

## ภาคผนวกที่ 5

### เอกสารสอบเทียบความถูกต้องของเครื่องมือ

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

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของ  
เครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม**

รายงานตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
<b>คุณภาพอากาศ</b>		
- TSP	- High Volume Air Sampler	- Electronic Balance
- PM <sub>10</sub>	- High Volume PM <sub>10</sub> Sampler	- Electronic Balance
- SO <sub>2</sub>	- Gas Sample Box	- Spectrophotometer
	- Rotameter	
- NO <sub>2</sub>	- NO <sub>2</sub> Analyzer	- NO <sub>2</sub> Analyzer
- CO	- CO Analyzer	- CO Analyzer
- THC	- Personal Pump SKC	- THC Analyzer
	- Rotameter	
<b>ระดับเสียง</b>		
- Leq 24 hr, Lmax, Ldn, L <sub>10</sub> , L <sub>90</sub> , L <sub>5</sub> และเสียงรบกวน	- Acoustic Calibrator	-
	- Sound Level Meter	-
<b>คุณภาพน้ำทิ้ง</b>		
- pH	-	- pH Meter
- BOD <sub>5</sub>	-	- DO Meter
- Total Suspended Solids	-	- Electronic Balance
- Total Dissolved Solids	-	- Electronic Balance
- TKN	-	- Block Digestion
- Sulfide	-	-
- Settleable Solid	-	-
- Grease & Oil	-	- Electronic Balance

## 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 (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	01/11/2021	y = 1.254x-6.224	0.998
B02	B02	03/11/2021	y = 1.080x+0.873	0.999
B03	B03	01/11/2021	y = 1.049x+1.608	0.995
B04	B04	01/11/2021	y = 1.140x-2.855	1.000
B05	B05	01/11/2021	y = 1.148x-2.655	0.996
B06	B06	01/11/2021	y = 1.203x-4.180	0.997
B07	B07	03/11/2021	y = 1.136x-3.132	0.996
B08	B08	03/11/2021	y = 1.211x-6.101	0.995
B09	B09	03/11/2021	y = 1.291x-7.760	0.997
B10	B10	09/11/2021	y = 1.091x+0.142	0.995
B11	B11	03/11/2021	y = 1.090x-0.694	0.996
B12	B12	03/11/2021	y = 1.165x-2.613	1.000
B13	B13	03/11/2021	y = 1.115x-2.066	1.000
B14	B14	03/11/2021	y = 1.174x-2.498	0.998
B15	B15	01/11/2021	y = 1.109x-0.219	0.999
B16	B16	01/11/2021	y = 1.211x-5.379	0.995
B17	B17	01/11/2021	y = 1.160x-2.153	0.997
B18	B18	01/11/2021	y = 1.235x-6.315	0.999
B19	B19	04/11/2021	y = 1.262x-7.960	0.997
B20	B20	04/11/2021	y = 1.263x-8.626	0.995
B21	B21	04/11/2021	y = 1.126x-1.642	0.998
B22	B22	04/11/2021	y = 1.224x-5.593	0.996
B23	B23	03/11/2021	y = 1.145x-2.521	0.999
B24	B24	03/11/2021	y = 1.097x-0.331	0.995
B25	B25	03/11/2021	y = 1.029x+2.874	0.997
B26	B26	03/11/2021	y = 1.121x-1.443	0.996
B27	B27	03/11/2021	y = 1.191x-5.420	0.997
B28	B28	03/11/2021	y = 1.248x-6.941	0.995
B29	B29	03/11/2021	y = 1.223x-5.741	0.997
B30	B30	03/11/2021	y = 1.171x-3.691	0.997
B31	B31	03/11/2021	y = 1.158x-2.458	1.000
B32	B32	03/11/2021	y = 1.197x-3.536	0.997
B33	B33	02/11/2021	y = 1.246x-6.869	0.999
B34	B34	09/11/2021	y = 1.251x-7.511	0.998



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High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	02/11/2021	y = 1.268x-7.802	1.000
B36	B36	02/11/2021	y = 1.127x-2.341	0.995
B37	B37	03/11/2021	y = 1.117x+0.086	0.997
B38	B38	03/11/2021	y = 1.141x-2.288	0.998
B39	B39	03/11/2021	y = 1.255x-6.396	1.000
B40	B40	03/11/2021	y = 1.177x-3.231	0.997
B41	B41	03/11/2021	y = 1.128x-0.683	0.998
B42	B42	04/11/2021	y = 1.126x-0.904	1.000
B43	B43	04/11/2021	y = 1.083x+0.949	0.996
B44	B44	04/11/2021	y = 1.338x-10.349	0.998
R01	R01	05/11/2021	y = 1.199x-4.664	0.997
R02	R02	02/11/2021	y = 1.176x-4.215	0.999
R03	R03	02/11/2021	y = 1.186x-5.147	0.996
R04	R04	02/11/2021	y = 1.115x-1.051	0.997
R05	R05	09/11/2021	y = 1.244x-7.591	0.996
R06	R06	02/11/2021	y = 1.339x-10.396	0.996
R07	R07	09/11/2021	y = 1.073x+0.747	0.996
R08	R08	09/11/2021	y = 1.157x-3.653	0.996
R09	R09	04/11/2021	y = 1.208x-5.357	0.997
R10	R10	04/11/2021	y = 1.211x-5.464	1.000
R11	R11	05/11/2021	y = 1.067x+1.406	0.996
R12	R12	04/11/2021	y = 1.188x-5.042	0.996
R13	R13	04/11/2021	y = 1.129x-1.431	0.999
R14	R14	08/11/2021	y = 1.105x-0.232	0.998
R15	R15	09/11/2021	y = 1.062x+1.362	0.995
R16	R16	01/11/2021	y = 1.144x-3.331	1.000
R17	R17	01/11/2021	y = 1.203x-4.883	0.999
R18	R18	01/11/2021	y = 1.285x-8.875	0.998
R19	R19	02/11/2021	y = 1.223x-4.925	1.000
R20	R20	02/11/2021	y = 1.201x-4.814	0.996





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Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	09/02/2022	y = 1.255x-7.443	0.998
B02	B02	02/02/2022	y = 1.075x+1.871	0.999
B03	B03	04/02/2022	y = 1.032x+1.126	0.997
B04	B04	04/02/2022	y = 1.158x-3.770	0.995
B05	B05	02/02/2022	y = 1.199x-5.374	1.000
B06	B06	01/02/2022	y = 1.215x-6.623	0.995
B07	B07	01/02/2022	y = 1.142x-4.465	0.997
B08	B08	02/02/2022	y = 1.241x-8.074	0.999
B09	B09	08/02/2022	y = 1.206x-5.652	0.995
B10	B10	07/02/2022	y = 1.095x+0.184	0.998
B11	B11	10/02/2022	y = 1.099x-2.021	0.996
B12	B12	09/02/2022	y = 1.169x-3.784	1.000
B13	B13	03/02/2022	y = 1.163x-4.662	0.996
B14	B14	07/02/2022	y = 1.169x-3.363	0.998
B15	B15	03/02/2022	y = 1.106x-1.273	0.998
B16	B16	09/02/2022	y = 1.218x-6.757	0.997
B17	B17	07/02/2022	y = 1.132x-1.890	0.998
B18	B18	16/02/2022	y = 1.239x-7.560	0.999
B19	B19	16/02/2022	y = 1.265x-8.934	0.997
B20	B20	0302/2022	y = 1.199x-6.304	0.998
B21	B21	17/02/2022	y = 1.120x-2.616	0.997
B22	B22	08/02/2022	y = 1.216x-6.597	0.995
B23	B23	03/02/2022	y = 1.139x-3.341	0.999
B24	B24	03/02/2022	y = 1.126x-2.172	1.000
B25	B25	09/02/2022	y = 1.016x+2.185	0.996
B26	B26	04/02/2022	y = 1.122x-2.540	0.997
B27	B27	08/02/2022	y = 1.192x-6.584	0.997
B28	B28	04/02/2022	y = 1.254x-8.360	0.995
B29	B29	02/02/2022	y = 1.217x-6.791	0.996
B30	B30	04/02/2022	y = 1.162x-4.303	0.997
B31	B31	16/02/2022	y = 1.101x-0.556	0.998
B32	B32	04/02/2022	y = 1.208x-5.034	0.997
B33	B33	07/02/2022	y = 1.242x-5.616	0.999
B34	B34	09/02/2022	y = 1.240x-8.273	0.999



