.44
B04	00006659	05/09/2023	1.004	49.37
B05	00007428	05/09/2023	0.996	49.77
R01	1561	06/09/2023	1.004	49.86
R02	8002513	08/09/2023	1.005	50.36
R03	1570	07/09/2023	0.997	49.55
R04	8002519	04/09/2023	1.004	49.69
R05	1503015	07/09/2023	0.999	50.08

Remark : Accept Value of y (test) is $0.97 < y < 1.03$

Accept Value of DH_g (test) is 46.7 ± 6.4 (mmH₂O)



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	01/11/2023	0.84	0.84
B37	S	0.99	01/11/2023	0.84	0.85
B38	S	0.99	02/11/2023	0.85	0.84
B39	S	0.99	03/11/2023	0.84	0.83
B40	S	0.99	04/11/2023	0.84	0.85
B41	S	0.99	04/11/2023	0.85	0.84
B44	S	0.99	04/11/2023	0.84	0.84
B45	S	0.99	01/11/2023	0.84	0.83
B46	S	0.99	01/11/2023	0.84	0.84
B47	S	0.99	01/11/2023	0.85	0.84
B48	S	0.99	01/11/2023	0.84	0.83
B49	S	0.99	01/11/2023	0.84	0.85
B54	S	0.99	02/11/2023	0.85	0.84
B56	S	0.99	02/11/2023	0.84	0.83
B57	S	0.99	03/11/2023	0.84	0.84
B58	S	0.99	03/11/2023	0.84	0.83

Remark : Accept value of Cp (test) is 0.84 ± 0.01



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R ²
					1	2	3	1	2	3		
B01	SKC	224-PCXR4	262101	02/10/2023	1,000	1,500	2,000	997	1,494	1,995	0.998x - 5.198	1.000
B02	SKC	224-PCXR4	626166	02/10/2023	1,000	1,500	2,000	995	1,491	1,987	0.995x - 0.239	1.000
B03	SKC	224-PCXR4	612968	02/10/2023	1,000	1,500	2,000	994	1,498	1,996	1.004x - 17.211	0.999
B04	SKC	224-PCXR4	602804	03/10/2023	1,000	1,500	2,000	1,001	1,502	1,997	0.999x - 3.961	1.000
B05	SKC	224-PCXR4	612693	03/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B06	SKC	224-PCXR4	262188	04/10/2023	1,000	1,500	2,000	999	1,497	1,998	1.005x - 13.275	1.000
B07	SKC	224-PCXR4	626262	04/10/2023	1,000	1,500	2,000	997	1,491	1,992	0.995x + 0.103	1.000
B08	SKC	224-PCXR4	626100	03/10/2023	1,000	1,500	2,000	995	1,490	1,994	0.999x - 3.162	1.000
B09	SKC	224-PCXR4	626479	04/10/2023	1,000	1,500	2,000	1,012	1,500	2,001	0.998x + 1.604	0.999
B10	SKC	224-PCXR4	091950	05/10/2023	1,000	1,500	2,000	992	1,486	1,994	1.002x - 11.842	1.000
B11	SKC	224-PCXR8	564315	05/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.010x - 26.335	0.999
B12	SKC	224-PCXR4	034656	05/10/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.007x - 17.721	0.999
B13	SKC	224-PCXR4	602073	04/10/2023	1,000	1,500	2,000	1,000	1,488	1,987	0.986x + 13.398	1.000
B14	SKC	224-PCXR4	626313	04/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.380	1.000
B15	SKC	224-PCXR4	626474	06/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.007x - 16.567	0.999
B16	SKC	224-PCXR4	626477	06/10/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.010x - 21.673	0.999
B17	SKC	224-PCXR4	626860	06/10/2023	1,000	1,500	2,000	1,000	1,492	1,998	0.997x - 1.859	1.000
B18	SKC	224-PCXR4	691484	03/10/2023	1,000	1,500	2,000	995	1,494	1,992	1.000x - 5.493	1.000
B19	SKC	224-PCXR4	691599	02/10/2023	1,000	1,500	2,000	991	1,500	1,998	1.015x - 32.922	0.999
B20	SKC	224-PCXR4	691587	02/10/2023	1,000	1,500	2,000	1,001	1,496	1,999	1.010x - 23.222	0.999
B21	SKC	224-PCXR4	691531	03/10/2023	1,000	1,500	2,000	994	1,491	1,997	1.004x - 12.681	1.000
B22	SKC	224-PCXR4	691654	03/10/2023	1,000	1,500	2,000	991	1,492	1,994	1.002x - 9.860	1.000
B23	SKC	224-PCXR4	798393	02/10/2023	1,000	1,500	2,000	991	1,498	1,997	1.014x - 33.810	0.999
B24	SKC	224-PCXR4	626363	02/10/2023	1,000	1,500	2,000	1,001	1,499	2,001	1.011x - 23.676	0.999
B25	SKC	224-PCXR4	798489	04/10/2023	1,000	1,500	2,000	996	1,497	1,989	0.991x + 6.619	1.000
B26	SKC	224-PCXR4	798479	05/10/2023	1,000	1,500	2,000	996	1,492	1,990	0.996x - 1.146	1.000
B27	SKC	224-PCXR4	691673	09/10/2023	1,000	1,500	2,000	989	1,506	1,998	1.016x - 34.646	0.999
B28	SKC	224-PCXR4	691570	09/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.996	1.000
B29	SKC	224-PCXR4	626472	09/10/2023	1,000	1,500	2,000	998	1,495	1,992	0.997x - 0.693	1.000
B30	SKC	224-PCXR4	691489	03/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.999x - 7.320	1.000
B31	SKC	224-PCXR4	691509	03/10/2023	1,000	1,500	2,000	1,001	1,497	1,997	1.007x - 18.788	0.999
B32	SKC	224-PCXR4	091567	04/10/2023	1,000	1,500	2,000	998	1,499	1,996	1.009x - 22.780	0.999
B33	SKC	224-PCXR4	091756	05/10/2023	1,000	1,500	2,000	1,000	1,489	1,994	0.995x - 0.223	1.000
B34	SKC	224-PCXR4	612962	05/10/2023	1,000	1,500	2,000	992	1,501	1,997	1.013x - 31.362	0.999
B35	SKC	224-PCXR4	602682	03/10/2023	1,000	1,500	2,000	998	1,496	1,998	0.998x - 7.157	0.999
B36	SKC	224-PCXR4	626164	07/10/2023	1,000	1,500	2,000	995	1,487	1,990	0.991x + 3.901	1.000
B37	SKC	224-PCXR4	626256	02/10/2023	1,000	1,500	2,000	990	1,500	1,993	1.000x - 6.520	1.000
B38	SKC	224-PCXR4	626167	03/10/2023	1,000	1,500	2,000	989	1,498	1,995	1.015x - 35.470	0.999
B39	SKC	224-PCXR4	034637	09/10/2023	1,000	1,500	2,000	991	1,495	1,994	1.004x - 14.572	1.000
B40	SKC	224-PCXR4	798349	07/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.526	0.999



