

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ

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1. (10%) In reading of literature for this paper, I learned that when we say "I got a bad grade" Δ (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) (154) (155) (156) (157) (158) (159) (160) (161) (162) (163) (164) (165) (166) (167) (168) (169) (170) (171) (172) (173) (174) (175) (176) (177) (178) (179) (180) (181) (182) (183) (184) (185) (186) (187) (188) (189) (190) (191) (192) (193) (194) (195) (196) (197) (198) (199) (200) (201) (202) (203) (204) (205) (206) (207) (208) (209) (210) (211) (212) (213) (214) (215) (216) (217) (218) (219) (220) (221) (222) (223) (224) (225) (226) (227) (228) (229) (230) (231) (232) (233) (234) (235) (236) (237) (238) (239) (240) (241) (242) (243) (244) (245) (246) (247) (248) (249) (250) (251) (252) (253) (254) (255) (256) (257) (258) (259) (260) (261) (262) (263) (264) (265) (266) (267) (268) (269) (270) (271) (272) (273) (274) (275) (276) (277) (278) (279) (280) (281) (282) (283) (284) (285) (286) (287) (288) (289) (290) (291) (292) (293) (294) (295) (296) (297) (298) (299) (300) (301) (302) (303) (304) (305) (306) (307) (308) (309) (310) (311) (312) (313) (314) (315) (316) (317) (318) (319) (320) (321) (322) (323) (324) (325) (326) (327) (328) (329) (330) (331) (332) (333) (334) (335) (336) (337) (338) (339) (340) (341) (342) (343) (344) (345) (346) (347) (348) (349) (350) (351) (352) (353) (354) (355) (356) (357) (358) (359) (360) (361) (362) (363) (364) (365) (366) (367) (368) (369) (370) (371) (372) (373) (374) (375) (376) (377) (378) (379) (380) (381) (382) (383) (384) (385) (386) (387) (388) (389) (390) (391) (392) (393) (394) (395) (396) (397) (398) (399) (400) (401) (402) (403) (404) (405) (406) (407) (408) (409) (410) (411) (412) (413) (414) (415) (416) (417) (418) (419) (420) (421) (422) (423) (424) (425) (426) (427) (428) (429) (430) (431) (432) (433) (434) (435) (436) (437) (438) (439) (440) (441) (442) (443) (444) (445) (446) (447) (448) (449) (450) (451) (452) (453) (454) (455) (456) (457) (458) (459) (460) (461) (462) (463) (464) (465) (466) (467) (468) (469) (470) (471) (472) (473) (474) (475) (476) (477) (478) (479) (480) (481) (482) (483) (484) (485) (486) (487) (488) (489) (490) (491) (492) (493) (494) (495) (496) (497) (498) (499) (500) (501) (502) (503) (504) (505) (506) (507) (508) (509) (510) (511) (512) (513) (514) (515) (516) (517) (518) (519) (520) (521) (522) (523) (524) (525) (526) (527) (528) (529) (530) (531) (532) (533) (534) (535) (536) (537) (538) (539) (540) (541) (542) (543) (544) (545) (546) (547) (548) (549) (550) (551) (552) (553) (554) (555) (556) (557) (558) (559) (560) (561) (562) (563) (564) (565) (566) (567) (568) (569) (570) (571) (572) (573) (574) (575) (576) (577) (578) (579) (580) (581) (582) (583) (584) (585) (586) (587) (588) (589) (590) (591) (592) (593) (594) (595) (596) (597) (598) (599) (600) (601) (602) (603) (604) (605) (606) (607) (608) (609) (610) (611) (612) (613) (614) (615) (616) (617) (618) (619) (620) (621) (622) (623) (624) (625) (626) (627) (628) (629) (630) (631) (632) (633) (634) (635) (636) (637) (638) (639) (640) (641) (642) (643) (644) (645) (646) (647) (648) (649) (650) (651) (652) (653) (654) (655) (656) (657) (658) (659) (660) (661) (662) (663) (664) (665) (666) (667) (668) (669) (670) (671) (672) (673) (674) (675) (676) (677) (678) (679) (680) (681) (682) (683) (684) (685) (686) (687) (688) (689) (690) (691) (692) (693) (694) (695) (696) (697) (698) (699) (700) (701) (702) (703) (704) (705) (706) (707) (708) (709) (710) (711) (712) (713) (714) (715) (716) (717) (718) (719) (720) (721) (722) (723) (724) (725) (726) (727) (728) (729) (730) (731) (732) (733) (734) (735) (736) (737) (738) (739) (740) (741) (742) (743) (744) (745) (746) (747) (748) (749) (750) (751) (752) (753) (754) (755) (756) (757) (758) (759) (760) (761) (762) (763) (764) (765) (766) (767) (768) (769) (770) (771) (772) (773) (774) (775) (776) (777) (778) (779) (780) (781) (782) (783) (784) (785) (786) (787) (788) (789) (790) (791) (792) (793) (794) (795) (796) (797) (798) (799) (800) (801) (802) (803) (804) (805) (806) (807) (808) (809) (810) (811) (812) (813) (814) (815) (816) (817) (818) (819) (820) (821) (822) (823) (824) (825) (826) (827) (828) (829) (830) (831) (832) (833) (83

Pilot Tube Identification Number:	BKK_FS0522	Calibration Date:	13 Jul 23
Lab test duct Number:	258-1-13-01	Standard Pilot ID:	BKK_FS0441
Calibration Sheet No.	C-130723-BKK_FS0522	Co Standard:	0.99

	Type s pilot tube Leg A,B	Standard pilot tube (ΔP , mm H ₂ O)	Type s pilot tube (ΔP , mm H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
			C_D	0.842	0.842

$$C_p(\infty) = C_p - \sqrt{\frac{\Delta P(\text{ride})}{\Delta P - (s)}}$$

$$|\bar{C}_{F(A)} - \bar{C}_{F(B)}|_{\max} \text{ME} \leq 0.01$$

$$\text{Average deviation}(A \text{ or } B) = \frac{\sum [C_F(s) - C_F(A \text{ or } B)]}{n} \text{ such that } BE \leq 0.01$$

C₂₀H₁₂O₂ Prostaglandin synthase

Nathapon Jangnam

(M. Hall-Kaplan, J. S. Langlois)

Specialist IT



Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK_FS0523 Calibration Date: 13 Jun 23
Lab test duct Number: 256-1-13-01 Standard Pitot ID: BKK_FS0441
Calibration Sheet No.: C-130723-BKK_FS0523 Cp Standard: 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm H ₂ O)	Type s pitot tube (ΔP , mm H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

$$Cp(s) = C_p = \sqrt{\frac{\Delta P(s)}{\Delta P(u)}}$$

$$|C_p(s) - C_p(B)|_{max} \leq 0.01$$

$$\text{Average deviation } A \text{ or } B = \frac{\sum |C_p(s) - C_p(A \text{ or } B)|}{n} \text{ must } BE \leq 0.01$$

Calibrated by: Saksit Phairatphong
(Mr. Sakit Phairatphong)
Field Scientist (A)

Approved by: Natthapol Jengwansong
(Mr. Natthapol Jengwansong)
Specialist (1)

FORM NO. F-84-017 REVISION NO. 2 ISSUE DATE 8 Feb 21



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date: 13 Jun 23 Ambient Temperature (°C): 25
Calibration Sheet No.: C-130723-BKK_FS0518 Relative Humidity (%): 80
Digital Temperature ID: BKK_FS0518 Reference Temperature ID: BKK_FS1144
Serial No.: 1504025 Serial No.: 20180000013
Model: XC-572-V Model: Digipen-CC-VTMS
New Calibrate: 18 Aug 24

Location	Reference Temperature (°C)	Digital Temperature (°C)	Error (°C)	MPE	Pass / Fail
Stick	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
Probe	250	250	0	±3	Pass
	300	300	0	±3	Pass
	400	400	0	±3	Pass
	500	500	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Oven	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Filter	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Exit	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Meter	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
AUX	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass

MPE: (Maximum permissible error of measurement) 4mm (maximum measurement error)

Calibrated by: Saksit Phairatphong
Mr. Sakit Phairatphong
Field Scientist (A)

Approved by: Natthapol Jengwansong
Mr. Natthapol Jengwansong
Specialist (1)

FORM NO. F-84-017 REVISION NO. 2 ISSUE DATE 8 Feb 21



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date: 13 Jun 23 Nozzle Set ID: BKK_FS0524
Calibration Sheet No.: C-130723-BKK_FS0524 Vermet Caliper ID: BKK_FS1123

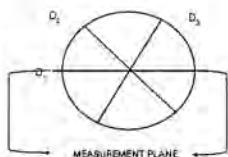
Nozzle ID #	Nozzle Diameter (mm)			16 - 10 ΔD	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃		
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.632	0.635	0.634	0.003	0.634
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.091	1.110	1.092	0.019	1.098
7	1.256	1.262	1.262	0.006	1.260
8	1.601	1.598	1.600	0.003	1.600

Where:

D₁, D₂, D₃ = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

D_{avg} = (D₁ + D₂ + D₃) / 3



Calibrated by: Saksit Phairatphong
(Mr. Sakit Phairatphong)
Field Scientist (A)

Approved by: Natthapol Jengwansong
(Mr. Natthapol Jengwansong)
Field Specialist (1)

FORM NO. F-84-017 REVISION NO. 2 ISSUE DATE 8 Feb 21



Calibration Certificate

Certificate No: G 660016
Date of issue: 23-Jan-23

Instrument description: Gas Analyzer
Instrument model: Testo 350 New
Instrument serial no.: 02985045
ID no. or control no.: RYG_FS0564
Manufacturer: Testo SE & Co. KGaA
Probe description: -
Probe model: -
Probe serial: -
Customer name: ALS LABORATORY GROUP (THAILAND) CO., LTD.
Customer address: 104 Phutthamonthon 40, Phutthamonthon Road, Khwaeng Phutthamonthon, Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate: 3 Pages
Receiving no.: 1-230152
Receiving date: 19 Jun 23
Parameter of calibration: Gas Calibration (Oxygen: 2.498, 10.04, 21.02, 30.00, 40.00, 50.00, 60.00, 70.00, 80.00, 90.00, 100.00, 110.00, 120.00, 130.00, 140.00, 150.00, 160.00, 170.00, 180.00, 190.00, 200.00, 210.00, 220.00, 230.00, 240.00, 250.00, 260.00, 270.00, 280.00, 290.00, 300.00, 310.00, 320.00, 330.00, 340.00, 350.00, 360.00, 370.00, 380.00, 390.00, 400.00, 410.00, 420.00, 430.00, 440.00, 450.00, 460.00, 470.00, 480.00, 490.00, 500.00, 510.00, 520.00, 530.00, 540.00, 550.00, 560.00, 570.00, 580.00, 590.00, 600.00, 610.00, 620.00, 630.00, 640.00, 650.00, 660.00, 670.00, 680.00, 690.00, 700.00, 710.00, 720.00, 730.00, 740.00, 750.00, 760.00, 770.00, 780.00, 790.00, 800.00, 810.00, 820.00, 830.00, 840.00, 850.00, 860.00, 870.00, 880.00, 890.00, 900.00, 910.00, 920.00, 930.00, 940.00, 950.00, 960.00, 970.00, 980.00, 990.00, 1000.00, 1010.00, 1020.00, 1030.00, 1040.00, 1050.00, 1060.00, 1070.00, 1080.00, 1090.00, 1100.00, 1110.00, 1120.00, 1130.00, 1140.00, 1150.00, 1160.00, 1170.00, 1180.00, 1190.00, 1200.00, 1210.00, 1220.00, 1230.00, 1240.00, 1250.00, 1260.00, 1270.00, 1280.00, 1290.00, 1300.00, 1310.00, 1320.00, 1330.00, 1340.00, 1350.00, 1360.00, 1370.00, 1380.00, 1390.00, 1400.00, 1410.00, 1420.00, 1430.00, 1440.00, 1450.00, 1460.00, 1470.00, 1480.00, 1490.00, 1500.00, 1510.00, 1520.00, 1530.00, 1540.00, 1550.00, 1560.00, 1570.00, 1580.00, 1590.00, 1600.00, 1610.00, 1620.00, 1630.00, 1640.00, 1650.00, 1660.00, 1670.00, 1680.00, 1690.00, 1700.00, 1710.00, 1720.00, 1730.00, 1740.00, 1750.00, 1760.00, 1770.00, 1780.00, 1790.00, 1800.00, 1810.00, 1820.00, 1830.00, 1840.00, 1850.00, 1860.00, 1870.00, 1880.00, 1890.00, 1900.00, 1910.00, 1920.00, 1930.00, 1940.00, 1950.00, 1960.00, 1970.00, 1980.00, 1990.00, 2000.00, 2010.00, 2020.00, 2030.00, 2040.00, 2050.00, 2060.00, 2070.00, 2080.00, 2090.00, 2100.00, 2110.00, 2120.00, 2130.00, 2140.00, 2150.00, 2160.00, 2170.00, 2180.00, 2190.00, 2200.00, 2210.00, 2220.00, 2230.00, 2240.00, 2250.00, 2260.00, 2270.00, 2280.00, 2290.00, 2300.00, 2310.00, 2320.00, 2330.00, 2340.00, 2350.00, 2360.00, 2370.00, 2380.00, 2390.00, 2400.00, 2410.00, 2420.00, 2430.00, 2440.00, 2450.00, 2460.00, 2470.00, 2480.00, 2490.00, 2500.00, 2510.00, 2520.00, 2530.00, 2540.00, 2550.00, 2560.00, 2570.00, 2580.00, 2590.00, 2600.00, 2610.00, 2620.00, 2630.00, 2640.00, 2650.00, 2660.00, 2670.00, 2680.00, 2690.00, 2700.00, 2710.00, 2720.00, 2730.00, 2740.00, 2750.00, 2760.00, 2770.00, 2780.00, 2790.00, 2800.00, 2810.00, 2820.00, 2830.00, 2840.00, 2850.00, 2860.00, 2870.00, 2880.00, 2890.00, 2900.00, 2910.00, 2920.00, 2930.00, 2940.00, 2950.00, 2960.00, 2970.00, 2980.00, 2990.00, 3000.00, 3010.00, 3020.00, 3030.00, 3040.00, 3050.00, 3060.00, 3070.00, 3080.00, 3090.00, 3100.00, 3110.00, 3120.00, 3130.00, 3140.00, 3150.00, 3160.00, 3170.00, 3180.00, 3190.00, 3200.00, 3210.00, 3220.00, 3230.00, 3240.00, 3250.00, 3260.00, 3270.00, 3280.00, 3290.00, 3300.00, 3310.00, 3320.00, 3330.00, 3340.00, 3350.00, 3360.00, 3370.00, 3380.00, 3390.00, 3400.00, 3410.00, 3420.00, 3430.00, 3440.00, 3450.00, 3460.00, 3470.00, 3480.00, 3490.00, 3500.00, 3510.00, 3520.00, 3530.00, 3540.00, 3550.00, 3560.00, 3570.00, 3580.00, 3590.00, 3600.00, 3610.00, 3620.00, 3630.00, 3640.00, 3650.00, 3660.00, 3670.00, 3680.00, 3690.00, 3700.00, 3710.00, 3720.00, 3730.00, 3740.00, 3750.00, 3760.00, 3770.00, 3780.00, 3790.00, 3800.00, 3810.00, 3820.00, 3830.00, 3840.00, 3850.00, 3860.00, 3870.00, 3880.00, 3890.00, 3900.00, 3910.00, 3920.00, 3930.00, 3940.00, 3950.00, 3960.00, 3970.00, 3980.00, 3990.00, 4000.00, 4010.00, 4020.00, 4030.00, 4040.00, 4050.00, 4060.00, 4070.00, 4080.00, 4090.00, 4100.00, 4110.00, 4120.00, 4130.00, 4140.00, 4150.00, 4160.00, 4170.00, 4180.00, 4190.00, 4200.00, 4210.00, 4220.00, 4230.00, 4240.00, 4250.00, 4260.00, 4270.00, 4280.00, 4290.00, 4300.00, 4310.00, 4320.00, 4330.00, 4340.00, 4350.00, 4360.00, 4370.00, 4380.00, 4390.00, 4400.00, 4410.00, 4420.00, 4430.00, 4440.00, 4450.00, 4460.00, 4470.00, 4480.00, 4490.00, 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Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.49% Vol	4719/21	Unide	30-Sep-25
Oxygen (O ₂) 10.94% Vol	CG-0153-21	Nmt	18-Nov-26
Oxygen (O ₂) 21.02% Vol	CG-0041-22	Nmt	10-Feb-27
Carbon monoxide (CO) 100.14 ppm	CG-0045-22	Nmt	14-Feb-27
Carbon monoxide (CO) 389.4 ppm	2583/21	Unide	23-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Unide	09-Aug-24
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Unide	22-Aug-24
Nitrogen Dioxide (NO ₂) 60.96 ppm	2641/22	Unide	26-Jun-24
Nitrogen Dioxide (NO ₂) 292.2 ppm	4739/21	Unide	20-Jun-23
Hydrogen Chloride (HCl) 30.46 ppm	CG-0289-21	Nmt	03-Jun-24
Hydrogen Chloride (HCl) 153.9 ppm	2867/21	Unide	21-Jun-23
Hydrogen Chloride (HCl) 320.6 ppm	2944/21	Unide	03-Jun-23
Sulphur Dioxide (SO ₂) 59.94 ppm	3205/21	Unide	25-Jul-23
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Unide	09-Nov-24
Sulphur Dioxide (SO ₂) 340.1 ppm	3204/21	Unide	20-Jul-23

Measured room conditions

Temperature: 22.6 °C Humidity: 58.5 %RH Pressure: 1012.5 mbar

Calibration conditions

Gas Temperature: 23 °C Flow rate: 1.200 ml/min Gas pressure: 1011.4 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.49%	2.45	-0.04%	0.20
O ₂ (%Vol)	10.94	9.89	-0.13	0.40
O ₂ (%Vol)	21.02	21.18	0.16	0.50
CO (ppm)	100.14	87	-1.36	3.6
CO (ppm)	389.9	313	-76.9	6.0
CO (ppm)	1003	1014	11	12
NO ₂ (ppm)	30.34	21.8	-8.44	8.0
NO ₂ (ppm)	60.96	55.3	-5.66	8.9
NO ₂ (ppm)	292.2	354.8	62.6	12
NO (ppm)	30.46	27	-3.06	8.0
NO (ppm)	150.9	145	-5.9	9.0
NO (ppm)	320.6	304	-16.6	12
SO ₂ (ppm)	59.94	50	-9.94	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	340.1	308	-32.1	13

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.49%	2.45	-0.04%	0.20
O ₂ (%Vol)	10.94	9.89	-0.13	0.40
O ₂ (%Vol)	21.02	21.18	0.16	0.50
CO (ppm)	100.14	87	-1.36	3.6
CO (ppm)	389.9	313	-76.9	6.0
CO (ppm)	1003	1014	11	12
NO ₂ (ppm)	30.34	21.7	-8.66	8.0
NO ₂ (ppm)	60.96	62.7	1.74	8.0
NO ₂ (ppm)	292.2	305.6	13.4	12
NO (ppm)	30.46	32	1.54	8.0
NO (ppm)	150.9	153	2.1	9.0
NO (ppm)	320.6	322	1.4	12
SO ₂ (ppm)	59.94	50	-9.94	6.0
SO ₂ (ppm)	100.8	107	6.2	6.0
SO ₂ (ppm)	340.1	308	-32.1	13

Remark: 1: 1 standard = 1 ppm; 1 ppm/mole = 1 ppm

End of Report

MULTI-POINT CALIBRATION REPORT

CUSTOMER NAME: ALS Laboratory Group (Thailand) Co. Ltd.

EQUIPMENT NAME: CO Analyzer

MANUFACTURER: Talsmate - API

MODEL: T300

SERIAL NO: 1215

STANDARD GAS CONCENTRATION (PPM): #512

CYLINDER NO: CG745188

CYLINDER PRESSURE (PSI): 1650

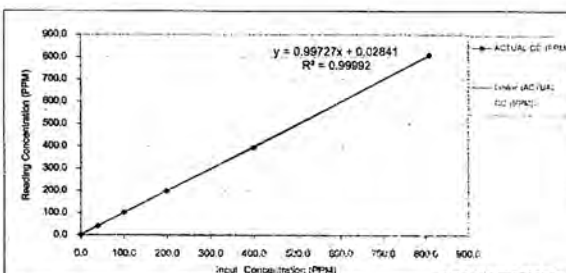
CERTIFIED DATE: Mar 10 2021

CERTIFIED BY: AIRGAS SPECIALTY GASES

EXPIRED DATE: Mar 10 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL (PPM)	ERROR (PPM)	% ERROR CO
ZERO	0.000	0.000	0.000	0.00%
1	100.000	100.000	0.000	0.00%
2	200.000	200.000	0.000	0.00%
3	300.000	300.000	0.000	0.00%
4	400.000	400.000	0.000	0.00%
5	500.000	500.000	0.000	0.00%
AVERAGE (%)				0.00%



CALIBRATED BY: [Signature]

DATE: 10/03/2026

สำหรับการตรวจสอบค่าความเข้มข้น: [Signature]

การสอบเทียบนี้จัดทำขึ้นเพื่อใช้ในการตรวจสอบค่าความเข้มข้นของก๊าซคาร์บอนมอนอกไซด์ (CO) ในตัวอย่างก๊าซที่ส่งมาทดสอบ โดยผลการสอบเทียบจะขึ้นอยู่กับความถูกต้องของวิธีการสอบเทียบและเครื่องมือที่ใช้ในการสอบเทียบ

KINETICS

บริษัท คิเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD

รายงานผลการสอบเทียบระบบแก๊สวิเคราะห์คาร์บอนมอนอกไซด์

ลูกค้า: บริษัท ALS Laboratory Group (Thailand) Co. Ltd

วันที่: 21 ธันวาคม 2565

รายชื่ออุปกรณ์ / เครื่องมือ: CO Analyzer

บริษัทผู้ผลิต: Talsmate API

หมายเลขอุปกรณ์ / เครื่องมือ: T300

หมายเลขอุปกรณ์ / เครื่องมือ: 1215

TEST VALUES

	API MODEL T300	BEFORE	AFTER
1. RANGE	0 - 1000 PPM	0 - 1000	0 - 1000
2. STABILITY	< 1 PPM	0.00%	0.00%
3. COEFFICIENT	0.99999	0.99999	0.99999
4. ZERO REFERENCE	0.000 PPM	0.000	0.000
5. OFFSET	0.000	0.000	0.000
6. PRECISION	0.000 PPM	0.000	0.000
7. SAMPLE FLOW	0.000 L/min	0.000	0.000
8. FLOW RATE	0.000 L/min	0.000	0.000
9. BENCH TEMP	25.0 °C	25.0	25.0
10. BENCH TEMP	25.0 °C	25.0	25.0
11. BENCH TEMP	25.0 °C	25.0	25.0
12. BENCH TEMP	25.0 °C	25.0	25.0
13. BENCH TEMP	25.0 °C	25.0	25.0
14. BENCH TEMP	25.0 °C	25.0	25.0
15. BENCH TEMP	25.0 °C	25.0	25.0
16. BENCH TEMP	25.0 °C	25.0	25.0
17. BENCH TEMP	25.0 °C	25.0	25.0
18. BENCH TEMP	25.0 °C	25.0	25.0
19. BENCH TEMP	25.0 °C	25.0	25.0
20. BENCH TEMP	25.0 °C	25.0	25.0
21. BENCH TEMP	25.0 °C	25.0	25.0
22. BENCH TEMP	25.0 °C	25.0	25.0
23. BENCH TEMP	25.0 °C	25.0	25.0
24. BENCH TEMP	25.0 °C	25.0	25.0
25. BENCH TEMP	25.0 °C	25.0	25.0
26. BENCH TEMP	25.0 °C	25.0	25.0
27. BENCH TEMP	25.0 °C	25.0	25.0
28. BENCH TEMP	25.0 °C	25.0	25.0
29. BENCH TEMP	25.0 °C	25.0	25.0
30. BENCH TEMP	25.0 °C	25.0	25.0

หมายเหตุ:

1. การสอบเทียบนี้จัดทำขึ้นเพื่อใช้ในการตรวจสอบค่าความเข้มข้นของก๊าซคาร์บอนมอนอกไซด์ (CO) ในตัวอย่างก๊าซที่ส่งมาทดสอบ โดยผลการสอบเทียบจะขึ้นอยู่กับความถูกต้องของวิธีการสอบเทียบและเครื่องมือที่ใช้ในการสอบเทียบ

KINETICS

บริษัท คิเนติกส์ คอร์ปอเรชั่น จำกัด

[Signature]

[Signature]

การสอบเทียบนี้จัดทำขึ้นเพื่อใช้ในการตรวจสอบค่าความเข้มข้นของก๊าซคาร์บอนมอนอกไซด์ (CO) ในตัวอย่างก๊าซที่ส่งมาทดสอบ โดยผลการสอบเทียบจะขึ้นอยู่กับความถูกต้องของวิธีการสอบเทียบและเครื่องมือที่ใช้ในการสอบเทียบ

การสอบเทียบนี้จัดทำขึ้นเพื่อใช้ในการตรวจสอบค่าความเข้มข้นของก๊าซคาร์บอนมอนอกไซด์ (CO) ในตัวอย่างก๊าซที่ส่งมาทดสอบ โดยผลการสอบเทียบจะขึ้นอยู่กับความถูกต้องของวิธีการสอบเทียบและเครื่องมือที่ใช้ในการสอบเทียบ



CALIBRATION LABORATORY CO., LTD.