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#### Calibration Data

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Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	16/02/2022	y = 1.274x-9.241	0.999
B36	B36	15/02/2022	y = 1.132x-3.625	0.996
B37	B37	04/02/2022	y = 1.157x+2.640	0.999
B38	B38	15/02/2022	y = 1.1432x-2.720	0.999
B39	B39	07/02/2022	y = 1.256x-7.614	1.000
B40	B40	15/02/2022	y = 1.175x-4.385	0.998
B41	B41	07/02/2022	y = 1.133x-1.951	0.998
B42	B42	04/02/2022	y = 1.127x-1.985	1.000
B43	B43	16/02/2022	y = 1.089x+0.223	0.996
B44	B44	03/02/2022	y = 1.339x-11.636	0.997
R01	R01	02/02/2022	y = 1.196x-5.960	0.996
R02	R02	09/02/2022	y = 1.175x-5.572	1.000
R03	R03	02/02/2022	y = 1.187x-6.283	0.995
R04	R04	07/02/2022	y = 1.100x-1.352	0.997
R05	R05	09/02/2022	y = 1.238x-8.500	0.997
R06	R06	01/02/2022	y = 1.328x-11.118	0.996
R07	R07	07/02/2022	y = 1.039x+1.507	0.995
R08	R08	04/02/2022	y = 1.141x-3.942	0.997
R09	R09	01/02/2022	y = 1.192x-5.710	0.997
R10	R10	09/02/2022	y = 1.194x-5.807	1.000
R11	R11	01/02/2022	y = 1.054x+0.098	0.996
R12	R12	04/02/2022	y = 1.171x-5.349	0.996
R13	R13	04/02/2022	y = 1.114x-1.755	0.999
R14	R14	07/02/2022	y = 1.100x-0.965	0.997
R15	R15	14/02/2022	y = 1.047x+1.073	0.995
R16	R16	09/02/2022	y = 1.129x-3.642	0.999
R17	R17	03/02/2022	y = 1.198x-5.739	1.000
R18	R18	02/02/2022	y = 1.268x-9.241	0.998
R19	R19	03/02/2022	y = 1.216x-5.626	0.999
R20	R20	01/02/2022	y = 1.197x-5.676	0.997



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Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
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 = 1.075x-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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Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	02/05/2022	y = 1.345x-12.323	0.999
B36	B36	03/05/2022	y = 1.154x-4.565	0.999
B37	B37	04/05/2022	y = 1.139x-2.122	0.996
B38	B38	06/05/2022	y = 1.126x-2.401	0.999
B39	B39	02/05/2022	y = 1.188x-5.455	0.998
B40	B40	06/05/2022	y = 1.156x-3.823	0.995
B41	B41	06/05/2022	y = 1.187x-6.052	0.997
B42	B42	04/05/2022	y = 1.063x+0.537	0.998
B43	B43	04/05/2022	y = 1.258x-9.645	0.998
B44	B44	03/05/2022	y = 1.252x-9.964	0.999
R01	R01	02/05/2022	y = 1.220x-6.992	0.999
R02	R02	10/05/2022	y = 1.121x-3.616	0.997
R03	R03	02/05/2022	y = 1.161x-5.046	0.999
R04	R04	06/05/2022	y = 1.115x-1.773	0.999
R05	R05	06/05/2022	y = 1.217x-7.663	0.998
R06	R06	04/05/2022	y = 1.245x-8.155	0.996
R07	R07	06/05/2022	y = 1.042x+1.155	0.995
R08	R08	04/05/2022	y = 1.220x-6.674	0.998
R09	R09	04/05/2022	y = 1.192x-5.710	0.997
R10	R10	10/05/2022	y = 1.209x-6.199	0.999
R11	R11	02/05/2022	y = 1.101x-2.414	0.999
R12	R12	10/05/2022	y = 1.209x-6.618	0.995
R13	R13	10/05/2022	y = 1.158x-3.923	0.999
R14	R14	06/05/2022	y = 1.128x-2.065	0.999
R15	R15	04/05/2022	y = 1.014x+2.496	0.998
R16	R16	04/05/2022	y = 1.159x-5.442	0.997
R17	R17	10/05/2022	y = 1.203x-5.717	0.999
R18	R18	02/05/2022	y = 1.325x-12.252	0.997
R19	R19	03/05/2022	y = 1.246x-7.147	0.998
R20	R20	04/05/2022	y = 1.230x-7.354	0.999



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### Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

#### Calibration Data

Gas Sampler Data		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	03/03/2022	200	200.5	199.0	200.4	199.0
B02	2 (A&B)	03/03/2022	200	200.3	198.9	200.5	199.1
B03	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.0
B04	2 (A&B)	03/03/2022	200	200.4	198.9	200.6	199.2
B05	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.1
B06	2 (A&B)	03/03/2022	200	200.6	199.2	200.4	199.0
B07	2 (A&B)	03/03/2022	200	200.5	199.0	200.5	199.1
B08	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.0
B09	2 (A&B)	04/03/2022	200	200.6	199.2	200.5	199.1
B10	2 (A&B)	04/03/2022	200	200.4	198.9	200.5	199.0
B11	2 (A&B)	04/03/2022	200	200.6	199.2	200.6	199.1
B12	2 (A&B)	04/03/2022	200	200.5	199.1	200.6	199.2
B13	2 (A&B)	04/03/2022	200	200.5	199.1	200.5	199.1
B14	2 (A&B)	04/03/2022	200	200.6	199.1	200.6	199.2
B15	2 (A&B)	04/03/2022	200	200.6	199.1	200.5	199.0
B16	2 (A&B)	04/03/2022	200	200.4	199.0	200.5	199.1
B17	2 (A&B)	04/03/2022	200	200.5	199.0	200.5	199.1



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### Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

#### Calibration Data

Gas Sampler Data		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	01/12/2021	200	200.6	199.1	200.7	199.2
B02	2 (A&B)	01/12/2021	200	200.5	199.1	200.4	199.0
B03	2 (A&B)	01/12/2021	200	200.6	199.2	200.5	199.1
B04	2 (A&B)	01/12/2021	200	200.5	199.0	200.5	199.1
B05	2 (A&B)	01/12/2021	200	200.7	199.2	200.6	199.2
B06	2 (A&B)	02/12/2021	200	200.6	199.2	200.6	199.1
B07	2 (A&B)	02/12/2021	200	200.5	199.1	200.4	199.0
B08	2 (A&B)	02/12/2021	200	200.6	199.2	200.7	199.2
B09	2 (A&B)	02/12/2021	200	200.5	199.1	200.5	199.0
B10	2 (A&B)	02/12/2021	200	200.5	199.1	200.6	199.1
B11	2 (A&B)	02/12/2021	200	200.5	199.1	200.6	199.2
B12	2 (A&B)	03/12/2021	200	200.5	199.0	200.5	199.1
B13	2 (A&B)	03/12/2021	200	200.4	199.0	200.5	199.0
B14	2 (A&B)	03/12/2021	200	200.5	199.0	200.6	199.1
B15	2 (A&B)	03/12/2021	200	200.6	199.2	200.5	199.1
B16	2 (A&B)	03/12/2021	200	200.5	199.1	200.6	199.2
B17	2 (A&B)	03/12/2021	200	200.5	199.1	200.4	199.0



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## Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