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R ²
					1	2	3	1	2	3		
B41	SKC	224-PCXR4	612669	10/10/2023	1,000	1,500	2,000	999	1,491	1,993	0.994x + 2.802	1.000
B42	SKC	224-PCXR4	626041	10/10/2023	1,000	1,500	2,000	994	1,490	1,989	0.995x - 1.759	1.000
B43	SKC	224-PCXR4	034636	07/10/2023	1,000	1,500	2,000	995	1,488	1,989	0.991x + 2.866	1.000
B44	SKC	224-PCXR8	529341	07/10/2023	1,000	1,500	2,000	992	1,503	1,998	1.009x - 23.051	0.999
B45	SKC	224-PCXR8	529594	10/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	0.989x + 10.094	1.000
B46	SKC	224-PCXR8	566743	02/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B47	SKC	224-PCXR8	566747	02/10/2023	1,000	1,500	2,000	994	1,502	1,996	1.011x - 27.787	0.999
B48	SKC	224-PCXR8	566753	03/10/2023	1,000	1,500	2,000	1,000	1,495	2,000	1.005x - 13.577	1.000
B49	SKC	224-PCXR8	566780	02/10/2023	1,000	1,500	2,000	998	1,498	2,000	1.010x - 21.853	0.999
B50	SKC	224-PCXR8	500400	07/10/2023	1,000	1,500	2,000	999	1,495	1,989	0.991x + 5.640	1.000
B51	SKC	224-PCXR8	500363	07/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.009x - 24.941	0.999
B52	SKC	224-PCXR8	093186	07/10/2023	1,000	1,500	2,000	994	1,500	1,991	0.996x + 2.910	1.000
B53	SKC	224-PCXR8	707670	06/10/2023	1,000	1,500	2,000	990	1,498	1,996	1.014x - 33.838	0.999
B54	SKC	224-PCXR3	509821	05/10/2023	1,000	1,500	2,000	991	1,499	1,995	1.012x - 30.494	0.999
B55	SKC	224-PCXR3	510710	05/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.301	1.000
B56	SKC	224-PCXR3	511450	05/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.797	1.000
B57	SKC	224-PCXR3	510798	04/10/2023	1,000	1,500	2,000	989	1,493	1,994	1.001x - 9.175	1.000
B58	SKC	224-PCXR3	509852	04/10/2023	1,000	1,500	2,000	1,000	1,497	1,997	1.009x - 21.172	0.999
B59	SKC	224-PCXR3	509862	04/10/2023	1,000	1,500	2,000	995	1,495	1,988	0.993x + 2.723	1.000
B60	SKC	224-PCXR3	512655	07/10/2023	1,000	1,500	2,000	992	1,498	1,997	1.013x - 31.979	0.999
B61	SKC	224-PCXR3	503915	07/10/2023	1,000	1,500	2,000	1,000	1,502	1,997	1.007x - 20.065	0.999
B62	SKC	224-PCXR3	505975	07/10/2023	1,000	1,500	2,000	996	1,489	1,991	0.990x + 6.791	1.000
B63	SKC	224-PCXR3	511432	07/10/2023	1,000	1,500	2,000	993	1,500	1,995	1.003x - 8.208	1.000
B64	SKC	224-PCXR3	508302	05/10/2023	1,000	1,500	2,000	991	1,496	1,988	0.998x - 5.262	1.000
B65	SKC	224-PCXR3	508310	05/10/2023	1,000	1,500	2,000	993	1,492	1,991	0.999x - 4.884	1.000
B66	SKC	224-PCXR3	509861	06/10/2023	1,000	1,500	2,000	996	1,493	1,985	0.992x + 2.675	1.000
B67	SKC	224-PCXR3	506295	04/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.009x - 21.534	0.999
B68	SKC	224-PCXR3	505872	04/10/2023	1,000	1,500	2,000	994	1,493	1,987	0.993x + 3.176	1.000
B69	SKC	224-PCXR3	508375	07/10/2023	1,000	1,500	2,000	999	1,495	1,996	1.005x - 19.592	0.999
B70	SKC	224-PCXR3	510623	04/10/2023	1,000	1,500	2,000	992	1,486	1,995	1.002x - 11.762	1.000
B71	SKC	224-PCXR3	508367	05/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.646	0.999
B72	SKC	224-PCXR3	505977	03/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.997x - 4.295	1.000
B73	SKC	224-PCXR3	512606	05/10/2023	1,000	1,500	2,000	995	1,495	1,989	0.994x + 1.210	1.000
B74	SKC	224-PCXR3	505993	05/10/2023	1,000	1,500	2,000	997	1,496	1,986	0.987x + 12.602	1.000
B75	SKC	224-PCXR3	509820	05/10/2023	1,000	1,500	2,000	994	1,490	1,991	0.998x - 5.143	1.000
B76	SKC	224-PCXR3	509811	06/10/2023	1,000	1,500	2,000	1,000	1,497	1,999	1.010x - 23.063	0.999
B77	SKC	224-PCXR3	508301	06/10/2023	1,000	1,500	2,000	992	1,501	1,998	1.013x - 32.023	0.999
B78	SKC	224-PCXR3	510677	05/10/2023	1,000	1,500	2,000	1,001	1,498	1,997	1.007x - 18.549	0.999
B79	SKC	224-PCXR3	510920	03/10/2023	1,000	1,500	2,000	999	1,509	1,997	0.996x + 4.999	1.000



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	502.9	994.2	1977.4	1.003x – 7.740	0.999
H-R02	Dwyer	VFB-65	06/10/2023	500	1,000	2,000	495.9	996.6	2008.4	0.995x + 3.124	1.000
H-R03	Dwyer	VFB-65	04/10/2023	500	1,000	2,000	504.3	990.1	1969.6	0.987x + 9.890	1.000
H-R04	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	496.9	986.1	2006.2	1.004x – 15.756	0.999
H-R05	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	503.1	991.3	2014.3	1.000x – 1.636	1.000
H-R06	Dwyer	VFB-65	05/10/2023	500	1,000	2,000	499.2	997.2	1974.6	0.994x + 3.462	0.999



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 230725081570

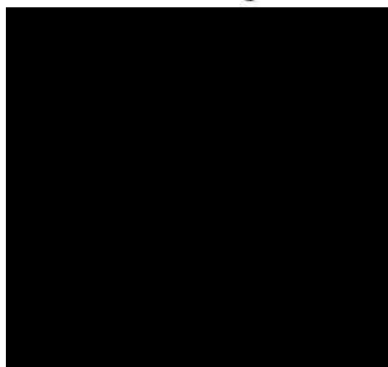
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By :



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. Q23081570

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	HI-LIGHT
MODEL / TYPE	:	N/A
SERIAL NO.	:	N/A[64-220088-1]
DATE OF CALIBRATION	:	26 July 2023
DUE DATE OF CALIBRATION	:	26 July 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 \pm 2) °C

Relative Humidity : (55 \pm 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPPP-05** according to **DKD-R 6-1** as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23081570

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 Yaek 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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.10	-32.13	-9.5	-9.5	+0.5	+0.5
-15	-49.20	-49.23	-14.5	-14.5	+0.5	+0.5
-20	-66.26	-66.26	-19.6	-19.6	+0.4	+0.4
-25	-83.30	-83.33	-24.6	-24.6	+0.4	+0.4
-30	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

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

End of Certificate

Certificate No. Q23081570

F3-011-04/01-12

page 3 of 3



@clccalibration



CERTIFICATE No : 23M2442

REFERENCE No : 68471-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

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 : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY :

ISSUED DATE :

RECEIVED DATE :



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23° 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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

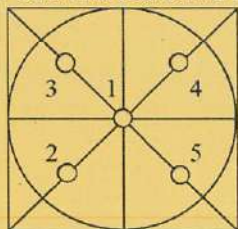
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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 :	02 November 2023	Brand :	API	Model :	300E
No.	CO-R01			Serial No.	704
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
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 : 48	
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	39.91	-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	4015.7	mV	2500-4800 mV		
CO Reference	3946.9	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.4	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	805	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.1	°C	48 ± 2		
Wheel Temperature	68.3	°C	68 ± 2		
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3038.9	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com <http://www.sithiphorn.com>

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

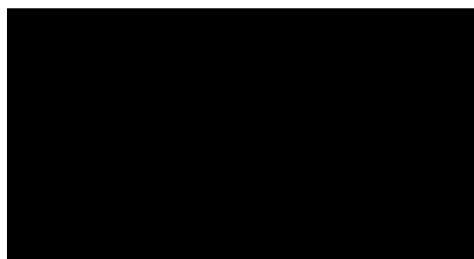
Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by :

Approved by :



This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01, ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

Resolution of Wavelength Mode 0.1 nm
Resolution of Photometric Mode 0.0001 A
Parameter Setting
Measurement Mode Wavelength, Absorbance
Wavelength Scan 1100 nm-190 nm
Scanning Speed 7.5 nm/min
Data Pitch 0.1 nm
Band width(Wavelength) 1.0 nm
Band width(Vis) 1.0 nm
Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0111	3.9564

**Specific Acceptance :

Transmission \leq 1.0 T(%), Absorbance \geq 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate

ลำดับที่ 3

ระดับเสียง

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

Submitted by : S.P.S.Consulting 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 : $(23 + 3) ^\circ\text{C}$

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

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

Standards used :

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 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

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	± 0.75 dB

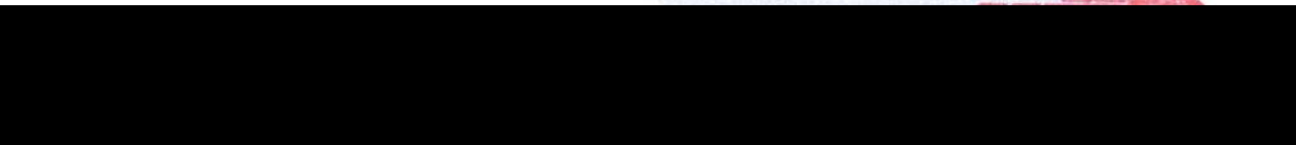
2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	$\pm 4.0\%$

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



Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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Head Office

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E-mail : sumalee@tistr.or.th

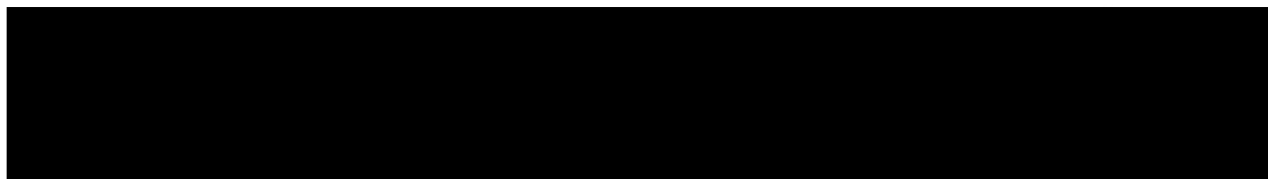


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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com.,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

Noise R_250-1/24

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		04 March 2024
				Due Date		04 March 2025
Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R13	ACO	6236	00172041	25 April 2024	93.9	93.9
ACO-R30	ACO	6236	00192042	25 April 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	





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

Noise Dose R_039/24

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 01/60
Model	SV34	Serial No.	33137
Calibration Range	114 dB, 1000 Hz	Last Calibration	22 August 2023
		Due Date	22 August 2024

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R02	SVANTEK	SV-104IS	60152	15 January 2024	113.5	113.5
NMD-R03	SVANTEK	SV-104IS	60153	15 January 2024	113.5	113.5
NMD-R05	SVANTEK	SV-104IS	60155	15 January 2024	113.6	113.5
NMD-R06	SVANTEK	SV-104IS	60146	15 January 2024	113.5	113.5
NMD-R13	SVANTEK	SV-104IS	63438	15 January 2024	113.5	113.5
NMD-R20	SVANTEK	SV-104IS	70035	15 January 2024	113.6	113.5
NMD-R22	SVANTEK	SV-104IS	80801	15 January 2024	113.5	113.5
NMD-R26	SVANTEK	SV-104IS	80836	15 January 2024	113.5	113.5
NMD-R27	SVANTEK	SV-104IS	80837	15 January 2024	113.5	113.5