210/11-14 55 Soi Praset Manu 20 Vong 4, Praset Manu Rd., Ladkrabang, Bangkok 10520
Tel: 02-578-0232-4 Fax: 02-578-0232-5 Email: info@clc-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DY087(BKK_F50481)
CLID. NO. : 212300279
JOB CONTROL NO. : 230211016391

CUSTOMER : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN RD.,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG, BANGKOK 10250, THAILAND

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 16 February 2023

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

Calibrated By : Sitipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotakomtom
Authorized Signatory
16 February 2023

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

Certificate No. Q23016391

F3-011-0401-12

Page 1 of 3



CALIBRATION LABORATORY CO., LTD.

210/11-14 55 Soi Praset Manu 20 Vong 4, Praset Manu Rd., Ladkrabang, Bangkok 10520
Tel: 02-578-0232-4 Fax: 02-578-0232-5 Email: info@clc-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DY087(BKK_F50481)
DATE OF CALIBRATION : 14 February 2023

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(58 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines.
The calibration was performed by direct measurement with Document Process-Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process-Calibrator, Fluke Model 744 5/20 8256007 with Pressure Module Model 700PV4 5/20 1929500

TRACEABILITY :

The measurements are traceable to International System of Units (SI) through National Institute of Metrology (Thailand).
Certificate No. MI-0195-22, Due Date 18 November 2023.

UNCERTAINTY :

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

Certificate No. Q23016391

F3-011-0401-12

Page 2 of 3



CALIBRATION LABORATORY CO., LTD.

210/11-14 55 Soi Praset Manu 20 Vong 4, Praset Manu Rd., Ladkrabang, Bangkok 10520
Tel: 02-578-0232-4 Fax: 02-578-0232-5 Email: info@clc-lab.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 3 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the mean value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (mHg)	STD Reading (mHg)		Correction (mHg)	
	Up	Down	Up	Down
0.00	0.000	0.000	0.000	0.000
-10.00	-9.973	-9.976	-0.027	-0.024
-50.00	-49.961	-49.963	-0.039	-0.037
-100.00	-99.957	-99.959	-0.043	-0.041
-25.00	-24.954	-24.956	-0.046	-0.044
-75.00	-74.951	-74.953	-0.049	-0.047

Uncertainty of measurement = 0.007 mHg.

Transmitting fluid : Air

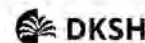
Note: The Scope of Accredited ANAB Certificate No. ACDM-2014 Version 009 Page 36 of 54

This report is valid for the above stated instruments only.

Certificate No. Q23016391

F3-011-0401-12

Page 3 of 3



Certificate of Calibration

Equipment : SPECTROPHOTOMETER
Model : DR8000
Serial No. (or ID.) : 1627845 (RYG_EN0037)
Manufacturer : HACH
Condition : In Condition

Certificate No. : C06220454
Issued Date : 27 September 2022
Job No. : KSPR2212224
Page : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY : N. Bangs
APPROVED BY : R. P.
NOMOCAL DATE : 97/3/14

Environment Condition : Temperature : $23.1 ^\circ\text{C}$
Humidity : $65.4 \% \text{RH}$

Calibration Place : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wet Chemistry)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By : Mr. Chatsaphon Fothong
Calibration Date : 27 September 2022
The Method used : In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability : This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 91415 and 91435
The standard for Photometric Certificate No. 91441 and 101088
The standard for Stray Light Certificate No. 101041 and 101046
The standard for Spectral resolution Certificate No. 101037

(Mr. Chatsaphon Fothong)
Person in charge

(Mr. Thalempol Pongnirun)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to International System of Units (SI) or other recognized national standard laboratories.
The measurement uncertainty stated in the reported uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) is provided a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited
2201 Warehouse Road, Bangkok, Thailand, 10260
Phone: +66 2829 7500 Email: info@dksh.com Website: www.dksh.com/indonesia-branch
Delivering Growth - In Asia And Beyond

CAL-M-006-15 20 JUL 2022

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of slit at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
419.81	418.4	0.21	0.14	
536.66	536.7	-0.04	0.14	
637.58	636.3	-0.32	0.14	
748.48	748.8	-0.32	0.14	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5805	0.583	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.057	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.653	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.6683	0.672	-0.0027	0.0045
	0.9604	0.964	-0.0036	0.0045
548.1 nm	0.0000	0.000	0.0000	0.0045
	0.5166	0.519	-0.0022	0.0045
	0.8903	0.891	-0.0007	0.0045
	0.9804	0.992	-0.0116	0.0046
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0016	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5387	0.538	-0.0013	0.0045
	0.6847	0.685	-0.0003	0.0046
	0.8823	0.983	-0.0007	0.0045

DKSH Technology Limited
2525 Sukhumvit Road, Bangkok, Thailand 10110
Phone: +66 2624 1000 Email: info@dksh.com

Delivering Growth - In Asia and Beyond

CAL-TH-006-13: 20 Jul 2022

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
257 nm	0.0000	0.000	0.0000	0.0080
	0.8609	0.861	-0.0001	0.0084
313 nm	0.0000	0.000	0.0000	0.0080
	0.2885	0.292	-0.0025	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6361	0.636	0.0001	0.0080
Slit light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (5T)	Absorbance (A)	
260.67 +/- 0.11 nm	260.7	2.1	1.878	
301.04 +/- 0.11 nm	301.8	1.7	1.770	
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.50	266.83	1.38	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4510	0.3178		
Absorbance (A)	0.373	0.288		

* Calibration Marked * Not TSI Accredited * In this Certificate have been included for completeness.

The End of Certificate

DKSH Technology Limited
2525 Sukhumvit Road, Bangkok, Thailand 10110
Phone: +66 2624 1000 Email: info@dksh.com

Delivering Growth - In Asia and Beyond

CAL-TH-006-13: 20 Jul 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212224

ชนิดเครื่อง: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627945

ตรวจสอบ (วัน)	รายการตรวจเช็ค		ตรวจสอบ (วัน)	หมายเหตุ	
27 Sep 2022			27 Sep 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-ภายนอก)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ On - Off (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.6 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	856.1 to 856.1 nm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องใส่ตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. วัสดุโถง (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิด/ป้องกัน Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้ง/โต๊ะ (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ความสูง/น้ำ (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ความละเอียดการวัด (>= 2.5 ไมล์ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Sampler					
<input type="checkbox"/>	<input type="checkbox"/>	18. การวัด Piston Burette	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบการควบคุมอุณหภูมิห้อง	<input type="checkbox"/>	<input type="checkbox"/>	

เห็นผลตรวจสอบ:

Mr. Chaturaphon Fongkang
Service Engineer

DKSH Technology Limited
2525 Sukhumvit Road, Bangkok, Thailand 10110
Phone: +66 2624 1000 Email: info@dksh.com

Delivering Growth - In Asia and Beyond

CAL-TH-031-09: 20 Jul 2022

RYG_EN0003

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huayfong, Bangkok 10310
Tel: +66 (0)2 6331 8 Email: service.thailand@sartorius.com



SARTORIUS

Certificate of Calibration

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 01/05/24

Model Number: MSE2245-100-DU	Certificate No.: 239C0115
Description: Analytical Balance	Issued Date: Friday, March 03, 2023
Serial Number: 0031709552	Reference No.: 204633
ID No.: RYG_EN0003	Page No.: 1 of 2
Manufacturer: Sartorius	
Customer Name: ALS Laboratory Group (Thailand) Co. Ltd. (Rayong Branch)	
616/10 Moo 5 T. Maenam Khru, A. Phrak Daeng, Rayong 21140, Thailand	
Calibrated Place: ALS Laboratory Group (Thailand) Co. Ltd. (Balance Room)	
616/10 Moo 5 T. Maenam Khru, A. Phrak Daeng, Rayong 21140, Thailand	
Calibrated By: Mr. Chonchai Inthana	Calibration Procedure No. This calibration was conducted by Using in-house calibration procedure number (WI-003)
Calibration Date: Wednesday, March 01, 2023	Based on UKAS LAB 14: 2016
Metrological data:	Ambient Conditions
Capacity: 220 g Readability: 0.0001 g	Temperature: 23.0 °C ± 5.0 °C
	Humidity: 56.0 % RH ± 10.0 % RH
	Pressure: ±
Reasons for calibration:	Equipment Condition: <input checked="" type="checkbox"/> Good <input type="checkbox"/> Damaged <input type="checkbox"/> Fair
<input type="checkbox"/> New Installation <input type="checkbox"/> Service / Repair <input checked="" type="checkbox"/> Recalibration / Maintenance	

Measurement Method: UKAS Publication Ref: Lab 14
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International System of Units (SI). Report of Tolerance (see form) is of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-03	Sartorius weight set 1mg - 5000g E2 YC5011-522-06	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Sartorius-Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate refers and apply the equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division
Sartorius (Thailand) Co., Ltd.

[Signature]
Mr. Chonchai Inthana (Technical Manager)

SOP FM 33: 03 February 2022



Certificate of Calibration

Model Number: MSE224S-100-02U
Description: Analytical Balance
Serial Number: 0031709552
ID No: RYG_EN0003
Manufacturer: Sartorius

Certificate No.: 23BCI0115
Issued Date: Friday, March 03, 2023
Reference No.: 204633
Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability

The repeatability is the ability of a weighing instrument to display nearly identical readings under constant conditions when the same load is weighed repeatedly in the same manner. The standard deviation is used to measure reproducibility quantitatively.

Nominal Value (Low Load)	20 g	200 g
Tolerance	0.0001 g	0.0005 g
Standard Deviation	0.000004	0.000005

Eccentricity (Off-center) loading error

The off-center loading error is caused by the difference between the measured and actual mass. It is caused by the difference between the measured and actual mass. It is caused by the difference between the measured and actual mass.

Nominal value	100 g	200 g
Tolerance	0.0004 g	0.0009 g
Difference	0.0000	0.0000

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the slope steps.

Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00003
0.05	0.0500	0.0500	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00014
100	100.0000	100.0000	0.0000	0.00014
200	200.0000	200.0000	0.0000	0.00014

End of Report

SOP FM 33-03 February 2022

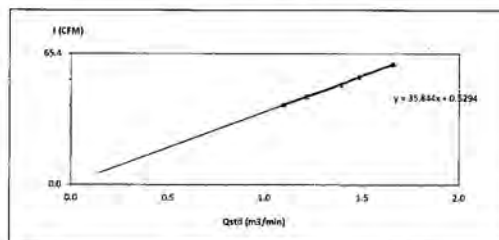


High Volume Air Sampler Calibration Worksheet

Project Site: Sam Polyethylene Co., Ltd.
Calibrate Location: Tachakulchai Road, Sam Polyethylene Co., Ltd.
Calibrate Date: 14-Sep-23
Calibration Sheet No.: C-149923-RYG-FS0291
Calibrator ID: RYG-FS0206
Calibrator Model: TE-5028A
Calibrator S/N: 1543

Barometric Pressure (mm Hg): 756
Temperature (°C): 30
High Volume ID: RYG-FS0291
High Volume Model: TE-5170D
High Volume S/N: 5113
Calibrator Slope: 1.47433
Calibrator Intercept: -0.01503

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I Chart (CFM)	Linear Regression
1	2.6	1.0968	40	Slope: 35.9440
2	3.2	1.2151	44	Intercept: 0.5294
3	4.2	1.3899	50	Correlation Coefficient: 0.9995
4	4.8	1.4948	54	
5	6.0	1.6583	60	



Calibrated by: Sitpavit S
(Mr. Sitpavit Suwananant)
Field Scientist(I)

Approved by: [Signature]
(Mr. Noppang Jantarapao)
Senior Field Coordinator Scientist (3)

FORM NO.: F-66-073 REVISION NO.: ISSUE DATE: 14/03/16

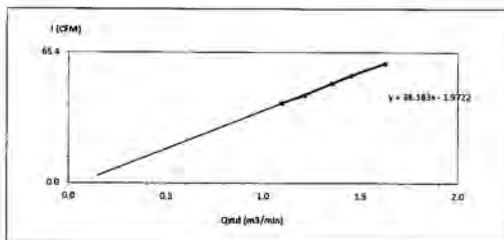


High Volume Air Sampler Calibration Worksheet

Project Site: Sam Polyethylene Co., Ltd.
Calibrate Location: Tachakulchai Road, Sam Polyethylene Co., Ltd.
Calibrate Date: 14-Sep-23
Calibration Sheet No.: C-149923-RYG-FS0664
Calibrator ID: RYG-FS0206
Calibrator Model: TE-5028A
Calibrator S/N: 1543

Barometric Pressure (mm Hg): 756
Temperature (°C): 30
High Volume ID: RYG-FS0664
High Volume Model: TE-5009X
High Volume S/N: 6261
Calibrator Slope: 1.87433
Calibrator Intercept: -0.01503

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I Chart (CFM)	Linear Regression
1	2.6	1.0968	40	Slope: 36.1028
2	3.2	1.2151	44	Intercept: -1.9722
3	4.2	1.3899	50	Correlation Coefficient: 0.9996
4	4.8	1.4948	54	
5	6.0	1.6583	60	



Calibrated by: Sitpavit S
(Mr. Sitpavit Suwananant)
Field Scientist(I)

Approved by: [Signature]
(Mr. Noppang Jantarapao)
Senior Field Coordinator Scientist (3)

FORM NO.: F-66-073 REVISION NO.: ISSUE DATE: 14/03/16

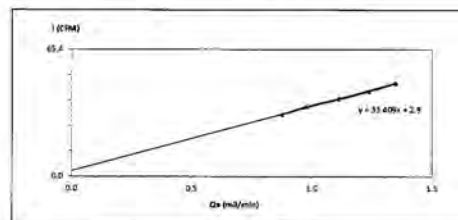


High Volume Air Sampler Calibration Worksheet

Project Site: Sam Polyethylene Co., Ltd.
Calibrate Location: Tachakulchai Road, Sam Polyethylene Co., Ltd.
Calibrate Date: 14-Sep-23
Calibration Sheet No.: C-149923-RYG-FS0665
Calibrator ID: RYG-FS0206
Calibrator Model: TE-5028A
Calibrator S/N: 1543

Barometric Pressure (mm Hg): 756
Temperature (°C): 30
High Volume ID: RYG-FS0665
High Volume Model: TE-5009X
High Volume S/N: 6264
Calibrator Slope: 0.92245
Calibrator Intercept: -0.0695

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I Chart (CFM)	Linear Regression
1	3.6	0.877	32	Slope: 33.4889
2	2.0	0.979	36	Intercept: 2.9000
3	2.6	1.111	39	Correlation Coefficient: 0.9972
4	3.2	1.236	44	
5	3.8	1.346	48	



Calibrated by: Sitpavit S
(Mr. Sitpavit Suwananant)
Field Scientist(I)

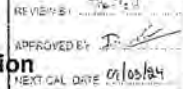
Approved by: [Signature]
(Mr. Noppang Jantarapao)
Senior Field Coordinator Scientist (3)

FORM NO.: F-66-074 REVISION NO.: ISSUE DATE: 14/03/16

Sartorius (Thailand) Co., Ltd.
126 Rama 9 Road, Huaywang, Huaywang, Bangkok 10110
Tel: +66 2643 8361-8, e-mail: service.thailand@sartorius.com



SARTORIUS



Certificate of Calibration

Model Number: LA1305-F
Description: Analytical Balance
Serial Number: 25408664
ID No.: RYG_EN0001
Manufacturer: Sartorius
Certificate No.: 23BC0110
Issued Date: Friday, March 03, 2023
Reference No.: 204933
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co. Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu. A. Phuk Daeng, Rayong 21140, Thailand

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T. Maenam Khu. A. Phuk Daeng, Rayong 21140, Thailand

Calibrated By: Mr. Chonchai Inthana
Calibration Date: Wednesday, March 01, 2023
Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number (WH-003) Based on UKAS LAB 14: 2019

Metrological data:
Capacity: 150 g Readability: 0.0001 g
Ambient Conditions:
Temperature: 24.2 °C ± 5.0 °C
Humidity: 60.0 % RH ± 10.0 % RH
Pressure: ±
Equipment Condition: ☒ New Installation ☐ Service / Repair ☐ Recalibration / Maintenance ☐ Gross Damage ☐ Failure

Measurement Method: UKAS Publication Ref: Lab 14
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International System of Units (SI). Report of Tolerance came from ISI of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 500g E2 YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-3825D	Humidity/Balometer/Temp. Lutor MHB-3825D	DKSH	C19220444	5-Sep-2023

This certificate valid and apply this equipment only.
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Mr. Chonchai Inthana

Mr. Chonchai Inthana / Technical Manager



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.
126 Rama 9 Road, Huaywang, Huaywang, Bangkok 10110
Tel: +66 2643 8361-8, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number: LA1305-F
Description: Analytical Balance
Serial Number: 25408664
ID No.: RYG_EN0001
Manufacturer: Sartorius
Certificate No.: 23BC0110
Issued Date: Friday, March 03, 2023
Reference No.: 204933
Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The repeatability is the ability of a weighing instrument to deliver nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability uncertainty.	The eccentric loading error is yielded by the difference between the reading of the load (e.g. 10 g) of maximum capacity, stored in the middle of the weighing pan and between each of four additional measurement points (positions) defined according to OIML R111.
Nominal Value (Low Load): 10 g Tolerance: 0.0001 g Standard Deviation: 0.000001 g	Nominal value: 50 g Tolerance: 0.0004 g Difference: 1, 2, 3, 4, 5, 6
Nominal Value (High Load): 100 g Tolerance: 0.0001 g Standard Deviation: 0.000001 g	

Linearity
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00002
0.05	0.0500	0.0500	0.0000	0.00002
0.1	0.1000	0.1000	0.0000	0.00002
0.5	0.5000	0.5000	0.0000	0.00002
1	1.0000	1.0000	0.0000	0.00002
2	2.0000	2.0000	0.0000	0.00002
5	5.0000	5.0000	0.0000	0.00002
10	10.0000	10.0000	0.0000	0.00002
20	20.0000	20.0000	0.0000	0.00002
100	100.0000	100.0000	0.0000	0.00002

End of Report

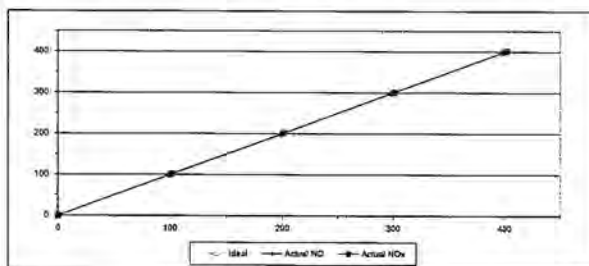
SOP FM 33 03 February 2022



MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23	Equipment Name: NOx Analyzer
Manufacturer: Teledyne API	Model: T200
Serial No.: 7238	Equipment ID: RYG_FS0533
Calibrator Manufacturer: Teledyne API	Model: 700
Serial No.: 947	
Std. Gas Concentration (PPM): 55.68	Cylinder No.: GN0027222
Cylinder Pressure (psi): 1800	Certified By: Algas Inc.
Certified Date: 9-Feb-22	Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.10	1.10	1.10
2	200.00	199.70	-1.30	-0.65	201.20	1.20	0.60
3	300.00	298.80	-1.20	-0.40	301.10	1.10	0.37
4	400.00	398.00	-2.00	-0.50	402.00	2.00	0.50
AVERAGE (%)				-0.39			0.53



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrant)
Assistant General Manager

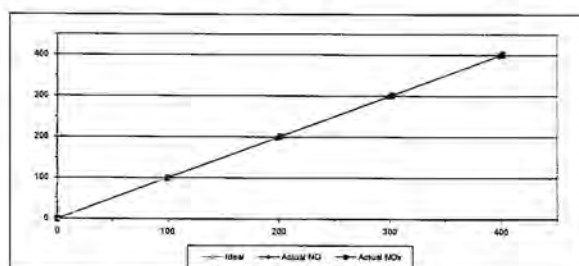
ALS Laboratory Group
FORM NO. F 06-006, REVISION NO. 1, ISSUE DATE: 03/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23	Equipment Name: NOx Analyzer
Manufacturer: HORIBA	Model: APNA-370
Serial No.: BEEAWS3E	Equipment ID: RYG_FS0261
Calibrator Manufacturer: Teledyne API	Model: 700
Serial No.: 947	
Std. Gas Concentration (PPM): 55.68	Cylinder No.: GN0027222
Cylinder Pressure (psi): 1800	Certified By: Algas Inc.
Certified Date: 9-Feb-22	Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-1.30	100.40	0.40	0.40
2	200.00	197.80	-2.20	-1.10	201.50	1.50	0.75
3	300.00	298.10	-1.90	-0.63	302.20	2.20	0.73
4	400.00	398.50	-1.50	-0.38	401.40	1.40	0.35
AVERAGE (%)				-0.65			0.47



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrant)
Assistant General Manager

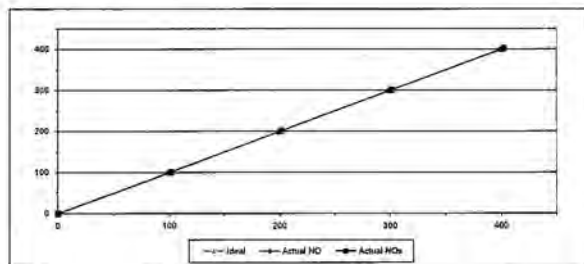
ALS Laboratory Group
FORM NO. F 06-006, REVISION NO. 1, ISSUE DATE: 03/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	UBADEAGK	Equipment ID	RYG_FB0551
Calibrator/Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GM027222
Cylinder Pressure (psi)	1800	Certified By	Algae Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.00	-1.00	-1.00	101.00	1.00	1.00
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	299.40	-1.60	-0.53	301.20	1.20	0.50
4	400.00	398.20	-1.80	-0.45	402.00	2.00	0.50
AVERAGE (%)				-0.53			0.55



Calibrated By

(Mr. Arwut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Banayuth Jitranont)
Assistant General Manager

ALS Laboratory Group
FORM NO. F-08-006 REVISION NO.: ISSUE DATE: 02/04/12



Approved calibration laboratory
ISO/IEC 17025:2017
MSC No. MS-17025
CALIBRATION 0367

Approved calibration laboratory
ISO/IEC 17025:2017
MSC No. MS-17025
CALIBRATION 0367

Approved measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

Wind Direction Sensor
Novamix
Sensor: WS-C2P
Data logger: 200 WS-250
Serial: A4560
RYG_150087
Used item
ALS Laboratory Group (Thailand) Co., Ltd.
104 Phantanasuan Rd., Phantanasuan Rd., Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:
The wind direction sensor was calibrated against
Standard Rotary Encoder model: AN2075-
00200-01 using a wind tunnel with 200 cm/sec
type wind tunnel with 200 cm/sec type wind tunnel.
The wind direction sensor was calibrated against
Standard Rotary Encoder model: AN2075-00200-01
using a wind tunnel with 200 cm/sec type wind tunnel.
The wind direction sensor was calibrated against
Standard Rotary Encoder model: AN2075-00200-01
using a wind tunnel with 200 cm/sec type wind tunnel.

Traceability:
This certificate provides a traceability of the
measurement to the national
standards, and to the realization of the international
system of units (SI) through the NIST (National
Bureau of Standards) of the United States of America
(NIST) and the NIST (National Bureau of Standards) of the
United States of America.

