

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

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|------------|---|
| เอกสาร 5-1 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ |
| เอกสาร 5-2 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง |
| เอกสาร 5-3 | เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง |

เอกสารที่ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ



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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l ³ /min)	R ²
B01	B01	04/05/2022	y = 1.313x-9.642	0.999
B02	B02	02/05/2022	y = 1.062x+2.593	1.000
B03	B03	04/05/2022	y = 1.045x+0.767	0.998
B04	B04	04/05/2022	y = 1.161x-3.677	0.996
B05	B05	02/05/2022	y = 1.218x-6.416	1.000
B06	B06	04/05/2022	y = 1.235x-6.768	0.998
B07	B07	06/05/2022	y = 1.178x-5.564	0.999
B08	B08	02/05/2022	y = 1.222x-6.991	1.000
B09	B09	04/05/2022	y = 1.240x-6.649	0.996
B10	B10	04/05/2022	y = 1.091x+0.142	0.995
B11	B11	04/05/2022	y = 1.120x-2.107	1.000
B12	B12	02/05/2022	y = 1.102x-1.916	0.996
B13	B13	03/05/2022	y = 1.187x-5.240	0.999
B14	B14	06/05/2022	y = 1.290x-9.276	0.998
B15	B15	03/05/2022	y = 1.093x-0.919	0.999
B16	B16	04/05/2022	y = 1.223x-6.745	0.999
B17	B17	03/05/2022	y = 1.172x-3.414	0.998
B18	B18	04/05/2022	y = 1.259x-8.700	1.000
B19	B19	03/05/2022	y = 1.307x-10.268	0.999
B20	B20	02/05/2022	y = 1.232x-7.260	0.999
B21	B21	04/05/2022	y = 1.209x-7.461	0.996
B22	B22	02/05/2022	y = 1.239x-7.827	0.999
B23	B23	03/05/2022	y = 1.227x-6.159	0.999
B24	B24	03/05/2022	y = 1.076x-0.925	0.997
B25	B25	04/05/2022	y = 0.997x+2.795	0.998
B26	B26	04/05/2022	y = 1.185x-5.015	0.998
B27	B27	06/05/2022	y = 1.146x-5.099	0.996
B28	B28	04/05/2022	y = 1.221x-6.454	1.000
B29	B29	02/05/2022	y = 1.181x-5.705	0.995
B30	B30	04/05/2022	y = 1.136x-3.406	0.999
B31	B31	04/05/2022	y = 1.114x-1.568	0.999
B32	B32	04/05/2022	y = 1.249x-6.749	1.000
B33	B33	06/05/2022	y = 1.195x-4.397	0.996
B34	B34	04/05/2022	y = 1.222x-7.759	0.999



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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 (l ³ /min)	R ²
B01	B01	01/08/2022	y = 1.310x-7.517	0.998
B02	B02	01/08/2022	y = 1.098x+2.659	0.997
B03	B03	01/08/2022	y = 1.089x+0.857	0.998
B04	B04	01/08/2022	y = 1.206x-3.858	0.995
B05	B05	01/08/2022	y = 1.285x-7.595	0.997
B06	B06	01/08/2022	y = 1.287x-6.981	0.998
B07	B07	01/08/2022	y = 1.197x-4.681	0.998
B08	B08	01/08/2022	y = 1.224x-5.592	0.999
B09	B09	01/08/2022	y = 1.275x-6.394	0.997
B10	B10	01/08/2022	y = 1.121x-1.091	0.995
B11	B11	04/08/2022	y = 1.165x-2.766	0.998
B12	B12	04/08/2022	y = 1.230x-4.896	0.998
B13	B13	01/08/2022	y = 1.249x-6.430	0.996
B14	B14	02/08/2022	y = 1.232x-4.320	0.996
B15	B15	02/08/2022	y = 1.134x-0.926	0.997
B16	B16	02/08/2022	y = 1.261x-6.890	0.998
B17	B17	02/08/2022	y = 1.175x-2.039	0.997
B18	B18	02/08/2022	y = 1.290x-7.805	0.999
B19	B19	02/08/2022	y = 1.375x-11.753	0.995
B20	B20	02/08/2022	y = 1.262x-7.100	0.999
B21	B21	03/08/2022	y = 1.142x-1.809	0.999
B22	B22	02/08/2022	y = 1.289x-8.540	0.997
B23	B23	02/08/2022	y = 1.216x-4.912	0.999
B24	B24	01/08/2022	y = 1.147x-1.299	1.000
B25	B25	02/08/2022	y = 1.025x+3.341	0.997
B26	B26	02/08/2022	y = 1.184x-3.486	0.995
B27	B27	03/08/2022	y = 1.237x-6.825	0.996
B28	B28	02/08/2022	y = 1.284x-7.704	0.998
B29	B29	02/08/2022	y = 1.305x-8.854	0.996
B30	B30	03/08/2022	y = 1.227x-5.387	0.996
B31	B31	03/08/2022	y = 1.215x-4.628	0.995
B32	B32	03/08/2022	y = 1.313x-8.558	0.995
B33	B33	03/08/2022	y = 1.330x-7.545	1.000
B34	B34	03/08/2022	y = 1.287x-8.617	0.999



