

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ

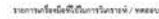
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51

[sloughball.com](http://sloughball.com)

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calib'n (Month)
Water Lab	pH & Green	Electronic Toploading Balance	BA1-100003	1-Aug-20	1-Aug-21	12
Water Lab	pH & Green	Electronic Toploading Balance	BA1-100008	27-Jun-20	27-Jun-21	12
Water Lab	Total Phosphorus	Digital Ion	BA1-100016	21-Apr-20	21-Apr-21	12
Water Lab	Total Phosphorus	Digital Ion	BA1-100017	21-Apr-20	21-Apr-21	12
Water Lab	Total Dissolved Nitrogen	Digital Ion	BA1-100015	21-Aug-20	21-Aug-21	12
Water Lab	Total Dissolved Nitrogen	Digital Ion	BA1-100011	1-Aug-20	1-Aug-21	12
Water Lab	Total Suspended Solids	Electronic Toploading Balance	BA1-100029	1-Aug-20	1-Aug-21	12
Water Lab	Total Suspended Solids	Electronic Toploading Balance	BA1-100011	18-May-20	18-May-21	18
Water Lab	Total Dissolved Solids, 180°C	Electronic Toploading Balance	BA1-100020	1-Aug-20	1-Aug-21	12
Water Lab	Total Dissolved Solids, 180°C	Digital Ion	BA1-100015	14-May-20	14-May-21	12
Water Lab	Conductivity	Conductivity Meter	BA1-100019	30-Dec-20	30-Dec-21	12
Water Lab	DO	DO Meter	BA1-100021	1-Feb-24	1-Feb-25	18
Water Lab	DO	Indicator	BA1-100012	22-Aug-20	22-Aug-21	12
Water Lab	ORP	Digital Ion	BA1-100015	27-Feb-20	27-Feb-21	12
Water Lab	Red Back	Red Back	BA1-100022	26-Apr-20	26-Apr-21	12
Water Lab	SS	Electrophoretometer	BA1-100018	18-Sep-20	18-Sep-21	12
Water Lab	ORP	ORP	BA1-100025	13-Dec-21	13-Dec-22	18
Water Lab	Red Back	Red Back	BA1-100014	25-Sep-21	25-Sep-22	12
Water Lab	Red Back	Chamber: Cooling Board	BA1-100017	6-Nov-21	6-Nov-22	12
Water Lab	ORP	ORP	BA1-100026	13-Dec-21	13-Dec-22	18
Water Lab	Red Back	Red Back	BA1-100014	22-Sep-21	22-Sep-22	12
Water Lab	Chamber: Cooling Board	Chamber: Cooling Board	BA1-100017	6-Nov-21	6-Nov-22	12
Water Lab	Total Chlorine	Indicator	BA1-100001	4-Nov-21	4-Nov-22	12
Water Lab	Total Chlorine	Indicator	BA1-100002	11-Jul-21	11-Jul-22	12
Water Lab	Total Chlorine	Red Back & Green	BA1-100013	10-Apr-20	10-Apr-21	12
Water Lab	Temperature	Digital Ion	BA1-100019	30-Dec-20	30-Dec-21	12
Water Lab	Chlorine	Electrophoretometer	BA1-100020	13-Aug-20	13-Aug-21	12
Water Lab	Chlorine	Chamber: Cooling Board	BA1-100017	6-Nov-21	6-Nov-22	12
Water Lab	Electronic Meter	Digital Ion	BA1-100017	27-Aug-20	27-Aug-21	12
Water Lab	Electronic Meter	Boyle	BA1-100011	17-Feb-20	17-Feb-21	18
Water Lab	Electronic Meter	Chamber: Cooling Board	BA1-100017	6-Nov-21	6-Nov-22	12
Water Lab	Electronic Meter	Ion Chromatography	BA1-100003	10-Jun-20	10-Jun-21	12
Water Lab	Electronic Meter	Ion Chromatography	BA1-100004	10-Jun-20	10-Jun-21	12
Water Lab	Electronic Meter	Red Back	BA1-100010	25-Feb-21	25-Feb-22	12
Water Lab	Red Back	Red Back	BA1-100019	26-Nov-21	26-Nov-22	12
Water Lab	Chamber: Cooling Board	Chamber: Cooling Board	BA1-100017	6-Nov-21	6-Nov-22	12
Water Lab	Electronic Meter	Electronic Meter	BA1-100018	6-Nov-21	6-Nov-22	12

3

[steinfeldt.com](http://www.steinfeldt.com)

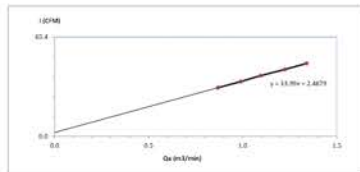
Sample Name	Parameter	Equipment Name	ID No.	Expirated Date	Test Cat.	Freq. Calibrate (months)
Sludge	Mercuric	ICP-OES	RAM_20207	28-Feb-20	28-Feb-20	12
Sludge	Mercuric	Asa-Rock	RAM_20205	22-Sep-19	22-Mar-20	18
Sludge	Mercuric	Chamber (Exhaust Room)	RAM_20202	8-Dec-19	8-Jun-20	18
Sludge	Mercuric	ICP-OES	RAM_20201	28-Feb-20	28-Feb-20	12
Sludge	Mercuric	Chamber (Exhaust Room)	RAM_20204	22-Sep-19	22-Mar-20	18
Sludge	Mercuric	Asa-Rock	RAM_20203	8-Dec-19	8-Jun-20	18
Sludge	Mercuric	ICP-OES	RAM_20206	28-Feb-20	28-Feb-20	12
Sludge	Mercuric	Asa-Rock	RAM_20208	22-Sep-19	22-Mar-20	18
Sludge	Mercuric	Chamber (Exhaust Room)	RAM_20209	8-Dec-19	8-Jun-20	18
Sludge	Selenium	ICP-OES	RAM_20207	28-Feb-20	28-Feb-20	12
Sludge	Selenium	Asa-Rock	RAM_20204	22-Sep-19	22-Mar-20	18
Sludge	Selenium	Chamber (Exhaust Room)	RAM_20202	8-Dec-19	8-Jun-20	18
Sludge	Selenium	ICP-OES	RAM_20201	28-Feb-20	28-Feb-20	12
Sludge	Selenium	Asa-Rock	RAM_20205	22-Sep-19	22-Mar-20	18
Sludge	Selenium	Chamber (Exhaust Room)	RAM_20203	8-Dec-19	8-Jun-20	18
Sludge	Selenium	ICP-OES	RAM_20206	28-Feb-20	28-Feb-20	12
Sludge	Selenium	Asa-Rock	RAM_20208	22-Sep-19	22-Mar-20	18
Sludge	Selenium	Chamber (Exhaust Room)	RAM_20209	8-Dec-19	8-Jun-20	18
Sludge	Vanadium	ICP-OES	RAM_20207	28-Feb-20	28-Feb-20	12
Sludge	Vanadium	Asa-Rock	RAM_20204	22-Sep-19	22-Mar-20	18
Sludge	Vanadium	Chamber (Exhaust Room)	RAM_20202	8-Dec-19	8-Jun-20	18
Sludge	Vanadium	ICP-OES	RAM_20201	28-Feb-20	28-Feb-20	12
Sludge	Vanadium	Asa-Rock	RAM_20205	22-Sep-19	22-Mar-20	18
Sludge	Vanadium	Chamber (Exhaust Room)	RAM_20203	8-Dec-19	8-Jun-20	18
Sludge	Vanadium	ICP-OES	RAM_20206	28-Feb-20	28-Feb-20	12
Sludge	Vanadium	Asa-Rock	RAM_20208	22-Sep-19	22-Mar-20	18
Sludge	Vanadium	Chamber (Exhaust Room)	RAM_20209	8-Dec-19	8-Jun-20	18
Sludge	Hexavalent Chromium	Electrochromator	RAM_202010	15-Dec-20	15-Jun-21	12

3

[enr.global.com](http://enr.global.com)