Uncertainty of Measurement:
The reported uncertainty of measurement is
based on the standard uncertainty multiplied by a
coverage factor k=2, which for a normal
distribution corresponds to a coverage probability
of approximately 95%. The standard uncertainty
has been determined in accordance with the GUM
(Evaluation of measurement uncertainty).
Note: Guide to the expression of uncertainty in
measurement.

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

Wet-type wind tunnel of JNAC Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area: 300 cm²
Wind direction: 180°
Diameter of mounting pipe: 128 mm
Blockage ratio of test object: 0.143 (-)

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurement are 23.0°C, 57.4% RH and 1010.5 hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Arwut Sakam
Mr. Banayuth Jitranont

Approved signature:

Mr. Banayuth Jitranont
Calibration Department Manager

Remarks:

* Sample cross-section area of the wind tunnel.
* Reported cross-section area of the tested object includes mounting pipe.
* Diameter of mounting pipe.
* Ratio: 1/1.

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY

Page 2 of 2 Pages

MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out in 40°
interval in clockwise and counter-clockwise direction after offset adjustment had been made. The true speed of wind tunnel facility is fully in full
with the sensor is rotated around its vertical axis. The results of calibration and estimated measurement uncertainties are reported in the table below.

Air speed	D _{ref}	D _{meas}	Error	U(k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
0.000	0	0	0	0.08
45.000	45	45	-2	0.74
90.000	90	90	-2	0.74
135.000	135	135	-2	0.74
180.000	180	180	-2	0.74
225.000	225	225	0	0.68
270.000	270	270	3	0.54
315.000	315	315	4	0.74

Remarks:

* Calibration results only apply for the tested conditions and measurement standards used which conform to the place.

Diameter of standard

Reference of Unit: 1/1

*** End of Certificate of Calibration ***



Approved calibration laboratory
ISO/IEC 17025:2017
MSC No. MS-17025
CALIBRATION 0367

Approved calibration laboratory
ISO/IEC 17025:2017
MSC No. MS-17025
CALIBRATION 0367

Approved measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

Cup anemometer
Novamix
Sensor: WS-C2P
Data logger: 200 WS-250
Serial: A4560
RYG_150087
Used item
ALS Laboratory Group (Thailand) Co., Ltd.
104 Phantanasuan Rd., Phantanasuan Rd., Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:
The cup anemometer was calibrated against
Standard Rotary Encoder model: AN2075-
00200-01 using a wind tunnel with 200 cm/sec
type wind tunnel with 200 cm/sec type wind tunnel.
The wind direction sensor was calibrated against
Standard Rotary Encoder model: AN2075-00200-01
using a wind tunnel with 200 cm/sec type wind tunnel.
The wind direction sensor was calibrated against
Standard Rotary Encoder model: AN2075-00200-01
using a wind tunnel with 200 cm/sec type wind tunnel.

Traceability:
This certificate provides a traceability of the
measurement to the national
standards, and to the realization of the international
system of units (SI) through the NIST (National
Bureau of Standards) of the United States of America
(NIST) and the NIST (National Bureau of Standards) of the
United States of America.

Uncertainty of Measurement:
The reported uncertainty of measurement is
based on the standard uncertainty multiplied by a
coverage factor k=2, which for a normal
distribution corresponds to a coverage probability
of approximately 95%. The standard uncertainty
has been determined in accordance with the GUM
(Evaluation of measurement uncertainty).
Note: Guide to the expression of uncertainty in
measurement.

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

Wet-type wind tunnel of JNAC Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area: 300 cm²
Wind direction: 180°
Diameter of mounting pipe: 128 mm
Blockage ratio of test object: 0.143 (-)

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurement are 23.0°C, 57.4% RH and 1010.5 hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Arwut Sakam
Mr. Banayuth Jitranont

Approved signature:

Mr. Banayuth Jitranont
Calibration Department Manager

Remarks:

* Sample cross-section area of the wind tunnel.
* Reported cross-section area of the tested object includes mounting pipe.
* Diameter of mounting pipe.
* Ratio: 1/1.

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY

Certificate Number
CC-058-56

Page 2 of 3 Pages

MEASUREMENT RESULTS

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calibrated by a standard air velocity transducer and above 5 m/s to 50 m/s was calibrated by a pitot tube with precision differential pressure meter which was installed 40 mm and 100 mm respectively away from wind tunnel nozzle. UUC was exercised at series of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 10 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainty are reported in the table below.

v_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{UUC} (m/s)	Error (m/s)	$\pm U(95\%)$ (m/s)
0.983	29.50	28.45	0.6	-0.2	0.17
2.035	29.49	28.45	1.3	-0.1	0.16
3.042	29.50	28.45	2.0	-0.2	0.10
4.135	29.50	28.45	3.0	-0.7	0.20
5.01	29.40	28.45	4.0	-0.1	0.18
6.100	29.50	28.45	5.0	-0.1	0.18
7.07	29.40	28.45	7.0	-0.3	0.19
8.18	29.50	28.45	8.0	-0.3	0.18
9.10	29.25	28.45	9.0	-0.3	0.20
10.09	29.44	28.45	8.9	-0.1	0.23
11.15	29.30	28.45	11.0	-0.1	0.21
12.14	29.42	28.45	12.0	-0.3	0.25
13.20	29.22	29.45	13.1	-0.1	0.26
14.25	29.34	29.45	14.2	-0.2	0.24
15.21	29.24	29.45	15.0	-0.3	0.26
16.33	29.24	29.45	16.1	-0.2	0.24

Remark:

* Calibration results only valid for the testing circumstances and measurement conditions during which calibration was done.

* Velocity at standard

* Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration setup of the cup anemometer calibration in the wind tunnel of Jiravate Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remarks: The position of the set-up is not true to scale due to imaging geometry.

End of Certificate of Calibration



Jiravate Associates Co., Ltd.
13/111, 13/112, 13/113, 13/114, 13/115, 13/116, 13/117, 13/118, 13/119, 13/120, 13/121, 13/122, 13/123, 13/124, 13/125, 13/126, 13/127, 13/128, 13/129, 13/130, 13/131, 13/132, 13/133, 13/134, 13/135, 13/136, 13/137, 13/138, 13/139, 13/140, 13/141, 13/142, 13/143, 13/144, 13/145, 13/146, 13/147, 13/148, 13/149, 13/150, 13/151, 13/152, 13/153, 13/154, 13/155, 13/156, 13/157, 13/158, 13/159, 13/160, 13/161, 13/162, 13/163, 13/164, 13/165, 13/166, 13/167, 13/168, 13/169, 13/170, 13/171, 13/172, 13/173, 13/174, 13/175, 13/176, 13/177, 13/178, 13/179, 13/180, 13/181, 13/182, 13/183, 13/184, 13/185, 13/186, 13/187, 13/188, 13/189, 13/190, 13/191, 13/192, 13/193, 13/194, 13/195, 13/196, 13/197, 13/198, 13/199, 13/200, 13/201, 13/202, 13/203, 13/204, 13/205, 13/206, 13/207, 13/208, 13/209, 13/210, 13/211, 13/212, 13/213, 13/214, 13/215, 13/216, 13/217, 13/218, 13/219, 13/220, 13/221, 13/222, 13/223, 13/224, 13/225, 13/226, 13/227, 13/228, 13/229, 13/230, 13/231, 13/232, 13/233, 13/234, 13/235, 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13/986, 13/987, 13/988, 13/989, 13/990, 13/991, 13/992, 13/993, 13/994, 13/995, 13/996, 13/997, 13/998, 13/999, 14/000, 14/001, 14/002, 14/003, 14/004, 14/005, 14/006, 14/007, 14/008, 14/009, 14/010, 14/011, 14/012, 14/013, 14/014, 14/015, 14/016, 14/017, 14/018, 14/019, 14/020, 14/021, 14/022, 14/023, 14/024, 14/025, 14/026, 14/027, 14/028, 14/029, 14/030, 14/031, 14/032, 14/033, 14/034, 14/035, 14/036, 14/037, 14/038, 14/039, 14/040, 14/041, 14/042, 14/043, 14/044, 14/045, 14/046, 14/047, 14/048, 14/049, 14/050, 14/051, 14/052, 14/053, 14/054, 14/055, 14/056, 14/057, 14/058, 14/059, 14/060, 14/061, 14/062, 14/063, 14/064, 14/065, 14/066, 14/067, 14/068, 14/069, 14/070, 14/071, 14/072, 14/073, 14/074, 14/075, 14/076, 14/077, 14/078, 14/079, 14/080, 14/081, 14/082, 14/083, 14/084, 14/085, 14/086, 14/087, 14/088, 14/089, 14/090, 14/091, 14/092, 14/093, 14/094, 14/095, 14/096, 14/097, 14/098, 14/099, 14/100, 14/101, 14/102, 14/103, 14/104, 14/105, 14/106, 14/107, 14/108, 14/109, 14/110, 14/111, 14/112, 14/113, 14/114, 14/115, 14/116, 14/117, 14/118, 14/119, 14/120, 14/121, 14/122, 14/123, 14/124, 14/125, 14/126, 14/127, 14/128, 14/129, 14/130, 14/131, 14/132, 14/133, 14/134, 14/135, 14/136, 14/137, 14/138, 14/139, 14/140, 14/141, 14/142, 14/143, 14/144, 14/145, 14/146, 14/147, 14/148, 14/149, 14/150, 14/151, 14/152, 14/153, 14/154, 14/155, 14/156, 14/157, 14/158, 14/159, 14/160, 14/161, 14/162, 14/163, 14/164, 14/165, 14/166, 14/167, 14/168, 14/169, 14/170, 14/171, 14/172, 14/173, 14/174, 14/175, 14/176, 14/177, 14/178, 14/179, 14/180, 14/181, 14/182, 14/183, 14/184, 14/185, 14/186, 14/187, 14/188, 14/189, 14/190, 14/191, 14/192, 14/193, 14/194, 14/195, 14/196, 14/197, 14/198, 14/199, 14/200, 14/201, 14/202, 14/203, 14/204, 14/205, 14/206, 14/207, 14/208, 14/209, 14/210, 14/211, 14/212, 14/213, 14/214, 14/215, 14/216, 14/217, 14/218, 14/219, 14/220, 14/221, 14/222, 14/223, 14/224, 14/225, 14/226, 14/227, 14/228, 14/229, 14/230, 14/231, 14/232, 14/233, 14/234, 14/235, 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14/361, 14/362, 14/363, 14/364, 14/365, 14/366, 14/367, 14/368, 14/369, 14/370, 14/371, 14/372, 14/373, 14/374, 14/375, 14/376, 14/377, 14/378, 14/379, 14/380, 14/381, 14/382, 14/383, 14/384, 14/385, 14/386, 14/387, 14/388, 14/389, 14/390, 14/391, 14/392, 14/393, 14/394, 14/395, 14/396, 14/397, 14/398, 14/399, 14/400, 14/401, 14/402, 14/403, 14/404, 14/405, 14/406, 14/407, 14/408, 14/409, 14/410, 14/411, 14/412, 14/413, 14/414, 14/415,

Certificate Number
CD-005-58

Page 2 of 3 Pages

MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard rotary anemometer by comparison method. During calibration, the measurement was carried out at 45 intervals in clockwise and counter-clockwise directions after initial adjustments have been made. The flow speed of wind tunnel (usually 3 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D ⁺ ₄₅ Degree (°)	D ⁻ ₄₅ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
43.000	44	45	-1	1.0
93.001	82	83	-1	1.0
135.000	119	120	-1	1.0
180.000	156	157	-1	1.0
225.001	234	235	-1	1.0
270.000	271	272	-1	1.0
315.000	310	311	-1	1.0
350.000	348	349	-1	1.0

Remark:
Calibration was carried out under the stated conditions and environmental stability during which calibration took place.
Deviation of standard
Deviation of Unit Under Calibration

End of Certificate of Calibration



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd., Banglumru, Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23005
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No. : 35002736
ID No. : RVG 150496

Condition As Found : GOOD

Customer : AIS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHU T SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 05 JANUARY 2023
Calibration Date : 17 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nalinakorn Petchumai

Approved by :

T. Petchumai
(Thanakul Petchumai)

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.

QI-TS12-04-04-020664

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-03

Cert. No. : ACC23005
Job No. : VC86AC0024
Pages : 2 of 3

Calibration Method :

This equipment was calibrated by based on IEC 60947-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33511B	MYX2302732	EF-0006-22	04-Feb-23
Digital Multimeter	33461A	MYX3220104	EDL-30P-04-0265	09-Feb-23
Digital Multimeter	33461A	MYX3220076	EDL-30P-03-0265	09-Feb-23
Digital Multimeter	33461A	MY60024755	FEL BP-05-0265	09-Feb-23
Programmable Attenuator	MA1-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1012-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560493	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B8060	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23005
Job No. : VC86AC0024
Pages : 3 of 3

Result of Calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.98	-0.02	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.35	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k = 2
or any value following calculation providing a level of confidence of approximately 95 %.

End of Calibration Certificate

QI-TS12-04-04-020664

T. Petchumai

QI-TS12-04-04-020664

T. Petchumai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/7 Sukhumvit Rd., Bangkok, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2431-1679 e-mail: center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23040
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-57 / Pre-amplifier NH-24
Serial No. : 00709746 / 187332 / 01297
ID No. : RYG (PS040)

Condition As Found : GOOD

Customer : AIS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (58.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nabakorn Pisutpaisan

Approved by : *T. Petchurai*
(Thanakul Petchurai)

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01-TS12-04-04-02004

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/02/65	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/02/65	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL_BP_05/02/65	09-Feb-23
Programmable Attenuator	MAT-1070	82100114	EF-0009-22	07-Feb-23
Condenser Microphone	4190	29779001	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

- National Institute of Metrology (Thailand).
- Thailand Institute of Scientific and Technological Research (TISTR).

01-TS12-04-04-02004

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Time burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

01-TS12-04-04-02004

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	12.5
C-weight	18.3
Flat	23.6

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.7	1.7	1.7	±5.0

01-TS12-04-04-02004

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.2	-0.2	-0.2	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	0.0	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QI-1512-04-04-020064

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.1	0.1	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.1	0.1	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

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T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.4	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23040
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QI-1512-04-04-020064

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sukhumi Rd, Bangkok, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2435-1679 e-mail:calcenter@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23042
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier PPH-24
Serial No. : 00900071 / 183464 / 01733
ID No. : RYG 150492

Condition As Found : GOOD

Customer : A/S LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN RD, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHEB SUKUMTHAI,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nithakorn Pisuwan

Approved by : *T. Petchurai*
(Thanakul Petchurai)

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QP-1512-04-01-0066

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY53202742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-01-04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-01-03/0265	09-Feb-23
Digital Multimeter	33461A	MY50024273	EEL-01-03/0265	09-Feb-23
Programmable Attenuator	MA7-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand)
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR)

QP-1512-04-01-0066

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.3
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C-weight	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-1512-04-01-0066

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.9
Flat	23.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.3	0.4	0.4	± 3.0

QP-1512-04-01-0066

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SI M Display at initial (dB)	SI M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.5	-0.5	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
26.0	27.9	-0.1	±1.1
27.0	26.8	-0.2	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.8	-0.2	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23042
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighting	SI M Display at initial (dB)	SI M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	127.0	127.0	0.0	±0.3

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

End of Calibration Certificate

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinakorn Rd., Bangpoo, Bangkok 10700 THAILAND
Tel: 0-2495-8800 Fax: 0-2493-1679 e-mail: sithiporn@thiporn.com http://www.sithiporn.com



Cert. No. : ACL23043
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00900072 / 188463 / 01734
ID No. : RYG TS0493

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHAKANAK 40, PHATTHAKANAK ROAD,
KIWAENG PHATTHAKANAK, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisuapaisan

Approved by :

(Thanakul Petchum)

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01-1512-04-04-02664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220106	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	23-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

01-1512-04-04-02664

5 B.T.A.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.5	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range normal	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

01-1512-04-04-02664

5 B.T.A.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electronic signal input device.

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.2
Flat	22.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.0	-0.9	-0.9	±5.0

01-1512-04-04-02664

5 B.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QH-TS12-04-04-020064

T. P. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QH-TS12-04-04-020064

T. P. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	124.0	124.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QH-TS12-04-04-020064

T. P. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL23043
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	89.6		

12. High level stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QH-TS12-04-04-020064

T. P. P. P.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd, Banginurua, Bangkok 10706 THAILAND.
Tel: 0-2435-8800 Fax: 0-2431-1679 e-mail: calcenter@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23045
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00900074 / 188467 / 01736
ID No. : RYG-TSM495

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
101 PHATTHANAKAN 40, PHAT THANAKAN ROAD,
KHUANG PHATTHANAKAN, KHUAT SUAN 1, UANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nakhorn Pisurpaian

Approved by :

T. Petchurui
(Thanakul Petchurui)

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QT-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests in Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

(The tests results of each items were made by observation of each Instruments display and also with SLM's display.)

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	FEEL_BP_040265	09-Feb-23
Digital Multimeter	33461A	MY53220076	FEEL_BP_030265	09-Feb-23
Digital Multimeter	34461A	MY60924273	FEEL_BP_050265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977990	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3003-22	22-Feb-23

2. (This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.)

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

- 3.1 National Institute of Metrology (Thailand);
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QT-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range extend	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QT-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency	Measured value
Weighting	(dB)
A-weight	9.9
C-weight	16.8
Flat	22.8

3. Acoustical signal tests of frequency weightings

Meier free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-2.0	-1.9	-1.9	±5.0

QT-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±0.0
125	0.0	0.0	0.0	±1.5
250	0.0	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	S.M Display at initial (dB)	S.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
126.0	126.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.1	0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Th (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C-sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	-0.1	±1.5
89.6	89.5		

12. High level stability

Frequency Weighting	S.M Display at initial (dB)	S.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	127.0	127.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k = 2
or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

151-451/1 Sirthorn Rd.,Bangbunru, Banglad Bangkok 10700 THAILAND
Tel:0-2433-8800 Fax:0-2433-1879 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22228
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-32 / Preamplifier NH-24
Serial No.: 00623389 / 198636 / 26417
ID No.:

Condition As Found : GOOD

Customer : AJS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 28 SEPTEMBER 2022
Calibration Date : 12-17 OCTOBER 2022
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pitsupaisan

Approved by :

(Thonakul Petchumai)

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.

QP-151204-04-020604

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 2 of 8

Calibration Procedure : (P-AC-01)

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33216A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QP-151204-04-020604

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
5000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-151204-04-020604

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.2

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
5000	1.0	1.1	1.1	±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QI-TS12-04-04-020664

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

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T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Th (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	135.0	135.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QI-TS12-04-04-020664

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighting	SIM Display at initial (dB)	SIM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QI-TS12-04-04-020664

T. Pich

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd., Bangumnu, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2435-1679 e-mail: center@sitiporn.com http://www.sitiporn.com



Cert. No. : ACL22230
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00623191 / 198638 / 26419
ID No. :

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 28 SEPTEMBER 2022
Calibration Date : 12-17 OCTOBER 2022
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaan

Approved by :

T. Petchum
(Thanakul Petchum)

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QP-TS12-04-01-020661

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0001-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	34461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	34461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62109114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3003-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QP-TS12-04-01-020661

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-TS12-04-01-020661

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	12.8
C-weight	18.6
Flat	24.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.0	0.0	1.0	± 5.0

QP-TS12-04-01-020661

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±2.0
8000	0.1	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leq	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.1	0.1	±0.3

QI-TS12-04-020664

7. R.L.

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.2	0.2	±1.1

QI-TS12-04-020664

7. R.L.

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5; -5.0
	2	8	108.0	107.9	-0.1	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.5	-0.9	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	123.0	123.0	0.0	-
Positive half cycle	125.4	125.1	-0.3	±2.0
Negative half cycle	125.4	125.1	-0.3	±2.0

QI-TS12-04-020664

7. R.L.

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QI-TS12-04-020664

7. R.L.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sithiporn Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel:0-2435-6600 Fax:0-2435-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22238
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00623392 / 196639 / 26420
ID No. :

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KJWANG PHATTANAKAN, KJEF SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 07 OCTOBER 2022
Calibration Date : 20-21 OCTOBER 2022
Date of Issue : 21 OCTOBER 2022

Calibrated by : Nethakorn Pinulpaisan

Approved by :

T. Petchumai
(Thunakul Petchumai)

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QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461 A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461 A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461 A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

- National Institute of Metrology (Thailand).
- Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.4
Flat	24.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.8	0.8	0.8	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
Leg	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 : -5.0
	2	8	117.0	117.0	0.0	1.0 : -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 : -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 : -5.0
SEL	2	8	108.0	108.0	0.0	1.0 : -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Once	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Cert. No. : ACC23009
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34178121
ID No. : RYG_FS0213

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHWAENG PIATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 24 JANUARY 2023
Calibration Date : 26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nuthakorn Pitsupaisan

Approved by :

(Thanakul Petchumai)

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QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23009
Job No. : VC66AC0031
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-HP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-HP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-HP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAL	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23009
Job No. : VC66AC0031
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.16	0.16	0.14	0.40

2. Frequency

Specified frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1003.2	0.3	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.97	0.10	3.0

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

End of Calibration Certificate

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Rd.,Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : AC123330
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 0022542 / 155375 / 155374
ID No. : NKH_FS0115

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHWAENG PIATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Nuthakorn Pitsupaisan

Approved by :

(Thanakul Petchumai)

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QI-TS12-04-04-020664

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-01

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 2 of 8

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017016	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5320104	EEL-BP 300266	13-FEB-24
Digital Multimeter	33461A	MY5320016	EEL-BP 290266	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	41B3	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Q1-151240-02-0106-1

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Q1-151240-02-0106-1

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 4 of 8

Result of Calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

Metre free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.2	1.2	1.2	± 5.0

Q1-151240-02-0106-1

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.2
C-weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Log	94.0	94.0	0.0	± 0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

Q1-151240-02-0106-1

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
130.0	130.1	0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QI-TS12-04-04-020604

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
Job No. : VC67AC0013
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23330
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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	S.L.M Display at initial (dB)	S.L.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation providing a level of confidence of approximately 95 %

End of Calibration Certificate

QI-TS12-04-04-020604

T. Petch

451-451/1 Srinthorn Rd, Bangbunma, Bangkok 10700 THAILAND
Tel:0-2435-8600 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23320
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00222528 / 195374 / 15360
ID No.: NKH_FS0114

Condition As Found : GOOD

Customer : A.I.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN 1 UANG,
BANGKOK, 10250, THAILAND.

Location :
Ambient Temperature : 23.0 ± 3.1 °C
Pressure : 101.3 ± 3.1 kPa
Relative Humidity : 50.0 ± 20.1 %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Nithakorn Pitsuppan

Approved by : T. Petch
(Thanakul Petchurai)

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QI-TS12-04-04-020604

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33710A	MY46017074	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53200104	EEL-BP 300266	13-FEB-24
Digital Multimeter	33461A	MY53200076	EEL-BP 290266	13-FEB-24
Digital Multimeter	34461A	MY60634273	EEL-BP 310266	14-FEB-24
Programmable Attenuator	MA7-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-1003-23	14-FEB-24

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

3. This certificate is acceptable to the International system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QT-TS12-04-04-02064

T. P. R. W.

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter.

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QT-TS12-04-04-02064

T. P. R. W.

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.2
Flat	25.0

3. Acoustical signal tests of frequency weightings

Micro free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.8	0.9	0.9	±5.0

QT-TS12-04-04-02064

T. P. R. W.

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.1	0.0	0.0	±1.5
500	0.1	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.1	0.1	±0.3

QT-TS12-04-04-02064

T. P. R. W.

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.2	0.2	±1.1

QI-TS12-04-04-020064

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23329
Job No. : VC67AC0013
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	99.0	98.8	-0.2	1.5; -5.0
SEI	2	8	108.0	107.9	-0.1	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QI-TS12-04-04-020064

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23329
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Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.2

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

End of Calibration Certificate

QI-TS12-04-04-020064

T. Petchum

451-451/1 Sindhorn Rd.,Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2435-1679 e-mail:cal-center@sitiporn.com http://www.sitiporn.com



Cert. No. : ACL23331
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00222553 / 195865 / 15385
ID No. : NKH_PS0116

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10230 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Nithakorn Pichaporn

Approved by : T. Petchum
(Thanakul Petchum)

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QI-TS12-04-04-020064

Continuation of Calibration Certificate

Cert. No. : ACL23331
Job No. : VC67AC0013
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weightings with Anechoic chamber and Reference Standard Instruments.