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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 (l ³ /min)	R ²
B01	B01	01/11/2022	y = 1.277x-6.403	0.999
B02	B02	03/11/2022	y = 1.083x+3.505	0.995
B03	B03	03/11/2022	y = 1.143x-1.010	0.996
B04	B04	04/11/2022	y = 1.206x-3.858	0.995
B05	B05	01/11/2022	y = 1.317x-8.733	0.997
B06	B06	01/11/2022	y = 1.268x-5.920	0.998
B07	B07	01/11/2022	y = 1.228x-6.265	0.998
B08	B08	08/11/2022	y = 1.160x-3.496	0.995
B09	B09	03/11/2022	y = 1.245x-5.341	0.997
B10	B10	01/11/2022	y = 1.097x+1.837	0.997
B11	B11	07/11/2022	y = 1.153x-2.164	0.998
B12	B12	04/11/2022	y = 1.201x-3.884	0.998
B13	B13	01/11/2022	y = 1.266x-6.916	0.995
B14	B14	02/11/2022	y = 1.269x-6.120	0.999
B15	B15	02/11/2022	y = 1.149x-1.829	0.997
B16	B16	02/11/2022	y = 1.212x-4.259	0.999
B17	B17	04/11/2022	y = 1.172x-2.143	0.997
B18	B18	04/11/2022	y = 1.321x-9.413	0.996
B19	B19	02/11/2022	y = 1.356x-11.184	0.997
B20	B20	04/11/2022	y = 1.310x-8.682	0.997
B21	B21	03/11/2022	y = 1.156x-2.174	0.999
B22	B22	02/11/2022	y = 1.288x-8.740	0.998
B23	B23	04/11/2022	y = 1.247x-5.764	0.996
B24	B24	01/11/2022	y = 1.161x-2.123	0.999
B25	B25	02/11/2022	y = 1.025x+3.341	0.997
B26	B26	02/11/2022	y = 1.234x-6.128	0.995
B27	B27	03/11/2022	y = 1.220x-5.822	0.997
B28	B28	02/11/2022	y = 1.253x-6.605	0.999
B29	B29	08/11/2022	y = 1.311x-8.876	0.997
B30	B30	07/11/2022	y = 1.264x-7.252	0.998
B31	B31	07/11/2022	y = 1.215x-4.628	0.995
B32	B32	03/11/2022	y = 1.258x-6.433	0.997
B33	B33	03/11/2022	y = 1.329x-7.779	0.995
B34	B34	03/11/2022	y = 1.267x-7.491	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 : 3095

Calibration Data

High Volume PM-10 Data

Calibration Data

Recorder No.	Blower No.	Date	Actual Flowrate (l ³ /min)	R ²
B01	B01	02/05/2022	y = 1.171x-0.211	0.997
B02	B02	02/05/2022	y = 0.960x+5.104	0.998
B03	B03	04/05/2022	y = 1.214x-5.211	0.996
B04	B04	02/05/2022	y = 1.310x-9.479	0.999
B05	B05	03/05/2022	y = 1.202x-5.734	0.999
B06	B06	04/05/2022	y = 1.241x-7.631	0.998
B07	B07	04/05/2022	y = 1.186x-4.480	0.999
B08	B08	03/05/2022	y = 1.322x-8.634	0.999
B09	B09	04/05/2022	y = 1.219x-5.756	0.998
B10	B10	03/05/2022	y = 1.234x-7.417	1.000
B11	B11	02/05/2022	y = 1.260x-7.479	0.999
B12	B12	02/05/2022	y = 1.225x-5.900	0.998
B13	B13	04/05/2022	y = 1.326x-10.711	0.999
B14	B14	07/05/2022	y = 1.197x-3.534	0.999
B15	B15	04/05/2022	y = 1.096x-0.244	0.998
B16	B16	04/05/2022	y = 1.209x-1.612	1.000
B17	B17	03/05/2022	y = 1.198x-3.075	0.999
B18	B18	07/05/2022	y = 1.159x-2.421	0.999
B19	B19	03/05/2022	y = 1.053x+1.562	0.999
B20	B20	03/05/2022	y = 1.206x-6.147	1.000
B21	B21	04/05/2022	y = 1.156x-0.999	0.998
B22	B22	04/05/2022	y = 1.293x-8.368	0.998
B23	B23	07/05/2022	y = 1.149x-2.644	1.000
B24	B24	02/05/2022	y = 1.250x-7.392	1.000
B25	B25	03/05/2022	y = 1.131x-2.476	0.999
B26	B26	07/05/2022	y = 1.154x+1.978	1.000
B27	B27	02/05/2022	y = 1.278x-8.984	0.998
B28	B28	04/05/2022	y = 1.093x-0.217	0.999
B29	B29	04/05/2022	y = 1.280x-9.168	0.999
B30	B30	03/05/2022	y = 1.290x-8.822	0.997
B31	B31	03/05/2022	y = 1.116x-0.814	0.997
B32	B32	05/05/2022	y = 1.156x-3.473	0.999
B33	B33	06/05/2022	y = 1.254x-8.880	0.998
B34	B34	03/05/2022	y = 1.157x-1.629	0.999