### Calibration Data

Gas Sampler Data		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	01/06/2022	200	200.4	199.0	200.6	199.2
B02	2 (A&B)	01/06/2022	200	200.6	199.1	200.5	199.0
B03	2 (A&B)	03/06/2022	200	200.5	199.0	200.5	199.1
B04	2 (A&B)	02/06/2022	200	200.5	199.1	200.6	199.2
B05	2 (A&B)	01/06/2022	200	200.4	199.0	200.5	199.1
B06	2 (A&B)	01/06/2022	200	200.5	199.1	200.4	198.9
B07	2 (A&B)	03/06/2022	200	200.3	198.9	200.5	199.1
B08	2 (A&B)	01/06/2022	200	200.5	199.1	200.4	199.0
B09	2 (A&B)	01/06/2022	200	200.4	199.0	200.3	198.9
B10	2 (A&B)	02/06/2022	200	200.5	199.0	200.5	199.0
B11	2 (A&B)	01/06/2022	200	200.4	199.0	200.7	199.2
B12	2 (A&B)	01/06/2022	200	200.5	199.1	200.5	199.0
B13	2 (A&B)	02/06/2022	200	200.4	199.0	200.5	199.1
B14	2 (A&B)	02/06/2022	200	200.5	199.0	200.4	198.9
B15	2 (A&B)	03/06/2022	200	200.6	199.2	200.6	199.2
B16	2 (A&B)	01/06/2022	200	200.5	199.0	200.5	199.1
B17	2 (A&B)	01/06/2022	200	200.5	199.0	200.4	199.0

Rotameter Calibration Report (For Personal Pump Low 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 <sup>2</sup>
L-B01	Dwyer	VFA-21	05/01/2022	50	100	200	50.5	99.3	199.9	0.992x + 0.587	1.000
L-B02	Dwyer	VFA-21	05/01/2022	50	100	200	49.4	99.2	199.3	0.993x - 0.049	1.000
L-B03	Dwyer	VFA-21	06/01/2022	50	100	200	50.0	98.8	198.5	0.998x - 0.422	1.000
L-B04	Dwyer	VFA-21	06/01/2022	50	100	200	49.5	100.4	200.3	0.994x + 0.727	1.000
L-B05	Dwyer	VFA-21	06/01/2022	50	100	200	49.8	98.4	199.2	1.004x - 1.156	1.000
L-B06	Dwyer	VFA-21	07/01/2022	50	100	200	49.9	100.7	198.8	0.992x + 0.922	1.000
L-B07	Dwyer	VFA-21	07/01/2022	50	100	200	49.8	100.2	199.2	1.007x - 1.047	1.000
L-B08	Dwyer	VFA-21	06/01/2022	50	100	200	50.2	99.9	200.7	0.994x + 0.789	1.000
L-B09	Dwyer	VFA-21	07/01/2022	50	100	200	49.8	99.8	199.6	1.010x - 1.438	1.000
L-B10	Dwyer	VFA-21	05/01/2022	50	100	200	50.6	100.2	201.6	0.991x + 1.825	1.000

Rotameter Calibration Report (For Personal Pump Low 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 <sup>2</sup>
L-B01	Dwyer	VFA-21	01/04/2022	50	100	200	50.7	99.5	198.5	0.985x + 1.282	1.000
L-B02	Dwyer	VFA-21	04/04/2022	50	100	200	49.8	99.8	198.3	1.016x - 2.084	1.000
L-B03	Dwyer	VFA-21	01/04/2022	50	100	200	50.4	98.8	197.9	1.017x - 2.646	1.000
L-B04	Dwyer	VFA-21	01/04/2022	50	100	200	49.5	101.6	201.1	0.995x + 1.217	1.000
L-B05	Dwyer	VFA-21	01/04/2022	50	100	200	50.1	98.1	201.2	0.993x + 0.208	1.000
L-B06	Dwyer	VFA-21	05/04/2022	50	100	200	50.3	100.1	202.6	1.010x + 0.004	1.000
L-B07	Dwyer	VFA-21	01/04/2022	50	100	200	49.8	100.4	200.1	1.016x - 1.655	1.000
L-B08	Dwyer	VFA-21	04/04/2022	50	100	200	50.2	100.9	198.1	0.999x - 0.281	1.000
L-B09	Dwyer	VFA-21	01/04/2022	50	100	200	49.2	99.6	201.1	1.022x - 2.466	1.000
L-B10	Dwyer	VFA-21	01/04/2022	50	100	200	50.6	100.2	203.2	0.992x + 2.233	1.000