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research
(TISTR)

113.53± 0.10 dB



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

Noise R_272/24

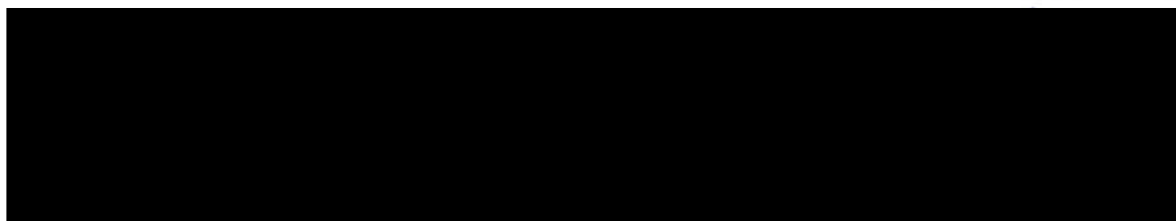
Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B29	ACO	6236	00182011	06 May 2024	93.9	93.9
ACO-B36	ACO	6236	00192027	06 May 2024	94.0	93.9
ACO-B41	ACO	6236	00192032	06 May 2024	93.9	93.9
ACO-B43	ACO	6236	00192034	06 May 2024	93.9	93.9
ACO-R40	ACO	6236	00192052	06 May 2024	93.9	93.9
ACO-R41	ACO	6236	00192053	06 May 2024	93.9	93.9
ACO-R50	ACO	6236	00192062	06 May 2024	94.0	93.9
ACO-R51	ACO	6236	00192063	06 May 2024	93.9	93.9
ACO-R52	ACO	6236	00192064	06 May 2024	93.9	93.9
NL 21-B01	RION	NL-21	00554245	06 May 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	



ลำดับที่ 4

คุณภาพน้ำจากระบบบำบัดน้ำเสีย



IRPC PUBLIC COMPANY LIMITED METROLOGY CENTER

299 Moo 5, Sukhumvit Road, Amphor Muang, Rayong, 21000 THAILAND
Tel. 0-3861-1333, 0-3861-3571-80 Ext. 4441, 4444 Fax. 0-3861-2812-3, 0-3889-8830



Certificate of Calibration

Reference : 30217692

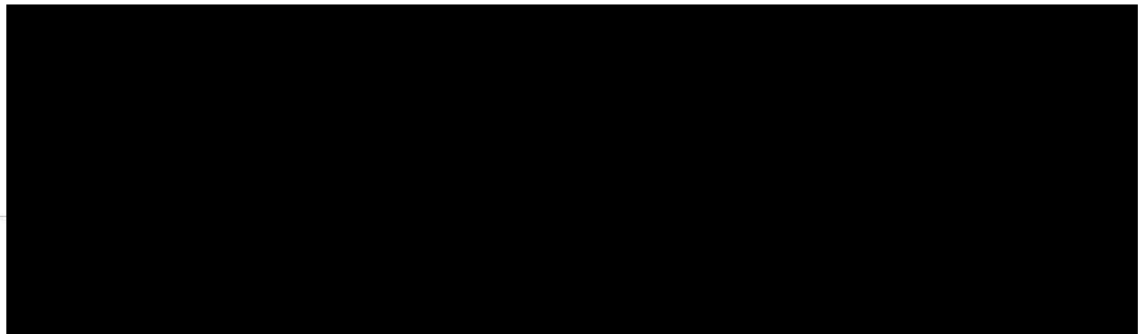
Certificate No. : CL1-M245008

Issued by : Mass Laboratory

Page : 1 of 4

Object.	:	Electronic Balance
Manufacturer.	:	Sartorius
Ident. No.	:	EN-01-006
Model / Type.	:	TE214S / Single range
Serial No.	:	SWB25909250
Customer.	:	ALEX/ALPO (ENV) 299 Moo 5, Sukhumvit Road, Tumbon Chenong Nern, Amphor Muang, Rayong, 21000
Date of Received.	:	25 January 2024
Date of Calibration.	:	25 January 2024
Place of Calibration	:	2nd Floor, Ethelene Building.

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



Continuation of Calibration Certificate No. : CL1-M245008

Page : 2 of 4

Object	:	Electronic Balance
Manufacturer	:	Sartorius
Identification No.	:	EN-01-006
Model / Type	:	TE214S / Single range
Serial No.	:	SWB25909250
Calibration Range	:	0 g to 200 g
Accuracy	:	N/A
Division / Resolution	:	0.0001 g
Condition of Object	:	In Condition

ENVIRONMENT CONDITIONS :

Air Temperature	:	24.3 °C ± 0.2 °C
Relative Humidity	:	48.0 % ± 1.1 %
Atmospheric Pressure	:	1015.0 mbar ± 0.2 mbar

MEASUREMENT METHOD :

- The balance is calibrated using the procedure according to the instruction manual number S10325200-2212. calibration method is based on UKAS Lab 14 Edition 6.
- For multi-interval or multiple range instruments where intervals or ranges are switched automatically these measurements may only be required on one such interval / range.
- Balance calibration is performed by comparing the conventional mass values of the reference weights with the readings on the balance display.

TRACEABILITY :

Instrument	Model	Serial No.	Certificate No.	Due date
1. Standard weight Set 1 mg to 1 kg	Class F1	15891	CL1-M232036	15-May-25

Note : This reference standard is traceable to SI Unit through the IRPC Metrology Center.

UNCERTAINTY OF MEASUREMENTS :

The uncertainty stated is the expanded uncertainty which results from multiplying the standard uncertainty by the coverage factor ($k = 2$). It has been determined according to "M3003 the Expression of Uncertainty and Confidence in Measurement" This mean the value of the measured lies within the assigned range of values with a probability of approximately 95%.



MEASUREMENT RESULTS :

Balance Serial No. : SWB25909250

Range Capacity : 0 g to 220 g

Resolution : 0.0001 g

A 'Zero-Tracking' facility of Weighing machines.

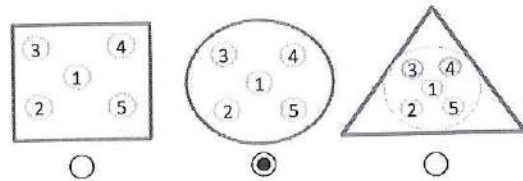
☐ Enable. ☐ Disabled. ☒ N/A. (No Application)
☐ Without adjustment.☐ Adjustment by internal calibration of Balance.☒ Adjustment using external weight.**1. Repeatability.**

Test Weight : 200 g

Measurement	Displayed value (g)
1	200.0000
2	199.9999
3	199.9999
4	200.0000
5	200.0000
6	199.9999
7	199.9999
8	200.0000
9	199.9999
10	199.9999
Average	199.9999
SD	0.000052

2. Eccentric or Off-centre loading.

Test Weight : 100 g



Load position	Displayed value (g)	Difference off-center (g)
1	100.0002	0.0000
2	99.9999	0.0003
3	100.0006	-0.0004
4	100.0005	-0.0003
5	100.0000	0.0002
Maximum difference off-Center		-0.0004

3. Effect of tare and/or balancing mechanism

Weight used for tare weight : 100 g

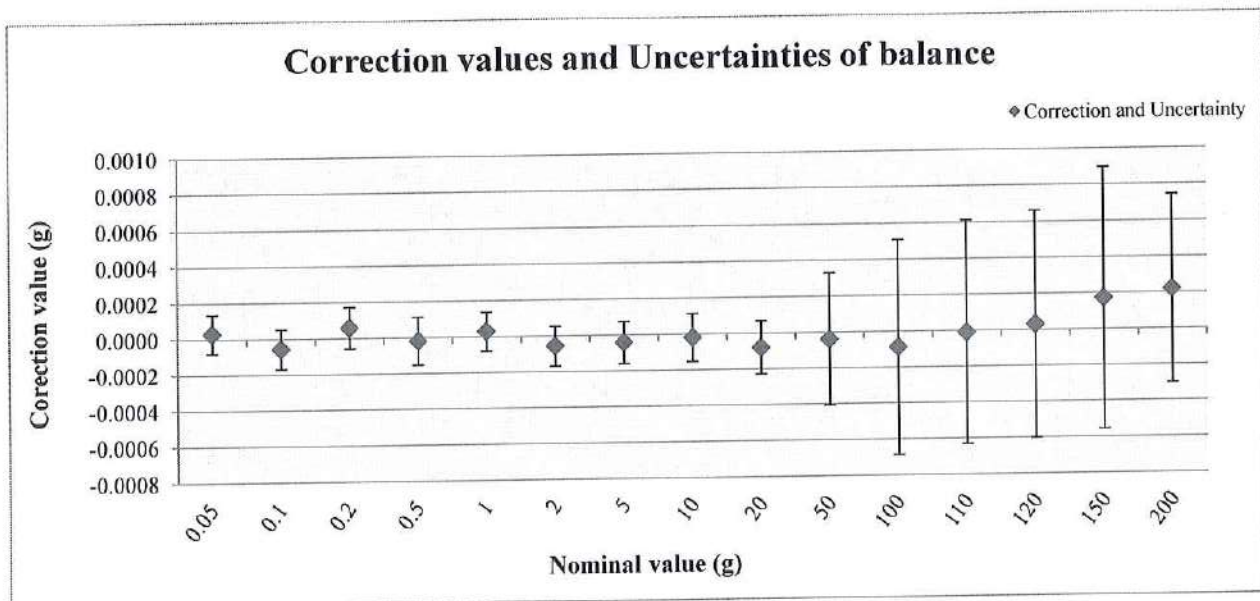
Nominal value (g)	Conventional mass (g)	Displayed value. (g)	Correction value. (g)
20	19.99992	20.0000	-0.0001
40	39.99985	39.9999	-0.0001
60	59.99994	60.0000	-0.0001
80	79.99986	79.9999	0.0000
100	100.00011	100.0002	-0.0001