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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	02/08/2022	y = 1.258x-2.366	0.998
B02	B02	02/08/2022	y = 0.987x+5.729	0.999
B03	B03	02/08/2022	y = 1.247x-5.106	0.999
B04	B04	01/08/2022	y = 1.242x-4.634	0.997
B05	B05	01/08/2022	y = 1.245x-5.869	0.997
B06	B06	01/08/2022	y = 1.360x-10.516	0.999
B07	B07	01/08/2022	y = 1.290x-6.671	0.999
B08	B08	01/08/2022	y = 1.353x-8.231	0.999
B09	B09	04/08/2022	y = 1.289x-6.478	0.999
B10	B10	04/08/2022	y = 1.317x-9.553	0.998
B11	B11	04/08/2022	y = 1.331x-8.248	0.999
B12	B12	04/08/2022	y = 1.317x-9.553	0.998
B13	B13	01/08/2022	y = 1.338x-9.806	0.999
B14	B14	01/08/2022	y = 1.230x-3.665	0.998
B15	B15	01/08/2022	y = 1.169x-2.069	0.998
B16	B16	01/08/2022	y = 1.240x-1.078	0.996
B17	B17	01/08/2022	y = 1.241x-3.121	0.997
B18	B18	01/08/2022	y = 1.190x-1.997	0.998
B19	B19	02/08/2022	y = 1.108x+0.786	0.999
B20	B20	02/08/2022	y = 1.251x-6.369	0.997
B21	B21	02/08/2022	y = 1.176x-0.519	0.999
B22	B22	02/08/2022	y = 1.291x-7.071	0.999
B23	B23	02/08/2022	y = 1.177x-2.290	0.998
B24	B24	03/08/2022	y = 1.367x-11.212	0.997
B25	B25	03/08/2022	y = 1.178x-3.689	0.999
B26	B26	03/08/2022	y = 1.204x-3.755	0.999
B27	B27	03/08/2022	y = 1.331x-10.619	0.998
B28	B28	03/08/2022	y = 1.139x-1.295	0.999
B29	B29	03/08/2022	y = 1.333x-10.613	0.999
B30	B30	01/08/2022	y = 1.344x-10.463	0.997
B31	B31	01/08/2022	y = 1.162x+0.382	0.997
B32	B32	01/08/2022	y = 1.204x-2.345	0.999
B33	B33	01/08/2022	y = 1.349x-10.216	0.999
B34	B34	01/08/2022	y = 1.289x-4.593	1.000



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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	02/11/2022	y = 1.206x-0.557	0.998
B02	B02	02/11/2022	y = 1.024x+3.762	0.999
B03	B03	02/11/2022	y = 1.243x-4.455	0.998
B04	B04	03/11/2022	y = 1.293x-7.303	0.997
B05	B05	03/11/2022	y = 1.252x-5.903	0.999
B06	B06	04/11/2022	y = 1.313x-7.710	0.997
B07	B07	02/11/2022	y = 1.290x-6.671	0.999
B08	B08	04/11/2022	y = 1.330x-6.996	0.999
B09	B09	04/11/2022	y = 1.280x-6.331	0.995
B10	B10	02/11/2022	y = 1.298x-8.225	0.997
B11	B11	04/11/2022	y = 1.273x-5.540	0.995
B12	B12	04/11/2022	y = 1.282x-7.018	0.996
B13	B13	01/11/2022	y = 1.320x-9.281	0.998
B14	B14	02/11/2022	y = 1.230x-3.665	0.998
B15	B15	02/11/2022	y = 1.166x-2.184	0.997
B16	B16	01/11/2022	y = 1.260x-2.121	0.998
B17	B17	04/11/2022	y = 1.277x-4.847	0.998
B18	B18	01/11/2022	y = 1.165x-1.164	0.999
B19	B19	02/11/2022	y = 1.094x+1.145	0.999
B20	B20	02/11/2022	y = 1.221x-5.301	0.997
B21	B21	01/11/2022	y = 1.176x-0.519	0.999
B22	B22	02/11/2022	y = 1.286x-7.131	0.998
B23	B23	03/11/2022	y = 1.181x-2.246	0.999
B24	B24	03/11/2022	y = 1.253x-5.274	0.995
B25	B25	04/11/2022	y = 1.159x-3.062	0.996
B26	B26	03/11/2022	y = 1.264x-8.317	0.998
B27	B27	03/11/2022	y = 1.332x-10.385	0.996
B28	B28	03/11/2022	y = 1.165x-2.689	0.998
B29	B29	03/11/2022	y = 1.271x-7.065	0.996
B30	B30	01/11/2022	y = 1.274x-7.435	0.996
B31	B31	01/11/2022	y = 1.244x-3.676	0.999
B32	B32	01/11/2022	y = 1.186x-1.847	0.999
B33	B33	04/11/2022	y = 1.268x-6.742	0.996
B34	B34	01/11/2022	y = 1.321x-5.654	0.998