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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.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B01	SKC	224-PCXR4	262101	05/01/2022	1,000	1,500	2,000	995	1,496	1,995	0.999x - 1.938	1.000
B02	SKC	224-PCXR4	626166	05/01/2022	1,000	1,500	2,000	998	1,504	2,001	1.011x - 24.413	0.999
B03	SKC	224-PCXR4	612968	05/01/2022	1,000	1,500	2,000	995	1,490	1,995	1.001x - 6.653	1.000
B04	SKC	224-PCXR4	602804	05/01/2022	1,000	1,500	2,000	996	1,496	1,993	0.999x - 4.391	1.000
B05	SKC	224-PCXR4	612693	05/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 21.952	0.999
B06	SKC	224-PCXR4	262188	05/01/2022	1,000	1,500	2,000	996	1,504	2,000	1.012x - 26.866	0.999
B07	SKC	224-PCXR4	626262	05/01/2022	1,000	1,500	2,000	998	1,492	1,994	0.996x + 1.898	1.000
B08	SKC	224-PCXR4	626100	05/01/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.011x - 21.912	0.999
B09	SKC	224-PCXR4	626479	05/01/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.550	1.000
B10	SKC	224-PCXR4	091950	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.016x - 32.434	0.999
B11	SKC	224-PCXR8	564315	06/01/2022	1,000	1,500	2,000	994	1,490	1,998	1.004x - 10.450	1.000
B12	SKC	224-PCXR4	034656	06/01/2022	1,000	1,500	2,000	1,001	1,503	2,003	1.012x - 22.618	0.999
B13	SKC	224-PCXR4	602073	06/01/2022	1,000	1,500	2,000	995	1,498	1,994	1.000x + 3.701	1.000
B14	SKC	224-PCXR4	626313	05/01/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.286	1.000
B15	SKC	224-PCXR4	626474	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 22.048	0.999
B16	SKC	224-PCXR4	626477	07/01/2022	1,000	1,500	2,000	993	1,504	2,000	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	07/01/2022	1,000	1,500	2,000	997	1,495	1,992	0.995x + 2.034	1.000
B18	SKC	224-PCXR4	691484	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.009x - 18.586	0.999
B19	SKC	224-PCXR4	691599	07/01/2022	1,000	1,500	2,000	992	1,499	1,997	1.003x - 9.253	1.000
B20	SKC	224-PCXR4	691587	07/01/2022	1,000	1,500	2,000	992	1,504	1,999	1.015x - 31.915	0.999
B21	SKC	224-PCXR4	691531	07/01/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 5.273	1.000
B22	SKC	224-PCXR4	691654	07/01/2022	1,000	1,500	2,000	1,005	1,501	2,003	1.010x - 18.195	0.999
B23	SKC	224-PCXR4	798393	07/01/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.683	0.999
B24	SKC	224-PCXR4	626363	07/01/2022	1,000	1,500	2,000	1,000	1,501	2,005	1.016x - 28.338	0.999
B25	SKC	224-PCXR4	798489	06/01/2022	1,000	1,500	2,000	1,000	1,495	1,997	0.997x + 2.018	1.000
B26	SKC	224-PCXR4	798479	06/01/2022	1,000	1,500	2,000	997	1,497	1,990	0.994x + 3.251	1.000
B27	SKC	224-PCXR4	691673	06/01/2022	1,000	1,500	2,000	994	1,503	2,001	1.015x - 31.951	0.999
B28	SKC	224-PCXR4	691570	06/01/2022	1,000	1,500	2,000	1,000	1,500	2,003	1.015x - 27.022	0.999
B29	SKC	224-PCXR4	626472	06/01/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 8.856	1.000
B30	SKC	224-PCXR4	691489	06/01/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.013x - 24.106	0.999
B31	SKC	224-PCXR4	691509	06/01/2022	1,000	1,500	2,000	995	1,495	1,995	1.001x - 4.894	1.000
B32	SKC	224-PCXR4	091567	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.014x - 28.866	0.999
B33	SKC	224-PCXR4	091756	06/01/2022	1,000	1,500	2,000	996	1,496	1,991	0.995x + 3.183	1.000
B34	SKC	224-PCXR4	612962	06/01/2022	1,000	1,500	2,000	1,001	1,501	2,002	1.012x - 22.531	0.999
B35	SKC	224-PCXR4	602682	06/01/2022	1,000	1,500	2,000	993	1,498	1,996	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	05/01/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 3.231	1.000
B37	SKC	224-PCXR4	626256	05/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 31.604	0.999
B38	SKC	224-PCXR4	626167	10/01/2022	1,000	1,500	2,000	999	1,497	1,996	1.000x - 1.875	1.000
B39	SKC	224-PCXR4	034637	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 23.643	0.999
B40	SKC	224-PCXR4	798349	10/01/2022	1,000	1,500	2,000	993	1,505	2,000	1.016x - 32.992	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.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	10/01/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 2.680	1.000
B42	SKC	224-PCXR4	626041	07/01/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 11.710	1.000
B43	SKC	224-PCXR4	034636	05/01/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 8.392	1.000
B44	SKC	224-PCXR8	529341	07/01/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.011x - 21.139	0.999
B45	SKC	224-PCXR8	529594	07/01/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.728	1.000
B46	SKC	224-PCXR8	566743	07/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.015x - 32.087	0.999
B47	SKC	224-PCXR8	566747	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.013x - 23.580	0.999
B48	SKC	224-PCXR8	566753	07/01/2022	1,000	1,500	2,000	1,000	1,494	1,996	0.996x + 1.567	1.000
B49	SKC	224-PCXR8	566780	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 22.236	0.999
B50	SKC	224-PCXR8	500400	07/01/2022	1,000	1,500	2,000	1,000	1,493	1,996	0.995x + 3.641	1.000
B51	SKC	224-PCXR8	500363	07/01/2022	1,000	1,500	2,000	995	1,504	2,000	1.013x - 27.704	0.999
B52	SKC	224-PCXR8	093186	07/01/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x - 0.283	1.000
B53	SKC	224-PCXR8	707670	10/01/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x - 23.580	0.999
B54	SKC	224-PCXR3	509821	05/01/2022	1,000	1,500	2,000	994	1,501	2,001	1.015x - 32.043	0.999
B55	SKC	224-PCXR3	510710	06/01/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.830	1.000
B56	SKC	224-PCXR3	511450	06/01/2022	1,000	1,500	2,000	1,004	1,502	2,002	1.010x - 19.248	0.999
B57	SKC	224-PCXR3	510798	06/01/2022	1,000	1,500	2,000	997	1,492	1,996	0.996x + 1.747	1.000
B58	SKC	224-PCXR3	509852	06/01/2022	1,000	1,500	2,000	997	1,499	2,000	1.011x - 27.010	0.999
B59	SKC	224-PCXR3	509862	06/01/2022	1,000	1,500	2,000	997	1,495	1,991	0.995x + 3.833	1.000
B60	SKC	224-PCXR3	512655	06/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.688	0.999
B61	SKC	224-PCXR3	503915	06/01/2022	1,000	1,500	2,000	994	1,488	1,999	1.005x - 12.631	1.000
B62	SKC	224-PCXR3	505975	10/01/2022	1,000	1,500	2,000	994	1,491	1,995	1.002x - 8.089	1.000
B63	SKC	224-PCXR3	511432	10/01/2022	1,000	1,500	2,000	992	1,501	2,000	1.016x - 33.906	0.999
B64	SKC	224-PCXR3	508302	10/01/2022	1,000	1,500	2,000	998	1,493	1,990	0.994x + 4.272	1.000
B65	SKC	224-PCXR3	508310	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.012x - 23.077	0.999
B66	SKC	224-PCXR3	509861	10/01/2022	1,000	1,500	2,000	997	1,494	1,994	0.995x + 3.953	1.000
B67	SKC	224-PCXR3	506295	10/01/2022	1,000	1,500	2,000	993	1,507	2,002	1.017x - 34.005	0.999
B68	SKC	224-PCXR3	505872	13/01/2022	1,000	1,500	2,000	1,000	1,495	1,994	0.995x + 4.188	1.000
B69	SKC	224-PCXR3	508375	13/01/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.984	0.999
B70	SKC	224-PCXR3	510623	13/01/2022	1,000	1,500	2,000	995	1,490	1,997	1.001x - 7.267	1.000
B71	SKC	224-PCXR3	508367	13/01/2022	1,000	1,500	2,000	991	1,506	2,001	1.017x - 35.429	0.999
B72	SKC	224-PCXR3	505977	13/01/2022	1,000	1,500	2,000	1,001	1,498	1,991	0.991x + 8.882	1.000
B73	SKC	224-PCXR3	512606	13/01/2022	1,000	1,500	2,000	1,001	1,501	2,004	1.013x - 23.520	0.999
B74	SKC	224-PCXR3	505993	13/01/2022	1,000	1,500	2,000	996	1,495	1,995	1.000x - 5.161	1.000
B75	SKC	224-PCXR3	509820	13/01/2022	1,000	1,500	2,000	996	1,499	1,992	0.996x + 1.831	1.000
B76	SKC	224-PCXR3	509811	13/01/2022	1,000	1,500	2,000	995	1,496	1,998	1.003x - 9.050	1.000
B77	SKC	224-PCXR3	508301	13/01/2022	1,000	1,500	2,000	1,001	1,500	2,004	1.014x - 26.595	0.999
B78	SKC	224-PCXR3	510677	13/01/2022	1,000	1,500	2,000	994	1,504	1,999	1.013x - 28.238	0.999
B79	SKC	224-PCXR3	510920	13/01/2022	1,000	1,500	2,000	994	1,504	1,999	0.999x - 4.304	1.000





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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.)				
					1	2	3	1	2	3	y	R²
B80	SKC	224-PCXR3	504569	12/01/2022	1,000	1,500	2,000	1,003	1,499	2,002	1.010x - 20.915	0.999
B81	SKC	224-PCXR3	503480	10/01/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.401	0.999
B82	SKC	224-PCXR3	505673	10/01/2022	1,000	1,500	2,000	993	1,499	1,996	1.003x - 7.857	1.000
B83	SKC	224-PCXR3	510785	13/01/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.548	0.999
B84	SKC	224-PCXR3	508333	12/01/2022	1,000	1,500	2,000	995	1,497	1,992	0.997x - 0.016	1.000
B85	SKC	224-PCXR3	505757	10/01/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.555	0.999
B86	SKC	224-PCXR3	512625	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 23.520	0.999
B87	SKC	224-PCXR3	504324	13/01/2022	1,000	1,500	2,000	997	1,499	1,997	1.000x - 1.667	1.000
B88	SKC	224-PCXR3	508307	13/01/2022	1,000	1,500	2,000	996	1,495	1,992	0.996x + 0.451	1.000
B89	SKC	224-PCXR3	509860	13/01/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.013x - 25.008	0.999
B90	SKC	224-PCXR3	508366	13/01/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.531	0.999
B91	SKC	224-PCXR3	510919	13/01/2022	1,000	1,500	2,000	998	1,498	1,997	1.001x - 4.563	1.000
B92	SKC	224-PCXR3	510987	13/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.996	0.999
B93	SKC	224-PCXR3	509845	13/01/2022	1,000	1,500	2,000	1,000	1,498	1,999	1.000x - 3.059	1.000