Project Site:	Wittmann Industrial Land Co., Ltd.	Barometric Pressure (mbar Hg):	758.9
Cathode Location:	gib-001-2019-08	Temperature (°C):	33.1
Cathode Date:	21-Oct-24	High Volume ID:	808_P03076
Calibration/Sheet No.:	0-211024-808_P03076	High Volume ID:	61455
Cathode ID:	808_45625	High Volume S/N:	1298
Calibrator Model:	TS-5028A	Cathode Slope:	1.04403
Cathode S/N:	2545	Cathode Intercept:	-0.01260

Test No.	Defl. $H_0$ (mm)	Q <sub>u</sub> (N/min)	1 - Chart (199)	Linear Regression	
1	2.6	0.009	32	Slope =	33.9961
2	2.6	0.009	36	Intercept =	2.5679
3	3.2	1.076	40	Correlation Coefficient =	0.9997
4	6.0	1.224	44		
5	6.8	1.340	48		



Thanesuan

Approved by: 2.0 [Signature]

( Mr. Thirumogan Sriharan )  
Field Service Technicians

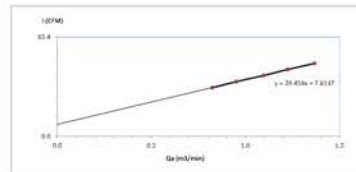
(Mr. Noppeng Jantarasophon)  
Entero Field Coordinator Scientist (5)

FORM NO. T-06-074 REVISED NO. 2 ISSUE DATE: 20/11/23



Project Site:	WYBARKER INDUSTRIAL LUMBER CO., Ltd. 10, 10th Avenue, Tama, Tama City, Yamalo	Barometric Pressure (mm Hg):	750.0
Calibration Location:	dhfM	Temperature (°C):	15.5
Calibration Date:	21-Oct-24	High Volume Flow:	808, 730/779
Calibration/Sheet No.:	C-211024-BRK, 730/779	High Volume Model:	TE-55026A
Calibrator ID:	808, 950625	High Volume S/N:	4158
Calibrator Model:	TE-55026A	Calibrator Slope:	1.0405
Calibrator S/N:	2505	Calibrator Intercept:	-0.017246

Test No.	Delta H, O (m/s)	Qs (m <sup>3</sup> /min)	F-Chart (CFM)	Linear Regression	
1	1.8	0.825	32	Slope:	29.8375
2	2.4	0.951	36	Intercept:	7.8137
3	3.2	1.096	40	Correlation Coefficient:	0.9998
4	4.0	1.224	44		
5	5.0	1.367	48		



Collected by Thaneson

Approved by: 2.0 P. [Signature]

( Mr.Thomson Schwaab )  
Field Senior Technician

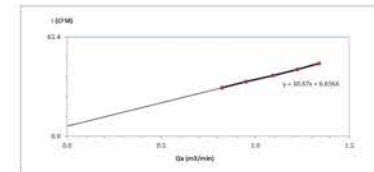
[Mr. Neppong Banjarapoi]  
 Area Field Coordinator, Schenck (T)

FORM NO. F 06-014 REVISION NO. 2 CORR DATE: 20/11/21



Project Site:	Wageningen Industrial Land Co., Ltd. 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, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 8
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Test No.	Delta H <sub>0</sub> (m/s)	Q <sub>0</sub> (m <sup>3</sup> /min)	I Chart (PSI)	Linear Regression
1	1.8	0.825	32	Slope: 31.6703
2	2.4	0.951	36	Intercept: 6.0566
3	3.2	1.096	40	Correlation Coefficient: 0.9993
4	4.0	1.224	44	
5	4.8	1.340	48	



Calibrated by Thaneswar

Approved by: 2. P. P.

(Mr. Thompson's Sergeant,  
Field Service Technician)

(Mr. Suppong Jantaragat)  
 Senior Field Coordinator Scientist (3)

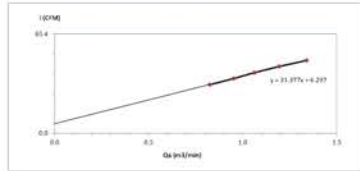
FORM NO. 106-018 REVISED 8.0.1 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site: WSA Sanket Industrial Land Co., Ltd. Barometric Pressure (mm Hg): 756.9  
Calibrate Location: 15, 16/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210 Temperature (°C): 33.1  
Calibrate Date: 21-Oct-24 High Volume ID: BSK-P30389  
Calibration Sheet No.: C-121124-BSK-P30389 High Volume Model: TS-50008  
Calibrator ID: BSK-P30625 High Volume S/N: 5129  
Calibrator Model: TS-5028A Calibrator Slope: 1.04893  
Calibrator S/N: 2565 Calibrator Intercept: -0.01206

Test No.	Delta H <sub>2</sub> O (cmH <sub>2</sub> O)	Q <sub>0</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	1.0	0.025	32	Slope: 31.3769
2	2.4	0.051	36	Intercept: 6.2470
3	3.0	1.062	40	Correlation Coefficient: 0.9989
4	3.0	1.193	44	
5	3.8	1.340	48	



Calibrated by: Thanee Sun

(Mr. Thanee Sun) Field Sensor Technician

Approved by: N. Nongprachin

(Mr. Nongprachin) Senior Field Coordinator Scientist (S)

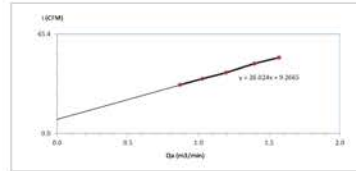
FORM NO. F-06-074 REVISION NO. 2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site: WSA Sanket Industrial Land Co., Ltd. Barometric Pressure (mm Hg): 756.6  
Calibrate Location: 15, 16/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210 Temperature (°C): 33  
Calibrate Date: 12-Nov-24 High Volume ID: BSK-P31060  
Calibration Sheet No.: C-121124-BSK-P31060 High Volume Model: TS-50008  
Calibrator ID: BSK-P30625 High Volume S/N: 5503  
Calibrator Model: TS-5028A Calibrator Slope: 1.04893  
Calibrator S/N: 2565 Calibrator Intercept: -0.01206

Test No.	Delta H <sub>2</sub> O (cmH <sub>2</sub> O)	Q <sub>0</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	2.0	0.070	32	Slope: 26.6236
2	2.8	1.027	36	Intercept: 9.2965
3	3.8	1.145	40	Correlation Coefficient: 0.9992
4	5.2	1.396	44	
5	6.4	1.571	50	



Calibrated by: Winyon B

(Mr. Winyon B) Field Sensor Technician

Approved by: N. Nongprachin

(Mr. Nongprachin) Senior Field Coordinator Scientist (S)

FORM NO. F-06-074 REVISION NO. 2 ISSUE DATE: 20/11/23



PLAY SOLUTION TECHNOLOGY COMPANY LIMITED  
176/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210  
Tel: +66 2 011 8925, Fax: +66 2 010 7700  
www.playstation.com



### CERTIFICATE OF CALIBRATION

Certificate No.: PST-0126-24

W/O No.: WO-0051-24

Customer: ALS LABORATORY GROUP (THAILAND) CO., LTD. Page no. 1 of 1

Company: ALS LABORATORY GROUP (THAILAND) CO., LTD.  
Address: 104 Phatthana Road, Phatthana Road, Khlong Phatthana,  
City / Province: Khlong Phatthana, Bangkok  
Zip/Postal: 10250

Device:  
Equipment: Electronic Balance Capacity: 120 / 220 g  
Manufacturer: Ohaus Readability: 0.0001 / 0.001 g  
Model: N11220ND ID No: BSK-P30603  
Serial No.: C200716688  
Condition: Normal

Environment Conditions:  
Location of Calibration: Environment Lab  
Ambient Temperature: 20.1 (°C) ± 0.3 °C  
Relative Humidity: 70.3 (RH%) ± 15 RH%  
Barometric Pressure: 1013.1 (mmHg) ± 0.30 mmHg  
Comment:

REVIEW BY: Junda K  
APPROVED BY: Suk P  
NEXT CAL DATE: 03/04/25

Date of Receipt: June 5, 2024  
Date of Calibration: June 5, 2024  
Issue Date: June 5, 2024

Calibrated by: Mr. Atchul Ratthaporn  
Calibrator

Approved by: Mr. Atchul Ratthaporn  
Approved Signature

The reported measurement result relates only to the measured and applies only at the time of measurement.

This Certificate is issued in accordance with the conditions of accreditation granted by Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognize national standards and to the unit 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 prior written approval of the calibration center, Play Solution Technology Co., Ltd.