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	07 July 2022	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B18	SERIAL NO.	N07543		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	05 August 2021		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	A00681SK	
Certified Date :	24 August 2020	Expired Date :	24 August 2022	Cylinder Conc. :	51.0 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	-
NO Span	400	400.1	0.025	400.0	1.006
NO _x Span	400	400.3	0.075	400.0	1.011
API Model TML-41M 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	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	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	1.011	-	1.0 ± 0.3		
NO Offset	1.4	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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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	17 August 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B09	SERIAL NO.	4412		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	04 August 2022		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	D636192	
Certified Date :	20 April 2022	Expired Date :	20 April 2024	Cylinder Conc. :	49.1 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	1.006
NO _x Span	400	400.3	0.075	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	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	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	1.4	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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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	07 September 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B07	SERIAL NO.	4338		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
			Cylinder Conc.	: 49.1 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	1.008
NO _x Span	400	400.3	0.075	400.0	1.011
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	513	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.5	mV	-20 - 150		
AZERO	94.3	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.3	°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	1.008	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO _x Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	26 October 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B09	SERIAL NO.	4412		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
			Cylinder Conc.	: 49.1 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	1.008
NO _x Span	400	400.3	0.075	400.0	1.011
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	507	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.5	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.2	°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	1.008	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO _x Offset	1.0	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 :	23 November 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B10	SERIAL NO.	4465		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 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	1.009
NO _x Span	400	400.3	0.075	400.0	1.012
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	509	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 46		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	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	1.009	-	1.0 ± 0.3		
NO _x Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO _x Offset	1.0	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 :	15 December 2022	BRAND :	API	MODEL :	200A
NO.	NOX-B02	SERIAL NO.	2409		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
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	399.6	-0.100	400.0	1.004
NO _x Span	400	399.9	-0.025	400.0	1.008
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	507	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	50.3	°C	50 ± 1		
BOX TEMP	29.5	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	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	1.004	-	1.0 ± 0.3		
NO _x Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO _x Offset	1.0	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					
SO ₂ FLUORESCENT ANALYZER					
DATE :	07 July 2022	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B08	SERIAL NO.	1003		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2021			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	400.2	0.050	400.0	1.010
API Model 100A 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	657	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3014.8	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2524	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.010	-	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)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 August 2022	BRAND :	Thermo	MODEL :	43C
NO.	SO2-B10	SERIAL NO.	43C-69604-364		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 04 August 2022			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	
Zero	0	0.11	-	0	
SO ₂ Span	400.0	399.7	-0.075	400.0	
INSTRUMENT STATUS					
CHAMBER TEMP	44.5	°C	FLOW	1.0	LPM
PRESSURE	728.7	mm Hg			



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	07 September 2022	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B11	SERIAL NO.	SO2187		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		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	400.5	0.125	400.0	1.017
API Model TML-50 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	662	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	3049.7	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.5	mV	-50 - 200		
DRK LMP	58.3	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2522	mV	2500 ± 200		
RCELL TEMP	50.5	°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	1.017	-	1.0 ± 0.3		
SO ₂ Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 pph)		



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	26 October 2022	BRAND :	Thermo	MODEL :	43C
NO.	SO2-B10	SERIAL NO.	43C-69604-364		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		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	
Zero	0	0.11	-	0	
SO ₂ Span	400.0	400.5	0.125	400.0	
INSTRUMENT STATUS					
CHAMBER TEMP	44.5 °C		FLOW	1.0 LPM	
PRESSURE	728.7 mm Hg				



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	23 November 2022	BRAND :	Thermo	MODEL :	43C
NO.	SO2-B09	SERIAL NO.	43C-59325-322		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		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	
Zero	0	0.11	-	0	
SO ₂ Span	400.0	400.5	0.125	400.0	
INSTRUMENT STATUS					
CHAMBER TEMP	44.5 °C		FLOW	1.0 LPM	
PRESSURE	728.6 mm Hg				