For tests results of each item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Referenced Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-21	08-FEB-24
Condenser Microphone	4160	2971900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560493	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

01-151244-0402666

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23331
Job No. : VC67AC0013
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Time burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter.

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

01-151244-0402666

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23331
Job No. : VC67AC0013
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.4
Flat	22.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.8	0.9	0.9	±5.0

01-151244-0402666

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23331
Job No. : VC67AC0013
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Imp	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

01-151244-0402666

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23331
Job No. : VC67AC0013
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL23331
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.75	1	109.0	109.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.75	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.6	0.0
Negative one-half cycle	89.6	0.0

12. High level stability

Frequency Weighting	N1 M Display at initial (dB)	SUM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QMS12-04-08-02-004

T. Petch

451-451/1 Srinthorn Rd., Bangbunni, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2435-1679 e-mail:center@sitthiporn.com http://www.sitthiporn.com



Cert. No. : ACL23332
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00222601 / 195913 / 15433
ID No. : NKH_F50120

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : 23.0 ± 3.1 °C
Pressure : 101.3 ± 3.1 kPa
Relative Humidity : 50.0 ± 29.7 %

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Nithakorn Pitsupaisan

Approved by : T. Petch
(Thanakul Petchurai)

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.

QMS12-04-08-02-004

Continuation of Calibration Certificate

Cert. No. : ACL23332
Job No. : VC67AC0013
Pages : 2 of 3

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For test results of each items were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0006-23	07-FEB-24
Waveform Generator	33511B	MY32302742	EP-0019-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-HP 310266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-HP 310266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-HP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EP-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Q1-TS12-04-04-020664

J. Peth...

Continuation of Calibration Certificate

Cert. No. : ACL23332
Job No. : VC67AC0013
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Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter.

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Q1-TS12-04-04-020664

J. Peth...

Continuation of Calibration Certificate

Cert. No. : ACL23332
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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

2.2 The microphone on the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.5

3. Acoustical signal tests of frequency weightings

Meets free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	±0.5

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J. Peth...

Continuation of Calibration Certificate

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Imp	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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J. Peth...

Continuation of Calibration Certificate

Cert. No. : ACL23332
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL23332
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.8	89.5	-0.3 ±1.5

12. High level stability

Frequency Weighting	S.L.M Display at initial (dB)	S.L.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±1.3

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

End of Calibration Certificate

UP-1512-04-04-02064

7. Peth



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	03 Jul 23	$Y = 1.2484x - 0.6741$	0.9931
BKK_FS0578	03 Jul 23	$Y = 1.0997x - 0.4918$	1.0000
BKK_FS0583	01 Jul 23	$Y = 1.0068x + 1.6459$	0.9998
BKK_FS0584	01 Jul 23	$Y = 0.9804x + 9.469$	0.9999
BKK_FS0585	07 Jul 23	$Y = 1.0248x + 0.8333$	0.9996
BKK_FS0586	01 Jul 23	$Y = 0.9007x + 11.074$	1.0000
BKK_FS0587	07 Jul 23	$Y = 0.986x + 17.77$	0.9993
BKK_FS0588	01 Jul 23	$Y = 0.9751x + 9.8452$	0.9999
BKK_FS0589	03 Jul 23	$Y = 1.0174x + 0.0391$	1.0000
BKK_FS0590	01 Jul 23	$Y = 1.0127x - 3.4333$	1.0000
BKK_FS0591	03 Jul 23	$Y = 1.0452x - 51.824$	0.9998
BKK_FS0592	07 Jul 23	$Y = 1.0003x + 14.344$	1.0000
BKK_FS0593	01 Jul 23	$Y = 1.0368x - 41.415$	0.9997
BKK_FS0594	07 Jul 23	$Y = 1.0025x + 6.32$	0.9999
BKK_FS0595	01 Jul 23	$Y = 1.0871x - 114.97$	0.9985
BKK_FS0596	03 Jul 23	$Y = 1.038x - 51.974$	0.9993
BKK_FS0597	01 Jul 23	$Y = 1.0059x - 9.9086$	1.0000
BKK_FS1004	01 Jul 23	$Y = 1.0188x + 6.731$	0.9995
BKK_FS1005	01 Jul 23	$Y = 0.9922x + 13.993$	0.9970
BKK_FS1006	01 Jul 23	$Y = 1.1747x - 3.1235$	0.9991
BKK_FS1007	07 Jul 23	$Y = 1.0737x + 0.8677$	0.9997
BKK_FS1008	07 Jul 23	$Y = 1.0446x + 1.2158$	0.9999
BKK_FS1009	01 Jul 23	$Y = 1.1044x - 0.8245$	1.0000
BKK_FS1010	03 Jul 23	$Y = 1.2271x - 2.0136$	1.0000
BKK_FS1011	03 Jul 23	$Y = 1.281x - 1.7003$	1.0000
BKK_FS1012	03 Jul 23	$Y = 0.9978x - 3.7229$	0.9999
BKK_FS1013	03 Jul 23	$Y = 1.0245x - 28.85$	0.9999
BKK_FS1014	01 Jul 23	$Y = 1.3135x - 7.0066$	0.9981
BKK_FS1015	01 Jul 23	$Y = 0.9802x + 3.8214$	0.9999
BKK_FS1016	01 Jul 23	$Y = 1.0728x - 85.581$	0.9985
BKK_FS1020	01 Jul 23	$Y = 1.1611x - 1.1988$	1.0000
BKK_FS1021	01 Jul 23	$Y = 0.9596x + 16.524$	0.9987
BKK_FS1022	01 Jul 23	$Y = 1.0712x - 89.51$	0.9990
BKK_FS1023	01 Jul 23	$Y = 1.3791x - 8.8721$	0.9944
BKK_FS1024	01 Jul 23	$Y = 0.9440x + 11.421$	0.9993
BKK_FS1025	01 Jul 23	$Y = 1.0477x - 41.116$	1.0000
BKK_FS1026	01 Jul 23	$Y = 1.3389x - 4.918$	1.0000
BKK_FS1027	01 Jul 23	$Y = 0.9852x + 1.5238$	1.0000
BKK_FS1028	01 Jul 23	$Y = 1.0261x - 10.867$	0.9996



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1029	01 Jul 23	$Y = 1.3382x - 0.9776$	0.9941
BKK_FS1030	01 Jul 23	$Y = 0.9518x + 2.3476$	0.9995
BKK_FS1031	01 Jul 23	$Y = 1.0526x - 64.415$	0.9997
BKK_FS1039	01 Jul 23	$Y = 0.965x + 14.823$	0.9997
BKK_FS1040	01 Jul 23	$Y = 1.0041x - 2.7552$	0.9999
BKK_FS1041	01 Jul 23	$Y = 1.116x - 1.0078$	0.9996
BKK_FS1042	01 Jul 23	$Y = 1.0209x + 3.56$	0.9980
BKK_FS1043	01 Jul 23	$Y = 1.0039x - 5.0143$	0.9999
BKK_FS1044	01 Jul 23	$Y = 1.0607x + 0.9837$	0.9998
BKK_FS1164	03 Jul 23	$Y = 1.0569x + 5.6061$	0.9996
BKK_FS1165	03 Jul 23	$Y = 0.9509x + 7.5262$	0.9981
BKK_FS1166	03 Jul 23	$Y = 1.0567x - 50.448$	0.9999
BKK_FS1200	03 Jul 23	$Y = 1.3534x - 1.3818$	0.9991
BKK_FS1201	03 Jul 23	$Y = 1.0388x - 7.0524$	0.9999
BKK_FS1202	03 Jul 23	$Y = 1.0518x - 59.531$	0.9996
RYG_FS0197	01 Jul 23	$Y = 1.0087x - 3.2838$	0.9999
RYG_FS0198	01 Jul 23	$Y = 0.9877x + 36.487$	0.9999
RYG_FS0199	01 Jul 23	$Y = 1.0286x - 0.367$	0.9992
PHK_FS0027	13 Jul 23	$Y = 1.1219x - 2.2432$	0.9984
PHK_FS0028	13 Jul 23	$Y = 1.0341x - 6.7067$	0.9999
PHK_FS0029	13 Jul 23	$Y = 0.9877x + 8.7629$	0.9999
SGK_FS0135	14 Jul 23	$Y = 0.9877x + 11.513$	0.9974
SGK_FS0138	13 Jul 23	$Y = 1.0571x - 1.1585$	0.9991
SGK_FS0139	13 Jul 23	$Y = 0.9601x + 8.0287$	0.9987
SGK_FS0140	13 Jul 23	$Y = 0.9678x + 11.644$	1.0000
SGK_FS0141	13 Jul 23	$Y = 1.1349x - 2.2887$	0.9990
SGK_FS0142	13 Jul 23	$Y = 0.9915x + 11.403$	0.9984
SGK_FS0143	13 Jul 23	$Y = 1.0054x - 4.0048$	1.0000

Review By: Wichan Choonharat
(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By: (Mr. Sarayuth Jittrantorn)
(Mr. Sarayuth Jittrantorn)
Assistant General Manager



ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	02 Oct 23	$Y = 1.2862x - 1.2952$	0.9983
BKK_FS0579	02 Oct 23	$Y = 1.2548x + 0.0065$	0.9946
BKK_FS0583	03 Oct 23	$Y = 1.0773x - 2.4138$	0.9989
BKK_FS0584	02 Oct 23	$Y = 0.9787x + 12.898$	0.9999
BKK_FS0585	18 Oct 23	$Y = 1.0322x + 3.7767$	0.9988
BKK_FS0586	02 Oct 23	$Y = 0.9777x + 15.405$	0.9987
BKK_FS0587	18 Oct 23	$Y = 1.0175x + 14.717$	0.9997
BKK_FS0589	03 Oct 23	$Y = 1.0148x - 2.4143$	1.0000
BKK_FS0590	03 Oct 23	$Y = 1.0685x - 0.8429$	1.0000
BKK_FS0591	02 Oct 23	$Y = 1.0733x - 88.805$	0.9989
BKK_FS0592	18 Oct 23	$Y = 1.0037x + 10.388$	1.0000
BKK_FS0593	02 Oct 23	$Y = 1.0538x - 60.63$	0.9986
BKK_FS0594	18 Oct 23	$Y = 1.0052x + 5.3238$	0.9999
BKK_FS0596	02 Oct 23	$Y = 1.0445x - 48.241$	0.9996
BKK_FS0597	03 Oct 23	$Y = 1.0697x - 53.62$	0.9994
BKK_FS1004	02 Oct 23	$Y = 0.9855x + 14.75$	0.9992
BKK_FS1005	02 Oct 23	$Y = 1.02x + 1.7167$	0.9996
BKK_FS1006	02 Oct 23	$Y = 1.1762x - 3.5819$	0.9988
BKK_FS1007	18 Oct 23	$Y = 1.1405x + 2.6044$	0.9983
BKK_FS1008	18 Oct 23	$Y = 1.1267x + 4.8333$	0.9991
BKK_FS1010	03 Oct 23	$Y = 1.0027x + 2.5832$	0.9986
BKK_FS1011	02 Oct 23	$Y = 1.3811x - 6.2068$	0.9998
BKK_FS1012	02 Oct 23	$Y = 1.0017x - 0.9$	1.0000
BKK_FS1013	02 Oct 23	$Y = 1.0593x - 46.02$	0.9994
BKK_FS1014	03 Oct 23	$Y = 1.0961x - 1.8895$	0.9983
BKK_FS1015	03 Oct 23	$Y = 0.9976x + 6.2595$	0.9993
BKK_FS1016	03 Oct 23	$Y = 1.0633x - 62.491$	0.9985
BKK_FS1017	06 Oct 23	$Y = 0.9681x - 2.2235$	0.9988
BKK_FS1018	06 Oct 23	$Y = 0.9817x - 20.653$	0.9999
BKK_FS1019	06 Oct 23	$Y = 1.0152x - 64.485$	0.9988
BKK_FS1020	02 Oct 23	$Y = 1.2601x - 2.4721$	0.9983
BKK_FS1021	02 Oct 23	$Y = 1.0036x + 2.3288$	0.9999
BKK_FS1022	02 Oct 23	$Y = 1.0633x - 73.288$	0.9990
BKK_FS1023	03 Oct 23	$Y = 1.0879x - 1.0894$	0.9984
BKK_FS1024	02 Oct 23	$Y = 1.0035x + 1.4857$	1.0000
BKK_FS1025	03 Oct 23	$Y = 1.0556x - 58.597$	0.9999
BKK_FS1026	02 Oct 23	$Y = 1.2684x - 1.497$	0.9970
BKK_FS1027	02 Oct 23	$Y = 1.0032x + 1.5187$	1.0000
BKK_FS1028	02 Oct 23	$Y = 1.0493x - 30.012$	0.9984



ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1029	02 Oct 23	$Y = 1.3494x - 3.5078$	0.9981
BKK_FS1030	02 Oct 23	$Y = 1.0015x + 1.2214$	1.0000
BKK_FS1031	02 Oct 23	$Y = 1.0516x - 56.998$	0.9994
BKK_FS1039	02 Oct 23	$Y = 0.9991x + 14.527$	0.9994
BKK_FS1040	02 Oct 23	$Y = 1.0049x - 2.4324$	1.0000
BKK_FS1041	02 Oct 23	$Y = 1.1682x - 2.1293$	1.0000
BKK_FS1042	02 Oct 23	$Y = 1.0051x + 6.2533$	0.9999
BKK_FS1043	02 Oct 23	$Y = 1.0022x + 3.98$	1.0000
BKK_FS1044	02 Oct 23	$Y = 1.0796x + 2.9808$	0.9993
BKK_FS1164	02 Oct 23	$Y = 1.2714x + 0.234$	0.9945
BKK_FS1165	02 Oct 23	$Y = 1.0029x + 3.3571$	0.9994
BKK_FS1166	02 Oct 23	$Y = 1.061x - 56.83$	1.0000
BKK_FS1200	02 Oct 23	$Y = 1.2803x - 1.4599$	0.9982
BKK_FS1201	02 Oct 23	$Y = 1.0374x - 8.1952$	1.0000
BKK_FS1202	02 Oct 23	$Y = 1.0469x - 44.05$	0.9987
PHK_FS0027	09 Oct 23	$Y = 1.1052x + 1.0293$	1.0000
PHK_FS0028	09 Oct 23	$Y = 1.0377x + 1.9833$	1.0000
PHK_FS0029	09 Oct 23	$Y = 1.0021x + 7.5248$	1.0000
RYG_FS0197	02 Oct 23	$Y = 1.0038x + 9.0133$	1.0000
RYG_FS0198	02 Oct 23	$Y = 0.9991x + 17.568$	1.0000
RYG_FS0199	02 Oct 23	$Y = 1.0814x - 1.2993$	0.9987
RYG_FS0654	02 Oct 23	$Y = 1.1168x - 2.1207$	1.0000
RYG_FS0655	02 Oct 23	$Y = 1.0086x + 5.2733$	0.9991
RYG_FS0656	02 Oct 23	$Y = 1.0009x + 8.48$	1.0000
RYG_FS0657	02 Oct 23	$Y = 1.0435x + 2.6459$	0.9999
RYG_FS0658	02 Oct 23	$Y = 0.9788x + 10.283$	0.9992
RYG_FS0659	02 Oct 23	$Y = 1.0074x - 6.621$	1.0000
SGK_FS0135	18 Oct 23	$Y = 0.9831x + 14.843$	0.9994
SGK_FS0138	06 Oct 23	$Y = 1.0831x - 0.6401$	0.9998
SGK_FS0139	06 Oct 23	$Y = 0.9826x + 8.6507$	1.0000
SGK_FS0140	06 Oct 23	$Y = 1.0011x + 7.6095$	1.0000
SGK_FS0141	06 Oct 23	$Y = 1.125x - 1.2259$	0.9998
SGK_FS0142	06 Oct 23	$Y = 0.9958x + 10.257$	0.9997
SGK_FS0143	06 Oct 23	$Y = 1.004x + 3.3105$	1.0000

Review By: Wichan Choonharat
(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By: (Mr. Sarayuth Jittrantorn)
(Mr. Sarayuth Jittrantorn)
Assistant General Manager

RYG_EN0004

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Phrasang, Bangkok 10110
Tel: +66 2842 5361-6, e-mail: service.thailand@sartorius.com



SARTORIUS
NIST-TRACEABLE
CALIBRATION LAB

Certificate of Calibration

REVIEWED: Tr. H. H.
APPROVED: J. J.
NEXT CAL DATE: 01/03/24

Model Number: MSE125P-100-DU Certificate No: 23BC0114
Description: Semi-micro Balance Issued Date: Friday, March 03, 2023
Serial Number: 6033108993 Reference No: 204833
ID No: RYG_EN0004
Manufacturer: Sartorius Page No: 1 of 3
Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khui, A. Phuek Daeng, Rayong 21140, Thailand
Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T. Maenam Khui, A. Phuek Daeng, Rayong 21140, Thailand
Calibrated By: Mr. Chonchai Inthana
Calibration Date: Wednesday, March 01, 2023
Calibration Procedure No: This calibration was conducted by using in-house calibration procedure number (WI-003) Based on UKAS LAB 14: 2015
Metrological data: Capacity: 120 g Readability: 0.00001 g
Ambient Conditions: Temperature: 24.0 °C ± 5.0 °C
Humidity: 63.0 % RH ± 10.0 % RH
Pressure: ±
Reasons for calibration: ☒ New Installation ☐ Service / Repair ☐ After-assembly Maintenance ☐ Equipment Condition: ☒ Good ☐ Question ☐ Fail

Measurement Method: UKAS Publication Ref: Lab 14
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards which represent the unit of measurement according to the International System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:
In-house Number: Description: Traceability: Certificate No: Due Date:
YC3011-S20-00: Sartorius weight set 100g - 5000g S2 YC3011-S20-00: SPC-RT: C0212565: 14-Sep-2023
N-19-382524: Humidity/Balance/Temp. Lutron MH-B-3825D: OKSH: C19220444: 5-Sep-2023

This certificate is valid only if used in accordance with the conditions of use. It is not valid if the conditions of use are not followed. The prior written approval of the Calibration Operator is required. Sartorius (Thailand) Co., Ltd.
Signature: (Mr. Chonchai Inthana) Technical Manager
SOP: PM 32: 01 February 2022

Certificate of Calibration

Model Number : MSE125P-100-DU
Description : Semi-micro Balance
Serial Number : 0033108993
ID No. : RYG_EN0004
Manufacturer : Sartorius
Certificate No. : 23BCI0114
Issued Date : Friday, March 03, 2023
Reference No. : 204633
Page No. : 2 of 3

Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
The repeatability is the ability of a weighing instrument to display nearly identical results under consistent test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.		The off-center loading error is caused by the difference between the results of the test 1 g, 1/5 or 1/10 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (corners) defined according to DIN 109.	
Nominal Value (Low Load)	5 g	Nominal Value	50 g
Tolerance	0.000015 g	Tolerance	0.00015 g
Nominal Value (High Load)	50 g		
Tolerance	0.000015 g		
Standard Deviation	0.000007		

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.00004 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.01000	0.01000	0.00000	0.000026
0.1	0.10000	0.10000	0.00000	0.000026
1	1.00000	1.00000	0.00000	0.000026
2	2.00000	2.00000	0.00000	0.000031
5	5.00000	5.00000	-0.00001	0.000033
10	10.00000	10.00000	0.00000	0.000038
20	20.00000	20.00000	0.00000	0.000048
30	30.00000	30.00000	0.00000	0.000060
40	40.00000	40.00000	-0.00001	0.000067
50	50.00000	50.00000	-0.00001	0.000081

SGP FM 33 03 February 2022

Certificate of Calibration

Model Number : MSE125P-100-DU
Description : Semi-micro Balance
Serial Number : 0033108993
ID No. : RYG_EN0004
Manufacturer : Sartorius
Certificate No. : 23BCI0114
Issued Date : Friday, March 03, 2023
Reference No. : 204633
Page No. : 3 of 3

Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
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Nominal Value (Low Load)	5 g	Nominal Value	50 g
Tolerance	0.000015 g	Tolerance	0.00015 g
Nominal Value (High Load)	50 g		
Tolerance	0.000015 g		
Standard Deviation	0.000007		

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.0001 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
65	65.0000	65.0000	0.00000	0.000026
70	70.0000	70.0000	0.00000	0.000035
75	75.0000	75.0000	0.00000	0.000046
80	80.0000	80.0000	0.00000	0.000057
85	85.0000	85.0000	0.00000	0.000068
90	90.0000	90.0000	0.00000	0.000079
95	95.0000	95.0000	0.00000	0.000090
100	100.0000	100.0000	0.00000	0.000100
110	110.0000	110.0000	0.00000	0.000126
120	120.0000	120.0000	0.00000	0.000152

End of Report

SGP FM 33 03 February 2022

BKK_EN0119

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-00 - GCMS-00

System ID : DM-2
Organization Name : ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location : 104 Phatthanakorn Rd., Khlongwong Suburb, Bangkok 10110
Date : April 18, 2023 3:15:25 PM
EQP Name : AgilentRecommended - AgilentRecommended
EQP Revision : GC 02.51, GCMS 02.51
Overall Qualification Status : Pass

System Inspection and Basic Safety and Operation

Name : 7890
Setpoint Status : Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Accuracy

Name : 7890
Front : MMH
Setpoint Status : Pass
Inlet Pressure : 25.0 psi
Actual : 25.0 psi
Accuracy : 0.0 psi
Agilent Recommended : <= 1.2

Overall Inlet Pressure Accuracy Test Status
Pass

GC Oven Temperature Accuracy

Name : 7890

Date : April 18, 2023 3:15:25 PM
System ID : DM-2

Page 2 / 16

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Agilent CrossLab Compliance Services

Setpoint Status : Pass
Zone : Oven
Setpoint/Actual : 230.0 / 230.1 °C
Temperature : 230.0 °C
Accuracy : 0.1 °C
Agilent Recommended : <= 1.0 °C
Setpoint Status : Pass
Zone : Oven
Setpoint/Actual : 100.0 / 100.4 °C
Temperature : 100.0 °C
Accuracy : 0.4 °C
Agilent Recommended : <= 1.0 °C

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name : 7890
Setpoint Status : Pass
Setpoint/Average : 100.0 / 100.4 °C
Temperature : 100.0 °C
Stability : 0.0 °C
Agilent Recommended : <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination : Front : MMH / External : SQ

Name : 8975C Inert XL with TAD

Setpoint Status : Pass

Date : April 18, 2023 3:15:25 PM
System ID : DM-2

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Overall Log Amp Test Status

Pass

RFPA

Tested Combination1

Front MMI / External SQ

Name:

5975C Inert XL with TAD

Setpoint Status:

Pass

Amu:

1000 m/z

Drift After Five Minutes:

RFPA Voltage:

441 mV

Agilent Recommended:

>= -100 and <= 100

<= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1

Front MMI / External SQ

Name:

5975C Inert XL with TAD

Setpoint Status:

Pass

Flame:

1

Setpoint Status:

Pass

Flame:

2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1

Front MMI / External SQ

Name:

7693A

Source:

EI - Inert

Date: April 18, 2023 3:15:25 PM
System ID: GM-2

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Setpoint Status:

Completed

Injection Volume on Column:

1.0 uL

Overall Scouting Run Status

Completed

Signal to Noise EI

Tested Combination1

Front MMI / External SQ

Name:

5975C Inert XL with TAD

Source:

EI - Inert

Flame:

1

Setpoint Status:

Pass

Signal to Noise:

456

Agilent Recommended:

>= 320

Source:

EI - Inert

Flame:

2

Setpoint Status:

Pass

Signal to Noise:

2034

Agilent Recommended:

>= 320

Overall Signal to Noise EI Test Status

Pass

Injection Precision

Tested Combination1

Front MMI / External SQ

Name:

7693A

Source:

EI - Inert

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Area RSD:

1.69 %

Agilent Recommended:

<= 5.00

Retention Time RSD:

0.04 %

<= 1.00

Overall Injection Precision Test Status

Pass

Date: April 18, 2023 3:15:25 PM
System ID: GM-2

Page 4 / 16

Mass Ratio Precision

Tested Combination1

Front MMI / External SQ

Name:

7693A

Source:

EI - Inert

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

RSD:

1.68 %

Agilent Recommended:

<= 5.00

Mass Ratio

0.39 %

<= 5.00

Overall Mass Ratio Precision Test Status

Pass

Date: April 18, 2023 3:15:25 PM
System ID: GM-2

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-2
Manufacturer	Agilent Technologies
Name	7690
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10120123
Firmware Revision	A.10.06
Usage	Sample Injection
Location	Front
Syringe Volume (uL)	10

Date: April 18, 2023 3:15:25 PM
System ID: GM-2

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Detector 1	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Date: Apr 18, 2023 3:15:25 PM
System ID: GM-2

MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Date: Apr 18, 2023 3:15:25 PM
System ID: GM-2

Purpose

This signature page was created and published because the ACE sign-off action was assessed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature but requires two distinct identification components: unique usernames and personal passwords. The Agent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained officer operator, the Agent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Full Name of Signer:	Supasak Nimsongtham
Typed On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	April 18, 2023
Reason for Signature:	Executed protocol and published this

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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Date: April 18, 2023 9:15:25 PM
System ID: CM-2

User Name: SuperAdmin@mydomain
Hostname: SCG111500C

System ID: CAA-0
 Print Date: Apr 18, 2022 2:15:20 PM

ALS CASE Transactions Inc.