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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.)				
					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	262186	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 - 22.760	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	1,986	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 - 4.672	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	626474	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	691631	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	798470	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	788349	12/04/2022	1,000	1,500	2,000	992	1,506	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-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.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	04/04/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 3.829	1.000
B42	SKC	224-PCXR4	626041	01/04/2022	1,000	1,500	2,000	1,003	1,496	1,993	0.990x + 12.348	1.000
B43	SKC	224-PCXR4	034636	11/04/2022	1,000	1,500	2,000	1,001	1,501	1,992	0.990x + 12.839	1.000
B44	SKC	224-PCXR8	629341	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.577	0.999
B45	SKC	224-PCXR8	529594	12/04/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.928	1.000
B46	SKC	224-PCXR8	566743	04/04/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 33.204	0.999
B47	SKC	224-PCXR8	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.202	0.999
B48	SKC	224-PCXR8	566753	01/04/2022	1,000	1,500	2,000	999	1,494	1,997	0.999x + 1.795	1.000
B49	SKC	224-PCXR8	566780	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.011x - 21.031	0.999
B50	SKC	224-PCXR8	500400	01/04/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x + 2.900	1.000
B51	SKC	224-PCXR8	500383	01/04/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.268	0.999
B52	SKC	224-PCXR8	093186	11/04/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x - 1.240	1.000
B53	SKC	224-PCXR8	707670	01/04/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x - 22.742	0.999
B54	SKC	224-PCXR3	509821	11/04/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x - 33.718	0.999
B55	SKC	224-PCXR3	510710	01/04/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.635	1.000
B56	SKC	224-PCXR3	511450	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 20.684	0.999
B57	SKC	224-PCXR3	510798	12/04/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x + 3.398	1.000
B58	SKC	224-PCXR3	509852	04/04/2022	1,000	1,500	2,000	1,001	1,498	2,000	1.007x - 19.631	0.999
B59	SKC	224-PCXR3	509862	01/04/2022	1,000	1,500	2,000	996	1,503	1,995	0.998x + 2.916	1.000
B60	SKC	224-PCXR3	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 23.891	0.999
B61	SKC	224-PCXR3	503915	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505975	12/04/2022	1,000	1,500	2,000	999	1,494	1,995	0.997x - 0.503	1.000
B63	SKC	224-PCXR3	511432	01/04/2022	1,000	1,500	2,000	991	1,501	2,000	1.017x - 36.139	0.999
B64	SKC	224-PCXR3	508302	04/04/2022	1,000	1,500	2,000	997	1,493	1,990	0.994x + 3.992	1.000
B65	SKC	224-PCXR3	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 23.109	0.999
B66	SKC	224-PCXR3	509861	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.701	1.000
B67	SKC	224-PCXR3	506295	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 33.104	0.999
B68	SKC	224-PCXR3	505872	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.556	1.000
B69	SKC	224-PCXR3	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.689	0.999
B70	SKC	224-PCXR3	510623	11/04/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.693	1.000
B71	SKC	224-PCXR3	508367	12/04/2022	1,000	1,500	2,000	991	1,506	2,002	1.018x - 36.227	0.999
B72	SKC	224-PCXR3	505977	12/04/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.992x + 7.087	1.000
B73	SKC	224-PCXR3	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 24.517	0.999
B74	SKC	224-PCXR3	505993	12/04/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x - 4.363	1.000
B75	SKC	224-PCXR3	509820	12/04/2022	1,000	1,500	2,000	996	1,499	1,992	0.995x + 2.429	1.000
B76	SKC	224-PCXR3	509811	12/04/2022	1,000	1,500	2,000	992	1,498	1,998	1.007x - 15.040	1.000
B77	SKC	224-PCXR3	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.643	0.999
B78	SKC	224-PCXR3	510677	01/04/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 27.520	0.999
B79	SKC	224-PCXR3	510920	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.705	1.000



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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

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.)				
					1	2	3	1	2	3	y	R²
B80	SKC	224-PCXR3	504569	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.010x - 20.517	0.999
B81	SKC	224-PCXR3	503480	01/04/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.561	0.999
B82	SKC	224-PCXR3	505673	01/04/2022	1,000	1,500	2,000	993	1,499	1,996	1.002x - 7.299	1.000
B83	SKC	224-PCXR3	510785	04/04/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.787	0.999
B84	SKC	224-PCXR3	508533	04/04/2022	1,000	1,500	2,000	995	1,497	1,991	0.997x - 0.383	1.000
B85	SKC	224-PCXR3	505757	04/04/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.476	0.999
B86	SKC	224-PCXR3	512825	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,004	1.012x - 22.463	0.999
B87	SKC	224-PCXR3	504324	11/04/2022	1,000	1,500	2,000	998	1,496	2,000	1.001x - 2.305	1.000
B88	SKC	224-PCXR3	508307	04/04/2022	1,000	1,500	2,000	997	1,498	1,993	0.996x + 1.212	1.000
B89	SKC	224-PCXR3	509860	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.546	0.999
B90	SKC	224-PCXR3	508566	04/04/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.850	0.999
B91	SKC	224-PCXR3	510919	04/04/2022	1,000	1,500	2,000	998	1,498	1,996	1.000x - 3.765	1.000
B92	SKC	224-PCXR3	510987	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.916	0.999
B93	SKC	224-PCXR3	509845	12/04/2022	1,000	1,500	2,000	1,000	1,498	1,996	1.000x - 2.261	1.000







CERTIFICATE No : 21M3169  
REFERENCE No : 60627-5

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : METTLER TOLEDO  
MODEL : XS105DU  
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 : 19-Mar-21  
APPROVED BY :   
ISSUED DATE : 20-Mar-21  
RECEIVED DATE : 19-Mar-21

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



CERTIFICATE No : 21M3169

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 19-Mar-21  
AIR PRESSURE : 1009mbar  $\pm$  1mbar CALIBRATION DATE : 19-Mar-21  
AMBIENT TEMPERATURE : 24°C  $\pm$  1°C RELATIVE HUMIDITY : 52 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-1-349	M21032358	26-Mar-23

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

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

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

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

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

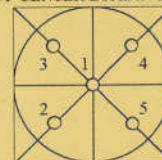
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 100 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	0.000066
0.02	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.0000	0.0000	0.000075
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  
COVERAGE FACTOR  $k=2$ , PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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 : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22

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

CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

ID No : BA 05/50 RECEIVED DATE : 11-Mar-22

AIR PRESSURE : 1008mbar  $\pm$  1mbar CALIBRATION DATE : 11-Mar-22

AMBIENT TEMPERATURE : 22° C  $\pm$  1° C RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

## CONDITION OF THIS RESULTS OF CALIBRATION

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

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

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g
4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
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  
COVERAGE FACTOR K = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT



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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 :	09 January 2022	BRAND :	API	MODEL :	300E
NO.	CO-B01	SERIAL NO.	782		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D824478	
Certified Date	: 15 April 2020	Expired Date	: 14 April 2022	Cylinder Conc.	: 4,740 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	40.06	0.150	40.00	
API Model 300E CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4014.2	mV	2500-4800 mV		
CO REFERENCE	3949.6	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.7	In-Hg-A	~2" ambient absolute pressure		
SAMPLE FLOW	809	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.5	°C	48 ± 4		
BENCH TEMPERATURE	48.2	°C	48 ± 2		
WHEEL TEMPERATURE	68.5	°C	68 ± 2		
BOX TEMPERATURE	30.6	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3031.8	mV	250 mV to 4750 mV		
SLOPE	1.016	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	09 January 2022	BRAND :	Thermo	MODEL :	48C
NO.	CO-B11	SERIAL NO.	0401304262		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D824478	
Certified Date	: 15 April 2020	Expired Date	: 14 April 2022	Cylinder Conc.	: 4,740 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	0.11	-	0	
CO Span	40.00	39.93	-0.175	40.00	
INSTRUMENT STATUS					
CHAMBER TEMP	47.4 °C		FLOW	1.5 LPM	
PRESSURE	730.3 mm Hg		MOTOR SPEED	100.00%	





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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, Chatuchak, Bangkok 10900  
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscn.com, www.spscn.com

CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	07 February 2022	BRAND :	Thermo	MODEL :	48C
NO.	CO-B11	SERIAL NO.	0401304262		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	20 September 2021		Serial No. :	421	
Reference Standard Gas					
Standard Gas :	Carbon Monoxide (CO)		Cylinder No. :	D824478	
Certified Date :	15 April 2020	Expired Date :	14 April 2022	Cylinder Conc. :	4,740 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°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	40.03	0.075	40.00	
INSTRUMENT STATUS					
CHAMBER TEMP	47.6 °C	FLOW	1.5 LPM		
PRESSURE	730.3 mm Hg	MOTOR SPEED	100.00%		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	07 February 2022	BRAND :	API	MODEL :	300E
NO.	CO-B13	SERIAL NO.	176		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	20 September 2021		Serial No. :	421	
Reference Standard Gas					
Standard Gas :	Carbon Monoxide (CO)		Cylinder No. :	D824478	
Certified Date :	15 April 2020	Expired Date :	14 April 2022	Cylinder Conc. :	4,740 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°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	39.89	-0.275	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	4015.3	mV	2500-4800 mV		
CO REFERENCE	3948.7	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	806	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.2	°C	48 ± 4		
BENCH TEMPERATURE	48.0	°C	48 ± 2		
WHEEL TEMPERATURE	68.6	°C	68 ± 2		
BOX TEMPERATURE	30.5	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3041.8	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	20 March 2022	BRAND :	API	MODEL :	300E
NO.	CO-B01	SERIAL NO.	782		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D824478	
Certified Date	: 15 April 2020		Expired Date	: 14 April 2022	
		Cylinder Conc.	: 4,740 PPM		
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	0.11	-	0	
CO Span	40.00	39.93	-0.175	40.00	
API Model 300E CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4013.5	mV	2500-4800 mV		
CO REFERENCE	3947.8	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.7	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	812	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.4	°C	48 ± 4		
BENCH TEMPERATURE	48.1	°C	48 ± 2		
WHEEL TEMPERATURE	68.3	°C	68 ± 2		
BOX TEMPERATURE	30.9	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3064.6	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	20 March 2022	BRAND :	API	MODEL :	300E
NO.	CO-B03	SERIAL NO.	3019		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D824478	
Certified Date	: 15 April 2020		Expired Date	: 14 April 2022	
		Cylinder Conc.	: 4,740 PPM		
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.09	0.225	40.00	
API Model 300E CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4014.7	mV	2500-4800 mV		
CO REFERENCE	3948.2	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.5	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	804	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.5	°C	48 ± 4		
BENCH TEMPERATURE	48.2	°C	48 ± 2		
WHEEL TEMPERATURE	68.5	°C	68 ± 2		
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3021.3	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	20 April 2022	BRAND :	Thermo	MODEL :	48C
NO.	CO-B12	SERIAL NO.	TL-65343-348		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	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	0.11	-	0	
CO Span	40.00	40.09	0.225	40.00	
INSTRUMENT STATUS					
CHAMBER TEMP	47.5	°C	FLOW	1.5	LPM
PRESSURE	730.4	mm Hg	MOTOR SPEED	100.00	%



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	20 April 2022	BRAND :	API	MODEL :	300EU
NO.	CO-B14	SERIAL NO.	131		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	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	40.10	0.250	40.00	
API Model 300EU CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4016.1	mV	2500-4800 mV		
CO REFERENCE	3949.8	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.5	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	810	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.3	°C	48 ± 4		
BENCH TEMPERATURE	48.1	°C	48 ± 2		
WHEEL TEMPERATURE	68.2	°C	68 ± 2		
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3035.1	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		





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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	17 May 2022	BRAND :	API	MODEL :	300E
NO.	CO-B03	SERIAL NO.	3019		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.06	0.150	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	4015.6	mV	2500-4800 mV		
CO REFERENCE	3948.5	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.7	In-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	808	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.2	°C	48 ± 4		
BENCH TEMPERATURE	48.0	°C	48 ± 2		
WHEEL TEMPERATURE	68.5	°C	68 ± 2		
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3009.5	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	17 May 2022	BRAND :	Thermo	MODEL :	48C
NO.	CO-B12	SERIAL NO.	TL-65343-348		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 PPM
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	0.11	-	0	
CO Span	40.00	40.11	0.275	40.00	
INSTRUMENT STATUS					
CHAMBER TEMP	47.5 °C		FLOW	1.5 LPM	
PRESSURE	730.8 mm Hg		MOTOR SPEED	100.00%	

CALIBRATION REPORT				
NON-DISPERSIVE INFRARED CO ANALYZER				
DATE :	20 June 2022	BRAND :	API	MODEL :
NO.	CO-B01	SERIAL NO.	782	
Calibrator (Dilution System)				
Brand	: API		Model	: 700
Last Cal. Date	: 20 September 2021		Serial No.	: 421
Reference Standard Gas				
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	
CYLINDER CONC. : 4,570 PPM				
CALIBRATING CONDITION				
Pressure	1011	mmbar	Temp.	24.5 °C
% RH	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	0.11	-	0
CO Span	40.00	40.10	0.250	40.00
API Model 300E CO Analyzer Check list				
Parameter	Observed Value	Units	Nominal Range	
RANGE	50	PPM	0-1000 ppm	
STABILITY	0.10	PPM	< 1 ppm with zero air	
CO MEASURE	4016.1	mV	2500-4800 mV	
CO REFERENCE	3949.8	mV	2500-4800 mV	
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air	
SAMPLE PRESSURE	28.5	In-Hg-A	~2" ambient absolute pressure	
SAMPLE FLOW	810	cc/min	800 ± 10%	
SAMPLE TEMPERATURE	48.3	°C	48 ± 4	
BENCH TEMPERATURE	48.1	°C	48 ± 2	
WHEEL TEMPERATURE	68.2	°C	68 ± 2	
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10	
PHOTO-DRIVE	3028.4	mV	250 mV to 4750 mV	
SLOPE	1.017	-	1.0 ± 0.3	
OFFSET	0.2	-	0 ± 0.3	

CALIBRATION REPORT				
NON-DISPERSIVE INFRARED CO ANALYZER				
DATE :	20 June 2022	BRAND :	API	MODEL :
NO.	CO-B03	SERIAL NO.	3019	
Calibrator (Dilution System)				
Brand	: API		Model	: 700
Last Cal. Date	: 20 September 2021		Serial No.	: 421
Reference Standard Gas				
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	
CYLINDER CONC. : 4,570 PPM				
CALIBRATING CONDITION				
Pressure	1011	mmbar	Temp.	24.5 °C
% RH	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	39.94	-0.150	40.00
API Model 300E CO Analyzer Check list				
Parameter	Observed Value	Units	Nominal Range	
RANGE	50	PPM	0-1000 ppm	
STABILITY	0.10	PPM	< 1 ppm with zero air	
CO MEASURE	4013.5	mV	2500-4800 mV	
CO REFERENCE	3947.4	mV	2500-4800 mV	
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air	
SAMPLE PRESSURE	28.7	In-Hg-A	~2" ambient absolute pressure	
SAMPLE FLOW	808	cc/min	800 ± 10%	
SAMPLE TEMPERATURE	48.4	°C	48 ± 4	
BENCH TEMPERATURE	48.2	°C	48 ± 2	
WHEEL TEMPERATURE	68.4	°C	68 ± 2	
BOX TEMPERATURE	30.9	°C	Ambient temp + 7 ± 10	
PHOTO-DRIVE	3014.7	mV	250 mV to 4750 mV	
SLOPE	1.017	-	1.0 ± 0.3	
OFFSET	0.2	-	0 ± 0.3	