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	15 December 2022	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B03	SERIAL NO.	1846		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		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.	24.6 °C	% RH	48
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	1.006
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	656	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3028.6	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2524	mV	2500 ± 200		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.006	-	1.0 ± 0.3		
SO ₂ Offset	22.2	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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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-II

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.)				
					1	2	3	1	2	3	y	R²
B01	SKC	224-PCXR4	262101	01/04/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.749	1.000
B02	SKC	224-PCXR4	626166	04/04/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.010x - 20.465	0.999
B03	SKC	224-PCXR4	612968	04/04/2022	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.986	1.000
B04	SKC	224-PCXR4	602804	01/04/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.928	1.000
B05	SKC	224-PCXR4	612693	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.061	0.999
B06	SKC	224-PCXR4	262188	01/04/2022	1,000	1,500	2,000	995	1,508	1,999	1.012x - 25.219	0.999
B07	SKC	224-PCXR4	626262	01/04/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.804	1.000
B08	SKC	224-PCXR4	626100	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.750	0.999
B09	SKC	224-PCXR4	626479	11/04/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.231	1.000
B10	SKC	224-PCXR4	091950	04/04/2022	1,000	1,500	2,000	994	1,503	2,001	1.016x - 32.594	0.999
B11	SKC	224-PCXR8	564315	06/04/2022	1,000	1,500	2,000	995	1,490	1,998	1.003x - 9.054	1.000
B12	SKC	224-PCXR4	034656	01/04/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.011x - 19.603	0.999
B13	SKC	224-PCXR4	602073	12/04/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 4.072	1.000
B14	SKC	224-PCXR4	626313	05/04/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 5.727	1.000
B15	SKC	224-PCXR4	629474	01/04/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.012x - 22.726	0.999
B16	SKC	224-PCXR4	626477	11/04/2022	1,000	1,500	2,000	994	1,504	2,000	1.014x - 30.827	0.999
B17	SKC	224-PCXR4	626860	04/04/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x + 0.479	1.000
B18	SKC	224-PCXR4	691484	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.424	0.999
B19	SKC	224-PCXR4	691599	01/04/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 8.224	1.000
B20	SKC	224-PCXR4	691687	04/04/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.520	0.999
B21	SKC	224-PCXR4	691531	04/04/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 4.714	1.000
B22	SKC	224-PCXR4	691654	04/04/2022	1,000	1,500	2,000	1,004	1,501	2,004	1.012x - 20.788	0.999
B23	SKC	224-PCXR4	798393	12/04/2022	1,000	1,500	2,000	994	1,505	2,002	1.017x - 33.567	0.999
B24	SKC	224-PCXR4	626363	04/04/2022	1,000	1,500	2,000	1,000	1,502	2,005	1.016x - 28.210	0.999
B25	SKC	224-PCXR4	798489	01/04/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.009	1.000
B26	SKC	224-PCXR4	798479	12/04/2022	1,000	1,500	2,000	998	1,499	1,993	0.997x + 1.855	1.000
B27	SKC	224-PCXR4	691673	04/04/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.826	0.999
B28	SKC	224-PCXR4	691570	04/04/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.013x - 24.230	0.999
B29	SKC	224-PCXR4	626472	06/04/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.378	1.000
B30	SKC	224-PCXR4	691489	06/04/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.431	0.999
B31	SKC	224-PCXR4	691509	12/04/2022	1,000	1,500	2,000	993	1,495	1,995	1.002x - 7.965	1.000
B32	SKC	224-PCXR4	091567	04/04/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 30.208	0.999
B33	SKC	224-PCXR4	091756	01/04/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.475	1.000
B34	SKC	224-PCXR4	612962	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.135	0.999
B35	SKC	224-PCXR4	602682	11/04/2022	1,000	1,500	2,000	994	1,498	1,996	1.001x - 6.493	1.000
B36	SKC	224-PCXR4	626164	04/04/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 2.393	1.000
B37	SKC	224-PCXR4	626256	01/04/2022	1,000	1,500	2,000	994	1,506	2,002	1.016x - 31.285	0.999
B38	SKC	224-PCXR4	626167	04/04/2022	1,000	1,500	2,000	997	1,497	1,996	1.001x - 4.387	1.000
B39	SKC	224-PCXR4	034637	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.012x - 22.527	0.999
B40	SKC	224-PCXR4	798349	12/04/2022	1,000	1,500	2,000	992	1,505	2,000	1.017x - 34.109	0.999