Date	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 18, 2023 2:42:35 PM	Auto	Session Created	Session	None
April 18, 2023 2:42:35 PM	Start	Configuration	Session	None
April 18, 2023 2:42:35 PM	Auto	EndSession	Logging	User is Field Engineer and can only run scripts in web tool
April 18, 2023 2:42:04 PM	Auto	ExpCreated	Session	ECSP details for primary location (ECSP) File path: C:\msdcs\PowerGen\Conf\PowerGen\ECSP\ECSP11.ecsp ECSP File Name: [ECSP11.ecsp], ECSP Name: [MajorPowerSourceECSP] on location [ECSP11] ECSP location for hydroelectric [hydro11 (ECSP)] File path: C:\msdcs\PowerGen\Conf\PowerGen\ECSP\ECSP11.ecsp ECSP File Name: [ECSP11.ecsp], ECSP Name: [MajorPowerSourceECSP]
April 18, 2023 2:42:35 PM	End	Configuration	Session	None
April 18, 2023 2:42:35 PM	Stop	Quit/EndUser	Session	CO
April 18, 2023 2:45:11 PM	Stop	EndSession	System Inspection and Static Safety and Observation - 738AC - Qualitative Test - 140 exposures estimated	None
April 18, 2023 2:47:27 PM	End	Conclusion	System inspection and Static Safety and Observation - 738AC - Qualitative Test - 140 exposures estimated	Run Count : 1

Elabor: April 18, 2023 3:15:25 PM
System ID: QIA-2

System ID: GM-2
Print Date: April 18, 2023 9:15:30 PM

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System 14: QM-2
Print Date: April 18, 2013 2:15:07 PM

Page 3/11

Page 12 / 18

System to OW 2
Print Date: April 18, 2023 2:45:56 PM

2001

Page 12/16

System ID: 026-2
Print Date: April 18, 2023 3:15:33 PM

Figure S-47

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Usher Marie: suzesab@nmsu.org
 Phone: 505/646-1540

Print Date: April 18, 2012 2:13:38 PM

ALSO IN Transaction Log :

[illegible]

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Date: April 18, 2023 3:15:25 PM
System ID: GAA-2

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Über Name: @ipad4.kf-reitung.de
Knotenname: SC01110940

System Id: GM-2
Print Date: April 18, 2022 3:19:50 PM

ALC G&T Transduction Inc.

Time	Examination State	Activity Performed	Type of Transaction	Optional Information
April 16, 2023 2:05:30 PM	Start	Completion	Signal to Initiate E2 - Injection Towers, Flow IMA, IQ2 - Injection E2 - Post-swing Fluorocarb 2 - L1 = 230	None
April 16, 2023 2:57:00 PM	End	Done	Call Manager	Call Manager was to do a dose verification task but the pump was not started
April 16, 2023 2:57:18 PM	End		Signal to Initiate E2 - Injection Towers, Flow IMA, IQ2 - Injection E2 - Post-swing Fluorocarb 2 - L1 = 230	See Line Path - E230-2 OCCUPANCY AND DISCHARGE
April 16, 2023 2:57:45 PM	End	Execution	Signal to Initiate E2 - Injection Towers, Flow IMA, IQ2 - Injection E2 - Post-swing Fluorocarb 2 - L1 = 230	None
April 16, 2023 2:58:09 PM	End	Execution	Signal to Initiate E2 - Injection Towers, Flow IMA, IQ2 - Injection E2 - Post-swing Fluorocarb 2 - L1 = 230	Run Check 1
April 16, 2023 3:01:14 PM	End	Quantification	Execution	OK
April 16, 2023 3:01:14 PM	End	Reporting	Execution	None
April 16, 2023 3:10:47 PM	OK	Reporting	Execution	Report Generated

Page 717

Date: April 18, 2023 3:15:25 PM
System ID: 03A-2

Page 562 VB

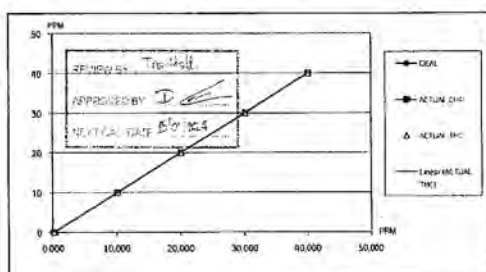
TEST REPORT

RYG EN0038

CUSTOMER NAME	ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส กรุ๊ป (ไทยแลนด์) จำกัด)		
EQUIPMENT NAME	THC Analyzer		
MANUFACTURER	HCHIBA	MODEL	APHAS 370
		SERIAL NO	U1A3N54TH
STANDARD GAS CONCENTRATION (PPM)	506.1 PPM	CYLINDER NO	CC734373
CYLINDER PRESSURE (psig)	1,000 PSI	CERTIFIED DATE	12/05/2020
CERTIFIED BY	AIRGAS	EXPIRED DATE	12/05/2026

TEST RESULTS

POINT NO	TEST RESULTS						
	IDEAL	ACTUAL CHA	ERROR CHA	MEASURE CHA	ACTUAL THC	ERROR THC	MEASURE THC
ZERO	0.000	0.210	0.210	—	0.200	0.200	—
1	10.000	10.050	0.050	0.50	10.050	0.050	0.50
2	20.000	20.120	0.120	0.60	20.100	0.100	0.75
3	30.000	30.110	0.110	0.57	30.050	0.050	0.17
4	40.000	40.030	0.030	0.08	40.030	0.030	0.08
AVERAGE (%)				0.39	0.37		



CALIBRATED BY _____
CHECKED BY - _____

CHECKED BY _____

J DATE: 25/1/66
NAC DATE: 25/1/66

[illegible]

CHECK LIST

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส กรุ๊ป จำกัด (มหาชน) จำกัด)			
EQUIPMENT NAME : THE Analyzer			
MANUFACTURER : HORIBA		MODEL : APHA-370	SERIAL NO. : U43037111

TEST VALUES

NO.	THC Analyzer (APHA - 370)	UNIT	BEFORE	AFTER
1	Signal (CH1)	mV	9.300	62.60
2	Signal (TH1C)	mV	3.200	64.40
3	Detection	Temp °C , Standard Value : Ambient temp (5°C to 15°C) Pressure kPa , Standard Value : (Ambient / 0.13) x (100 - 200) kPa	46.700 70.000	50.000 70.10
4	Ambient	kPa current, atmospheric pressure	101.000	101.10
5	Purifier	°C , Standard Value : 300 °C to 430 °C kPa , Normal value : 8 kPa to 25 kPa	420.400 9.800	421.20 9.80
6	HWIE	°C , Standard Value : 250 °C to 260 °C	244.600	245.10
7	DC 24 V	V , Standard Value : 24 V ± 0.5 V	23.900	23.90
8	DC 5 V	V , Standard Value : 5 V ± 0.5 V	5.000	5.00
9	Bypass (Optional)	L/min, Normal value : 0.9 L/min ± 0.3 L/min		
10	Flow Filter (Optional)	L/min, Standard Value : 0.8 L/min or More		
11	CH1C Sampling Reading	PPM	5.550	2.30
12	NM1C Sampling Reading	PPM	4.280	1.10
13	TH1C Sampling Reading	PPM	6.810	3.40
14	Zero Gas (CH1/TH1C)	PPM	0.71/0.20	0.00/0.00
15	Span Gas	PPM	54.87/55.78	40.03/40.03
16	Gas PG	20 PSI		20

Revised: Release: IX-EN-017.5b - Analysis HC Monitor NPIA-370 Operation Manual Page 48

Newark: (Amsted) Institute = 3°C to 40°C.

ฮากวูที่เรารู้จัก

Service Maintenance:

រាងកាយនៃការសិក្សា

- 1/3 Calibration Zero/Scale - 1.441 points

ผลการดำเนินงาน

เริ่มโดย... (text continues)

CALIBRATED BY _____
CHECKED BY _____

CHECKED BY: John Lane



J
NAC
ULTIMATE ASSOCIATES CO., LTD.

DATE 25/1/66
DATE 25/1/66

ติดต่อขอข้อมูลเพิ่มเติม: สหกรณ์ปศุสัตว์ไทย โทร 02-868-0912-4 1516-1-1/11 Engleborg@aradise.com

โทร 63/16-15.67/35-36 แฟกซ์ 02-668-0812 โทรสาร 02-668-1889



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
234 BATTANAKARN, ROAD 50, SUWASUKHANG, SUWASUKHANG, BANGKOK 10250
TEL: 0-2717-8602 FAX: 0-2717-8641



Cert.No.: 23CH275
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : C104059460
ID No. : RYG_END183
Condition As-Received : Used Item
Received Date : 24 February 2023
Calibration Date : 27 February 2023
Reference : 2302-0860DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5, T. Maenam, Kh. A. Phraekong
Rayong 21140, Thailand
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)
- CP-CH8 by comparison with standard thermometer
Calibrated by : Waiarak Sintean
Approved by :
Approved Signature
I. Motee Buksuea
✓ Sathip Meangnui
I. Waiarak Lemgagrakul
Issue Date : 28 February 2023
This Uncertainty is for a confidence probability of approximately 95%
The calibration is valid only for the item calibrated on date and place of calibration.
This certificate is valid only for the item calibrated on date and place of calibration.

0.000000



Cert.No.: 23CH275
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 54030048 130PC118 23E2769 24 Aug 2023
2) Ref. Standard Thermometer 4982054 110RC044 221306 27 Oct 2023
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. AN-1835

Buffer Solution Manufacturer Lot No. Exp. date
pH 4.008 CPA chem 826588 09 July 2024
pH 6.867 CPA chem 826588 09 July 2023
pH 10.010 CPA chem 863035 28 Dec 2023

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: C104059460	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

Sathip

0.1149525



Cert.No.: 23CH275
Page: 3 of 3

Calibration Results

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: 1453404	4.008	4.008	179.1	0.0046	2.00
	6.867	6.868	4.7	0.0084	2.00
	10.010	10.013	-172.4	0.0069	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

Model : HiLabExpert Pro-ISM
Serial No. : 1453404

Dimension of probe:

Length : 120 mm

Diameter : 12 mm

Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.001	24.8	-0.201	0.12	2.00

Remark : * UUC* = Unit Under Calibration.

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

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0.1149524



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Certificate of Calibration

Certificate No.: 23E753
Page: 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : C104059460
ID No. : RYG_END183
Condition As-Received : Used Item
Received Date : 24 February 2023
Calibration Date : 26 February 2023
Reference : 2302-0860DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 10) %
This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services
616/10 Moo 5, T. Maenam, Kh. A. Phraekong
Rayong 21140, Thailand
Procedure used : Calibration were conducted using In-house calibration Procedure CP-E17 According to direct measurement method with Multi-Product Calibrator.

Condition of this result of calibration

1. Reference standard instruments :
Instrument Model Serial No. Certificate No. Due Date
1) Multi-Product Calibrator 5500A 6440007 276187C 18 May 2023
2. The result of calibration was made on request at the point specified by customer.
3. This certificate is valid only to the item calibrated on date and place of calibration.
This Certification is traceable to the International System of Unit maintained at:
- National Institute of Metrology (Thailand) (NIMT)

Calibrated by : Waiarak Sintean
Issued Date : 27 Feb 2023
Approved Signature :
I. Phairote Prabparat
I. Waiarak Sintean
I. Pongtana Tameyakul

0.0309672



Cert. No.: 23E753
Page: 2 of 2

Result of calibration:- (*) Without adjustment () After adjustment

Function:	DC voltage measurer	Range:	2000	mV
Standard Value	UUC* Reading	Error	Uncertainty	
(mV)	(mV)	(mV)	(± µV)	
-200.0000	-200.0	0.0	72	
-150.0000	-150.0	0.0	68	
-100.0000	-100.0	0.0	65	
-50.0000	-50.0	0.0	62	
0.0000	0.0	0.0	58	
50.0000	50.0	0.0	62	
100.0000	99.9	-0.1	65	
150.0000	149.9	-0.1	68	
200.0000	199.9	-0.1	72	

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

UUC* = Unit Under Calibration.

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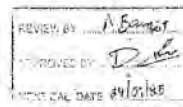


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TEL: 0-2717-3000 FAX: 0-2719-6464

Cert.No.: 23TW168
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102798
ID No. : RYG_EK0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5, T. Maenam Khu, A. Phakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In-house method : CP-DH9
by Comparison Technique with Azide Modification Method
Tested by : Watlak Sathian
Approved by : Sathip
Approved Signatory
() Malee Butkuee
(✓) Sathip Meangma
() Warekorn Lemgagrakul
Issue Date : 26 July 2023



0320211



Cert. No.: 23TW168
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	25CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material

Material	Manufacturer	Lot No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM17E3316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E103464

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.18	8.17	0.0055

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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1172155



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TEL: 0-2717-3000 FAX: 0-2719-6464



Cert. No.: 23LM125
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102798
ID No. : RYG_EK0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5 T. Maenam Khu A. Phakdaeng,
Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Preecha Hirahib
Approved by : Preecha Hirahib
Approved Signatory
() Pormthippa Tanmayakul
() Malee Butkuee
(✓) Suwit Injai
Issue Date : 31 July 2023

The Uncertainty is for a confidence probability of approximately 95%

A 0053616



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713OSC-2
Procedure Used :-

Cert. No.: 23LM125
Page: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	221285	TPA	21 Oct 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (") Without Adjustment

Function : Temperature measurement

This instrument was connected with temperature sensor, S/N: 1226475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

UUC* : Unit Under Calibration

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

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1159515



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35-3 PATANAKARN ROAD, 2ND FLOOR, SUKUMVIT 11, KLONG TOE, BANGKOK, THAILAND
TEL: 02-271-8888, 02-271-8889



Cert. No.: 23TM982
Page: 1 of 3

Certificate of Calibration

Equipment : Low Temp. Incubator
Manufacturer : Memmen
Model : IPP750
Serial No. : V616 0084
ID No. : RYG_EN0154

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu.
A. Phukdaeng, Rayong 21140 Thailand
Location : BOC Room

Received Order : 28 May 2023
Calibration Date : 29 May 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Patanapongpaiboon

Approved by :

() Pominipha Tameyaku
() Melee Butkrua
(x) Suwit Imjai

Issue Date : 7 June 2023

The uncertainties are for a confidence probability of approximately 95 %

The uncertainties are for a confidence probability of approximately 95 %
Approved by: (Signature) Approved Signatory

A 0054957



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2305-0690OC-2
Procedure Used :-

Cert. No.: 23TM982
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	23LM93	02 Jul 2023

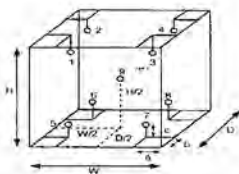
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (") Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details:

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber:

D = 0.50 m
W = 1.0 m
H = 1.2 m
Capacity = 0.75 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	23
REL Humid. (%)	54	56
AC Supply (Volt)	223	222

Position	Ref. Std. ID No.
1	18-18RTD-01
2	16-18RTD-02
3	16-18RTD-03
4	16-18RTD-04
5	16-18RTD-05
6	16-18RTD-10
7	16-18RTD-07
8	22-18RTD-06
9 (ref.)	16-18RTD-09

1165130



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2305-0690OC-2
Result of Calibration :- (") Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM982
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.019	0.72	1.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.547	19.780	19.487	19.538	19.408	20.130	20.112	20.406	20.116	0.30

Average*: The average of 30 values in each position.

Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at its close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation UUC* : Unit Under Calibration

Note: The reported uncertainty of measurement was included stability and excluded uniformity.

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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1165129



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230441
Issued Date: 19 September 2023
Job No.: WO-00005382
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
 616/10 Moo 5 T. Maenam Khu,
 A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 23.8 °C ± 0.2
 Humidity 65.3 %RH ± 1.4

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Weil Chemistry)
 616/10 Moo 5 T. Maenam Khu,
 A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Nattapal Rungruang
Calibration Date: 18 September 2023
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sigma Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111594
 The standard for Photometric Certificate No. 9114584 and 111555
 The standard for Stray light Certificate No. 111586 and 111585
 The standard for Spectral resolution Certificate No. 111587

REVIEW BY: *[Signature]*
 APPROVED BY: *[Signature]*
 NEXT CAL DATE: 18/12/25

[Signature]
 (Mr. Nattapal Rungruang)
 Person in charge

[Signature]
 (Mr. Nitinun Sriwanan)
 Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI), it provides traceability of measurement to international (SI) national standard or other recognized national standard laboratories.
 The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%, it is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
 These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.
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 Phone: +66 2027 1200 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-15/ 12 Sep 2022

Certificate No.: C06230441 Page 2 of 3

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm			
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.98	638.3	-0.32	0.13
748.48	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)			
Wavelength	Standard absorbance	Unit Under Calibration	Correction
420 nm	0.0000	0.000	0.0000
	0.2930	0.289	0.0040
	0.5168	0.518	-0.0022
	1.0298	1.029	0.0006
440 nm	0.0000	0.000	0.0000
	0.2867	0.283	0.0037
	0.5073	0.509	-0.0017
	1.0083	1.007	0.0013
485 nm	0.0000	0.000	0.0000
	0.2516	0.250	0.0016
	0.4695	0.452	-0.0325
	0.9334	0.933	0.0004
546.1 nm	0.0000	0.000	0.0000
	0.2461	0.245	0.0011
	0.4652	0.466	-0.0006
	0.9466	0.946	0.0006
590 nm	0.0000	0.000	0.0000
	0.2594	0.259	0.0004
	0.5040	0.505	-0.0010
	1.0032	1.002	0.0012
635 nm	0.0000	0.000	0.0000
	0.2579	0.257	0.0009
	0.4871	0.497	-0.0001
	0.9720	0.971	0.0010

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 Phone: +66 2027 1200 Email: info@dksh.com Website: www.dksh.com

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CAL-FM-C06-15/ 12 Sep 2022

Certificate No.: C06230441 Page 3 of 3

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)			
Wavelength	Standard absorbance	Unit Under Calibration	Correction
235 nm	0.0000	0.000	0.0000
	0.7255	0.737	-0.0015
	0.8574	0.857	0.0004
257 nm	0.0000	0.000	0.0000
	0.2864	0.289	-0.0036
313 nm	0.0000	0.000	0.0000
	0.2864	0.289	-0.0036
350 nm	0.0000	0.000	0.0000
	0.6374	0.637	0.0004

Stray light *			
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.62 ± 0.11 nm	260.6	1.3	1.896
391.44 ± 0.11 nm	391.4	1.3	1.896

Spectral Resolution *			
Nominal Resolution 0.02 % w/v	Peak	Trough	Ratio
Standard Wavelength (nm)	260.66	266.69	1.38
UUC: Wavelength (nm)	260.2	266.1	
Std Absorbance (A)	0.4566	0.2780	
Absorbance (A)	0.413	0.300	

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

The End of Certificate

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CAL-FM-C06-15/ 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องวัด: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจสอบ	ตรวจสอบ (วัน)		หมายเหตุ
18 Sep 2023			16 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์ของเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายในของเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. หัววัด ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. แป้นกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แสงฟลูออเรสเซนซ์ (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แสงฟลูออเรสเซนซ์ (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ขั้ววัดหลายตัว (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. ขั้วไฟฟ้า (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งขั้วไฟฟ้า (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	16. ถังความทึบ (No Sample)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	17. ระดับการกรองตัวอย่าง (>= 2.5 ไมครอน 3.0)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	18. หัวฉีด Piston Burettes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	20. ระบบจ่ายยาและอุปกรณ์ประกอบ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

เส้นความยาวคลื่น: *656.1nm-656.1nm
 *486.0nm-486.5nm

Mr. Nattapal Rungruang
 Service Engineer

While Accuracy and Validity only
 DKSH Technology Limited
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 2533 Sukhumvit Road, Bangkok, Thailand 10260
 Phone: +66 2027 1200 Email: info@dksh.com Website: www.dksh.com

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CAL-FM-R31-03/ 20 Jul 2022

RYG_EN0002

Sartorius (Thailand) Co., Ltd.
125 Rama 9 Road, Huaywang, Huaywang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367 e-mail: sarthos@thailand.sartorius.com



SARTORIUS
REVIEWED BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 01/03/24

Certificate of Calibration

Model Number: MSE2245-100-DU Certificate No.: 238C0112
Description: Analytical Balance Issued Date: Friday, March 03, 2023
Serial Number: 0025207038 Reference No.: 204933
ID No.: RYG_EN0002
Manufacturer: Sartorius Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu. A. Pluak Daeng, Rayong 21140, Thailand.

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T. Maenam Khu. A. Pluak Daeng, Rayong 21140, Thailand.

Calibrated By: Mr. Chonchai Wintana
Calibration Date: Wednesday, March 01, 2023

Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number (WH-003) based on UKAS LAB 14: 2019

Metrolological data:
Capacity: 220 g Readability: 0.0001 g
Ambient Conditions:
Temperature: 23.6 °C ± 5.0 °C
Humidity: 60.0 % RH ± 10.0 % RH
Pressure: ±

Reasons for calibration:
☐ New Installation ☐ Service / Repair ☐ Recalibration / Maintenance ☐ Equipment Condition ☐ Good Operation ☐ Fail

Measurement Method UKAS Publication Ref: Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrolological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-00	Sartorius weight set 1mg - 5000g E2 YC5011-522-00	SFC-RT	C02212569	14-Sep-2023
MHB-3825D	Humidity/Saturation Temp. Lutron MHB-3825D	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division
Sartorius (Thailand) Co., Ltd.

SOP FM 31 03 February 2022

Mr. Chonchai Wintana (Technical Manager)



Sartorius (Thailand) Co., Ltd.

125 Rama 9 Road, Huaywang, Huaywang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367 e-mail: sarthos@thailand.sartorius.com

SARTORIUS

Certificate of Calibration

Model Number: MSE2245-100-DU Certificate No.: 238C0112
Description: Analytical Balance Issued Date: Friday, March 03, 2023
Serial Number: 0025207038 Reference No.: 204933
ID No.: RYG_EN0002
Manufacturer: Sartorius Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under constant conditions when the same load is used. A measurement is taken at least 10 times on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is tested by the difference between the results of the load vs. 100% of maximum capacity, placed on the middle of the weighing pan and between each of four additional measurement points (position defined according to GMA, RFE).		
Nominal Value (Low Load)	20 g	185.9999	Nominal value	100 g	
Tolerance	0.0001 g	0.0001 g	Tolerance	0.0004 g	
0.0001 g	0.0001 g	0.0001 g			
Nominal Value (High Load)	200 g	185.9999			
Tolerance	0.0001 g	0.0001 g			
0.0001 g	0.0001 g	0.0001 g			
Standard Deviation					

Linearity

The linearity, also called loading error, determines the deviation of the characteristic curve of a weighing instrument from the linear scale.

Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00014
100	100.0000	100.0000	0.0000	0.00014
200	200.0000	200.0000	0.0000	0.00014

End of Report

SOP FM 31 03 February 2022

RYG_EN0010



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE HEADQUARTERS FOR INDUSTRIAL AND TECHNOLOGY SERVICES
101/101 ANSANG ROAD, SUKHVITHEE, BANGKOK 10110, THAILAND
TEL: +66 2 275 5401-2 FAX: +66 2 275 5401



Cert. No.: 22TM1517
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: UFE 500
Serial No.: G511 1572
ID No.: RYG_EN0010
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu. A. Pluak Daeng, Rayong 21140 Thailand
Location: Oven Room
Received Order: 20 October 2022
Calibration Date: 20 October 2022
Ambient Temperature: (26 ± 1) °C
Relative Humidity: (50 ± 3) %
Calibrated by: Man Pabonapongpailoon

REVIEWED BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 20/04/24

Approved by: [Signature]
Approved Signature

1. Poulleppa Tameyaka
2. Nakee Buthyok
3. Suwila Imja

Issue Date: 2 November 2022

The measurement uncertainty is (confidence probability of approximately 95%)



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-0376OC-2
Procedure Used:

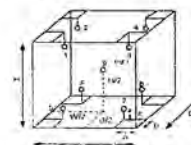
Cert. No.: 22TM1517
Page: 2 of 3

Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type 1.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

- Reference standard instrument:
 - This certificate is valid only to the item calibrated on date and place of calibration.
 - This certification is traceable to the International System of Unit.
- Result of Calibration: (°C) Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Close



Probe Installation Details: Dimension of Chamber:
L = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³

Environment during calibration		
Parameter	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	54	59
AC Supply (V)	223	225

Ref. Std. ID No.: @ Calibration Point		
Position	(188) °C	(104) °C
1	21-16TC-01	20-16RTD-01
2	21-16TC-02	20-16RTD-02
3	21-16TC-03	20-16RTD-03
4	21-16TC-04	20-16RTD-04
5	21-16TC-05	22-16RTD-05
6	21-16TC-06	22-16RTD-06
7	21-16TC-07	20-16RTD-07
8	21-16TC-08	22-16RTD-08
9 (ref.)	21-16TC-09	22-16RTD-09

a 1132466



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-2
Result of Calibration: (°) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

Cert. No.: 22TM1517
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.68	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.788	103.734	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.489	180.361	180.114	180.131	180.243	179.605

Average*: The average of 30 values in each position.
Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.
UUC*: Unit Under Calibration.
Note: The reported uncertainty of measurement was included stability and excluded uniformity.
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%.

-080-

1132465

RYG_EN0006



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
214 PATTANASARAKI ROAD MOO 5, T. MAENAM ITHU, A. PHUKHATONG, RAYONG 21140, THAILAND
TEL: 037-546227 FAX: 037-546444



Cert. No.: 22TM1492
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: LM 400
Serial No.: 6495.0899
ID No.: RYG_EN0006
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
516/10 Moo 5, T. Maenam Ithi, A. Phukhatong, Rayong 21140, Thailand
Location: Oven Room
Received Order: 20 October 2022
Calibration Date: 20 October 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Preecha Hahb
Approved by:
() Pornthipa Tameyaku
() Malek Bulkrusa
() Suwit Imjai

Issue Date: 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%.

The uncertainty has been calculated using the following formula:
U = (U₁² + U₂² + U₃² + U₄² + U₅²)^{1/2}

A 0046805



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-1

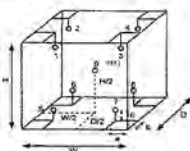
Cert. No.: 22TM1492
Page: 2 of 3

Procedure Used: Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition system connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

- Reference standard instrument:
Instrument: Model: Serial No.: Cert. No.: Due Date:
1) Data Acquisition 34970A MV44035217 21LM30 23 Dec 2022
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Units.

Result of Calibration: (°) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close



Probe Installation Details: Dimension of Chamber
a = 5.0 cm D = 0.33 m
b = 5.0 cm W = 0.40 m
c = 5.0 cm H = 0.40 m
Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL Humid. (%)	43	47
AC Supply (Volt)	220	221

Position	Ref. Std. ID No.
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

1132473



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-1
Result of Calibration: (°) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

Cert. No.: 22TM1492
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
70.0	70.0	70.0	0.078	0.47	0.77	0.42	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
70.0	70.262	69.985	70.079	70.177	70.654	70.039	70.688	70.149	70.328

Average*: The average of 30 values in each position.
Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.
UUC*: Unit Under Calibration.
Note: The reported uncertainty of measurement was included stability and excluded uniformity.
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%.

-080-

1132472



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICE & CALIBRATION LABORATORY AND TESTING SERVICE
554/4 PATTANAKARN RD. 5TH FLOOR, SUKUMVIT 55, ANUARD, BANGKOK, 10250
TEL: 02-015-1000-27 FAX: 02-015-9994



Cert. No.: 22TM1491
Page: 1 of 3

Certificate of Calibration

Equipment: Water Bath
Manufacturer: Memmert
Model: WNB22
Serial No.: L513 0648
ID No.: RYG_EN0061
Submitted by: A/S Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Phukdaeng,
Rayong 21140, Thailand
Location: Wet Chemistry Lab
Received Order: 20 October 2022
Calibration Date: 20 October 2022
Ambient Temperature: $(25 \pm 10)^\circ\text{C}$
Relative Humidity: $(50 \pm 20)\%$
Calibrated by: Praecha Hlabh
Approved by:
Approved Signatory
() Ponnthippa Tameyakul
(x) Malee Butkruea
() Suwit Imjai
Issue Date: 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%.

Approved by the head of Calibration Service:
Approved by the head of Calibration Service:

A 0046306



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2210-03760C-4
Procedure Used: -

Cert. No.: 22TM1491
Page: 2 of 3

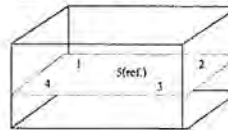
Calibration were conducted using in-house calibration procedure CP-DT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1 Reference standard instrument:
Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34870A MY44035217 21LM30 23 Dec 2022
2 This certificate is valid only to the item calibrated on date and place of calibration.
3 This certification is traceable to the International System of Unit.
Result of Calibration: () Without Adjustment
Function of UUC*: Temperature Source

	Environmental		AC Voltage Supply
	($^\circ\text{C}$)	(%R.H.)	(Voh)
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

Position	Ref. Std. S.N.:
1	N37P300726
2	N37P300727
3	N37P300728
4	N37P300729
5(ref.)	N37P300730

a 1132471



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2210-03760C-4
Result of Calibration: () Without Adjustment
Function of UUC*: Temperature Source

Cert. No.: 22TM1491
Page: 3 of 3

Calibration point ($^\circ\text{C}$)	UUC* Setting ($^\circ\text{C}$)	UUC* Reading ($^\circ\text{C}$)	Average* Standard Reading ($^\circ\text{C}$)				
			Position				
85.0	85.0	85.0	1	2	3	4	5 (ref.)
			84.527	84.563	84.626	84.515	84.580

Calibration point ($^\circ\text{C}$)	Uniformity ($^\circ\text{C}$)	Stability ($\pm^\circ\text{C}$)	Uncertainty ($\pm^\circ\text{C}$)	Coverage Factor
85.0	0.12	0.081	0.18	2

Average*: The average of 30 values in each position.

Uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature uniformity or homogeneity within the chamber under steady-state conditions.

Stability: One-half of the greatest maximum difference of measured temperature at any one probe.

UUC*: Unit Under Calibration

Note: The reported uncertainty of measurement was included stability and excluded uniformity.

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 %.

-080-

a 0130470



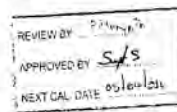
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICE & CALIBRATION LABORATORY AND TESTING SERVICE
554/4 PATTANAKARN RD. 5TH FLOOR, SUKUMVIT 55, ANUARD, BANGKOK, 10250
TEL: 02-015-1000-27 FAX: 02-015-9994



Cert. No.: 23CH442
Page: 1 of 2

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenGo TM pH/mV 52
Serial No.: C202355608
ID No.: RYG_FS0574
Condition As-Received: Used Item
Received Date: 31 March 2023
Calibration Date: 03 April 2023
Reference: 2303-1133DSC-3
Submitted by: A/S Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616/10 Moo 5, T. Maenam Khu,
A. Phukdaeng, Rayong 21140, Thailand
Ambient Temperature: $(25 \pm 2.5)^\circ\text{C}$
Relative Humidity: $(50 \pm 15)\%$
Calibration Procedure: In-house method
- CP-CHS by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by: Warakorn Lemgagrakul
Approved by:
Approved Signatory
(x) Malee Butkruea
() Saisit Meangma
() Warakorn Lemgagrakul
Issue Date: 5 April 2023



The Uncertainties are for a confidence probability of approximately 95%.

Approved by the head of Calibration Service:
Approved by the head of Calibration Service:

A 0052954

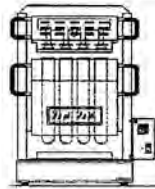
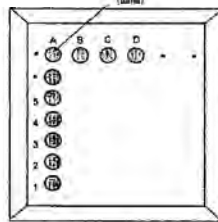


Fig. 1: Front view



Location of standard

Fig. 2: Digestion block

Definitions

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

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

Calibration Results:

Before adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	350	380	380	378.1	-4.9	1.5
A2				374.3	-5.7	1.5
A3				374.6	-5.4	1.5
A4				376.3	-3.7	1.5
A5				373.2	-6.8	1.5
B1				374.4	-5.6	1.5
B2				374.3	-5.7	1.5
B3				374.6	-5.4	1.5
B4				376.2	-4.8	1.5
B5				375.1	-4.9	1.5
C1				373.8	-6.2	1.5
C2				372.9	-7.1	1.5
C3				372.1	-7.9	1.5
C4				372.2	-7.8	1.5
C5				374.5	-5.5	1.5
D1				374.7	-5.3	1.5
D2				375.3	-4.7	1.5
D3				375.5	-4.5	1.5
D4				375.8	-4.2	1.5
D5				375.1	-4.9	1.5

Calibration Results:

After adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	379.0	-1.0	1.5
A2				376.7	-1.3	1.5
A3				376.4	-0.6	1.5
A4				376.2	-0.8	1.5
A5				379.2	-0.8	1.5
B1				379.6	-0.4	1.5
B2				379.2	-0.8	1.5
B3				376.5	-0.5	1.5
B4				376.9	-1.1	1.5
B5				376.1	-0.9	1.5
C1				379.1	-0.9	1.5
C2				377.7	-2.3	1.5
C3				376.4	-1.6	1.5
C4				376.3	-1.7	1.5
C5				378.0	-2.0	1.5
D1				376.5	-0.5	1.5
D2				376.7	-1.3	1.5
D3				376.7	-0.3	1.5
D4				376.5	-0.5	1.5
D5				379.4	-0.6	1.5

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

ชนิดเครื่อง: Block Digestion Unit

รุ่น: KT-20s

เลขที่ใบงาน: KSPR2304362

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (วันที่)		รายการตรวจสอบ	ตรวจสอบ (วันที่)		หมายเหตุ
15 Mar 2023			15 Mar 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สลัก Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สลักเปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลักล็อคเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลักควบคุมอุณหภูมิของ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Signature

Mr. Nakenin Ruencia
Service Engineer



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Bangpa, A. Kaengkhro, Saraburi 18110, Thailand

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6651 : +668 9247 2360

Website : www.sci-eco.co.th E-Mail : calibrate@scg.com



Certificate No. T230116

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : MODULAR

Model : IREVC00COO

Serial No. : C00351459

Customer Code : RYG_EN0184

ID No. : T1939A5

Customer : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)

616/10 Moo 5 T. Maenam Kho,

A. Phukdaeng, Rayong 21140

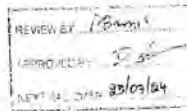
Customer Location : Laboratory

Date of Receipt : 23 January 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Boonchai Suriyavong (Site Calibration Manager)

Date of Issue : 07 FEB 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

TM-LS-017-15-05-63



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Bangpa, A. Kaengkhro, Saraburi 18110, Thailand



Certificate No. T230116

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 25 January 2023

Environment : Temperature : 23.4-24.9 °C

Line Voltage : 221.4-230.2 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert 16 standard thermocouples type T into its chamber. The meter one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986). All data shown below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023
- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS (T202 CALIBRATION 0344))
- Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour

Event Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max

☒ Not Available
- Adjustment : (X) Without adjustment () after adjustment

Approved By: Boonchai Suriyavong

TM-LS-017-15-05-63



Metrological Center

SCI ECO Services Company Limited

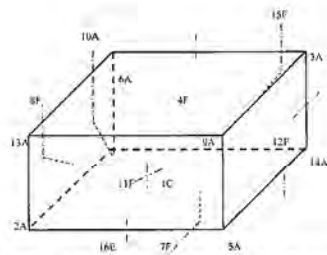
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Certificate No. T230116

Page 3 of 4

Calibration Report



1C = TN141	12F = TN152
2A = TN142	13A = TN153
3A = TN143	14A = TN154
4F = TN144	15F = TN155
5A = TN145	16E = TN156
6A = TN146	
7F = TN147	
8F = TN148	
9A = TN149	
10A = TN150	
11F = TN151	

Approved By: Boonchai Suriyavong

TM-LS-017-15-05-63



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Bangpa, A. Kaengkhro, Saraburi 18110, Thailand



Certificate No. T230116

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3.0	3.03	3.16	3.15	3.19	3.45	3.47	3.21	3.35	3.54	3.45
	TN151	TN154	TN155	TN156						
	3.28	3.22	3.29	3.21						

Setting (°C)	Reading (°C)			Temperature Distribution			
	Min	Max	Average	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
3.0	2.8	4.1	3.5	1.20	1.20	1.00	2.07

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: Boonchai Suriyavong

TM-LS-017-15-05-63



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE LABORATORY EQUIPMENT CALIBRATION AND TESTING SERVICE
333-4 PATTANAKARN RD. (M. 33) MAE LAENG SUBDISTRICT (BANGKOK) 10250
TEL. 02-215-0909-20 FAX. 02-215-0904



Cert.No.: 23CH1088
Page.: 1 of 2

Certificate of Calibration

Equipment: Conductivity Meter
Manufacturer: Mettler Toledo
Model: S23C
Serial No.: 8241407147
ID No.: RYO_EN0029
Condition As-Received: Used Item
Received Date: 01 September 2023
Calibration Date: 04 September 2023
Reference: 7306-00100SC-7
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
619/10 Moo 5, T. Maenam Khu
A. Puaakdaeng, Rayong 21140, Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 15) %
Calibration Procedure: In-house method
- CP-CHE, based on direct measurement by
using certified reference material (CRM)
Calibrated by: Warikom Lomgagrakul
Approved by:
() Sathap Meangmai
() Warikom Lomgagrakul
() Porpan Palaim
Issue Date: 7 September 2023

The uncertainty is for a confidence probability of approximately 95%

0058059



Cert.No.: 23CH1088
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument -
Instrument Serial No. ID No. Certificate No. Due date
1) Thermometer 9549224 130RC003 231435 10 Apr 2024
- This Calibration is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials -

- Conductivity calibration solution, CPA chem Ltd. The measurement results are traceable to SI
through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AN-1935

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84.000 µS/cm	CPA Chem	885120	28 Mar 2024
1413.0 µS/cm	CPA Chem	913566	14 July 2024
12.880 mS/cm	CPA Chem	885123	28 Mar 2024

- Control Conductivity calibration solution temperature by Water bath (25.0 ± 1) °C

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

Calibration results

Function: Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 5823251000

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
84.000 µS/cm	83.8 µS/cm	85.2 µS/cm	0.62 µS/cm	2.00
1413.0 µS/cm	1386 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.41 mS/cm	12.63 mS/cm	0.086 mS/cm	2.00

Remark: - UUC* = Unit Under Calibration
- Cell constant = 0.545371 cm⁻¹

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 %.

-00-

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Automation Service Co., Ltd. BKK-EN0066
929/2091 Soi Patanakarn 30, Patanakarn Rd., Suanluang, Suanluang, Bangkok 10250
Head Office: Tel: 02-215-2994 ext.1 Fax: 02-215-4361 E-mail: ats@automation.co.th
Rayong Branch: 1/15 Huayong Rd., A. Muang, Rayong 21150 Tel: 038-810-152 Fax: 038-897-346
Lamphun Branch: 1225 M.4, T. Ban Klang, A. Muang, Lamphun 51000 Tel/Fax: 053-581-876
website: www.automation.co.th

MTOC: L-0508/2023

Report No.: ALS-416/01

TOC-L Maintenance Report

Instrument: Total Organic Carbon Analyzer Measuring: TC O - 30000 mg/L
Model: TOC-LCSH Place of Installation: -
Serial No.: HS4425300416 Department: LABORATORY
Manufacture: Shimadzu

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khaen Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance: 11 / 05 / 2023

Ambient Condition: Temperature 25.5 ± 5 °C

Humidifier: 56 ± 15 %RH

Maintenance By:
(Mr. Peorapong Sangpan)
Technician

Approved By:
(Mr. Nipon Phungsomsak)
Technician Manager

User Name:
(Sinituk Phungsomsak)

SHIMADZU ANALYZER
1/4



Automation Service Co., Ltd.

929/2091 Soi Patanakarn 30, Patanakarn Rd., Suanluang, Suanluang, Bangkok 10250
Head Office: Tel: 02-215-2994 ext.1 Fax: 02-215-4361 E-mail: ats@automation.co.th
Rayong Branch: 1/15 Huayong Rd., A. Muang, Rayong 21150 Tel: 038-810-152 Fax: 038-897-346
Lamphun Branch: 1225 M.4, T. Ban Klang, A. Muang, Lamphun 51000 Tel/Fax: 053-581-876
website: www.automation.co.th

MTOC: L-0508/2023

Report No.: ALS-416/01

Maintenance Sheet

Customer: ALS Laboratory Date: 11 / 05 / 2023
Model: TOC-LCSH Serial No.: HS4425300416

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Check functionality of the device	O.K.		
	Check furnace temperature (Standard cat. 680 °C / for TN cat. 720 °C)	O.K.		
	Check dehumidifier temperature (1 °C)	O.K.		
	Check the entire flow line related to leakage	O.K.		
	Check baseline status (OK)	O.K.		
	Check carrier gas pressure (200 ±10 kPa)	O.K.		
	Check carrier gas flow rate (150 mL/min)	O.K.		
2.	Tubes			
	Check all tubing for contamination, if necessary clean them	O.K.		
	Check all tubing for tight connection	O.K.		
3.	Container and Drainage			
	Fill up humidifier with pure water to max. level	O.K.		
	Check filling of dilution water and acid container	O.K.		
	Rinse Drain Pot, after wards refill again with pure water	O.K.		
	Check if outlet flow is in proper conditions	O.K.		
4.	TC and IC Injection			
	Clean injector Block	O.K.		
	Check injector Block for wear	O.K.		
	Check injection tube adjustment	O.K.		
	Check injection for leakage	O.K.		
	Check injection for clogging	O.K.		
5.	IC Measurement (N-type)			
	Check acidification in syringe			
	Check sparging in syringe			
6.	Eye check of B-Port valve, for sample residues or moist spots that indicate possible leakage	O.K.		
7.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See list of consumable, maintenance parts

Inspection by:
(Mr. Peorapong Sangpan)
Technician

SHIMADZU ANALYZER
2/4



Automation Service Co., Ltd.

323/25511 Soi Patsaborn 30, Patanakorn Rd., Samutprakan, Bangkok 10260
 Head Office: Tel. 02-315-9994 ext.1 Fax 02-315-9981 E-mail: abc@automation.co.th
 Rayong Branch: 1/15 Huayong Rd., A. Muang, Rayong 21150 Tel. 038-692-152 Fax. 038-692-245
 Lamphun Branch: 1225 M.A. 7 Ban Klang, A. Muang, Lamphun 51000 Tel/Fax. 053-561-876
 website : www.automation.co.th

MTOC: L-0508/2023

Report No.: ALS-416/01

Item	Carry out maintenance work	Result	Exchange	Comments
8.	Due to instrument condition, clean the instrument inside and outside.	O.K.		
9.	After checking the system and exchanging of consumable and maintenance parts a new 1-3 point calibration have to be done.	O.K.		Addition test 1.
10.	After wards the calibration perform check sample measurement.	O.K.		Addition test 2.

Addition test

Test no.	Test conditions	Meas. value	Result
1.	Calibration TC standard solution at 0, 0.1, 0.5, 1, 5, 10, 20 injection volume 50 µL No. of measurement 2 times (Max.3) Criteria: $R^2 = 0.995$ or more	1.0000	Pass
2.	Measurement of reagent water and TC standard solution at 5.0 mg/L injection volume 50 µL No. of measurement 2 times (Max.3) and calculate accuracy by Meas. of TC standard - Meas. of Reagent water Criteria: Accuracy % Recovery 10% or less	5.202 - 0.2705 = 4.9315 ppm	Pass

Inspection by: Peerapong Sangpan
 (Mr. Peerapong Sangpan)
 Technician

SHIMADZU ANALYZER
 3/4



Automation Service Co., Ltd.

323/25511 Soi Patsaborn 30, Patanakorn Rd., Samutprakan, Bangkok 10260
 Head Office: Tel. 02-315-9994 ext.1 Fax 02-315-9981 E-mail: abc@automation.co.th
 Rayong Branch: 1/15 Huayong Rd., A. Muang, Rayong 21150 Tel. 038-692-152 Fax. 038-692-245
 Lamphun Branch: 1225 M.A. 7 Ban Klang, A. Muang, Lamphun 51000 Tel/Fax. 053-561-876
 website : www.automation.co.th

MTOC: L-0508/2023

Report No.: ALS-416/01

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	036-11209-84	O-ring, 46 P10A (Viton, for TC/IC Slider)	O.K.	✓	1 time per year, Depending on condition
2.	036-11219-84	O-ring, 46 P20 (for sealing TC-Combustion tube)	O.K.		1 time per year, Depending on condition
3.	638-15025	O-ring, P1FE (for TC/IC Slider)	O.K.		1 time per year, Depending on condition
4.	630-00105-01	Platinum net, (2pcs/set) (to support catalyst)	O.K.		6 month same time as catalyst exchange
5.	630-00867	Silica Wool (to support catalyst)	O.K.		6 month same time as catalyst exchange
6.	630-00992	Halogen Scrubber	O.K.		6 month
7.	630-00996	High Sensitivity TC Catalyst (When installed)	N/A		Depending on condition
8.	638-60116	Regular Catalyst (33g) (When installed)	O.K.		6 month
9.	638-56251-01	8-Port valve rotor	O.K.		1 time per year
10.	638-41323	TC-Combustion Tube	O.K.		6 month same time as catalyst exchange
11.	631-43404-01	Packing, gasket slider (for TC-Injection tube)	O.K.		1 time per year, Depending on condition
12.	638-56296	Syringe 5mL	O.K.		Depending on condition
13.	638-59296-01	Plunger Tip (for syringe 5mL)	O.K.	✓	6 month
14.	042-00405-11	IC reagent supply pump head	O.K.		1 time per year
15.	630-00999	CO2-Absorber (for cell space purge)	O.K.		1 time per year
16.	630-00964	Molecular Sieves 13x	O.K.		1 time per year

Note: Table indicates the guidelines replacement periods when NPOC measurement is performed on sample that are comparatively as clean as tap water, use standard catalyst and at a rate of about 500 sample per month (operating five days a week)

Inspector By: Peerapong Sangpan
 (Mr. Peerapong Sangpan)
 Technician

SHIMADZU ANALYZER
 4/4

TOC-Control L Report

3/10/2023 23:01 PM

Basic Information

Instrumentation
 Catalyst

TOC/HSC/Lupl
 Regular Security

Cal. Curve

Sample Name:
 Sample ID:
 Cal. Curve:
 Status:

Unit:
 Method:
 TC SL: 20 ppm, 2023_03_12_18_36.mn
 Grouped:

Standard: TC
 Conc: 0.000mg/L

Area	Mean Area	SD Area	CV Area
0.000	0.000	0.000	0.000



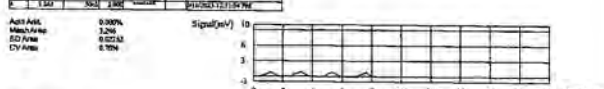
Conc: 0.1800mg/L

Area	Mean Area	SD Area	CV Area
1.128	1.128	0.000	0.000



Conc: 0.5000mg/L

Area	Mean Area	SD Area	CV Area
1.128	1.128	0.000	0.000



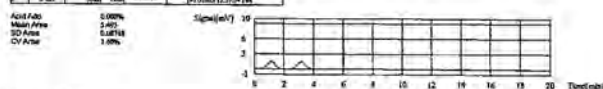
Conc: 1.0000mg/L



TOC-Control L Report

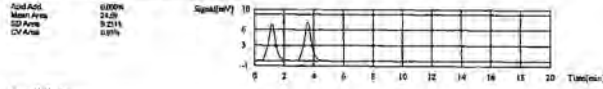
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Area	Mean Area	SD Area	CV Area
0.000	0.000	0.000	0.000



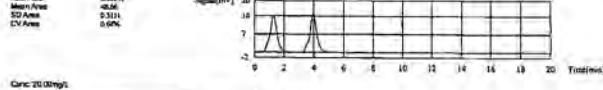
Conc: 5.000mg/L

Area	Mean Area	SD Area	CV Area
2.115	2.115	0.000	0.000



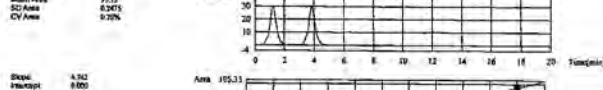
Conc: 10.00mg/L

Area	Mean Area	SD Area	CV Area
2.115	2.115	0.000	0.000



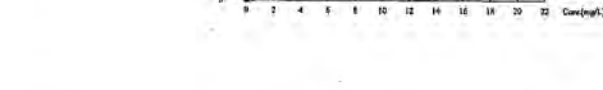
Conc: 20.00mg/L

Area	Mean Area	SD Area	CV Area
2.115	2.115	0.000	0.000



Conc: 25.00mg/L

Area	Mean Area	SD Area	CV Area
2.115	2.115	0.000	0.000



Conc: 30.00mg/L



TOC-Control L Report

00000000000000000000

Test Information

Instrument Online
Calibrated

TOC/ASTC User
Regular Sensitivity

Sample

Sample Name:
Sample ID:
Origin:
Batch:
Chk. Result:

TC-2
U.S. Dist.
TC-0.1 - 20 ppm cc
Completed



1. Out

Anal. TC

Time (min)	TOC (ppm)	Flow (mL/min)	Pressure (psi)	Temperature (°C)	Humidity (%)
0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00
0.02	0.00	0.00	0.00	0.00	0.00
0.03	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00
0.05	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00
0.07	0.00	0.00	0.00	0.00	0.00
0.08	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00
0.11	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00
0.14	0.00	0.00	0.00	0.00	0.00
0.15	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00
0.18	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.00	0.00	0.00

Main Axis
Mean Conc. 0.00

Signal (mV) 10



01000000000000000000

TOC-Control L Report

00000000000000000000

Test Information

Instrument Online
Calibrated

TOC/ASTC User
Regular Sensitivity

Sample

Sample Name:
Sample ID:
Origin:
Batch:
Chk. Result:

TC-2
U.S. Dist.
TC-0.1 - 20 ppm cc
Completed



1. Out

Anal. TC

Time (min)	TOC (ppm)	Flow (mL/min)	Pressure (psi)	Temperature (°C)	Humidity (%)
0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00
0.02	0.00	0.00	0.00	0.00	0.00
0.03	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00
0.05	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00
0.07	0.00	0.00	0.00	0.00	0.00
0.08	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00
0.11	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00
0.14	0.00	0.00	0.00	0.00	0.00
0.15	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00
0.18	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.00	0.00	0.00

Main Axis
Mean Conc. 0.00

Signal (mV) 10



01000000000000000000



Automation Service Co., Ltd.