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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	09 January 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B11	SERIAL NO.	4467		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
			Cylinder Conc.	: 49.9 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°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	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.007
NO <sub>x</sub> Span	400	400.5	0.125	400.0	1.012
API Model 200E NO <sub>x</sub> 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	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.3	mV	-20 ~ 150		
AZERO	94.2	mV	-20 ~ 150		
HVPS	671	V	420 ~ 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.0	°C	8 ~ 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	09 January 2022	BRAND :	API	MODEL :	200E
NO.	NOX-R09	SERIAL NO.	252		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
			Cylinder Conc.	: 49.9 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°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	399.5	-0.125	400.0	0.998
NO <sub>x</sub> Span	400	399.8	-0.050	400.0	1.003
API Model 200E NO <sub>x</sub> 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	103.0	mV	-20 ~ 150		
AZERO	93.8	mV	-20 ~ 150		
HVPS	669	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	314.8	°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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	0.998	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.003	-	1.0 ± 0.3		
NO Offset	0.8	mV	-20 to +150		
NO <sub>x</sub> Offset	0.4	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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	07 February 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B04	SERIAL NO.	750		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc. : 49.9 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	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.008
NO <sub>x</sub> Span	400	400.4	0.100	400.0	1.013
API Model 200E NO <sub>x</sub> 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	94.0	mV	-20 ~ 150		
HVPS	674	V	420 ~ 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	28.9	°C	8 ~ 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.8	°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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.013	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	07 February 2022	BRAND :	API	MODEL :	200E
NO.	NOX-R09	SERIAL NO.	252		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc. : 49.9 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	399.8	-0.050	400.0	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.007
API Model 200E NO <sub>x</sub> 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	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 ~ 150		
AZERO	94.1	mV	-20 ~ 150		
HVPS	671	V	420 ~ 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.5	°C	8 ~ 48		
PMT TEMP	7.0	°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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO <sub>x</sub> 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 / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 March 2022	BRAND :	API	MODEL :	200A
NO.	NOX-B02	SERIAL NO.	2409		
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.	: A00917SK	
Certified Date	: 01 June 2020	Expired Date	: 01 June 2022	Cylinder Conc.	: 49.9 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	400.2	0.050	400.0	1.008
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.012
API Model 200A NO <sub>x</sub> 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	78	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.7	°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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 March 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B11	SERIAL NO.	4467		
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.	: A00917SK	
Certified Date	: 01 June 2020	Expired Date	: 01 June 2022	Cylinder Conc.	: 49.9 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	399.9	-0.025	400.0	1.006
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011
API Model 200E NO <sub>x</sub> 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	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.3	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 April 2022	BRAND :	API	MODEL :	200A
NO.	NOX-B02	SERIAL NO.	2409		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc.				: 49.9 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°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	0.11	-	0	-
NO Span	400	399.8	-0.050	400.0	1.004
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.008
API Model 200A NO <sub>x</sub> 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	103.0	mV	-20 ~ 150		
AZERO	93.8	mV	-20 ~ 150		
HVPS	669	V	420 ~ 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.5	°C	8 ~ 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO <sub>x</sub> 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 / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 April 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B04	SERIAL NO.	750		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc.				: 49.9 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°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	400.1	0.025	400.0	1.006
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.010
API Model 200E NO <sub>x</sub> 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	78	cc/min	80 ± 15		
PMT	103.1	mV	-20 ~ 150		
AZERO	94.2	mV	-20 ~ 150		
HVPS	674	V	420 ~ 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	8 ~ 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.2	°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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.010	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	17 May 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B11	SERIAL NO.	4467		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc.	: 49.9 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°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	-
NO Span	400	399.6	-0.100	400.0	0.998
NO <sub>x</sub> Span	400	399.8	-0.050	400.0	1.003
API Model 200E NO <sub>x</sub> 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	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	0.998	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.003	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO <sub>x</sub> 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 / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	17 May 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B19	SERIAL NO.	353		
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.	: A00917SK	
Certified Date	: 01 June 2020		Expired Date	: 01 June 2022	
Cylinder Conc.	: 49.9 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°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 <sub>x</sub> Span	400	400.3	0.075	400.0	1.009
API Model 200E NO <sub>x</sub> 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	94.2	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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO <sub>x</sub> 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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 June 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B05	SERIAL NO.	2284		
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	48	
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	399.8	-0.050	400.0	1.004
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.008
API Model 200E NO <sub>x</sub> 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	103.2	mV	-20 ~ 150		
AZERO	93.9	mV	-20 ~ 150		
HVPS	670	V	420 ~ 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.2	°C	8 ~ 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.3	mV	-20 to +150		
NO <sub>x</sub> 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		

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	20 June 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B07	SERIAL NO.	4338		
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	48	
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	399.7	-0.075	400.0	1.003
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.006
API Model 200E NO <sub>x</sub> 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	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 ~ 150		
AZERO	94.1	mV	-20 ~ 150		
HVPS	673	V	420 ~ 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 ~ 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.003	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.006	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO <sub>x</sub> 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		





NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP21011

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 :** ( 24.5 ± 5 ) °C  
**Relative Humidity :** ( 68.0 ± 25 ) %

**Received Date :** 30 AUGUST 2021  
**Calibration Date :** 30 AUGUST 2021  
**Date of Issue :** 31 AUGUST 2021

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. : SP21011

Job No. : VC64SP0012

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	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0030-20	13/02/2022

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	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.1	0.01	0.16	2.00
	864.94	865.3	0.36	0.16	2.00

UUC\* = Unit Under Calibration

## Continuation of Calibration Certificate

Cert. No. : SP21011  
Job No. : VC64SP0012  
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	1.0524	1.0530	0.0006	0.0030	2.00
		29914	0.7	0.7454	0.7458	0.0004	0.0032	2.00
		29381	0.5	0.5426	0.5421	-0.0005	0.0030	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0030	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0031	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0030	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0030	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0031	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0030	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0031	2.00
		29381	0.5	0.5214	0.5210	-0.0004	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	0.2436	0.2450	0.0014	0.0101	2.00	
		40	0.4905	0.4880	-0.0025	0.0115	2.00	
		60	0.7453	0.7420	-0.0033	0.0067	2.00	
		80	0.9920	0.9883	-0.0037	0.0071	2.00	
		100	1.2487	1.2475	-0.0012	0.0073	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	
Transmission T(%)	Absorbance(A)
0.0159	3.8142

\*\*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



Calibration Report Total Hydrocarbon Analyzer			
Date : 05 January 2022		Brand : HORIBA	Model : APHA-360CE
No. B01		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 05 August 2021		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )		Cylinder No. : D595075	
Certified Date : 17 March 2015	Expired Date : 17 March 2023	Cylinder Conc. : 456 ppm	
Calibrating Condition			
Pressure 1011 mmbar	Temp. 24.6 °C	% RH 48	
Start Time : 2:00 PM			
Pre-Calibration Checks			
Change Particulate Filter Yes		Station Temp : 25.0 °C	
Leak Test Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain: 0.997		Finish Time: 3:00 PM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.2	mV	800-1,350
Signal (THC)	916.1	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	258.6	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 February 2022		Brand : HORIBA	Model : APHA-360CE
No. B01		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 05 August 2021		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )		Cylinder No. : D595075	
Certified Date : 17 March 2015	Expired Date : 17 March 2023	Cylinder Conc. : 456 ppm	
Calibrating Condition			
Pressure 1011 mmbar	Temp. 24.5 °C	% RH 48	
Start Time : 10:00 AM			
Pre-Calibration Checks			
Change Particulate Filter Yes		Station Temp : 25.0 °C	
Leak Test Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.11	0
Span	10	10.05	10
Calibration Setting (Final)			
Span Instrument Gain: 0.999		Finish Time: 11:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	910.2	mV	800-1,350
Signal (THC)	915.6	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 - 25
NMC	258.9	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8



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

Calibration Report Total Hydrocarbon Analyzer			
Date :	07 March 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2021	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH <sub>4</sub> )	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	48
		Start Time :	1:00 PM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain:	0.999	Finish Time:	2:00 PM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	910.3	mV	800-1,350
Signal (THC)	915.7	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	259.8	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8



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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 Total Hydrocarbon Analyzer			
Date :	05 April 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2021	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH <sub>4</sub> )	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.6 °C
		% RH	48
		Start Time :	2:00 PM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.05	10
Calibration Setting (Final)			
Span Instrument Gain:	0.995	Finish Time:	3:00 PM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.3	mV	800-1,350
Signal (THC)	916.7	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.3	kPa	8 - 25
NMC	259.6	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 May 2022		Brand : HORIBA	Model : APHA-360CE
No. B01		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 05 August 2021		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )		Cylinder No. : D695075	
Certified Date : 17 March 2015	Expired Date : 17 March 2023	Cylinder Conc. : 456 ppm	
Calibrating Condition			
Pressure : 1011 mmbar	Temp. : 24.5 °C	% RH : 48	
Start Time : 10:00 AM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain: 0.998		Finish Time: 11:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	912.4	mV	800-1,350
Signal (THC)	917.2	mV	800-1,350
Detector	78.2	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	259.1	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 June 2022		Brand : HORIBA	Model : APHA-360CE
No. B01		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 05 August 2021		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )		Cylinder No. : D595075	
Certified Date : 17 March 2015	Expired Date : 17 March 2023	Cylinder Conc. : 456 ppm	
Calibrating Condition			
Pressure : 1011 mmbar	Temp. : 24.6 °C	% RH : 48	
Start Time : 2:00 PM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.04	10
Calibration Setting (Final)			
Span Instrument Gain: 0.995		Finish Time: 3:00 PM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.5	mV	800-1,350
Signal (THC)	916.7	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 - 25
NMC	258.9	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

## 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 :

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### Ambient Environment

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

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

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

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

2. Measuring Amplifier Brüel&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 Brüel&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.