MEASUREMENT RESULTS :**4. Error of indication from nominal or conventional mass value.**

Nominal value (g)	Conventional Mass (g)	Displayed value (g)	Correction value (g)	Uncertainty $k = 2$ \pm (g)
0.05	0.050027	0.0500	0.0000	0.00011
0.1	0.100041	0.1001	-0.0001	0.00011
0.2	0.199956	0.1999	0.0001	0.00012
0.5	0.49988	0.4999	0.0000	0.00013
1	1.00003	1.0000	0.0000	0.00011
2	2.00004	2.0001	-0.0001	0.00011
5	4.99996	5.0000	0.0000	0.00012
10	9.99988	9.9999	0.0000	0.00013
20	19.99992	20.0000	-0.0001	0.00015
50	50.00006	50.0001	0.0000	0.00037
100	100.00011	100.0002	-0.0001	0.00060
110	109.99999	110.0000	0.0000	0.00062
120	120.00003	120.0000	0.0000	0.00063
150	150.00017	150.0000	0.0002	0.00073
200	199.99982	199.9996	0.0002	0.00052

The graphs of correction values and uncertainties are shown as follows.



Remark : This result of calibration was found accurate as shown on date, place and stated object of calibration only.

*** End of report ***

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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 FAX. 0-2719-9484

Cert.No.: 23TW121

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	WTW
Model :	Oxi7310
Serial No. :	18020813
ID No. :	-
Received Date :	25 May 2023
Test Date :	26 May 2023
Reference :	2305-0831DC-1
Submitted by :	IRPC Public Company Limited 299 Moo.5, Sukhumvit Road, T.Cherngner, A.Muang, Rayong 21000
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean

Approved by :

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lernagtrakul

Issue Date : 29 May 2023

B 0314935



Cert.No.: 23TW121

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 21460008

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.13	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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a 1164064

**SCIMET Co., Ltd.**

1194 Soi Wachirathamsathit 57, Bangchak,
Phrakhanong, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel: 02 460 9239
<https://www.scimet.co.th>

Certificate No. C16240009

Calibration Certificate

Equipment:	COD Reactor	Job No.:	KSMT2400611
Model:	Digital PREP Cube	Received Date:	23 April 2024
Serial No.(or ID):	CBB0412050122 (EN-05-001)	Issued Date:	26 April 2024
Manufacturer:	SCP SCIENCE	Page:	1 of 5
Covers:	None		
Condition:	In Condition		

Customer

IRPC PUBLIC CO., LTD.
299 Moo 5, Sukhumvit Road, Tambol Choengneon, Amphur Muang, Rayong 21000 Thailand

Calibration Place

IRPC PUBLIC CO., LTD. (Gc Lab)
299 Moo 5, Sukhumvit Road, Tambol Choengneon, Amphur Muang, Rayong 21000 Thailand

Calibration Date

23 April 2024

Environment Condition

Temperature: 26.5 °C ± 0.4 °C
Humidity: 63.8 %RH ± 2.6 %RH

The Method used

In-house method, based on Direct Measurement with
Standard Thermometer

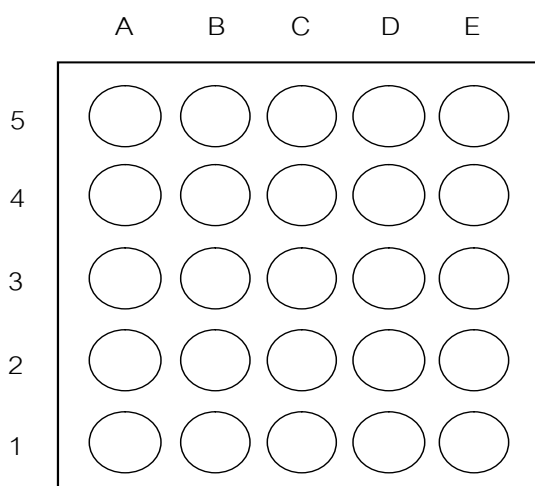
Traceability

This certificate is traceable to the SI Units maintained by
National Institute of Metrology (NIMT), Thailand through
Quality Reborn Co.,Ltd.Certificate No. QR23-1906

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

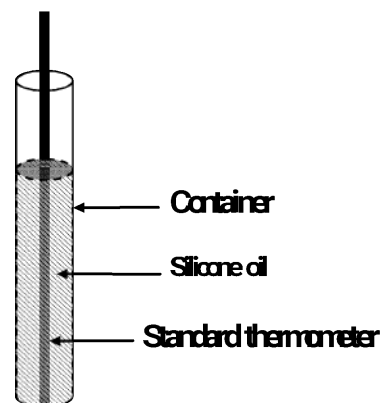
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.



Top view

Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Calibration Results:**Pre-Calibration**

Locations heating Block:	Desired (°C)	Setting (°C)	Unit Under Calibration (°C)
Single	150.0	150.0	150.0

Location heating Block:	Measured Temperature (°C)	Correction (°C)
A1	147.37	2.63
A2	147.40	2.60
A3	148.13	1.87
A4	147.71	2.29
A5	147.07	2.93
B1	148.00	2.00
B2	147.93	2.07
B3	148.71	1.29
B4	147.58	2.42
B5	147.95	2.05
C1	148.06	1.94
C2	149.39	0.61
C3	148.22	1.78
C4	150.69	-0.69
C5	147.79	2.21
D1	147.79	2.21
D2	148.40	1.60
D3	149.02	0.98
D4	148.86	1.14
D5	147.33	2.67
E1	146.89	3.11
E2	148.10	1.90
E3	147.89	2.11
E4	148.46	1.54
E5	147.84	2.16

Calibration Results:

Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Single	152.0	152.0

Location heating Block:	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
A1	149.27	-0.73	0.26
A2	149.68	-0.32	0.27
A3	149.64	-0.36	0.27
A4	150.03	0.03	0.27
A5	149.09	-0.91	0.26
B1	150.52	0.52	0.27
B2	150.33	0.33	0.28
B3	151.10	1.10	0.27
B4	149.73	-0.27	0.28
B5	149.83	-0.17	0.27
C1	149.82	-0.18	0.27
C2	151.55	1.55	0.27
C3	150.44	0.44	0.29
C4	150.42	0.42	0.28
C5	149.52	-0.48	0.27
D1	149.42	-0.58	0.29
D2	150.02	0.02	0.26
D3	150.27	0.27	0.27
D4	150.10	0.10	0.27
D5	148.98	-1.02	0.29
E1	149.56	-0.44	0.28
E2	149.36	-0.64	0.26
E3	149.54	-0.46	0.27
E4	149.88	-0.12	0.27
E5	148.57	-1.43	0.29

Characterization of the unit under calibration:

Locations heating Block	Desired	Unit Under Calibration (°C)		Measured Temperature (°C)
	(°C)	Setting	Reading	Stability (±°C)
Single	150.0	152.0	152.0	0.13

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2400611

ชนิดเครื่องมือ: COD Reactor

รุ่น: Digital PREP Cube

หมายเลขเครื่อง: CBB0412050122 (EN-05-001)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
23 Apr 2024			23 Apr 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :





Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31231895
Model:	UF 55	Issued Date:	07 September 2023
Serial No.(or ID):	B216.2858 (EN-05-033)	Job No.:	WO-00004496
Manufacturer:	Memmert	Page:	1 of 3
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: IRPC PUBLIC CO., LTD.
299 Moo 5, Sukhumvit Road, Tambol Choengneon,
Amphur Muang, Rayong 21000 Thailand

Environment Condition:

Temperature:	23 °C	±	1.1 °C
Humidity:	57 %RH	±	3.8 %RH
Voltage:	218 VAC	±	7.5 VAC

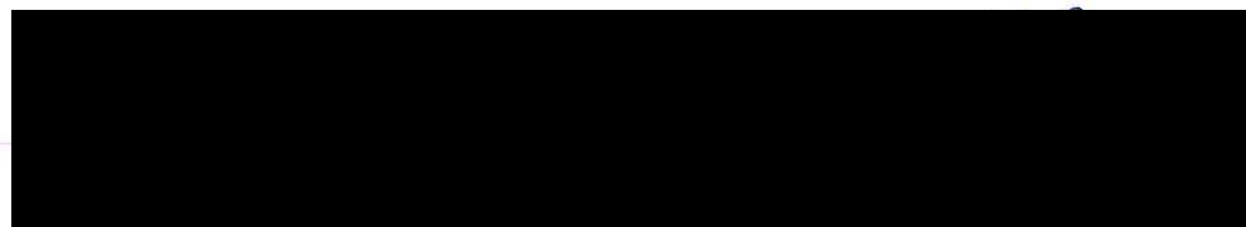
Calibration Place: IRPC PUBLIC CO., LTD. (Envi Lab Instrument Room)
299 Moo 5, Sukhumvit Road, Tambol Choengneon,
Amphur Muang, Rayong 21000 Thailand