FORM NO. F-06-074 REVISION NO. 2 ISSUE DATE: 20/11/23



PLAY SOLUTION TECHNOLOGY COMPANY LIMITED  
176/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210  
Tel: +66 2 011 8925, Fax: +66 2 010 7700  
www.playstation.com



### CERTIFICATE OF CALIBRATION

Certificate No.: PST-0126-24

W/O No.: WO-0051-24

Result of Calibration: Without Adjustment

Page no. 2 of 2

#### 1. Repeatability

Weighting Range	g	Nominal Value	g	Standard Deviation	g
Max capacity	220	90	0.000013		
		200	0.000046		

#### 2. Linearity: Departure of indication from nominal value

Weighting Range	Nominal Value	Standard Value	Indication	Error of Indication	Expanded Uncertainty	Factor k
0.01	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
0.1	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
0.5	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
1	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
5	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
10	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
50	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
100	0.00000	0.00000	0.00000	0.00000	0.00000	1.97
200	0.00000	0.00000	0.00000	0.00000	0.00000	1.97

F-028

REV.03 20/08/24



PLAY SOLUTION TECHNOLOGY COMPANY LIMITED  
176/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210  
Tel: +66 2 011 8925, Fax: +66 2 010 7700  
www.playstation.com



### CERTIFICATE OF CALIBRATION

Certificate No.: PST-0126-24

W/O No.: WO-0051-24

Result of Calibration:

Page no. 3 of 3

1. Repeatability  
Test load at least 1/3 of the maximum capacity, typically placed between 1/2 and 1/3 of the distance from the center of the load holder to the edge.



Weighting Range	Test Load	Indication	g
1	100.00000	100.00000	1.97
2	100.00000	100.00000	1.97
3	100.00000	100.00000	1.97
4	100.00000	100.00000	1.97
5	100.00000	100.00000	1.97
Max Deviation	0.00000		

#### Standard method

The calibration was performed by using calibration laboratory's in-house calibration method: CP-M-001 based on:

"JLAD LAB 14: Calibration of weighing measure", edition 1 (October 2023)

#### Reference standards instrument

Serial Number	Class	SN	Certificate No.	Exp. Date
02	000001.01	13-128718	November 15, 2024	
Standard Weight Set	-	-	-	-
Standard Weight Set	-	-	-	-
Standard Weight Set	-	-	-	-
Standard Weight Set	-	-	-	-

#### Measurement Uncertainty

The given measurement uncertainty is the standard of the measurement multiplied by an extension factor k, which corresponds to a confidence level of about 95% for a normal distribution. The standard uncertainty was calculated according to GUM M2005.

Traceability: The measurement is traceable to national standard, which refers the physical unit of measurement (SI) through the reference calibration laboratory of Asia Medical and Agricultural Laboratory and Research Center Co., Ltd.

END OF REPORT

F-028

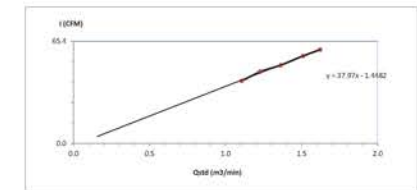
REV.03 20/08/24



### High Volume Air Sampler Calibration Worksheet

Project Site: WSA Sanket Industrial Land Co., Ltd. Barometric Pressure (mm Hg): 756.9  
Calibrate Location: 15, 16/75 Nong Prachin Road, Sihan, Omsung, Bangkok 10210 Temperature (°C): 33.1  
Calibrate Date: 21-Oct-24 High Volume ID: BSK-P30389  
Calibration Sheet No.: C-121124-BSK-P30389 High Volume Model: TS-50008  
Calibrator ID: BSK-P30625 High Volume S/N: 5129  
Calibrator Model: TS-5028A Calibrator Slope: 1.04893  
Calibrator S/N: 2565 Calibrator Intercept: -0.01206

Test No.	Delta H <sub>2</sub> O (cmH <sub>2</sub> O)	Q <sub>0</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	3.4	1.1057	40	Slope: 27.0700
2	4.2	1.2108	46	Intercept: -1.4402
3	5.2	1.3429	50	Correlation Coefficient: 0.9977
4	6.4	1.5099	56	
5	7.4	1.6221	60	



Calibrated by: Thanee Sun

(Mr. Thanee Sun) Field Sensor Technician

Approved by: N. Nongprachin

(Mr. Nongprachin) Senior Field Coordinator Scientist (S)

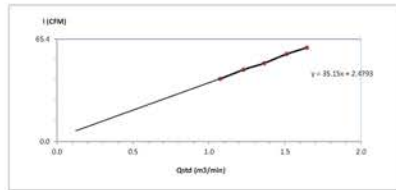
FORM NO. F-06-074 REVISION NO. 2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WSA Sarabhai Industrial Land Co., Ltd.  
Barometric Pressure (mm Hg) : 758.9  
Calibrate Location : 95, Thanebhai Vastani Sarabhai Road, 400002  
Temperature (°C) : 33.1  
Calibrate Date : 21-Oct-24  
High Volume ID : BKK\_F50369  
Calibration Sheet No. : C-211024-BKK\_F50369  
High Volume Model : TS-5009X  
Calibrator ID : BKK\_F50625  
High Volume S/N : 4165  
Calibrator Model : TS-5020A  
Calibrator Slope : 1.67329  
Calibrator S/N : 2585  
Calibrator Intercept : -0.01925

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I Chart (CFM)	Linear Regression
1	3.2	1.0733	40	Slope : 35.1506
2	4.2	1.2268	46	Intercept : -2.4793
3	5.2	1.3829	50	Correlation Coefficient : 0.9968
4	6.4	1.5099	56	
5	7.6	1.6437	60	



Calibrated by : *Thanesuan*  
(Mr. Thanesuan Srivastav)  
Field Service Technician

Approved by : *[Signature]*  
(Mr. Nagesh Jantarpur)  
Senior Field Coordinator Scientist (3)

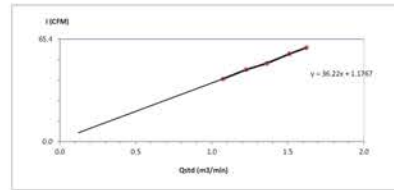
FORM NO. F-06-071 REVISION NO.2 ISSUE DATE: 29/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WSA Sarabhai Industrial Land Co., Ltd.  
Barometric Pressure (mm Hg) : 758.9  
Calibrate Location : 95, Thanebhai Vastani Sarabhai Road, 400002  
Temperature (°C) : 33.1  
Calibrate Date : 21-Oct-24  
High Volume ID : BKK\_F50369  
Calibration Sheet No. : C-211024-BKK\_F50369  
High Volume Model : TS-5009X  
Calibrator ID : BKK\_F50625  
High Volume S/N : 4165  
Calibrator Model : TS-5020A  
Calibrator Slope : 1.67329  
Calibrator S/N : 2585  
Calibrator Intercept : -0.01925

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I Chart (CFM)	Linear Regression
1	3.2	1.0733	40	Slope : 36.2198
2	4.2	1.2268	46	Intercept : 1.1767
3	5.2	1.3829	50	Correlation Coefficient : 0.9991
4	6.4	1.5099	56	
5	7.6	1.6221	60	



Calibrated by : *Thanesuan*  
(Mr. Thanesuan Srivastav)  
Field Service Technician

Approved by : *[Signature]*  
(Mr. Nagesh Jantarpur)  
Senior Field Coordinator Scientist (3)

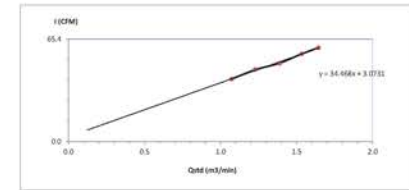
FORM NO. F-06-071 REVISION NO.2 ISSUE DATE: 29/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WSA Sarabhai Industrial Land Co., Ltd.  
Barometric Pressure (mm Hg) : 758.9  
Calibrate Location : 95, Thanebhai Vastani Sarabhai Road, 400002  
Temperature (°C) : 33.1  
Calibrate Date : 21-Oct-24  
High Volume ID : BKK\_F50370  
Calibration Sheet No. : C-211024-BKK\_F50370  
High Volume Model : TS-5009X  
Calibrator ID : BKK\_F50625  
High Volume S/N : 4798  
Calibrator Model : TS-5020A  
Calibrator Slope : 1.67329  
Calibrator S/N : 2585  
Calibrator Intercept : -0.01925