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-II

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.)				
					1	2	3	1	2	3	y	R²
B01	SKC	224-PCXR4	262101	04/07/2022	1,000	1,500	2,000	994	1,497	1,998	1.002x - 4.028	1.000
B02	SKC	224-PCXR4	626166	01/07/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 20.106	0.999
B03	SKC	224-PCXR4	612968	04/07/2022	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.907	1.000
B04	SKC	224-PCXR4	602804	04/07/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.688	1.000
B05	SKC	224-PCXR4	612693	04/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.383	0.999
B06	SKC	224-PCXR4	262188	04/07/2022	1,000	1,500	2,000	996	1,508	2,009	1.020x - 35.110	0.999
B07	SKC	224-PCXR4	626262	01/07/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.884	1.000
B08	SKC	224-PCXR4	626100	01/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.269	0.999
B09	SKC	224-PCXR4	626479	01/07/2022	1,000	1,500	2,000	997	1,490	1,994	0.993x + 3.909	1.000
B10	SKC	224-PCXR4	091950	01/07/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.950	0.999
B11	SKC	224-PCXR8	564315	04/07/2022	1,000	1,500	2,000	995	1,490	1,999	1.004x - 10.290	1.000
B12	SKC	224-PCXR4	034656	04/07/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.015x - 19.404	0.999
B13	SKC	224-PCXR4	602073	04/07/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 3.554	1.000
B14	SKC	224-PCXR4	626313	04/07/2022	1,000	1,500	2,000	999	1,491	1,988	0.992x + 7.243	1.000
B15	SKC	224-PCXR4	626474	04/07/2022	1,000	1,500	2,000	1,003	1,508	2,005	1.013x - 23.723	0.999
B16	SKC	224-PCXR4	626477	01/07/2022	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.425	0.999
B17	SKC	224-PCXR4	626860	04/07/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x - 0.558	1.000
B18	SKC	224-PCXR4	691484	01/07/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 18.825	0.999
B19	SKC	224-PCXR4	691599	01/07/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 7.985	1.000
B20	SKC	224-PCXR4	691587	01/07/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.719	0.999
B21	SKC	224-PCXR4	691531	04/07/2022	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.187	1.000
B22	SKC	224-PCXR4	691654	01/07/2022	1,000	1,500	2,000	1,004	1,501	2,003	1.011x - 19.990	0.999
B23	SKC	224-PCXR4	798393	04/07/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.763	0.999
B24	SKC	224-PCXR4	626363	01/07/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.826	0.999
B25	SKC	224-PCXR4	798489	04/07/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 4.850	1.000
B26	SKC	224-PCXR4	798479	05/07/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.692	1.000
B27	SKC	224-PCXR4	691673	05/07/2022	1,000	1,500	2,000	993	1,503	2,002	1.017x - 32.988	0.999
B28	SKC	224-PCXR4	691570	05/07/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 23.632	0.999
B29	SKC	224-PCXR4	626472	05/07/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.856	1.000
B30	SKC	224-PCXR4	691489	05/07/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.013x - 22.910	0.999
B31	SKC	224-PCXR4	691509	04/07/2022	1,000	1,500	2,000	993	1,495	1,998	1.004x - 9.879	1.000
B32	SKC	224-PCXR4	091567	05/07/2022	1,000	1,500	2,000	992	1,504	2,001	1.016x - 32.243	0.999
B33	SKC	224-PCXR4	091756	05/07/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.634	1.000
B34	SKC	224-PCXR4	612962	05/07/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.693	0.999
B35	SKC	224-PCXR4	602682	04/07/2022	1,000	1,500	2,000	993	1,498	1,996	1.001x - 7.411	1.000
B36	SKC	224-PCXR4	626164	04/07/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.948	1.000
B37	SKC	224-PCXR4	626266	01/07/2022	1,000	1,500	2,000	994	1,506	2,000	1.014x - 28.892	0.999
B38	SKC	224-PCXR4	626167	04/07/2022	1,000	1,500	2,000	997	1,497	1,996	1.002x - 5.504	1.000
B39	SKC	224-PCXR4	034637	04/07/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.011x - 22.048	0.999