Calibration By: Mr. Nattapat Rungrueang

Calibration Date: 05 September 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

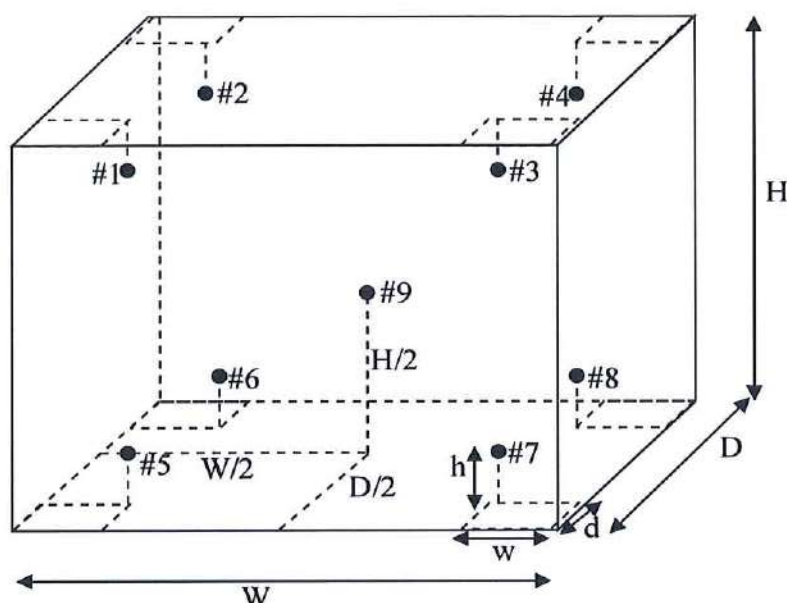
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230019



This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: $W = 40$ (cm) $D = 33$ (cm) $H = 40$ (cm)

Standard Locations (#1, #2, #3, #4): $w = 5$ (cm) $d = 5$ (cm) $h = 5$ (cm)

Standard Locations (#5, #6, #7, #8): $w = 5$ (cm) $d = 5$ (cm) $h = 5$ (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:

104.0 104.0 104.59 103.96 104.44 104.40 104.16 104.06 103.92 104.65 104.37

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.13	0.13	0.39
#2	103.50	-0.50	0.39
#3	104.00	0.00	0.39
#4	103.96	-0.04	0.39
#5	103.70	-0.30	0.39
#6	103.59	-0.41	0.39
#7	103.45	-0.55	0.39
#8	104.25	0.25	0.39
#9	103.89	-0.11	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.13	103.50	104.00	103.96	103.70	103.59	103.45	104.25	103.89	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.63	0.17	1.03

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$) .
; PFA – Probability of False Accept

After adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.13	0.13	0.39	1.0	Pass
#2	103.50	-0.50	0.39	1.0	Pass
#3	104.00	0.00	0.39	1.0	Pass
#4	103.96	-0.04	0.39	1.0	Pass
#5	103.70	-0.30	0.39	1.0	Pass
#6	103.59	-0.41	0.39	1.0	Pass
#7	103.45	-0.55	0.39	1.0	Pass
#8	104.25	0.25	0.39	1.0	Pass
#9	103.89	-0.11	0.39	1.0	Pass

Correction* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

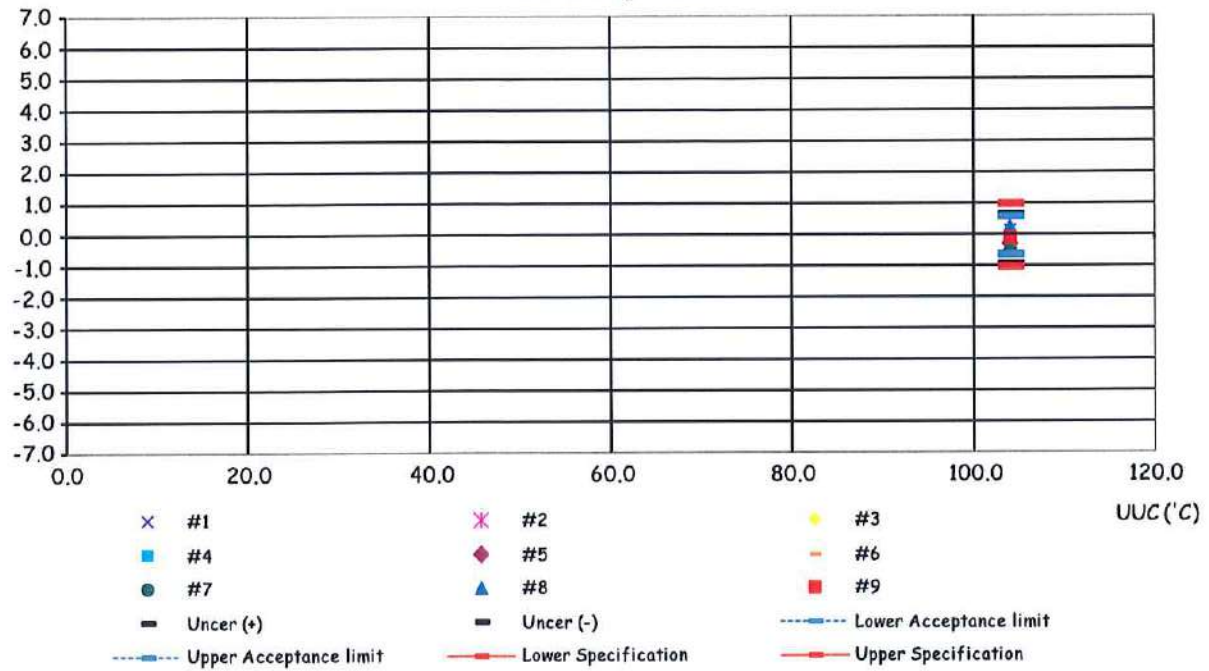
The End of Statements of Conformity

Corr_Distribution & Max_Measurement Uncertainty

Job_No. WO-00004496

Correction ('C)

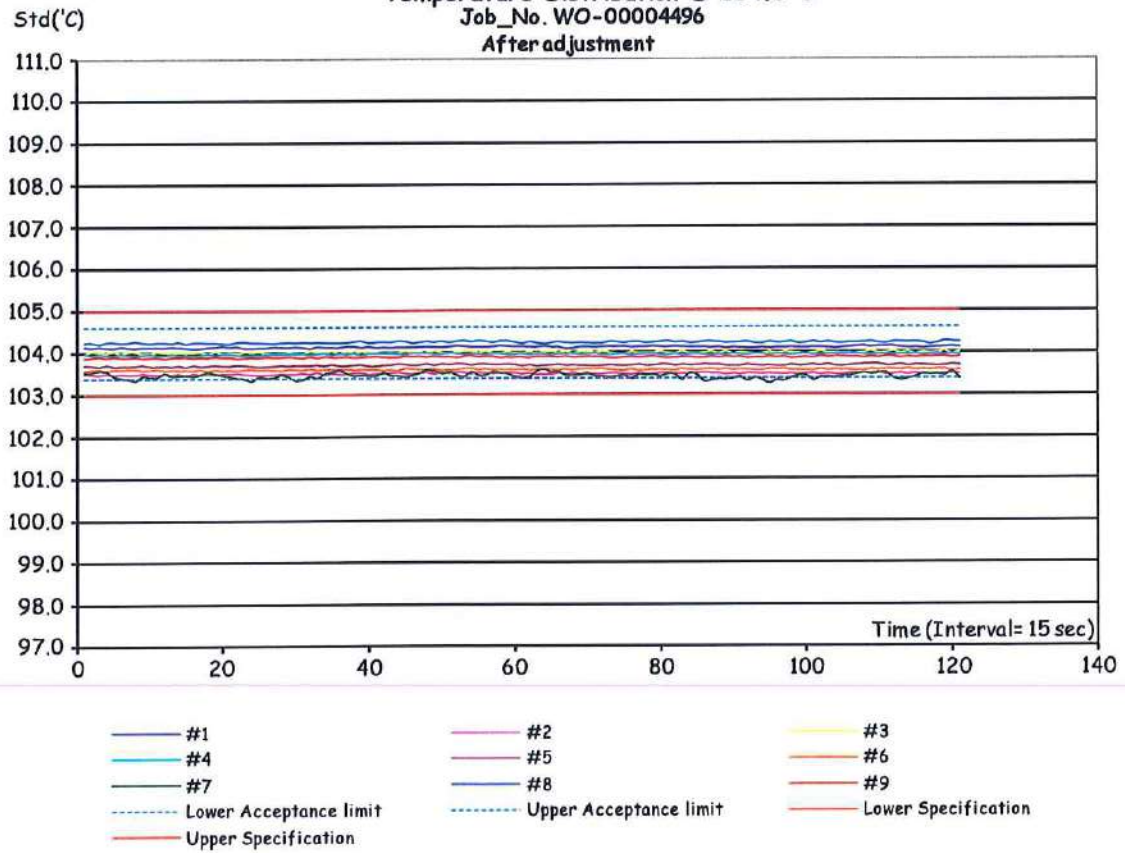
After adjustment



Temperature Distribution @ 104.0°C

Job_No. WO-00004496

After adjustment



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00004496

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B216.2858 (EN-05-033)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
05 Sep 2023			05 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Nattapat Rungrueang