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I Chart (CFM)	Linear Regression
1	3.2	1.0733	40	Slope : 34.6602
2	4.2	1.2268	46	Intercept : -3.0721
3	5.2	1.3883	50	Correlation Coefficient : 0.9973
4	6.8	1.5338	56	
5	7.6	1.6437	60	



Calibrated by : *Thanesuan*  
(Mr. Thanesuan Srivastav)  
Field Service Technician

Approved by : *[Signature]*  
(Mr. Nagesh Jantarpur)  
Senior Field Coordinator Scientist (3)

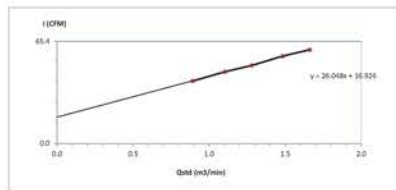
FORM NO. F-06-071 REVISION NO.2 ISSUE DATE: 29/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WSA Sarabhai Industrial Land Co., Ltd.  
Barometric Pressure (mm Hg) : 756.8  
Calibrate Location : 95, Thanebhai Vastani Sarabhai Road, 400002  
Temperature (°C) : 33  
Calibrate Date : 12-Nov-24  
High Volume ID : BKK\_F51056  
Calibration Sheet No. : C-121124-BKK\_F51056  
High Volume Model : TS-5009X  
Calibrator ID : BKK\_F50625  
High Volume S/N : 5499  
Calibrator Model : TS-5020A  
Calibrator Slope : 1.67329  
Calibrator S/N : 2585  
Calibrator Intercept : -0.01925

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I Chart (CFM)	Linear Regression
1	2.2	0.0922	40	Slope : 26.0477
2	3.4	1.1044	46	Intercept : 16.9257
3	4.6	1.2813	50	Correlation Coefficient : 0.9991
4	6.2	1.4846	56	
5	7.8	1.6629	60	



Calibrated by : *Winyan B*  
(Mr. Winyan Srivastav)  
Field Scientist (2)

Approved by : *[Signature]*  
(Mr. Nagesh Jantarpur)  
Senior Field Coordinator Scientist (3)

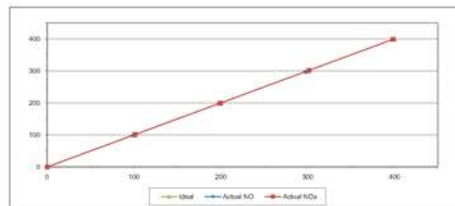
FORM NO. F-06-071 REVISION NO.2 ISSUE DATE: 29/11/23



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 2-Jul-24  
Manufacturer : Teledyne API  
Serial No. : 080  
Calibrator Manufacturer : Teledyne API  
Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 55.88  
Cylinder No. : QN0027222  
Cylinder Pressure (psi) : 1800  
Certified By : Argas Inc.  
Certified Date : 9-Feb-22  
Expired Date : 9-Feb-30

Point	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	99.80	-0.20	-0.20	101.10	1.10	1.10
2	200.00	199.30	-0.70	-0.35	199.30	-0.70	-0.35
3	300.00	297.60	-2.40	-0.80	301.70	1.70	0.57
4	400.00	398.70	-1.30	-0.33	398.20	-1.80	-0.45
AVERAGE (%)				-0.41			0.19



Calibrated By : *[Signature]*  
(Mr. Jitendra Sakam)  
Field Environmental Scientist (2)

Approved By : *[Signature]*  
(Mr. Sarayuth Jitarpur)  
Assistant General Manager

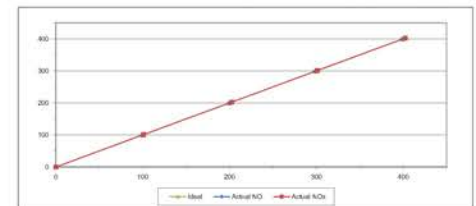
ALS Laboratory Group  
FORM NO. F-06-056 REVISION NO.1 ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 2-Jul-24  
Manufacturer : Teledyne API  
Serial No. : 4378  
Calibrator Manufacturer : Teledyne API  
Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 55.88  
Cylinder No. : QN0027222  
Cylinder Pressure (psi) : 1800  
Certified By : Argas Inc.  
Certified Date : 9-Feb-22  
Expired Date : 9-Feb-30

Point	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	99.10	-0.90	-0.90	101.10	1.10	1.10
2	200.00	199.60	-0.40	-0.20	202.70	2.70	1.35
3	300.00	298.20	-1.80	-0.60	301.20	1.20	0.40
4	400.00	398.60	-1.40	-0.35	402.50	2.50	0.63
AVERAGE (%)				-0.39			0.71



Calibrated By : *[Signature]*  
(Mr. Jitendra Sakam)  
Field Environmental Scientist (3)

Approved By : *[Signature]*  
(Mr. Sarayuth Jitarpur)  
Assistant General Manager

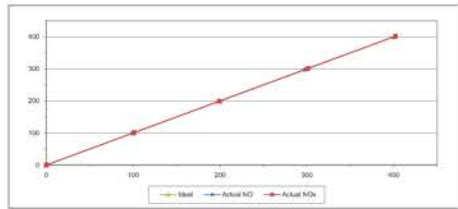
ALS Laboratory Group  
FORM NO. F-06-056 REVISION NO.1 ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-24	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	200E
Serial No.	4379	Equipment ID	BKK_FS0778
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas 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	99.20	-0.80	-0.80	101.10	1.10	1.10	
2	200.00	199.30	-0.70	-0.35	199.50	-0.50	-0.25	
3	300.00	297.30	-2.70	-0.90	301.30	1.30	0.43	
4	400.00	401.50	1.50	0.38	402.10	2.10	0.53	
AVERAGE (%)				-0.31				0.38



Calibrated By

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

Approved By

(Mr. Sarayuth Jittrant)  
Assistant General Manager

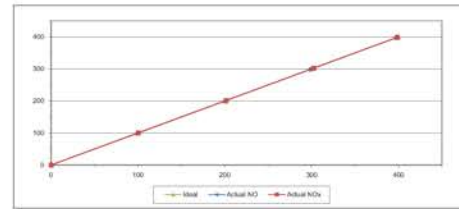
ALS Laboratory Group  
FORM NO.: F-06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-24	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	PPQMSH0H	Equipment ID	BKK_FS1070
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas 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	98.80	-1.20	-1.20	100.30	0.30	0.30	
2	200.00	201.30	1.30	0.65	201.50	1.50	0.75	
3	300.00	298.30	-1.70	-0.57	302.30	2.30	0.77	
4	400.00	398.80	-1.20	-0.30	398.60	-1.40	-0.35	
AVERAGE (%)				-0.36				0.35



Calibrated By

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

Approved By

(Mr. Sarayuth Jittrant)  
Assistant General Manager

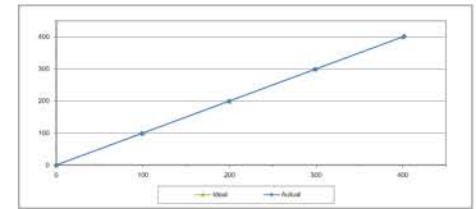
ALS Laboratory Group  
FORM NO.: F-06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	080	Equipment ID	BKK_FS0740
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.30	-1.50	-1.50
2	200.00	199.30	-0.70	-0.35
3	300.00	298.50	-1.50	-0.50
4	400.00	401.80	1.80	0.45
AVERAGE (%)				-0.36



Calibrated By

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

Approved By

(Mr. Sarayuth Jittrant)  
Assistant General Manager

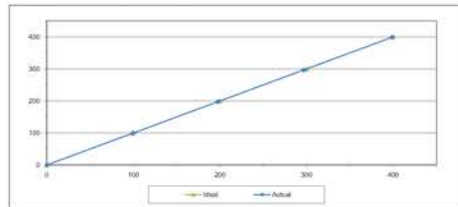
ALS Laboratory Group  
FORM NO.: F-06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	100E
Serial No.	3468	Equipment ID	BKK_FS0772
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.40	-0.60	-0.60
2	200.00	197.70	-2.30	-1.15
3	300.00	296.40	-3.60	-1.20
4	400.00	398.70	-1.30	-0.33
AVERAGE (%)				-0.64