B40	SKC	224-PCXR4	798349	05/07/2022	1,000	1,500	2,000	992	1,505	1,998	1.015x - 32.514	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 ± 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	06/10/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.789	1.000
B02	SKC	224-PCXR4	626166	03/10/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 19.707	0.999
B03	SKC	224-PCXR4	612968	03/10/2022	1,000	1,500	2,000	998	1,494	2,001	1.006x - 12.308	1.000
B04	SKC	224-PCXR4	602804	03/10/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.004x - 5.919	1.000
B05	SKC	224-PCXR4	612693	06/10/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.622	0.999
B06	SKC	224-PCXR4	262188	06/10/2022	1,000	1,500	2,000	995	1,507	1,999	1.005x - 11.738	1.000
B07	SKC	224-PCXR4	626262	04/10/2022	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.405	1.000
B08	SKC	224-PCXR4	626100	04/10/2022	1,000	1,500	2,000	1,002	1,499	2,003	1.013x - 24.18	0.999
B09	SKC	224-PCXR4	626479	06/10/2022	1,000	1,500	2,000	996	1,490	1,994	0.994x + 1.675	1.000
B10	SKC	224-PCXR4	091950	03/10/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 34.588	0.999
B11	SKC	224-PCXR4	564315	06/10/2022	1,000	1,500	2,000	994	1,490	2,003	1.007x - 14.438	1.000
B12	SKC	224-PCXR4	034656	03/10/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.005	0.999
B13	SKC	224-PCXR4	602073	03/10/2022	1,000	1,500	2,000	995	1,500	1,993	0.997x + 2.708	1.000
B14	SKC	224-PCXR4	626313	03/10/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.007	1.000
B15	SKC	224-PCXR4	626474	03/10/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.003x - 10.123	0.999
B16	SKC	224-PCXR4	626477	03/10/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 31.624	0.999
B17	SKC	224-PCXR4	626860	03/10/2022	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.239	1.000
B18	SKC	224-PCXR4	691484	03/10/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 16.073	0.999
B19	SKC	224-PCXR4	691599	03/10/2022	1,000	1,500	2,000	993	1,503	2,000	1.005x - 8.623	1.000
B20	SKC	224-PCXR4	691587	03/10/2022	1,000	1,500	2,000	991	1,504	1,999	1.016x - 33.631	0.999
B21	SKC	224-PCXR4	691531	06/10/2022	1,000	1,500	2,000	993	1,500	1,994	1.001x - 6.669	1.000
B22	SKC	224-PCXR4	691654	04/10/2022	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 20.429	0.999
B23	SKC	224-PCXR4	798393	04/10/2022	1,000	1,500	2,000	993	1,505	2,002	1.018x - 34.843	0.999
B24	SKC	224-PCXR4	626363	06/10/2022	1,000	1,500	2,000	999	1,502	2,000	1.012x - 23.225	0.999
B25	SKC	224-PCXR4	798489	06/10/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.049	1.000
B26	SKC	224-PCXR4	798479	06/10/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.892	1.000
B27	SKC	224-PCXR4	691673	06/10/2022	1,000	1,500	2,000	994	1,503	1,999	1.011x - 22.778	0.999
B28	SKC	224-PCXR4	691570	04/10/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.007x - 13.301	1.000
B29	SKC	224-PCXR4	626472	06/10/2022	1,000	1,500	2,000	1,000	1,496	1,998	1.002x - 5.261	1.000
B30	SKC	224-PCXR4	691489	03/10/2022	1,000	1,500	2,000	1,007	1,500	2,004	1.010x - 18.482	0.999
B31	SKC	224-PCXR4	691509	03/10/2022	1,000	1,500	2,000	993	1,497	1,998	1.004x - 8.882	1.000
B32	SKC	224-PCXR4	091567	03/10/2022	1,000	1,500	2,000	992	1,504	2,001	1.007x - 15.630	1.000
B33	SKC	224-PCXR4	091756	06/10/2022	1,000	1,500	2,000	994	1,498	1,991	0.996x + 0.714	1.000
B34	SKC	224-PCXR4	612962	03/10/2022	1,000	1,500	2,000	1,002	1,501	2,001	1.009x - 17.944	0.999
B35	SKC	224-PCXR4	602682	03/10/2022	1,000	1,500	2,000	993	1,498	1,995	1.001x - 7.331	1.000
B36	SKC	224-PCXR4	626164	06/10/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.866	1.000
B37	SKC	224-PCXR4	626256	06/10/2022	1,000	1,500	2,000	994	1,506	1,999	1.013x - 28.214	0.999
B38	SKC	224-PCXR4	626167	06/10/2022	1,000	1,500	2,000	997	1,496	1,996	1.002x - 6.342	1.000
B39	SKC	224-PCXR4	034637	06/10/2022	1,000	1,500	2,000	1,006	1,500	2,001	1.008x - 16.624	0.999
B40	SKC	224-PCXR4	798349	05/10/2022	1,000	1,500	2,000	994	1,505	1,998	1.014x - 29.642	0.999