Service Engineer



Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31231896
Model:	UF 55	Issued Date:	07 September 2023
Serial No.(or ID):	B216.3478 (EN-05-034)	Job No.:	WO-00004496
Manufacturer:	Memmert	Page:	1 of 4
Condition:	In Condition	Ventilation Valve:	Closed
Shelves(pc.):	1		

Customer: IRPC PUBLIC CO., LTD.
299 Moo 5, Sukhumvit Road, Tambol Choengneon,
Amphur Muang, Rayong 21000 Thailand

Environment Condition:

Temperature:	24 °C	±	1.0 °C
Humidity:	57 %RH	±	3.8 %RH
Voltage:	218 VAC	±	7.5 VAC

Calibration Place: IRPC PUBLIC CO., LTD. (Envi Lab Instrument Room)
299 Moo 5, Sukhumvit Road, Tambol Choengneon,
Amphur Muang, Rayong 21000 Thailand

Calibration By: Mr. Nattapat Rungrueang

Calibration Date: 05 September 2023

The Method used: In house method, CAL-WI-16, base on TLAS-G20

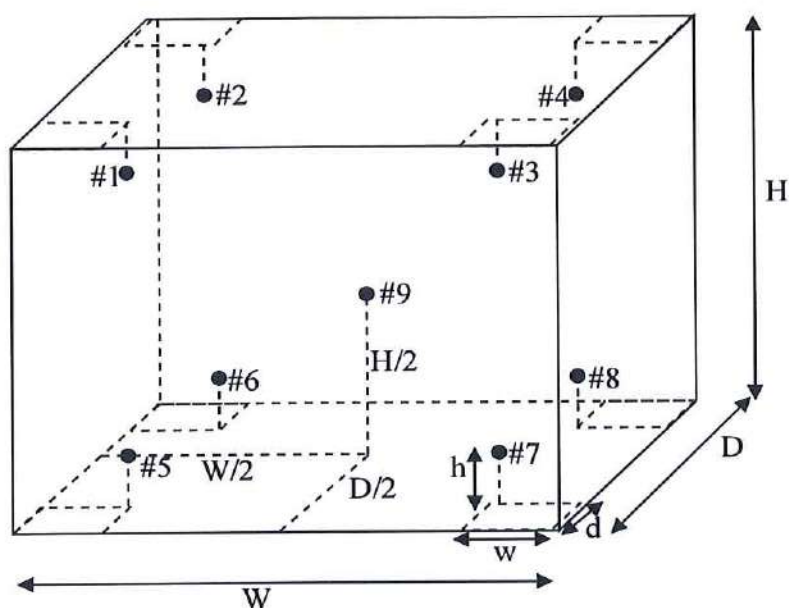
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230019

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: $W = 40$ (cm) $D = 33$ (cm) $H = 40$ (cm)

Standard Locations (#1, #2, #3, #4): $w = 5$ (cm) $d = 5$ (cm) $h = 5$ (cm)

Standard Locations (#5, #6, #7, #8): $w = 5$ (cm) $d = 5$ (cm) $h = 5$ (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.29	0.29	0.39
#2	103.75	-0.25	0.39
#3	104.01	0.01	0.39
#4	104.15	0.15	0.39
#5	104.12	0.12	0.39
#6	103.79	-0.21	0.40
#7	103.65	-0.35	0.39
#8	104.06	0.06	0.39
#9	104.24	0.24	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.29	103.75	104.01	104.15	104.12	103.79	103.65	104.06	104.24	0.40

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.65	0.08	0.77

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	180.38	0.38	0.44
#2	179.01	-0.99	0.45
#3	179.85	-0.15	0.47
#4	180.14	0.14	0.44
#5	179.98	-0.02	0.47
#6	179.35	-0.65	0.48
#7	179.06	-0.94	0.47
#8	179.86	-0.14	0.46
#9	180.27	0.27	0.45

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	180.38	179.01	179.85	180.14	179.98	179.35	179.06	179.86	180.27	0.48

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.32	0.13	1.53

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

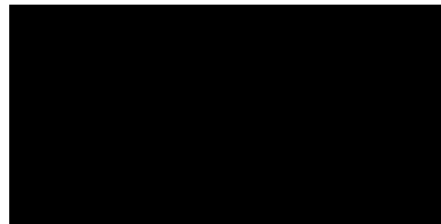
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$).
; PFA – Probability of False Accept



Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.29	0.29	0.39	1.0	Pass
#2	103.75	-0.25	0.39	1.0	Pass
#3	104.01	0.01	0.39	1.0	Pass
#4	104.15	0.15	0.39	1.0	Pass
#5	104.12	0.12	0.39	1.0	Pass
#6	103.79	-0.21	0.40	1.0	Pass
#7	103.65	-0.35	0.39	1.0	Pass
#8	104.06	0.06	0.39	1.0	Pass
#9	104.24	0.24	0.39	1.0	Pass

Correction* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Statements of conformity:(Cont.)
Without adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	180.38	0.38	0.44	2.0	Pass
#2	179.01	-0.99	0.45	2.0	Pass
#3	179.85	-0.15	0.47	2.0	Pass
#4	180.14	0.14	0.44	2.0	Pass
#5	179.98	-0.02	0.47	2.0	Pass
#6	179.35	-0.65	0.48	2.0	Pass
#7	179.06	-0.94	0.47	2.0	Pass
#8	179.86	-0.14	0.46	2.0	Pass
#9	180.27	0.27	0.45	2.0	Pass

Correction* = Measured Temperature - Desired Temperature

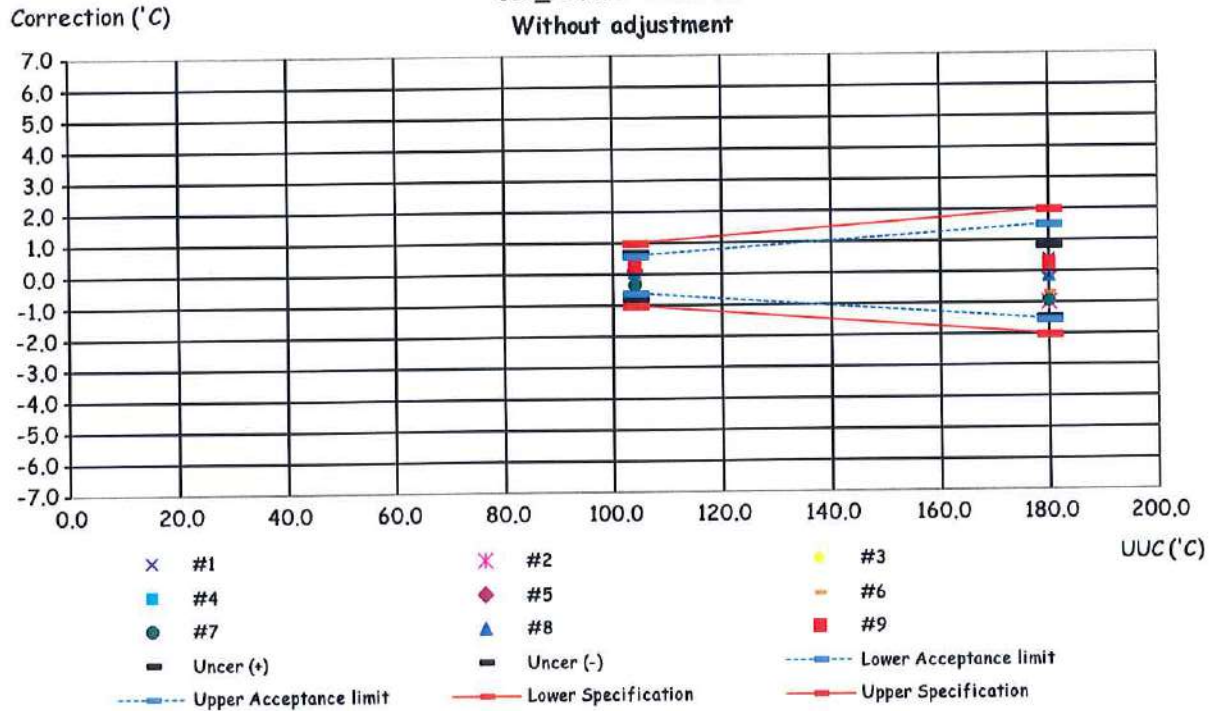
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