Calibrated By

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

Approved By

(Mr. Sarayuth Jittrant)  
Assistant General Manager

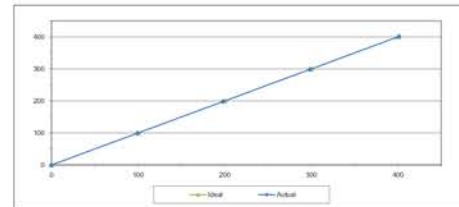
ALS Laboratory Group  
FORM NO.: F-06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	100E
Serial No.	3469	Equipment ID	BKK_FS0775
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00
2	200.00	198.00	-2.00	-1.00
3	300.00	298.30	-1.70	-0.57
4	400.00	401.30	1.30	0.33
AVERAGE (%)				-0.43



Calibrated By

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

Approved By

(Mr. Sarayuth Jittrant)  
Assistant General Manager

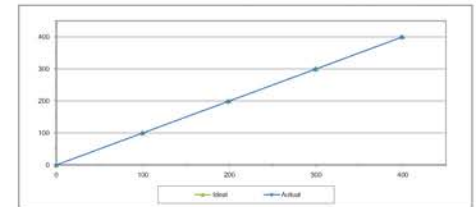
ALS Laboratory Group  
FORM NO.: F-06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	70Y1RBR0	Equipment ID	BKK_FS1068
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.00	-2.00	-1.00
3	300.00	298.70	-1.30	-0.43
4	400.00	398.70	-1.30	-0.33
AVERAGE (%)				-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-06-056 REVISION NO.: - ISSUE DATE: 02/04/12





**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NO. TIS 719.17025  
CALIBRATION 0367

Address: Associate Co., Ltd.  
KATA FL, 42111-01  
Pattana 1, 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, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

**CERTIFICATE OF CALIBRATION**

Certificate No. : C09-003-02 Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger

MANUFACTURER : N/A

MODEL/TYPE : 200-W5-2118

SERIAL NUMBER : A5248

ID NUMBER : 1000-100000

CONDITION AS RECEIVED : Used item

CUSTOMER : A5 Laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak Rd., Phatthanasak Rd., Khwaeng Suan Luang, Khwaeng Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023

MEASUREMENT DATE : 04 Jan 2024

ISSUE DATE : 08 Jan 2024

ENVIRONMENTAL CONDITIONS : Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 0.5 °C  
Relative Humidity : 55.0 ± 5.0 %RH

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

TABULATION OF RESULTS : The table on next page give the measured values.

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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

**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NO. TIS 719.17025  
CALIBRATION 0367

Continuation of Certificate of Calibration Number: C09-003-02 Page 2 of 2 Pages

Measurement Results : This equipment was connected with indoor air quality probe and displayed (DPI) on display. Model: HAPDS, Serial number: H003002.

Result of Calibration : ☒ Without Adjustment ☐ With Adjustment

Calibration Range : 20%RH to 80%RH

Table 3: The results of calibration of relative humidity are reported in table below:

Determined (RH%)	Standard Reading (RH%)	USC Reading (RH%)	Error (RH%)	Uncertainty (RH%)
20.0	20.04	19.8	-1.3	0.40
50.0	51.50	49.0	-2.5	1.0
80.0	81.00	79.2	-1.8	1.1

USC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NO. TIS 719.17025  
CALIBRATION 0367

Continuation of Certificate of Calibration Number: C09-003-02 Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor

MANUFACTURER : N/A

MODEL/TYPE : 200-W5-2118

SERIAL NUMBER : A5248

ID NUMBER : 1000-100000

CONDITION AS RECEIVED : Used item

CUSTOMER : A5 Laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak Rd., Phatthanasak Rd., Khwaeng Suan Luang, Khwaeng Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 29 May 2024

MEASUREMENT DATE : 08 Jun 2024

ISSUE DATE : 10 Jun 2024

ENVIRONMENTAL CONDITIONS : Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 0.5 °C  
Relative Humidity : 55.0 ± 5.0 %RH

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

TABULATION OF RESULTS : The table on next page give the measured values.

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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

**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number: C09-003-02 Page 2 of 2 Pages

Result of Calibration : ☒ Without Adjustment ☐ With Adjustment

Calibration Range : 20 °C to 40 °C

Function : Table 3: This equipment was connected with temperature sensor Model: HAPDS, Serial number: H003002.

Table 3: The results of calibration of temperature are reported in table below:

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.000	19.8	-0.2	0.20
70	25.000	24.8	-0.2	0.20
70	30.000	29.8	-0.2	0.20
70	35.000	34.4	-0.6	0.30
70	40.000	39.6	-0.4	0.20

USC\*: Unit Under Calibration

Remarks: The reported uncertainty of measurement is 0.36, based on standard uncertainty multiplied by a coverage factor k=2.9, providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NO. TIS 719.17025  
CALIBRATION 0367

Continuation of Certificate of Calibration Number: C09-003-02 Page 1 of 2 Pages

Measurement Results : The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration : ☒ Without Adjustment ☐ With Adjustment

Table 3: The results of calibration of relative humidity at 20 °C are reported in table below:

At Temperature (°C)	Standard Reading (RH%)	USC Reading (RH%)	Error (RH%)	Uncertainty (RH%)
20.0	20.0	19.8	-0.2	0.20
20.0	50.0	49.7	-0.3	0.3
20.0	80.0	79.5	-0.5	0.3

USC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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**J NAC**  
HIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number: C09-003-02 Page 2 of 2 Pages

Measurement Results : The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration : ☒ Without Adjustment ☐ With Adjustment

Table 3: The results of calibration of relative humidity at 20 °C are reported in table below:

At Temperature (°C)	Standard Reading (RH%)	USC Reading (RH%)	Error (RH%)	Uncertainty (RH%)
20.0	20.0	19.8	-0.2	0.20
20.0	50.0	49.7	-0.3	0.3
20.0	80.0	79.5	-0.5	0.3

USC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

Calibration by : J NAC  
Approved signature : Mr. Patsara Boonchanon  
Calibration Department Manager

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## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

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

Cap anemometer  
Komet  
Komet WS-02P  
Data logger: 200 WS-02B  
(Sensor: WS-02A)  
Data logger: WS-02B  
Serial: 100101  
Used item  
JAN Laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 (Thailand)

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

24 May 2024  
10 Jun 2024  
10 Jun 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature  
Relative humidity  
Atmospheric Pressure

(23.0 ± 0.5 °C  
(55.0 ± 0.5 %RH  
(1013.0 ± 0.5 hPa

### PLACE OF CALIBRATION

Off-site wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross section area  
Wind direction (up/down)  
Diameter of measuring area  
Blockage ratio of test object

300 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.111 %

### Preconditioning

24 hours at ambient conditions.  
The average values during measurement are (24.0 ± 0.5 °C, 55.0 ± 0.5 %RH and (1013.0 ± 0.5 hPa).

### TABULATION OF RESULTS

The table on next page give the measured values.

Calibrated by  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.  
Approved signature  
Mr. Pannas Boonchuan  
Calibration Department Manager

Remarks:  
\* Wind tunnel cross section area of the wind tunnel.  
\* Measured cross section area of the wind tunnel inside measuring area.  
\* Diameter of measuring area.  
\* Blockage ratio.

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 Cap anemometer, Unit Under Calibration (UUC) was received at 10 m/s for 1 seconds prior to calibration being performed. The standard air velocity (U<sub>ref</sub>) to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity (U<sub>ref</sub>) to 5 m/s was calculated by a pitot tube with pressure differential pressure sensor which was installed 40 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UUC was measured on a wind tunnel tube of the same size as center of 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 uncertainties are reported in the table below.