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 20  $\mu\text{Pa}$  at 1000 Hz

Acoustic Output in dB re 20  $\mu\text{Pa}$ , Corrected to Reference Conditions: 101.325 kPa, 23.0  $^\circ\text{C}$  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 Brüel&Kjaer 4180	93.93	-0.07	$\pm 0.10$	$\pm 0.40 \text{ dB}$

### 2. Frequency

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

### 3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

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.



Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

## CALIBRATION CERTIFICATE

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

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

Calibrated at :

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-73

Serial No. : 10727909

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

7. Condenser Microphone B&amp;K 4180 S/N 2633526.

### Ambient Environment

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

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

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

**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 : 16 Aug. 2021

Date of Calibration : 18 Aug. 2021

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

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

Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0  $^\circ\text{C}$  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	93.88	-0.12	$\pm 0.10$	$\pm 0.40 \text{ dB}$

### 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	980.9	-19.1	$\pm 1.5$	$\pm 1.0\%$

### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.56	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Date of Calibration : 18 Aug. 2021

Date of Issue : 23 Aug. 2021

End of Certificate

2 / 2

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

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



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

Noise B\_005/22

### Sound Level Meter Calibration Report

#### Acoustic Calibrator Data

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

#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B05	ACO	6236	00142002	09 January 2022	94.0	94.0
ACO-B24	ACO	6236	00182005	09 January 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	



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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 : sales@spscon.com, www.spscon.com

Noise B\_064/22

### Sound Level Meter Calibration Report

#### Acoustic Calibrator Data

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

#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NL 21-B13	RION	NL-21	00932860	07 February 2022	94.1	94.0
ACO-B05	ACO	6236	00142002	07 February 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Noise B\_158/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B14	ACO	6236	00172034	20 March 2022	93.9	94.0
ACO-B24	ACO	6236	00182005	20 March 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Noise B\_205/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B05	ACO	6236	00142002	19 April 2022	93.9	94.0
ACO-B24	ACO	6236	00182005	19 April 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	





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

Noise B\_256/22

### Sound Level Meter Calibration Report

#### Acoustic Calibrator Data

Brand	RION	Number	AC 02/40
Model	NC-73	Serial No.	10727909
Calibration Range	94 dB, 1000 Hz	Last Calibration	16 August 2021
		Due Date	18 August 2022

#### 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 May 2022	93.9	94.0
ACO-B31	ACO	6236	00182013	17 May 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.88 ± 0.40 dB	



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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 B\_370/22

### 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	20 June 2022	94.0	94.0
ACO-B24	ACO	6236	00182005	20 June 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

### เอกสารที่ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES



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 :** [Redacted]  
**Approved by :** [Redacted]  
(✓) Malee Butkruea  
( ) Salthip Meangmal  
( ) Warakorn Lernagtrakul  
**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 : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
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

Buffer Solution	Manufacturer	Lot No.	Exp. date
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 ( ±mV )	Coverage factor k
	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 ( ± )	Coverage factor k
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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a 1072797





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES



Cert.No.: 21TW101  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-230V  
Serial No. : 15B100751  
ID No. : -  
Received Date : 28 April 2021  
Test Date : 30 April 2021  
Reference : 2104-0741WN-1  
Submitted by : S.P.S. Consulting Service Co.,Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd.,  
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 :

( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lemgagtrakul

Issue Date : 7 May 2021

B 0259620



Cert.No.: 21TW101  
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 14K100246

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.08	8.09	0.0071

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 1053122



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

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 :

( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

Issue Date : 25 April 2022

B 0286555



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).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

#### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
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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a 1105753



CERTIFICATE No : 21M3167  
REFERENCE No : 60627-3

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 : 19-Mar-21

APPROVED BY : 

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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

CERTIFICATE No : 21M3167

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA 09/61 RECEIVED DATE : 19-Mar-21

AIR PRESSURE : 1009mbar  $\pm$  1mbar CALIBRATION DATE : 19-Mar-21

AMBIENT TEMPERATURE : 24°C  $\pm$  1°C RELATIVE HUMIDITY : 52 %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 :-

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

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

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

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

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

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.0	0.0000	0.0000	0.000075
0.1	0.1000	0.0000	0.000075
0.2	0.2000	0.0000	0.000076
0.5	0.5000	0.0000	0.000076
1.0	1.0000	0.0000	0.000077
2.0	2.0000	0.0000	0.000077
5.0	5.0000	0.0000	0.000079
10.0	10.0000	0.0000	0.000082
20.0	20.0000	0.0000	0.000086
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	199.9997	0.0003	0.00032

## 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0001
4	100.0000
5	99.9999
OFF-CENTER LOADING	0.0001

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  
COVERAGE FACTOR  $k=2$ , PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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

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



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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	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.

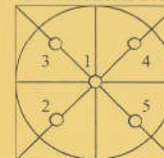
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

## 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%.





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

## CALIBRATION CERTIFICATE

Certificate No. : AD2108-008-0001

Date Issued : 16-Aug-21

**Customer** : S.P.S. CONSULTING SERVICE CO., LTD.  
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,  
Bangkok 10900

**Equipment** : Block Digestion (Gerhardt, TR)

**Manufacturer** : Gerhardt

**Model** : -

**Serial No.** : 4061832

**ID No./Tag No.** : KJ 01/43

**Date Received** : 06-Aug-21

**Date Calibrated** : 15-Aug-21

**Calibrated by** :

### Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

### Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Technical Manager, Miracle International Technology Company Limited.

Approved by :

Page 1 of 2

Certificate No. : AD2108-008-0001

**Environment** : Ambient Temperature :  $(25 \pm 2)^{\circ}\text{C}$   
Relative Humidity :  $(50 \pm 15)\%\text{RH}$

Calibration Temperature ( $^{\circ}\text{C}$ )	Setting Temperature ( $^{\circ}\text{C}$ )	Indicating Temperature ( $^{\circ}\text{C}$ )	Measured Stability <sup>1</sup> ( $^{\circ}\text{C}$ )	Measured Uniformity <sup>2</sup> ( $^{\circ}\text{C}$ )	Overall Variation <sup>3</sup> ( $^{\circ}\text{C}$ )
380	380	380	1.03	1.51	2.60

Calibration Temperature ( $^{\circ}\text{C}$ )	Standard Reading ( $^{\circ}\text{C}$ ), Probe No. 8 is Reference Probe					Uncertainty <sup>4</sup> ( $\pm^{\circ}\text{C}$ )
380	No. 1	No. 2	No. 3	No. 4	No. 5	1.9
	380.46	380.79	380.65	380.83	380.53	
	No. 6	No. 7	No. 8	No. 9	No. 10	
	380.57	379.82	380.26	379.62	380.52	
	No. 11	No. 12	No. 13	No. 14	No. 15	
	380.36	380.53	380.47	380.73	380.35	
	No. 16	No. 17	No. 18	No. 19	No. 20	
	380.23	379.61	379.71	380.50	380.77	

Without adjustment

No. 1	No. 6	No. 11	No. 16
No. 2	No. 7	No. 12	No. 17
No. 3	No. 8	No. 13	No. 18
No. 4	No. 9	No. 14	No. 19
No. 5	No. 10	No. 15	No. 20

Top view position

### **Measurement Standards Used & Traceability :**

The International System of Units (SI) through

MIT Certificate No. AD2108-085-0002 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011204, Due 02-Feb-22

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
  2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
  3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
  4. The uncertainty of measurement is included temperature stability.

End of Certificate