829,929/1 Soi Pathumwan 30, Pathumwan Rd., Suanluang, Bangkok 10250
Head Office : Tel. 02-319-9994 ext. 1 Fax 02-319-4961 E-mail : atoc@automation.co.th
Rajong Branch : 1115 Rajong Rd., A. Muang, Rajong 21150 Tel. 054-692-152 Fax. 028-492-345
Lamphun Branch : 122/5 M.4, T. Ban Klang, A. Muang, Lamphun 51000 Tel/Fax. 052-581-876
website : www.automation.co.th

MTQC : L-0509/2023

Report No. : ALS-799/01

ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL
Model : ASI-L Place of Installation :
Serial No. : H57415200799 Department : LABORATORY
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaen Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance : 11 / 05 / 2023

Ambient Condition : Temperature 25.5 ± 5 °C
Humidifier 56 ± 15 %RH

Maintenance By : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

Approved By : H. Nipon Phungsomsak
(Mr. Nipon Phungsomsak)
Technician Manager

User Name : Sinluk P.
(Mr. Sinluk Pungsang)

SHIMADZU ANALYZER
1/3

REVIEW BY	<u>Sinluk P.</u>
APPROVED BY	<u>H. Nipon Phungsomsak</u>
NEXT CAL. DATE	<u>11/5/2024</u>



Automation Service Co., Ltd.

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website : www.automation.co.th

MTQC : L-0509/2023

Report No. : ALS-799/01

Maintenance Sheet

Customer : ALS Laboratory Date : 11 / 05 / 2023
Model : ASI-L Serial No. : H57415200799

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Arm Drive section	O.K.		
	Check Arm Drive Belt for wear and tension	O.K.		
	Check grease of Screw Arm Drive	O.K.		
2.	Rinse pump (only ASI-V 24ml, 40ml)	O.K.		
	Check pump rate (>40ml/min)	O.K.		
	Check pump and tube connection for leakage	O.K.		
	Check if outlet flow is in proper condition	O.K.		
3.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See appropriate list of maintenance parts
4.	Check Stirrer (When installed)	O.K.		
5.	Verify ASI function via mechanical check	O.K.		

Inspection by : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

SHIMADZU ANALYZER
2/3



Automation Service Co., Ltd.

908/9091 Soi Petchaburi 30, Petchaburi Rd., Suanluang, Bangkok 10250
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Rangsit Branch: 1173 Rangsit Rd., A. Muang, Rangsit 10100 Tel. 028-652-132 Fax 028-696-345
Lamphun Branch: 122/5 M.4, 1 Ban Klang, A. Muang, Lamphun 51000 Tel/Fax: 053-581-876
website: www.automation.co.th

MYOC: L-0509/2023

Report No.: ALS-799/01

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	017-27021-01	Grease Paste, Lubricant 100g	O.K.	✓	1 time per year
2.	032-22661-02	Belt, 60S2m596, Arm Drive	O.K.		1 time per year
3.	034-03067-02	Spring, F-642, Arm Drive	O.K.		Depending on condition
4.	042-00405-11	Pump Head, for ASI Rinse Pump (only ASI-V 24mL, 40mL)	O.K.		After 300 h of operating
5.	638-41448-01	Std. Needle Type1 24mL, 40mL* (for tube 2, 1x1.5) (Sparg needle)	N/A		Depending on condition
6.	638-41448-02	Std. Needle Type1 125mL* (for tube 2, 1x1.5)	N/A		Depending on condition
7.	631-41660-03	Flare Pipe 2x1.5x700mm* (for Standard Needle Type1 24mL, 40mL, 125mL)	N/A		Depending on condition (may cut to origin length 600mm)
8.	638-41450-01	Needle for Suspended Particles,* 0.8mm (only ASI-V 24mL, 40mL)	N/A		Depending on condition
9.	638-41450-01	Std. Needle Type2 125mL* (for tube 1.4x0.9)	N/A		Depending on condition
10.	638-41472-01	Std. Needle Type2 24mL, 40mL* (for tube 1.4x0.9)	O.K.		Depending on condition
11.	631-41660-02	Flare Pipe 1.4x0.9x600mm* (for Suspended + Needle Type2)	O.K.		Depending on condition
12.	638-41449-01	Double Needle, only 24mL, 40mL (simultaneous sparge type)*	N/A		Depending on condition
13.	631-41660-01	Flare Pipe 1.1x0.6x600mm* (for Double Needle 24mL, 40mL)	N/A		Depending on condition

*Note: needed parts depending on installed needle types!

Inspection by: Peerapong Sangsan
(Mr. Peerapong Sangsan)
Technician

SHIMADZU ANALYZER
3/3

BKK_EN0284

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-00 + GCMS-00

System ID: GM-10
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Pathanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250
Date: May 25, 2023 11:05:07 AM
EQP Name: Agilent Recommended, Agilent Recommended
EQP Revision: GC 02.52, GCMS 02.51
Overall Qualification Status: Pass

CD5 Logon Verification - GC

Logon: SESSIONNAME

Overall CD5 Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front MM

Setpoint Status: Pass

Segment Actual
Inlet Pressure: 25.0 PSI 24.9 PSI

Accuracy: 0.1 PSI

Agilent Recommended: < 1.2 PSI

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Agilent CrossLab Compliance Services

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.0 °C

Accuracy: 0.0 °C

Agilent Recommended: ± 1.0 °C

± 1.0 °C

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.0 °C

Accuracy: 0.0 °C

Agilent Recommended: ± 1.0 °C

± 1.0 °C

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.0333 °C

Stability: 0.1 °C

Agilent Recommended: ± 0.5 °C

± 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Agilent CrossLab Compliance Services

Tune E1

Tested Combination1

Name:

7890

Setpoint Status:

Pass

Flame:

1

Setpoint Status:

Pass

Flame:

2

Overall Tune E1 Test Status

Pass

Scouting Run

Tested Combination1

Name:

Injection Tower

Source:

EI - Extractor

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1

Name:

Injection Tower

Source:

EI - Extractor

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Instrument Detection Limit Test Status

Completed

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Setpoint Status: Pass

Injection Volume on Column: 1.0 μ L

Area: 10.08 %

Retention Time: 0.05 %

Minimum RSD: <= 12.00 %

Agilent Recommended: Pass

Instrument Detection Limit: 3.69552 ng

Agilent Recommended: <= 4.03880

Status: Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination: Front MMI External TO

Injection Tower

Name: 7693A

Source: EI - Extractor

Setpoint Status: Pass

Injection Volume on Column: 1.0 μ L

Area Mass 1: 3.22 %

Mass Ratio: 14.06 %

RSD: <= 7.50 %

Agilent Recommended: Pass

Overall Mass Ratio Precision Test Status

Pass

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID: GM-10

Manufacturer: Agilent Technologies

Name: 7690

Flow Data Input: Manual Data

Temperature Data Input: Manual Data or Other Data Logging

Tested Combination

Injection Technique: Injection Tower

Inlet: Front

Detector: External

LTM Included?: No

Sampler 1

Manufacturer: Agilent Technologies

Type: Injection Tower

Name: 7693A

Model Number: G4513A

Serial Number: CN16150093

Firmware Revision: A.11.02

Usage: Sample Injection

Location: Front

Syringe Volume (μ L): 10

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Sampler 2

Manufacturer: Agilent Technologies

Type: Tray

Name: 7693A

Model Number: G4514A

Serial Number: CN18176137

Firmware Revision: A.11.03

Vial Heater: Not installed

Mainframe 1

Manufacturer: Agilent Technologies

Name: 7890

Model Number: G3442B

Serial Number: CN19153080

Firmware Revision: G.00.06

Oven Type: Standard

Inlet 1

Manufacturer: Agilent Technologies

Name: 7890

Type: MMI

Location: Front

Carrier Gas: Helium

Control Type: Electronic Pressure Control (EPC)

Purged Inlet: Yes

Inlet 2

Manufacturer: Agilent Technologies

Name: 7890

Type: SSL

Location: Back

Carrier Gas: Helium

Control Type: Electronic Pressure Control (EPC)

Purged Inlet: Yes

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Detector 1

Manufacturer: Agilent Technologies

Name: Mass Spectrometer

Type: Mass Spectrometer

Location: External

Mass Spectrometer 1

Manufacturer: Agilent Technologies

Type: TO

Name: 7890D

Serial Number: US1826U106

Firmware Revision: G.7000.065A

High Vacuum System: Turbo Pump

Scoping Run Standard: CFN Std

MS EI Source 1

Manufacturer: Agilent Technologies

Source Type: EI - Extractor

Number of Elements: 2

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

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Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Full Name of Signer:	Nattapol Hangcharoen
Logged On User Name:	nattapolhangcharoen@egilant.com
Signature Creation Date:	May 25, 2023
Reason for Signature:	Executed protocol and published this original version of document

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System ID: GM-18
Print Date: May 28, 2023 11:05:28 AM

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 20, 2023 13:22 PM	Audit	Session Closed	Session	Name
May 20, 2023 13:23 PM	Start	Configuration	Session	Name
May 20, 2023 13:23 PM	Audit	Endscreen	Logging	User ID Field; program and does not require an address code
May 20, 2023 13:49 PM	Audit	Expanded	Session	ECP Search for primary definition [S6] File path: [ProgramName]GSMConfig and search [S6]; [S6.S6] ECP File Name: [GLT23.83].ecl ECP Name: [HighestRecommended Price of Purchase (P)SLD-SK ECP results for hybridized contract (C6)] File path: [ProgramName]GSMConfig search[S6.13]C6[SLD-83.1] and ECP File Name: [GMA23.83].ecl ECP Name: [HighestRecommended]
May 22, 2023 13:57 PM	End	Configuration	Session	Name
May 22, 2023 13:58 PM	Start	Grid Control	Session	CDS
May 22, 2023 13:59 PM	Start	Execution	CDS Logon Verification - GC	Name
May 22, 2023 14:27 PM	Start	Execution	CDS Logon Verification - GC	Name: - GridActive bin.
May 22, 2023 20:23 PM	Stop	Execution	Instream Deduct on Limit - Market Timer, Pool AGA, TCZ - Auction - FV Forecast - BBO L (Ave) = 12.96% - RDD L [Net Time] = 1.89%	Name:

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System für G&H
Print Date: May 25, 2023 11:09:08 AM

Time	Transcendental State	Activity Performed	Type of Transmutation	Optional Information
May 22, 2023 8:00:07 PM	Start	Exercitation	CGS Logics Verification - GC ; - Qualitative test	None
May 21, 2023 8:03:33 PM	End	Exercitation	CGS Logics Verification - GC ; - Qualitative test	Run Count : 1
May 25, 2023 8:34:38 PM	Start	Exercitation	System Inspection and Basic Safety and Operation - TENC ; Qualitative Test - No seconds accumulated	None
May 22, 2023 2:56:02 PM	End	Exercitation	System Inspection and Basic Safety and Operation - TENC ; Qualitative Test - No seconds accumulated	Run Count : 1
May 22, 2023 2:15:17 PM	Start	Exercitation	Joint Pressure Assessment - Force ; - 0.5 to 2 psi - L = 1.2 psi	None
May 22, 2023 2:15:22 PM	End	Exercitation	Joint Pressure Assessment - Force ; - 0.5 to 2 psi - L = 1.2 psi	Run Count : 1
May 22, 2023 2:15:24 PM	Start	Exercitation	GC Over Temperature Accuracy - 7800 - Temperature ; - Over - 5.20°C (L = -1.0 AND < 1.0 % seconds in A	None
May 22, 2023 2:15:49 PM	End	End	GC Over Temperature Accuracy - 7800 - Temperature ; - Over - 5.20°C (L = -1.0 AND < 1.0 % seconds in A	Manual Data Entry
May 22, 2023 2:16:04 PM	End	Exercitation	GC Over Temperature Accuracy - 7800 - Temperature ; - Over - 5.20°C (L = -1.0 AND < 1.0 % seconds in A	Run Count : 1

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SystemId: 648-10
Print Date: May 23, 2023 11:03:08 AM

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
May 21, 2012 2:30:01 PM	Start	Execution	OC Oven Temperature Accuracy = 7.80% - Temperature (Open = 100.0°C - L = +1.0 MID = +1.0 N supplied in K	None
May 22, 2012 2:59:58 PM	Start	Execution	Informal Detection Limit Injection Tower, From MW, TQ - Source: E1 - Extensor - MID - L (MW) = +12.00% - MID L - (MW, TQ) = +1.00% - (MW, TQ) = +1.00%	None
May 22, 2012 3:08:09 PM	Start	Execution	Sampling From - Injection Tower, From MW, TQ - Source: E1 - Extensor - End of OCMS System Preparation	None
May 21, 2012 2:40:34 PM	Start	Execution	Informal Detection Limit Injection Tower, From MW, TQ - Source: E1 - Extensor - MID - L (MW) = +12.00% - MID L - (MW, TQ) = +1.00% - (MW, TQ) = +1.00%	None
May 21, 2012 2:10:01 PM	Start	Execution	None Radio Detection - Injection Tower, From MW, TQ - Source: E1 - Extensor - L (MW) = 0.50%	None
May 22, 2012 2:17:49 PM	Start	Execution	OC Oven Temperature Accuracy = 7.80% - Temperature (Open = 100.0°C - L = +1.0 MID = +1.0 N supplied in K	None
May 22, 2012 2:17:30 PM	Start	Execution	OC Oven Temperature Accuracy = 7.80% - Temperature (Open = 100.0°C - L = +1.0 MID = +1.0 N supplied in K	None
May 21, 2012 2:16:05 PM	Start	End	OC Oven Temperature Accuracy = 7.80% - Temperature (Open = 100.0°C - L = +1.0 MID = +1.0 N supplied in K	Manual Data Entry

7219

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User Name: jantayal@agilent.com
 Password: AS56K9W235
 System ID: QM-10
 Print Date: May 25, 2023 11:05:43 AM

ALS_QM-10 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 9:15:17 PM	End	Execution	QC Over Temperature	Run Count: 1
			Accuracy - 7862 - Temperature	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 9:35:57 PM	Start	Execution	Sampling Run - Injection Tower, None	
			Front Mix, TO - Source - E1	
			Extraction Part of GCMS	
			System Preparation	
May 25, 2023 9:39:10 PM	Start	Execution	Instrument Detection Limit - None	
			Injection Tower, Front Mix, TO	
			Source - E1 - Extractor - RSD	
			L (Area) = 12.00% - RSD L	
			(Rel. Time) = 1.00%	
May 25, 2023 9:42:29 PM	Start	Execution	Instrument Detection Limit - None	
			Injection Tower, Front Mix, TO	
			Source - E1 - Extractor - RSD	
			L (Area) = 12.00% - RSD L	
			(Rel. Time) = 1.00%	
May 25, 2023 9:50:08 PM	Start	Execution	QC Over Temperature Stability - None	
			7860 - Temperature - Over	
			100.0% - L1=1.0	
May 25, 2023 9:59:52 PM	Auto	Data	QC Over Temperature Stability - Manual Data Entry	
			7860 - Temperature - Over	
			100.0% - L1=1.0	
May 25, 2023 10:01:54 PM	End	Execution	QC Over Temperature Stability - Run Count: 1	
			7860 - Temperature - Over	
			100.0% - L1=1.0	
May 25, 2023 10:11:15 PM	Auto	Acquisition	Section	None
May 25, 2023 10:21:19 PM	Auto	Acquisition	Section	None
May 25, 2023 10:41:15 PM	Auto	Acquisition	Section	None
May 25, 2023 10:51:57 PM	Auto	Acquisition	Section	None
May 25, 2023 10:57:12 PM	Auto	Acquisition	Section	None

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Date: May 25, 2023 11:05:07 AM
 System ID: QM-10

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User Name: jantayal@agilent.com
 Password: AS56K9W235
 System ID: QM-10
 Print Date: May 25, 2023 11:05:43 AM

ALS_QM-10 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:27:13 AM	Start	Execution	Section	05
May 25, 2023 10:27:16 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:27:42 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:27:58 AM	End	Execution	Section	05
			Section - 10000 TO - Source - Run Count: 1	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:27:57 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:28:07 AM	End	Execution	Section	05
			Section - 10000 TO - Source - Run Count: 1	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:28:08 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:28:11 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	
May 25, 2023 10:28:20 AM	Start	Execution	Section	05
			Section - 10000 TO - Source - None	
			E1 - Extractor - RSD	
			Qualitative - No sample	

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Date: May 25, 2023 11:05:07 AM
 System ID: QM-10

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User Name: jantayal@agilent.com
 Password: AS56K9W235
 System ID: QM-10
 Print Date: May 25, 2023 11:05:43 AM

ALS_QM-10 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:28:58 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:29:29 AM	Start	Execution	Sampling Run - Injection Tower, None	Run Count: 1
			Front Mix, TO - Source - E1	
			Extraction Part of GCMS	
			System Preparation	
May 25, 2023 10:29:25 AM	Start	Execution	Instrument Detection Limit - None	
			Injection Tower, Front Mix, TO	
			Source - E1 - Extractor - RSD	
			L (Area) = 12.00% - RSD L	
			(Rel. Time) = 1.00%	
May 25, 2023 10:30:27 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:40 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:53 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	

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Date: May 25, 2023 11:05:07 AM
 System ID: QM-10

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User Name: jantayal@agilent.com
 Password: AS56K9W235
 System ID: QM-10
 Print Date: May 25, 2023 11:05:43 AM

ALS_QM-10 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	
May 25, 2023 10:30:50 AM	Auto	Data	Section	05
			Section - 10000 TO - Source - E1	
			Chrom - 100.0% - L1=1.0	
			AND - 1.0% - L1=1.0	

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Date: May 25, 2023 11:05:07 AM
 System ID: QM-10

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Bara Scientific

Bara Scientific Co., Ltd.
908 U Chai Long Building 17th Floor Bangkok
10000 Bangkok Bangkok Thailand 10000
Tel: 02-4354200 Fax: 02-4354201
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-36723 Number of Pages: 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5763	0.5763	0.0010	0.0042
	0.7026	0.7024	-0.0004	0.0042
	1.0708	1.0716	0.0010	0.0042
	0.0000	0.0000	0.0000	0.0042
440.0	0.5871	0.5865	-0.0004	0.0042
	0.7455	0.7452	-0.0003	0.0042
	0.9088	0.9088	0.0000	0.0042
	0.0000	0.0000	0.0000	0.0042
465.0	0.5227	0.5229	0.0002	0.0042
	0.6880	0.6873	-0.0007	0.0042
	0.8487	0.8485	-0.0001	0.0042
	0.0000	0.0000	0.0000	0.0042
540.1	0.5227	0.5211	-0.0004	0.0042
	0.8973	0.8960	-0.0013	0.0042
	0.9259	0.9241	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
560.0	0.5544	0.5538	-0.0006	0.0042
	0.7253	0.7236	-0.0017	0.0042
	1.0942	1.0925	-0.0017	0.0042
	0.0000	0.0000	0.0000	0.0042
635.0	0.5616	0.5612	-0.0004	0.0042
	0.8927	0.8909	-0.0018	0.0042
	1.5681	1.5666	-0.0015	0.0042

*CNR = Customer not requires

4. Stray Light

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (NT)	Absorbance (A)
200.56±0.11nm	200.55	0.8770	2.0104

The Stray light transmission reference is less than 1.0% and Stray light absorbance reference is greater than 2.00%.

*Stray Light not NSC-ONSC Accredited

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor of 2, providing a level of confidence of approximately 95%.

End of Certificate

Bara Scientific Co., Ltd. is a member of the International Bureau of Standards (IBS) and is a member of the International Union of Pure and Applied Chemistry (IUPAC).

BARA/UV-36723 Rev. 01 12/21/2021

Agilent Technologies

Agilent Technologies (Thailand) Limited
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Bangkok 10500 Thailand
Tel: +662 432 4343
Fax: +662 432 4334
Email: tcc-ent@agilent.com
Website: www.agilent.com/thailand

Customer Contact:

ALS Laboratory Group (Thailand) Co. Ltd.
Head Office
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Khaeng PhatthanaKhaeng Phatthana
TAX ID: 0105540004859
bounced.iamtham.chirotan@agilent.com
22715478019

Service To:

ALS Laboratory Group (Thailand) Co. Ltd.
Head Office
104 PHOTONHAKAN 41 PHOTONHAKAN RD
Khaeng PhatthanaKhaeng Phatthana

Delivery Site:

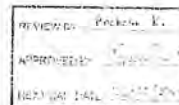
ALS Laboratory Group (Thailand) Co. Ltd.
Head Office
104 PHOTONHAKAN 41 PHOTONHAKAN RD
Khaeng PhatthanaKhaeng Phatthana

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number:
70371013	70371013
Service Request:	Service Request Date:
Service Order:	Service Confirmation:
160506297	6504837528



Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: tcc-ent@agilent.com
Contact Telephone: +662 432 4334
Contact Fax: +662 432 4334

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Chulab N.A. Bangkok Branch
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Sub-district, Wattana District, Bangkok 10110 Thailand
Tel: 011-4452-087
288 Bang Bang Road P.O.
Bang Bang Sub-district, Wattana District, Bangkok 10110 Thailand

Page 1 of 3

Service Confirmation Number: 6504837528
Service Confirmation Date: 06.04.2023

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICP-MS 7900 System			
GBA10A	SPS 4 Autosampler	AU15436722	ICP-MS 7900	SYS-IM-7900
GBA11A	ISIS 3 for Agilent 7854/7900/8900	JP15510727	ICP-MS 7900	SYS-IM-7900
G2202A	PSC 610GT Chiller	AU1541848	ICP-MS 7900	SYS-IM-7900
GB433A	Agilent 7900 ICP-MS	JP15471169	ICP-MS 7900	SYS-IM-7900

Service Items:

Item	Service / Part #	Description	Qty	Entitlement	Service Start / Service End
1100	E00	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	06.04.2023 06.04.2023
1101	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered	

Additional Information:

Service Confirmation Number: 6504837528
Service Confirmation Date: 06.04.2023

Service Information:

Problem Description:
VIA-S-00-ICP-MS 7900-8001143313

Service Provided:

Test 00 control of instrument ICP-MS = BKK_EL0043 After done all instrument test all Pass

Service Overview Code:

Reason Code: Scheduled Service
Diagnosis Code: Scheduled Service
Resolution Code: Scheduled Service

Reported Hours:

5.0

Travel Hours:

1.0

Customer Field Service Representative Name:
Pantep Krasathien

Customer Field Service Representative Signature:

Date:
06 Apr 2023

Customer Name:
Anchalak Khamjan

Customer Signature:

Date:
06 Apr 2023

Additional Comments:



Metrological Center

SCI ECO Services Company Limited

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK_EL0054

ID No. : TS306A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 13 September 2023

Calibrated By : Saneek Musikawan (Site Calibration Manager)

Approved By :  / Saneek Musikawan (Site Calibration Manager)

Date of Issue : 21 SEP 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

PM-L13 RB 30-05-57



Metrological Center

SCI ECO Services Company Limited

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Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber - the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NIST-TIS-TIS (1921 CALIBRA (1921))

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 7 Hour 20 Minute At 95 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment.