U <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)
1.00	24.00	24.00	1.00	0.9	0.9
2.00	24.00	24.00	2.00	1.8	1.8
3.00	24.00	24.00	3.00	2.7	2.7
4.00	24.00	24.00	4.00	3.6	3.6
5.00	24.00	24.00	5.00	4.5	4.5
6.00	24.00	24.00	6.00	5.4	5.4
7.00	24.00	24.00	7.00	6.3	6.3
8.00	24.00	24.00	8.00	7.2	7.2
9.00	24.00	24.00	9.00	8.1	8.1
10.00	24.00	24.00	10.00	9.0	9.0
11.00	24.00	24.00	11.00	9.9	9.9
12.00	24.00	24.00	12.00	10.8	10.8
13.00	24.00	24.00	13.00	11.7	11.7
14.00	24.00	24.00	14.00	12.6	12.6
15.00	24.00	24.00	15.00	13.5	13.5

### Remarks:

\* Calibration results only valid for the stated environmental and measurement conditions during which calibration took place.  
\* Values of standard.  
\* Values of test under calibration.

### PHOTO OF CALIBRATION SET UP



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



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

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

Wind direction sensor  
Komet  
Komet WS-02P  
Data logger: 200 WS-02B  
(Sensor: WS-02A)  
Data logger: WS-02B  
Serial: 100101  
Used item  
JAN Laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 (Thailand)

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

24 May 2024  
10 Jun 2024  
10 Jun 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature  
Relative humidity  
Atmospheric Pressure

(23.0 ± 0.5 °C  
(55.0 ± 0.5 %RH  
(1013.0 ± 0.5 hPa

### PLACE OF CALIBRATION

Off-site wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross section area  
Wind direction (up/down)  
Diameter of measuring area  
Blockage ratio of test object

300 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.111 %

### Preconditioning

24 hours at ambient conditions.  
The average values during measurement are (24.0 ± 0.5 °C, 55.0 ± 0.5 %RH and (1013.0 ± 0.5 hPa).

### TABULATION OF RESULTS

The table on next page give the measured values.

Calibrated by  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.  
Approved signature  
Mr. Pannas Boonchuan  
Calibration Department Manager

Remarks:  
\* Wind tunnel cross section area of the wind tunnel.  
\* Measured cross section area of the wind tunnel inside measuring area.  
\* Diameter of measuring area.  
\* Blockage ratio.

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Page 1 of 2 Pages

### MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard rotary anemometer by comparison method. During calibration, the measurement was carried out at 40° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 1 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)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00
40.00	40.00	40.00	40.00	40.00

### Remarks:

\* Calibration results only valid for the stated environmental and measurement conditions during which calibration took place.  
\* Direction of standard.  
\* Direction of test under calibration.

Calibrated by  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.  
Approved signature  
Mr. Pannas Boonchuan  
Calibration Department Manager

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

24 Aug 2024  
10 Aug 2024  
10 Aug 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature  
Relative humidity  
Atmospheric Pressure

(23.0 ± 0.5 °C  
(55.0 ± 0.5 %RH  
(1013.0 ± 0.5 hPa

### PLACE OF CALIBRATION

Off-site wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross section area  
Wind direction (up/down)  
Diameter of measuring area  
Blockage ratio of test object

300 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.111 %

### Preconditioning

24 hours at ambient conditions.  
The average values during measurement are (24.0 ± 0.5 °C, 55.0 ± 0.5 %RH and (1013.0 ± 0.5 hPa).

### TABULATION OF RESULTS

The table on next page give the measured values.

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

Cap anemometer  
Komet  
Komet WS-02P  
Data logger: 200 WS-02B  
(Sensor: WS-02A)  
Data logger: WS-02B  
Serial: 100101  
Used item  
JAN Laboratory group (Thailand) Co., Ltd.  
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 (Thailand)

Calibration procedure:  
The Cap anemometer was calibrated against standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity (U<sub>ref</sub>) to 5 m/s was calculated by a pitot tube with pressure differential pressure sensor which was installed 40 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UUC was measured on a wind tunnel tube of the same size as center of 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 uncertainties are reported in the table below.

### RECEIVED DATE

24 Aug 2024

### MEASUREMENT DATE

10 Aug 2024

### ISSUE DATE

10 Aug 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature  
Relative humidity  
Atmospheric Pressure

(23.0 ± 0.5 °C  
(55.0 ± 0.5 %RH  
(1013.0 ± 0.5 hPa

### PLACE OF CALIBRATION

Off-site wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross section area  
Wind direction (up/down)  
Diameter of measuring area  
Blockage ratio of test object

300 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.00 m<sup>2</sup>  
0.111 %

### Preconditioning

24 hours at ambient conditions.  
The average values during measurement are (24.0 ± 0.5 °C, 55.0 ± 0.5 %RH and (1013.0 ± 0.5 hPa).

### TABULATION OF RESULTS

The table on next page give the measured values.



Calibrated by  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.  
Approved signature  
Mr. Pannas Boonchuan  
Calibration Department Manager

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Page 2 of 2 Pages

### MEASUREMENT RESULTS

The Cap anemometer, Unit Under Calibration (UUC) was received at 10 m/s for 1 seconds prior to calibration being performed. The standard air velocity (U<sub>ref</sub>) to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity (U<sub>ref</sub>) to 5 m/s was calculated by a pitot tube with pressure differential pressure sensor which was installed 40 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UUC was measured on a wind tunnel tube of the same size as center of 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 uncertainties are reported in the table below.

U <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)	U <sub>ref</sub> (m/s)
1.00	24.00	24.00	1.00	0.9	0.9
2.00	24.00	24.00	2.00	1.8	1.8
3.00	24.00	24.00	3.00	2.7	2.7
4.00	24.00	24.00	4.00	3.6	3.6
5.00	24.00	24.00	5.00	4.5	4.5
6.00	24.00	24.00	6.00	5.4	5.4
7.00	24.00	24.00	7.00	6.3	6.3
8.00	24.00	24.00	8.00	7.2	7.2
9.00	24.00	24.00	9.00	8.1	8.1
10.00	24.00	24.00	10.00	9.0	9.0
11.00	24.00	24.00	11.00	9.9	9.9
12.00	24.00	24.00	12.00	10.8	10.8
13.00	24.00	24.00	13.00	11.7	11.7
14.00	24.00	24.00	14.00	12.6	12.6
15.00	24.00	24.00	15.00	13.5	13.5

### Remarks:

\* Calibration results only valid for the stated environmental and measurement conditions during which calibration took place.  
\* Values of standard.  
\* Values of test under calibration.

### PHOTO OF CALIBRATION SET UP



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









Cert. No. : ACC24026  
Job No. : VC67AC0105  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.14	0.14	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.7	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.56	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

*T. Petch*

Cert. No. : ACL24006  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858521 / 158765 / 58767  
ID No. : BKK, FS0111

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023  
Calibration Date : 05-08 JANUARY 2024  
Date of Issue : 09 JANUARY 2024



Calibrated by : Natchanon Pitsuppan

Approved by : *T. Petch*  
( Thanakul Petchum )

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.

Cert. No. : ACL24006  
Job No. : VC67AC0043  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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

*T. Petch*

Cert. No. : ACL24006  
Job No. : VC67AC0043  
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)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	12.6
C-weight	19.2
Flat	24.3

3. Acoustical signal tests of frequency weightings

Measure 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	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.5	-1.5	-1.4	±5.0

Cert. No. : ACL24006  
Job No. : VC67AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 20/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	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).

*T. Petch*

Cert. No. : ACL24006  
Job No. : VC67AC0043  
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	0.0	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	0.1	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
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

*T. Petch*



## 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	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

T. Rethi

## 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	134.1	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
	0.25	8	99.0	99.0	-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, Leqpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Rethi

## 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

T. Rethi

Request No. 21-670231

MTC No. EEL- BP. 1640167

## CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Address : 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Phatthanasak, Khet Suan Luang, Bangkok, 10250  
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Ministry and Testing Service Centre, Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10230.

Instrument Calibrated :  
Description : Sound Level Meter  
Manufacturer : Rion  
Model : NL-42  
Serial No. : 0085833 (ID : HKK, FS0113)  
Microphone : UC-52 No.158774  
Preamplifier : NH-24 No.58775

Ambient Environment  
Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325 ± 1.5) kPa

- Standards used :
- Band Pass Filter Wavetek 752A S/N 90010494.
  - Condenser Microphone Brüel&Kjær 4180 S/N 2898971
  - Decade Attenuator Ando AL-205 S/N 0046480.
  - Function/Arbitrary Waveform Generator Agilent 33220A S/N MY4404268.
  - Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 123037.
  - Digital Multimeter Fluke 850A S/N 4985007.
  - Pinpointing Rion NC-72 S/N 00402446.
  - Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan. 2024

Date of Calibration : 21 Feb. 2024

1/9

The results relate only to the items submitted for calibration or value assigned.