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

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

www.qcalibration.com



CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS 105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY :

CALIBRATION DATE :

APPROVED BY :

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22

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



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

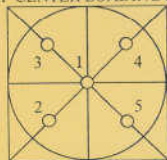
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



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

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

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A

COVERAGE FACTOR K = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

เอกสารที่ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

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

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

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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 20μPa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.93	-0.07	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.44	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Ref : 2011265042601787001

2 / 2

End of Certificate

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

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

FM.BLMTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Noise B_405/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B05	ACO	6236	00142002	07 July 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Noise B_493/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B14	ACO	6236	00172034	17 August 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Noise B_516/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand	ACO		Number	AC 03/56		
Model	2127		Serial No.	130006		
Calibration Range	94 dB, 1000 Hz		Last Calibration	28 April 2022		
			Due Date	28 April 2023		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B14	ACO	6236	00172034	07 September 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Noise B_592/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand	ACO		Number	AC 03/56		
Model	2127		Serial No.	130006		
Calibration Range	94 dB, 1000 Hz		Last Calibration	28 April 2022		
			Due Date	28 April 2023		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B31	ACO	6236	00182013	26 October 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Noise B_623/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand	ACO		Number	AC 03/56		
Model	2127		Serial No.	130006		
Calibration Range	94 dB, 1000 Hz		Last Calibration	28 April 2022		
			Due Date	28 April 2023		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B14	ACO	6236	00172034	23 November 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Noise B_661/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand	ACO		Number	AC 03/56		
Model	2127		Serial No.	130006		
Calibration Range	94 dB, 1000 Hz		Last Calibration	28 April 2022		
			Due Date	28 April 2023		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B31	ACO	6236	00182013	15 December 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

เอกสารที่ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1216

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : HANNA
Model : HI 3512
Serial No. : 08685754
ID No. : -
Condition As-Received: Used Item
Received Date : 14 September 2021
Calibration Date : 16 September 2021
Reference : 2109-0508WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road,
Jompol, Chatuchak, Bangkok10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

22 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0032410



Cert. No.: 21CH1216

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results**Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00
	7.000	0.00	0.4	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

Function : pH Measurement**Performing three buffers standard curve by using buffer nominal pH (4,7,10)**

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor <i>k</i>
pH Electrode S/N.: 061416CM	4.008	4.008	169.2	0.0046	2.00
	6.985	6.985	-4.4	0.0075	2.00
	10.015	10.013	-178.9	0.013	2.05

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

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



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : pH 04/56
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 :

CALIBRATION DATE :

15-Sep-22

APPROVED BY :

ISSUED DATE :

15-Sep-22

RECEIVED DATE :

14-Sep-22

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



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 ° C ± 1 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 15-Sep-22
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/</u> <u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.171	0.14	2.0
354.95	355.6	-0.65	0.860	0.14	2.0
295.80	296.4	-0.60	1.892	0.14	2.0
236.64	237.2	-0.56	2.922	0.14	2.0
177.48	178.0	-0.52	3.954	0.14	2.0
118.32	118.8	-0.48	4.985	0.14	2.0
59.16	59.7	-0.54	6.016	0.14	2.0
0.00	0.5	-0.50	7.049	0.14	2.0
-59.16	-58.8	-0.36	8.136	0.14	2.0
-118.32	-117.9	-0.42	9.223	0.14	2.0
-177.48	-177.1	-0.38	10.311	0.14	2.0
-236.64	-236.3	-0.34	11.399	0.14	2.0
-295.80	-295.5	-0.30	12.487	0.14	2.0
-354.95	-354.7	-0.25	13.575	0.14	2.0
-414.11	-413.9	-0.21	14.662	0.14	2.0

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CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report**RESULT OF CALIBRATION (CONTINUE) :****2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M**

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.007	4.007	0.000	3.996	0.012	2.0
7.004	7.006	-0.002	6.944	0.012	2.0
10.016	10.012	0.004	10.194	0.014	2.0

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm °C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



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.: 22TW98

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	YSI
Model :	5000-230V
Serial No. :	15B100751
ID No. :	-
Received Date :	20 April 2022
Test Date :	21 April 2022
Reference :	2204-0429WC-1
Submitted by :	S.P.S. Consulting Service Co.,Ltd. 7 Phaholyothin 24, Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900
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 :	
Approved by :	 Approved Signatory
Issue Date :	25 April 2022



Cert.No.: 22TW98

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	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

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.: 14J100195

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.14	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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CERTIFICATE No : 22M2569

REFERENCE No : 64386-3

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 : 

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22M2569

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 11-Mar-22
AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22
AMBIENT TEMPERATURE : 22°C \pm 1°C RELATIVE HUMIDITY : 51 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

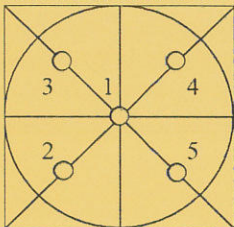
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000079
2.00	2.0000	0.0000	0.000080
5.00	5.0000	0.0000	0.000081
10.00	10.0000	0.0000	0.000084
20.00	20.0000	0.0000	0.000089
50.00	50.0000	0.0000	0.00011
100.00	100.0000	0.0000	0.00019
200.00	199.9999	0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998
OFF-CENTER LOADING	0.0001

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

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

END OF CALIBRATION REPORT