Approved By : 

PM-L13 RB 30-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

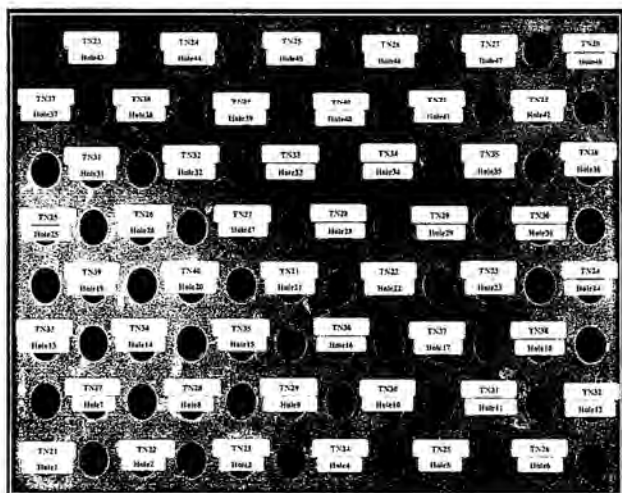
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By : 

PM-L13 RB 30-05-57



Metrological Center

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Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	94.51	95.17
95	Min	94.57	93.95	94.75	94.92	94.60
	Average	94.79	94.18	94.98	95.17	94.56
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.35	95.43	95.19	95.16	95.33
	Min	94.90	94.95	94.72	94.71	94.80
	Average	95.15	95.19	94.96	94.93	95.15
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.32	95.21	95.33
	Min	94.89	95.09	94.78	94.42	94.88
	Average	95.18	95.30	95.00	95.02	95.11
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.82	94.52	94.24	94.63
	Min	95.21	94.86	94.13	93.85	94.29
	Average	95.40	94.34	94.33	94.06	94.45
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.99	95.30	95.14
	Min	94.85	95.03	92.56	94.95	94.79
	Average	95.01	95.20	92.75	95.12	94.96
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24
	Min	94.24	94.55	94.44	93.56	93.92
	Average	94.45	94.72	94.60	94.14	94.08
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.59
	Min	93.91	94.05	93.67	93.48	94.28
	Average	94.17	94.24	93.86	93.65	94.44
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.96	95.67	95.28	95.29	95.45
	Min	95.57	95.15	94.82	94.84	94.96
	Average	95.76	95.39	95.05	95.07	95.23

Approved By : 

PM-L13 RB 30-05-57



Metrological Center

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
H1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
T141 POINT	Max	105.22	104.72	105.27	105.25	104.65
	Min	104.94	103.95	105.15	105.04	104.11
	Average	105.08	104.33	105.29	105.15	104.28
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	104.12	105.19	105.22	104.12
	Min	105.11	104.92	104.96	105.00	104.92
	Average	105.20	105.02	105.07	105.11	105.02
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69
	Min	105.17	105.37	104.75	104.96	104.50
	Average	105.27	105.50	104.88	104.69	104.60
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	105.41	104.71	105.63
	Min	105.08	104.23	105.15	104.41	105.37
	Average	105.19	104.33	105.28	104.56	105.50
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	105.24	105.72	105.59
	Min	104.67	103.96	105.06	105.36	105.68
	Average	104.81	106.11	105.21	105.67	105.68
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.78	104.86	104.89	105.29	104.80
	Min	104.54	104.60	104.59	105.00	104.72
	Average	104.65	104.75	104.69	105.10	104.76
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.58
	Min	104.09	104.72	104.66	104.49	104.63
	Average	104.19	104.81	104.75	104.57	104.66
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.81	105.42
	Min	105.45	105.61	105.14	105.25	104.91
	Average	105.58	105.73	105.27	105.54	105.30

Approved By:

TN-L13 105 1045-57



Metrological Center

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Certificate No. T231676

Page 6 of 6

Calibration Report

Measurement Results

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.3, 100.5	100.4	0.26	0.31
107.0	107.0, 107.1	107.1	0.19	0.25

* The quoted uncertainty exclude: * uniformity

The calibration result apply only to the above calibrated item

(The result of test was found acceptable) shown indicate and place to test only

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k, which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: _____

TN-L13 105 1045-57



Metrology

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Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851, +668 8247 2350

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Certificate No. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthananan 40, Phatthananan Rd., Khwaeng Phatthananan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : / Boonchai Suriyayuwong (Site Calibration Manager)

Date of Issue : 09 JAN 2024

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

FM-L14 118/18-08-66



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber. The other unit standard thermocouples type T use for ambient temperature measurement. The calibration was done in accordance to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 2024.)

4. Condition of calibrated item : good

Equipment Description :
Time Constant : 1 Hour
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Not Available

5. Adjustment :
(X) without adjustment () after adjustment

Approved By:

FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

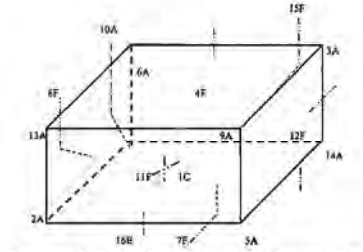
33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T232160

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = TN161	12F = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15F = TN175
5A = TN165	16E = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

Approved By:

FM-L15118/18-08-66



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T232160

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
1.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.38	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)
	Min, Max	Average				
3.0	2.8, 4.1	3.5	3.36	1.10	2.00	1.93
						2.09

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t -distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15118/18-08-66

BKK_EL0023

analytikjena

REVIEW BY:

APPROVED BY:

NEXT CAL DATE: 24 JUL 2024

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

analytikjena

Serial-No.: K170A0143 Customer-No.:
Date: 24 May 2023 Carried out by: Srichai Fak-on

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)

Company: บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

User:

Department: ห้องแล็บปฏิบัติการ

Street: 104 ซอย 40 ถนนพัฒนาการ แขวงสวนหลวง เขตสวนหลวง

Zip Code, City: กรุงเทพมหานคร 10250

Country: ประเทศไทย

Phone:

Fax:

E-mail:

My agenda

lightness visual check inside the Mercur
visual check if gold-traps are broken
visual check if spectrometer is contaminated
visual check of the fluorescence cell
visual check of the absorption cell: Incl. window
reactor cleaning
check pump-noise, if necessary change it
check swirl drive (SEV)
check drying hose, output gas-liquid separator
test Bubble-Sensor
check gas flows
check volume flows, reagents
recording stray light values
measurement with 30 ml

Serial No.: 701 739

- lubricate the dosing-winding (Teflon-grease-spray)
- clean the dosing cylinder, if necessary exchange it
- lubricate the winding system of the height drive with some drops of oil
- check the toothed belt:
- check the position of the mechanical stopper (height: 13mm)
- check the pump rate of mixing pump (<14s ASS2 typ.7s/<20s ASS2S. typ.10s)
- check the pump rate of washing cup
- check the electrical hose connections for good contact
- check the connectors of the magnetic valves
- check the dosing hose for buckling, if necessary exchange it

STYLLINGEN

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
lens	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses	n.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor	o.k. <input checked="" type="checkbox"/>	not o.k. <input type="checkbox"/>
Check gasflow		
Argon pressure Valve 4	1.2 - 1.5 bar	1.5 bar
Valve 1	0.16 NL/min or 50 Nl/h or 0.633 NL/(min)	0.163 NL/min
Valve 2		0.403 NL/min
Valve 3	5 Nl/h or 0.083 NL/min 10 Nl/h or	0.140 NL/min
Valve 4	0.166 NL/min	0.108 NL/min
Check liquidflow		
Acid	2.5ml/min ± 1 ml	2.5 ml/min
Red-agent	2.5ml/min ± 1 ml	2.5 ml/min
Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values		
(V)	from file	
100	0	0
200	0	0
300	0	0
350	0	0
400	0	0
450	2	2
500	5	5
550	10	10
575	15	14
600	20	20

folgt das 100. millionte

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions : max conc. 10 µg/L PMT-voltage: 350 V		
Blank-solution		Int. 0.00024
without enrichment / FBR 30 ng/L	Int. > 0.0015 RSD < 3 %	Int. 0.00172 RSD 9.45 %
Conditions : max conc. 1.7 µg/L PMT-voltage: 352 V		
Blank-solution		Int. 0.00370
with enrichment / FBR 30 ng/L	Int. > 0.008 RSD < 3 %	Int. 0.01890 RSD 5.36 %
Fok - factor (Int ₂ / Int ₁)	> 3.5	6.16
Analytical parameters Absorption cell		
Blank-solution		Ext. 0.00093
without enrichment / FBR 100 ng/L	Ext. > 0.0012 RSD < 5 %	Ext. 0.00449 RSD 2.58 %
Comments		

Sridhar Paker
Signature Technician

24 May 2023
Place, Date (DD/MM/YYYY)



Orawan T
Signature Customer

24 May 2023
Place: Date (DD/MM/YYYY)

As Enders-Hargraves Company

El Mouni, 145 Place Kheng Khet, Hanoi
 Vietnam 11100 Hanoi
 Phone: +8431 1262910 / 2
 Fax: +8431 1262973
 e-mail: el.mouni@univ-hanoi.vn

Service Report

Customer's address 55th Avenue, Richmond Hill, Ontario, ON		Customer's Ref. No.	
For quote or information, please contact (phone/fax) Appointment: 10:00			
E-mail	Phone	E-fax	
Job No. 20050224 PM	User	Service Engineer Mike Wood	Date 24/5/2005 Page 1
Instrument model Petroler	Serial No. R70A01943	Software Version No. 4.7.0	
<input type="checkbox"/> Rental (RM)	<input type="checkbox"/> Maintenance (RM)	<input type="checkbox"/> Installation (RM)	<input type="checkbox"/> Warranty
<input type="checkbox"/> Application (RM)	<input type="checkbox"/> Site Prep (RM)	<input type="checkbox"/> Visits	<input type="checkbox"/> True Cost
Fault: Client — problem with fuel pump. Is 16.2500000 (INV2308-033) — problem first Contact Year 2003 (1 Time Nov 2003)			
History (RM): — Manufacturer not been used — Check device parameter — Check gas flow — Check liquid flow — Check adaptations light-values # Test run Analytical parameter Fluorescence cell Test run Analytical parameter Absorption cell			
Action Pending / Recommendation problem solved		 	
<input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration			
Serial No.	Name	Quantity	Unit Price
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Remarks: The undersigned hereby declares and warrants that he/she provided the above information in writing, the proper function of the device and the correct delivery of the requested spare parts. The undersigned hereby releases and agrees to pay the amount after the return of the device without further charge.			
Date	Signature of Customer Orsman T	Date	Signature of Service Engineer Mike Wood
Mark completed:		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Subject will be subject to the General Terms and Conditions of Analysis Jura AG, which will be upon request.

Mercur

Report file: C:\WinAAS\TMP\2023\May\Pro_032
 Program version: 4.7.10.0 Printed on: 5/24/2023 12:46
 Recording started on 5/24/2023 12:35 GMT+7.0
 Operator: PSU.OTA
 Laboratory: ALS-BKK
 Code: IL_Hg095_2023

Remarks:
 Food, water

Method parameters

Method: Without enrichment / FBR 30ng/L_PM24052023
 Created on 5/24/2023 Time 12:27
 Program: ---

Parameters Mercur Technique: Hg fluorescence

Line: 253.7 nm
 Lamp type: Hg-LP
 Integr. mode: Peak height Integr. time: 30 s
 PMT: 360 V
 AZ time: 5 s Peak smoothing: 8/5
 Delay: 0 s
 Working mode: w/o enrich System cleaning: Acid
 FBR technique: on Wash time acid: 10 s
 Pump speed: 3 Soaking time: 20 s
 Sample load time: 10 s Gas load time: 5 NL/h
 Reaction time: 10 s
 Waiting time AZ: 5 s
 Delay: 0 s
 Purge time1: 28 s
 Purge time2: 15 s Gas wash time2: 10 NL/h

Autosampler

Autosampler: AS515/F
 Working mode: continuous Tray type: 87/139

Dilution: ---

Mercur

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std. 2 no.	1(30.000 ng/L)
QC std. 1 no.	1(30.000 ng/L)	QC std. 2 limit	± 50.00%
QC std. 1 limit	± 50.00%	Reaction	flag + continue
QC std. act.	flag + continue	Reaction	off
Expect. blank abs.	0.0100 ± 0.0100	QC Recal. factor	Off
QC precision	off		

Calibration settings

Calib. meth	Standard calib	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	ug/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

No.	Name	State	Pos.	Conc. / ng/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	78	0.000	H: 0.000246 A: 0.004274	0.000132 0.001698	53.13 39.72
2	Cal-Std1	(-)	80	30.000	H: 0.001720 A: 0.02172	0.000007 0.000023	0.455 0.107

Hg

Mercur

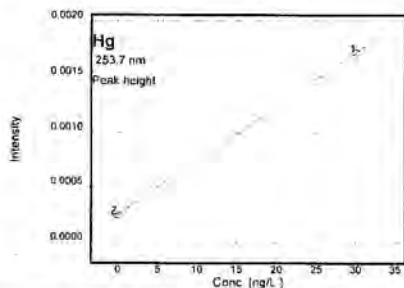
Calibration function 1 5/24/2023 12:44 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000249 k2=0.000049

Recal. factor: ---

Slope	0.00005 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---

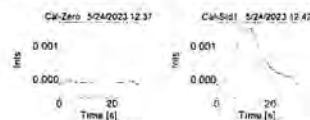


Measurements and events (sorted by time)

Hg	Without enrichment / FBR 30ng/L_PM 24052023	5/24/2023 12:35
ID	Conc.	Ints BG SD RSD/% Int. type Time
Cal-Zero		0.000143 12:37
		0.000397 12:38
		0.000207 12:40
	0ng/L	0.000249 0.0001324 53.13 12:40
Cal-Std1		0.001720 12:42
		0.001712 12:43
		0.001728 12:44
	30.00ng/L	0.001720 0.000007897 0.455 12:44
Calibration	Calibration function 01	12:44

Mercur

Peak plots



Hg

Mercur

Mercur

Report file: C:\WinAAS\TMP\2023\May\Pro_033
 Program version: 4.7.10.0 Printed on: 5/24/2023 14:01
 Recording started on: 5/24/2023 13:37 GMT+7.0
 Operator: PSU.OTA
 Laboratory: ALS-BKK
 Code: IL_Hg095_2023

Remarks:
 Food, water

Method parameters

Method: Enrichment / FER 30ng/L PM_24052023
 Created on: 5/24/2023 Time: 13:38
 Program: ---

Parameters Mercur Technique: Hg fluorescence

Line: 253.7 nm
 Lamp type: Hg-LP
 Integr. mode: Peak height Integr. time: 40 s
 PMT: 352 V
 AZ time: 5 s Peak smoothing: 12/11
 Delay: 0 s
 Working mode: Enr. w/o reload System cleaning: Off
 FBR technique: off Wash time acid: 10 s
 Pump speed: 3 Soaking time: 20 s
 Sample load time: 10 s Gas load time: 10 NL/h
 Reaction time: 10 s
 Waiting time AZ: 10 s Gas AZ wait: 10 NL/h
 Purge time1: 30 s
 Purge time2: 15 s Gas wash time2: 5 NL/h
 Purge time3: 20 s
 Heat time coil 1: 20 s Cool. time coil 1: 30 s

Hg

Mercur

QC parameters

Conc. check		QC check samp. 2	
QC type	---	Conc.	---
QC check samp. 1	---	Error limit	---
Conc.	---	Reaction	flag = continue
Error limit	---	QC std. 2 no.	1(20 000 ng/L)
Rep. measurement	off	QC std. 2 limit	± 50.00%
QC std. 1 no.	1(20 000 ng/L)		
QC std. 1 limit	± 50.00%		
QC std. act.	flag = continue		
Expect blank abs	0.0100 ± 0.0100	Reaction	flag = continue
QC precision	off	Reaction	off
		QC Recal factor	Off

Calibration settings

Standard calib.		Calibr. unit	
Calib. meth.	---	Conversion fac.	1000000
No. standards	1	Standard prep.	Premixed
Type of standards	---	Blank correct	---
		Recalib. std. no.	---
		Conversion fac.	1000
Output unit	µg/L	Meas. cycles	3
Calib. stat.	Mean	Blank cycles	1
		Stock sol. 2	---
Stock sol. 1	---	Stock sol. 4	---
Stock sol. 3	---	Intercept	calculated
Type of cal. curve	linear	Grubbs stat.	off
Weighted cal.	off		
Check of cal. curve	no outlier test		

Sample statistics

Sial. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blank cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No.	Name	State	Pos.	Conc. / ng/L	Ints.	SD	RSD, %
1	Cal-Zero	(-)	#	0.000	H: 0.003700 A: 0.02531	0.000081 0.000153	2.192 0.607
2	Cal-Std1	(-)	#	30.000	H: 0.01060 A: 0.00689	0.000253 0.002166	2.386 4.136

Mercur

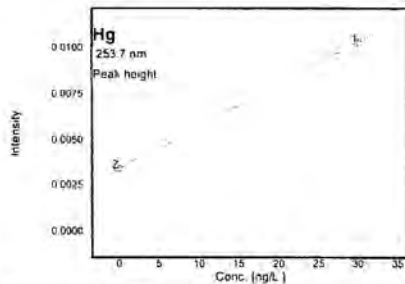
Calibration function 1 5/24/2023 14:00 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.003700 k2=0.000230

Recal. factor: ---

Slope: 0.00023 (Ints/ng/L) R2-adjusted: 1.0000
 scd: 1.00000 ng/L
 Lower limit: 0 ng/L Upper limit: 33.0 ng/L
 Detection limit: --- Detector limit: ---

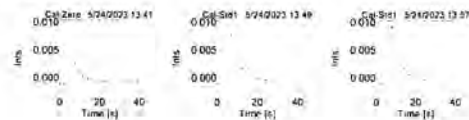
**Measurements and events (sorted by time)**

Hg	Enrichment / FER 30ng/L PM_24052023	5/24/2023 13:37
ID	Conc.	Ints BG SD RSD, % Int. type Time
Cal-Zero		0.003702 13.41
		0.003666 13.43
		0.003640 13.44
	0 ng/L	0.003700 0.00001050 2.192 13.44
Cal-Std1		0.009159 13.48
		0.008353 13.50
		0.008961 13.52
	30.00 ng/L	0.000931 0.0005830 6.526 13.52
Cal-Std1		0.01031 13.57
		0.01074 13.58
		0.01076 14.00
	30.00 ng/L	0.01060 0.0002531 2.386 14.00
Calibration	Calibration function: 01	14.00

Mercur

Peak plots

Hg



Mercur

Mercur

Report file: C:\WINAAS\TMP\2023\May\Pro_034
 Program version: 4.7.10.0 Printed on: 5/24/2023 14:33
 Recording started on 5/24/2023 14:19 GMT+7.0
 Operator: PSU.OTA
 Laboratory: ALS-BKK
 Code: IL_Hg095_2023

Remarks:
 Food, water

Method parameters

Method: Without enrichment / Abs / FBR 100ng/L_PM 24052023
 Created on 5/24/2023 Time 14:18
 Program: ---

Parameters Mercur Technique: Hg absorption

Line: 253.7 nm
 Lamp type: Hg-LP
 Integr. mode: Peak height Integr. time: 55 s
 PMT: 225 V
 AZ. time: 5 s Peak smoothing: 2/5
 Delay: 8 s
 Working mode: w/o enrich System cleaning: Acid
 FBR technique: on Wash time acid: 15 s
 Pump speed: 4 Soaking time: 20 s
 Sample load time: 8 s Gas load time: 5 NL/h
 Reaction time: 12 s
 Waiting time AZ: 15 s
 Delay: 10 s
 Purge time1: 50 s
 Purge time2: 10 s Gas wash time2: 10 NL/h

Hg

Mercur

QC parameters

QC type	Conc. check	QC check samp. 2
QC check samp. 1	---	---
Conc.	---	---
Error limit	---	---
Rep. measurement	off	Reaction
QC std. 1 no.	1(100.00 ng/L)	QC std. 2 no.
QC std. 1 limit	± 50.00%	QC std. 2 limit
QC std. act.	flag + continue	Reaction
Expect. blank abs.	0.0100± 0.0100	flag + continue
QC precision	off	Reaction
		QC Recal. factor

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blank cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cat.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles
Confid. level	95.4 %	Blind cycles
Grubbs stat.	---	

Calibration standards

Hg

No.	Name	State	Pos	Conc. / ng/L	Abs	SD	RSD/%
1	Cal-Zero	(-)	#	0.00	H: 0.000932 A: 0.035926	0.000138 0.005208	14.88 17.28
2	Cal-Std1	(-)	#	100.00	H: 0.004484 A: 0.061286	0.000116 0.001275	2.586 2.082

Mercur

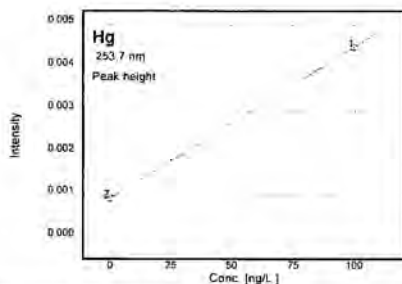
Calibration function 1 5/24/2023 14:33 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000932 k2=0.000036

Recal. factor: ---

Slope	0.00004 Abs/(ng/L)	R2-adjusted	1.0000
scd <td>1.00000 ng/L <td>Charact. conc <td>122.411 (ng/L)/1%</td> </td></td>	1.00000 ng/L <td>Charact. conc <td>122.411 (ng/L)/1%</td> </td>	Charact. conc <td>122.411 (ng/L)/1%</td>	122.411 (ng/L)/1%
Lower limit <td>0 ng/L <td>Upper limit <td>110 ng/L</td> </td></td>	0 ng/L <td>Upper limit <td>110 ng/L</td> </td>	Upper limit <td>110 ng/L</td>	110 ng/L
Detection limit <td>---</td> <td>Deter. limit <td>---</td> </td>	---	Deter. limit <td>---</td>	---



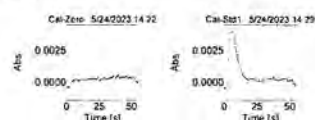
Measurements and events (sorted by time)

Hg	Without enrichment / Abs / FBR 100ng/L_PM 24052023					5/24/2023	14:19
ID	Conc.	Abs	BG	SD	RSD/%	Int. type	Time
Cal-Zero	0ng/L	0.001039				PKH	14:22
		0.000775					14:23
		0.000981					14:25
		0.000932		0.00013872	14.88		14:25
Cal-Std1	100ng/L	0.004528				PKH	14:29
		0.004364					14:31
		0.004569					14:33
		0.004494		0.00011623	2.586		14:33
Calibration	Calibration function: D1						14:33

Mercur

Peak plots

Hg



Mercur