Corr_Distribution & Max_Measurement Uncertainty

Job_No. WO-00004496

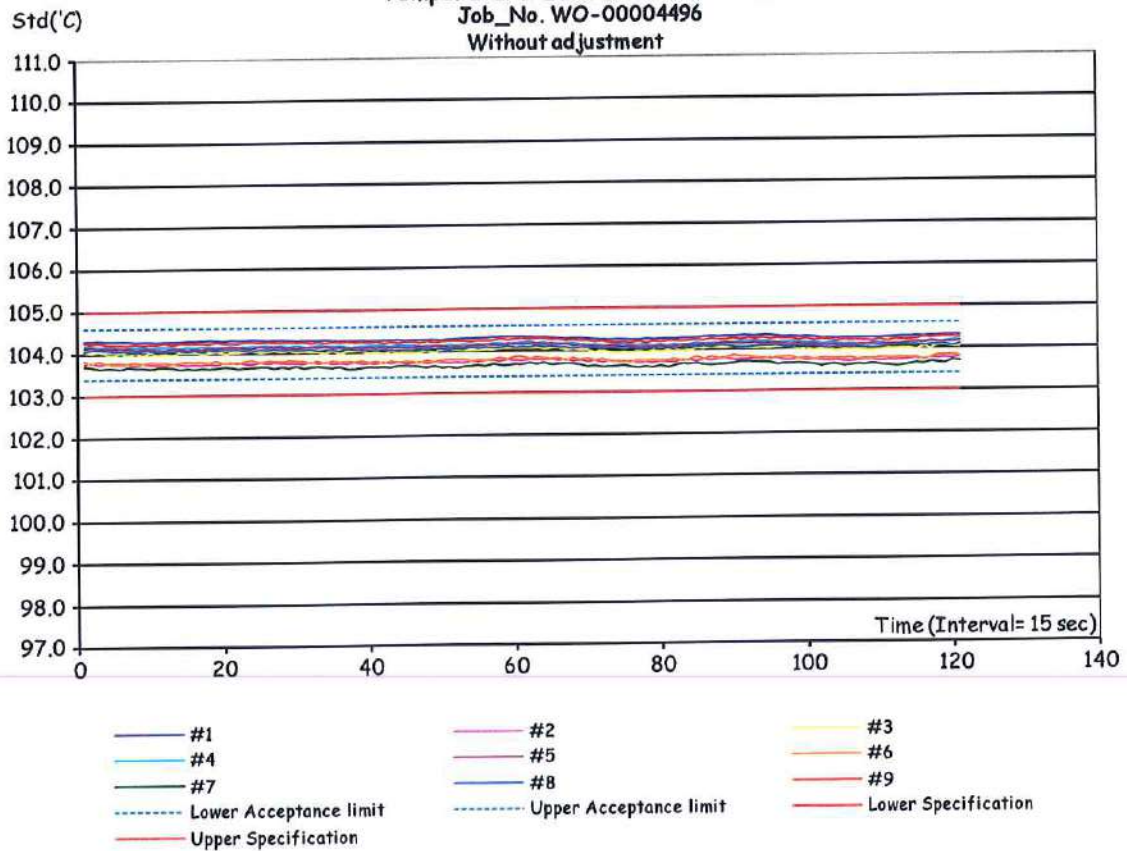
Without adjustment



Temperature Distribution @ 104.0°C

Job_No. WO-00004496

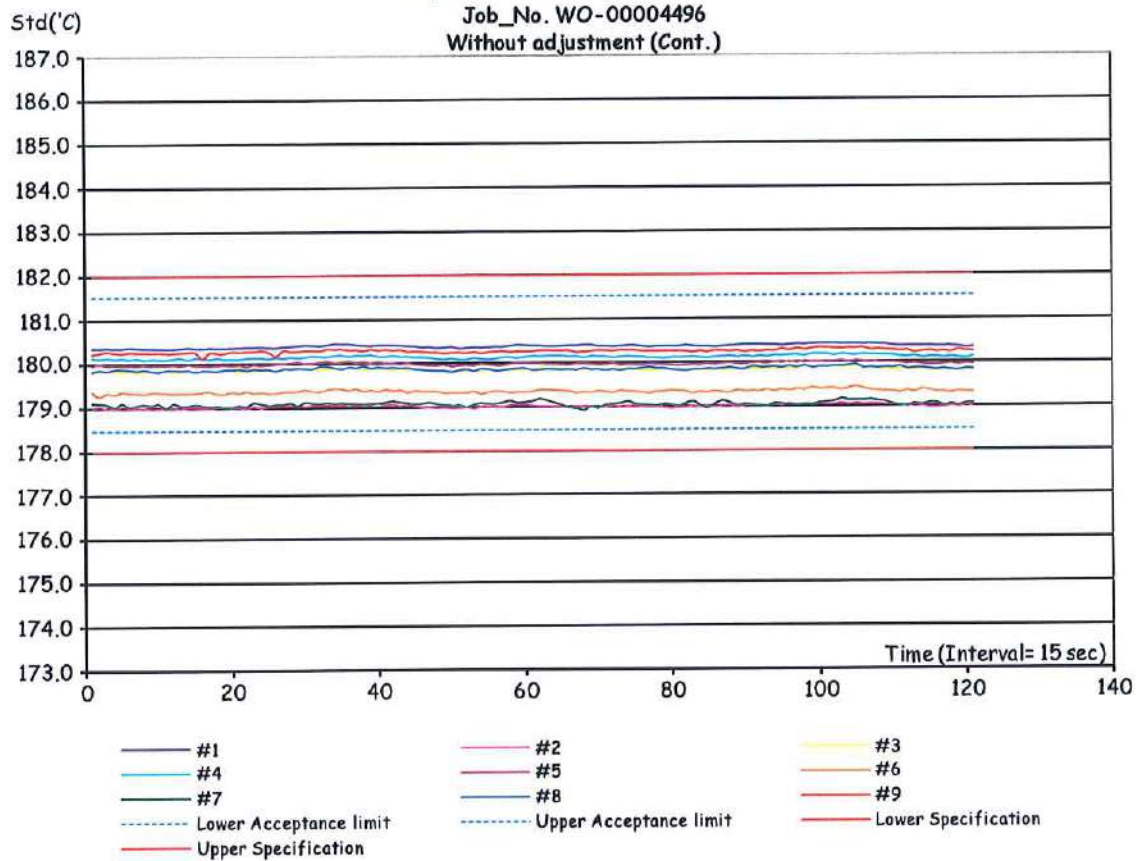
Without adjustment



Temperature Distribution @ 180.0°C

Job_No. WO-00004496

Without adjustment (Cont.)



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00004496

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B216.3478 (EN-05-034)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
05 Sep 2023			05 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความชื้น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :



บริษัท ไออาร์พีซี จำกัด (มหาชน)
IRPC Public Company Limited

IRPC PUBLIC COMPANY LIMITED
METROLOGY CENTER

299 Moo 5, Sukhumvit Road, Amphor Muang, Rayong, 21000 THAILAND
Tel. 0-3861-1333, 0-3861-3571-80 Ext. 4441, 4444 Fax. 0-3861-2812-3, 0-3889-8830

Certificate of Calibration

Reference : 30217680
Issued by : Temperature Laboratory

Certificate No. : CL1-T249004
Page : 1 of 3

Object : Incrurator

Manufacturer : N/A

Ident. No. : 201000001002

Model / Type : UNE 400

Serial No. : 40328062

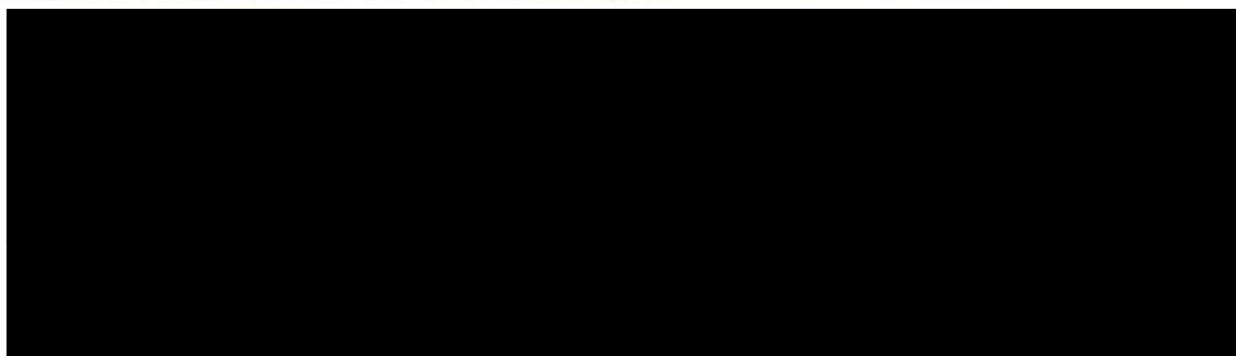
Customer : ALEX
IRPC Public Company Limited
299 Moo 5, Sukhumvit Road, Amphor Muang, Rayong, 21000

Date of Received : 29 January 2024

Date of Calibration : 29 January 2024

Place of Calibration : QC1 Building (2nd floor)

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



This calibration certificate may not be reproduced other than in full except with the permission of the IRPC Public Company Limited.

Continuation of Calibration Certificate No. : CL1-T249004

Page : 2 of 3

Object : Incubator
Manufacturer : N/A
Identification No. : 201000001002
Model / Type : UNE 400
Serial No. : 40328062
Calibration Range : 20 °C
Accuracy : ± 1 °C
Division : 1 °C
Condition of Object : Used Item

ENVIRONMENT CONDITIONS :

Temperature : 25 °C to 25.3 °C
Relative Humidity : 53 % RH to 55 % RH

MEASUREMENT METHOD :

The calibration was performed by using Instruction manual no. 10325200-2306 in-house method based on TLAS-G20.

TRACEABILITY :

Instrument	Model	Serial No.	Certificate No.	Due date
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-009	CL1-T236015	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-001	CL1-T236016	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-002	CL1-T236017	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-003	CL1-T236018	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-004	CL1-T236019	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-005	CL1-T236020	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-006	CL1-T236021	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-007	CL1-T236022	24-Apr-24
Temp. Indicator With Sensor	ALMEM05690-2	A12010009/PT100-008	CL1-T236023	24-Apr-24

Note :

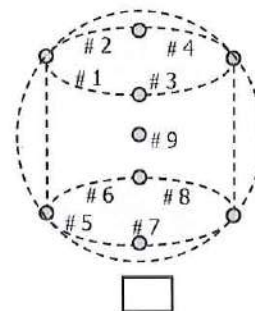
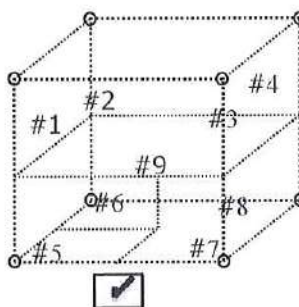
This reference standard is traceable to SI Unit through to Metrology Center IRPC Public Company Limited.

UNCERTAINTY OF MEASUREMENTS :

The uncertainty stated is the expanded uncertainty which results from multiplying the standard uncertainty by the coverage factor $k = 2$, It has been determined according to " EA - 4/02 the Expression of the Uncertainty of Measurement in Calibration" This mean the value of the measured lies within the assigned range of values with a probability of 95%.

MEASUREMENT RESULTS :

Sensor Installation
Rectangular or
Cubical Shape



Correction of temperature distribution

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
20	19.7	19.8	20.9	19.7	20.3	20.0	19.9	20.0	19.6	1.3

Correction of temperature average at spread locations

Setting Temperature (°C)	Indicating Temperature (°C)	STD. Reading (°C)	Correction (°C)	Uncertainty (±°C)
20	20	20.0	-0.02	1.3

Chamber Characterization Result

Setting Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (°C)	Temperature Uniformity (°C)	Overall Variation (°C)
20	20	0.42	0.38	1.3

Remark : This result of calibration was found accurate as shown on date, place and stated object of calibration only.

*** End of report ***

28.

Certificate No. C08240042

Calibration Certificate

Equipment:	pH METER	Job No.:	KSMT2400619
Model:	HQ40d	Received Date:	23 April 2024
Serial No.(or ID):	130500088588 (L09-AT-SP003-A2)	Issued Date:	05 May 2024
Manufacturer:	Hach	Page:	1 of 3
Condition:	In Condition		

Customer

IRPC PUBLIC CO., LTD.
299 Moo 5, Sukhumvit Road, Tambol Choengneon, Amphur Muang, Rayong 21000 Thailand

Calibration Place

IRPC PUBLIC CO., LTD.(Gc Lab)
299 Moo 5, Sukhumvit Road, Tambol Choengneon, Amphur Muang, Rayong 21000 Thailand

Calibration Date

23 April 2024

Environment Condition

Temperature: 26.2 °C ± 0.1 °C
Humidity: 65.9 %RH ± 0.8 %RH

The Method used

In-house method, WI08, based on ASTM E 70-07

Traceability

This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO17034) Certificate No. 938374, 938376, 938375, pH Scale and Temperature test are traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230443EA, through Quality Reborn CO.,Ltd Certificate No.QR23-1169

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (<i>k</i>)
	(mV)	Error (mV)	(pH)		
414.12	414.0	-0.12	0.011	0.065	2.00
354.96	354.9	-0.06	1.010	0.065	2.00
295.80	295.7	-0.10	2.008	0.065	2.00
236.64	236.6	-0.04	3.006	0.065	2.00
177.48	177.5	0.02	4.005	0.065	2.00
118.32	118.3	-0.02	5.003	0.065	2.00
59.16	59.1	-0.06	6.002	0.065	2.00
0.00	0.0	0.00	7.000	0.065	2.00
-59.16	-59.2	-0.04	7.999	0.065	2.00
-118.32	-118.3	0.02	8.997	0.065	2.00
-177.48	-177.5	-0.02	9.995	0.065	2.00
-236.64	-236.6	0.04	10.994	0.065	2.00
-295.80	-295.8	0.00	11.992	0.065	2.00
-354.96	-354.9	0.06	12.990	0.065	2.00
-414.12	-414.1	0.02	13.989	0.065	2.00

Electrode Test Results*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997

The practical slope of the pH electrode; 58.33 (mV/pH), 98.60%

The zero point of the pH electrode; 6.86 (pH)

Sample Test Results

Electrode Serial No.: 232822613909

Model: PHC201

Manufacturer: Hach

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (<i>k</i>)
4.008	4.017	0.009	0.0046	2.00
6.985	6.997	0.012	0.0085	2.00
9.997	9.994	-0.003	0.0073	2.00

Temperature Electrode

Dimension of Probe;

Length : 120 mm
Diameter : 12 mm
Immersion Depth : 80 mm

STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty of Measurement (±°C)	Coverage Factor (<i>k</i>)
24.98	25.1	-0.12	0.20	2.00

* Calibration Marked for Electrode Test" Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

Statements of conformity:

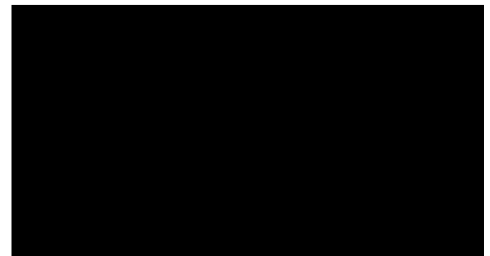
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 70-07. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :**
- ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk $< 50\%$ PFA
 - ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Specific Risk $< 2.5\%$ PFA
 - ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$) .
; PFA – Probability of False Accept



pH Scale

Tolerance : 1 mV

Input (mV)	pH Meter Reading			Guard Band (w) (mV)	Tolerance (mV)	Conformity
	(mV)	Error (mV)	(pH)			
414.12	414.0	-0.12	0.011	0.065	1.0	Pass
354.96	354.9	-0.06	1.010	0.065	1.0	Pass
295.80	295.7	-0.10	2.008	0.065	1.0	Pass
236.64	236.6	-0.04	3.006	0.065	1.0	Pass
177.48	177.5	0.02	4.005	0.065	1.0	Pass
118.32	118.3	-0.02	5.003	0.065	1.0	Pass
59.16	59.1	-0.06	6.002	0.065	1.0	Pass
0.00	0.0	0.00	7.000	0.065	1.0	Pass
-59.16	-59.2	-0.04	7.999	0.065	1.0	Pass
-118.32	-118.3	0.02	8.997	0.065	1.0	Pass
-177.48	-177.5	-0.02	9.995	0.065	1.0	Pass
-236.64	-236.6	0.04	10.994	0.065	1.0	Pass
-295.80	-295.8	0.00	11.992	0.065	1.0	Pass
-354.96	-354.9	0.06	12.990	0.065	1.0	Pass
-414.12	-414.1	0.02	13.989	0.065	1.0	Pass

Sample Test

Tolerance : 0.05 pH

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Guard band (w) (pH)	Tolerance (pH)	Conformity
4.008	4.017	0.009	0.0046	0.050	Pass
6.985	6.997	0.012	0.0085	0.050	Pass
9.997	9.994	-0.003	0.0073	0.050	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

ใบตรวจสอบสภาพเครื่อง pH Meter

เลขที่ใบงาน: KSMT2400619

ชนิดเครื่องมือ: pH METER

รุ่น: HQ40d

หมายเลขเครื่อง: 130500088588

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
23 Apr 2024			23 Apr 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สายอิเล็กโทรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	-

เพิ่มเติม/ข้อแนะนำ :



ลำดับที่ 5

ระดับความร้อนในสถานประกอบการ



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0356	12-Jan-24	11-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0360	15-Jan-24	14-Jan-25	12



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
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E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-018-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 18018311
ID NUMBER : RYG_FS0356
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024
MEASUREMENT DATE : 12 Jan 2024
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.



Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

Reference Used During Calibration:

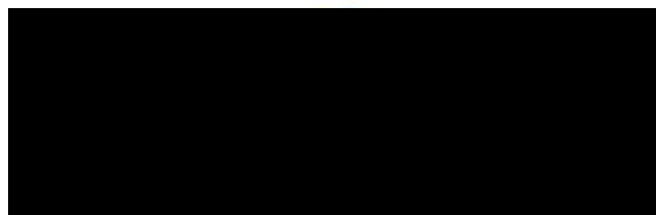
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol
☐ Miss Ruangumpai Phoommit



Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021466.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	-0.1	0.099
80	25.045	25.0	0.0	0.099
80	30.040	30.0	0.0	0.099
80	35.039	35.0	0.0	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020493.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.0	0.0	0.14
110	25.045	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.030	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021258.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.2	0.1	0.099
75	25.045	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.039	34.9	-0.1	0.099
75	40.030	39.9	-0.1	0.099

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor $k=2.14$ providing a level of confidence of approximately 95%

End of Certificate of Calibration

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-022-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 18018316
ID NUMBER : RYG_FS0360
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024
MEASUREMENT DATE : 15 Jan 2024
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021471.
Dimension: Diameter 3.3 mm. Length 170 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.060	20.0	-0.1	0.099
80	25.051	25.0	-0.1	0.099
80	30.041	30.0	0.0	0.099
80	35.035	35.0	0.0	0.099
80	40.024	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020502.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.060	20.1	0.0	0.099
110	25.051	25.1	0.0	0.099
110	30.041	30.1	0.1	0.099
110	35.036	35.1	0.1	0.099
110	40.025	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021266.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.060	20.1	0.0	0.099
75	25.051	25.0	-0.1	0.099
75	30.041	29.8	-0.2	0.099
75	35.036	34.7	-0.3	0.099
75	40.025	39.6	-0.4	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration