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

Request No. 21-670231

MTC No. EEL- BP. 1640167

- Power Amplifier Brüel&Kjær 2706 S/N 1517450.
- Speaker Tannoy Limited, Great Britain British Patent No. 315300.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Programmable Attenuator Tamagawa TPA-301A S/N 2312.

## Calibration Procedure :

This instrument was calibrated by using calibration procedures on CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 21 Feb. 2024

2/9

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Request No. 21-670231

MTC No. EEL- BP. 1640167

## 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
	Before adjust	After adjust				
113.91	114.2	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was finally performed. The internal calibration adjustment was then completed at the display of 113.5 dB.

## 2. Self-generated noise

## 2.1 Normal test

Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
19.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
A-Weight	10.9	0.10	N/A
C-Weight	17.5	0.10	N/A
Flat	21.7	0.10	N/A

Date of Calibration : 21 Feb. 2024

3/9

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	-0.4	0.5	0.5	0.6
1 000	-0.1	0.5	0.5	0.6
8 000	-2.6	0.5	0.5	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	0.1	0.0	0.0	0.6
125	0.0	0.0	0.0	0.6
250	0.0	0.0	0.0	0.6
500	0.0	0.0	0.0	0.6
1 000	0.0	0.0	0.0	0.6
2 000	-0.1	0.0	0.0	0.6
4 000	-0.2	0.0	0.0	0.6
8 000	0.0	0.0	0.0	0.7

Date of Calibration : 21 Feb. 2024

4 / 9

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Fax. 0462 2579 8932  
E-mail : tistr@tistr.go.th

TISTR-MTC-002 Rev.4

### 5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 21 Feb. 2024

5 / 9

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E-mail : tistr@tistr.go.th

TISTR-MTC-002 Rev.4

### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.1	0.1	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
129	129.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.1	0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3

Date of Calibration : 21 Feb. 2024

6 / 9

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TISTR-MTC-002 Rev.4

### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
39	39.0	0.0	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

### 8. Level linearity including the level range control

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 21 Feb. 2024

7 / 9

The results relate only to the items tested/calibrated or value assigned.  
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TISTR-MTC-002 Rev.4

### 8. Level linearity including the level range control

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Timeburst Duration, T (sec)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	+1.0	0.20	0.3
	2	108.9	-0.1	+1.0/-2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5/-5.0	0.20	0.3
Slow	200	119.5	-0.1	+1.0	0.20	0.3
	2	99.9	-0.1	+1.0/-5.0	0.20	0.3
	200	120.0	0.0	+1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0/-2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5/-5.0	0.20	0.3

Date of Calibration : 21 Feb. 2024

8 / 9

The results relate only to the items tested/calibrated or value assigned.  
Advising the Report/Certificate and validity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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TISTR-MTC-002 Rev.4

### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

### 11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	136.9	0.0	1.5	0.20
Negative one-half cycle	136.9	0.0	1.5	0.20

### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by:

Wittawat Sapanuch

(Mr. Wittawat Sapanuch)

Approved by:

Pattana Pongthong

(Mr. Pattana Pongthong)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2024

Date of Issue : 22 Feb. 2024

Ref : 2011267012400160002

End of Certificate

9 / 9

The results relate only to the items tested/calibrated or value assigned.  
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TISTR-MTC-002 Rev.4

Cert. No.: ACL24086  
Pages: 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858525 / 170383 / 72889  
ID No.: HKK\_J90115

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG 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 : 11 JANUARY 2024  
Calibration Date : 22-24 JANUARY 2024  
Date of Issue : 24 JANUARY 2024

Calibrated by : Natchorn Pitsupaisan

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

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No.: ACL24086  
Job No.: VC67AC0655  
Pages: 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by follow on IEC-61672-1 (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	MY48017676	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY53202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 3040266	13-FEB-24
Digital Multimeter	33461A	MY53220676	EEL-BP 2980266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 3160266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	3450495	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 as :

3.1 National Institute of Metrology (Thailand).

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

*T. Petchu*Cert. No.: ACL24086  
Job No.: VC67AC0655  
Pages: 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.9)	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	12.6
C - weight	18.6
Flat	24.4

## 3. Acoustical signal tests of frequency weightings

Motor 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	0.2	0.3	0.3	±1.5
1000	0.0	0.1	0.1	±1.0
8000	-0.8	-0.7	-0.7	±5.0

*T. Petchu*Cert. No.: ACL24086  
Job No.: VC67AC0655  
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	Anticipated Value ( dB )	Measured Value ( dB )	Deviation 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 )	Deviation 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 )	Deviation Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	±0.3

*T. Petchu*Cert. No.: ACL24086  
Job No.: VC67AC0655  
Pages: 3 of 8

## Summary of Measurement Result :

Parameter	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	-	0.2
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

*T. Petchu*

# SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Cert. No. : ACL24086  
Job No. : VC67AC0855  
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 <sub>b</sub> (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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Petchum

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Cert. No. : ACL24086  
Job No. : VC67AC0855  
Pages : 8 of 8

## 11. Overload indication

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

T. Petchum

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Cert. No. : ACL24087  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858526 / 175176 / 83721  
ID No.: BKCF\_F50116

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHUANG 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 : 11 JANUARY 2024  
Calibration Date : 22-24 JANUARY 2024  
Date of Issue : 24 JANUARY 2024



Calibrated by : Nathorn Pitsupaisan

Approved by : T. Petchum  
( Thanakul Petchum )

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Cert. No. : ACL24087  
Job No. : VC67AC0855  
Pages : 2 of 8

## Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by follow 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 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY33220104	EEL-BF 305066	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 294066	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 314066	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	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 :

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

T. Petchum

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Cert. No. : ACL24087  
Job No. : VC67AC0855  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	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

T. Petchum

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Cert. No. : ACL24087  
Job No. : VC67AC0855  
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	11.6
C-weight	17.7
Flat	23.4

### 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	0.0	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	2.5	2.6	2.6	±5.0

T. Petchum



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Cert. No. : ACL24087  
Job No. : VC67AC0655  
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	0.0	-0.1	±0.0
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
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

T. Petch

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Cert. No. : ACL24087  
Job No. : VC67AC0655  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
177.0	177.0	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	84.1	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	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.1	0.1	±1.1

T. Petch

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Cert. No. : ACL24087  
Job No. : VC67AC0655  
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
Slow	200	800	134.0	134.0	0.0	±1.0
	2	8	108.0	108.0	0.0	1.5; -5.0
SEL	200	800	127.6	127.6	0.0	±1.0
	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	±3.0
One	136.6	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	133.6	133.1	-0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

T. Petch

# SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

409-4091 Sirethorn Road, Bangkum, Bangkok, 10700 Thailand  
Tel: +66 2432 8328 Email: calibration@sithiporn.com



Cert. No. : ACL24087  
Job No. : VC67AC0655  
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	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

T. Petch



Bara Scientific Co., Ltd.  
908 U Chu Liang Building Floor 7 Ramat Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: (02-6243300 Fax: (02-6275496-7  
Email: barascientific@barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-37424  
Equipment Model UNV1800 Spectrophotometer  
Manufacturer Shimadzu  
Serial No. A1454908333 CD  
ID No. BSKLJN0018  
Date of receipt 13 September 2024  
Date of calibration 13 September 2024  
Date of issue 13 SEP 2024

Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (25.3 - 26.7) °C (On site)  
Humidity (55.4 - 55.9) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Preparation Lab

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 190372 and 190371  
Photometric Accuracy is traceable to certificate No. 190364 and 111396  
Stray Light is traceable to certificate No. 190377  
The above certificates are traceable to SI unit through Bara Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 9609)

Calibrated by Mr. Wanchana Jarinyai

Approved by

Mr. Bontit Tumbonkashul  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising this report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

BARA-UV-37424 Rev.01 (23/09/24)



Bara Scientific Co., Ltd.  
908 U Chu Liang Building Floor 7 Ramat Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: (02-6243300 Fax: (02-6275496-7  
Email: barascientific@barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-37424

Number of Page(s) 2 of 3

Calibration Results:

### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
241.70	241.55	-0.15	0.18
354.02	353.85	-0.17	0.18
418.93	418.82	-0.04	0.18
572.98	572.97	-0.02	0.18
879.41	879.17	-0.24	0.18

### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (A)
235	0.0000	0.0000	0.0000	0.0075
	0.7171	0.7189	-0.0002	0.0075
257	0.9009	0.9000	0.0009	0.0075
	0.8954	0.8945	-0.0009	0.0075
313	0.9000	0.9000	0.0000	0.0075
	0.2786	0.2781	-0.0005	0.0075
350	0.9000	0.9000	0.0000	0.0075
	0.8199	0.8194	-0.0005	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising this report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

BARA-UV-37424 Rev.01 (23/09/24)



## Certificate of Calibration

Certificate No. BSCC-UV-37424 Number of Page(s) 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
	0.0791	0.0796	0.0004	0.0042
	0.1119	0.1105	-0.0014	0.0042
	0.1518	0.1514	-0.0004	0.0042
	0.0000	0.0000	0.0000	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.0610	0.0613	0.0003	0.0042
	0.1001	0.0994	-0.0007	0.0042
	0.0000	0.0000	0.0000	0.0042
460.0	0.0000	0.0000	0.0000	0.0042
	0.0225	0.0232	0.0007	0.0042
	0.0814	0.0808	-0.0006	0.0042
	0.1459	0.1444	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
480.0	0.0000	0.0000	0.0000	0.0042
	0.0349	0.0345	-0.0004	0.0042
	0.0875	0.0866	-0.0009	0.0042
	0.1509	0.1494	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
500.0	0.0000	0.0000	0.0000	0.0042
	0.0500	0.0498	-0.0002	0.0042
	0.1000	0.0998	-0.0002	0.0042
	0.1500	0.1498	-0.0002	0.0042
	0.0000	0.0000	0.0000	0.0042
520.0	0.0000	0.0000	0.0000	0.0042
	0.0668	0.0668	0.0000	0.0042
	0.1250	0.1250	0.0000	0.0042
	0.1882	0.1881	-0.0001	0.0042

\*CNR = Customer not request

#### 4. Stray Light

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%)	Absorbance (A)
200 (Short) 1100	200.58	0.0020	2.0017

The stray light transmission reference is less than 1.0% and stray light absorbance reference is greater than 2.00A.

\*Stray Light not NSC-ONSC Accredited.

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

\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mentioned in this report / certificate. Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

FM-L13-11818-08-06

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 Phatthakanan 40, Phatthakanan Rd., Khwaeng Phatthakanan,  
Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Prin Zeb Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 05 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-L13-11818-08-06

Certificate No. T232160

## 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 one standard thermocouples type T use for ambient temperature measurement. The calibration was done in accordance to WI-T201 (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.

Instrument	Model	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-TIS-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :  
Time Constant : 1 Hour 30 Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
Close  
☒ Not Available

5. Adjustment : ( X ) without adjustment ( ) after adjustment

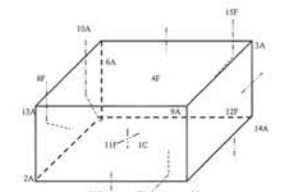
Approved By : Prin Zeb

FM-L13-11818-08-06

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 : Prin Zeb

FM-L13-11818-08-06

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
3.0	3.83	3.34	2.95	3.46	3.45	3.76	3.23	3.46	3.39	3.50
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.23	3.39	3.15	3.43						

Chamber (Cooling Room)			Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor	
	Min.	Max.						Average
3.0	2.8	4.1	3.5	3.36	1.10	2.00	3.90	2.00

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on data 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 : Prin Zeb

FM-L13-11818-08-06

Maintenance Plan YEAR : 2024

เดือน	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ทำ												

### Periodical maintenance check list for Konelab

	6M	12M	Note
1. Diluent-wash tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
2. ISE tubing change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
3. Syringe check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
4. Dispensing check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
5. Waste tubing change when necessary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
6. Lamp check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
7. Mixer paddle/paddle change (not Konelab20)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
8. ISE needles check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
9. Pump tubing check/ change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
10. Broken/worn out part check/ change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
11. Peristaltic pump check/ cleaning/ lubrication	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
12. Heating check	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
13. Cooling check	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
14. Dispenser mechanic check/adjustment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
15. Cuvette transfer mechanic check/adjustment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
16. Dispenser movement check/adjustment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
17. Sample/reagent register check/adjustment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
18. Dispensing tubing tightness check	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
19. Photometer and optics cleaning/check/adjustment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
20. Workstation PC cleaning if necessary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
21. Mechanic cleaning/lubrication	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
22. Instrument cleaning if necessary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
23. Complete analyzer testing with waterblank/QC or sample	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
24. Test parameters/Adjustment/config. Save to USB key	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes
25. UPS Test	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Yes

Place: REI LAB Instrument: Konelab  
Date/Time: 16/12/23 Serial no: 8031  
Service done by: Prin Zeb Install date:  
Signature of customer: Prin Zeb Date/Time: 16/12/23

Accuracy results Aquilaw 7.2.AQ7 Page: 1

6/16/2024 16:52

Reference: 6/15/2024  
Int: HQ34

ADJUSTMENT CALIBRATION

Parameter	Result	Limit	Warning
Temperature (°C)	27.8	27.0 ± 1.0	
Dispensing ratio	18.4	14.5 - 21.2	
Dispensing ratio CV%	0.38	<1.7	
Photometric index			
Max SD 240 ± 0.8	0.17	<2.0	
Max SD 240 ± 0.8	0.87	<3.0	
Linearity of photometer			
Slope	1.0143	0.94 - 1.06	
Intercept	0.0013	-1 - 1.02	
Max slope from linear fit (m)	1.1	<12.0	
Max slope %	-1.5	-1 - 6.0	
Linearity of sample dispensing			
Dispense volume 10.235 (1)	2.26	1.35 - 2.16	
Dispense volume 10.235 (2)	4.14	3.85 - 4.40	
Dispense CV%	1.20	<2.0	
Dispense CV%	0.90	<2.0	
Dispense CV%	0.68	<2.0	
Needle fill volume	0.002	<0.060	
Standard deviation (m)	0.007	<0.005	
Volume (1.1)	0.03	<0.32	

DISPENSING RATIO

Dispensing ratio	Thermoc. volume SD (m)
10.235 (1)	0.1140
10.235 (2)	0.1145
10.235 (3)	0.1137
10.235 (4)	0.1144
10.235 (5)	0.1141
10.235 (6)	0.1141

Accuracy results Aquilaw 7.2.AQ7 Page: 2

6/16/2024 16:52

Linearity of sample dispensing

Temp. Dispensing (°C)

20.722 0.104

20.724 0.442

20.726 1.473

Linearity of photometer

Target (m)	Test (m)	Delta (m)	Delta %
0.000	0.000	-0.004	-2.7%
0.454	0.452	-0.002	-1.5%
1.431	1.440	0.009	0.6%
1.916	1.943	0.027	1.4%
2.415	2.414	-0.001	-0.1%

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

Certificate of Calibration Cert.No.: 24CH1295 Page: 1 of 3

Equipment: pH Meter

Manufacturer: Hach

Model: HQ4115

Serial No.: 20010031163

ID No.: BKK\_EN0342

Condition As-Received: Used Item

Received Date: 18 October 2024

Calibration Date: 17 October 2024

Reference: 2410-0548DSG-0

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanasarn Rd.,  
Khuang Phatthanasarn, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature: (25 ± 2.5) °C

Relative Humidity: (50 ± 10) %

Calibration Procedure: In-house method:  
- OP-CHS by direct measurement with  
certified reference material (CRM)  
- OP-CHS by comparison with temperature standard

Calibrated by: Watsorn Lemsangkul

Approved by: Sathap  
Approved Signatory

Issue Date: 21 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Cert.No.: 24CH1295 Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
18Ref. Standard Thermometer	218050	130RC044	241022	16 Sep 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials

The measurement results are traceable to SI through Hach Lange GmbH Ltd.  
Deutsche Akkreditierungsstelle, Accredited No.D-RL-15184-01-00  
The measurement results are traceable to SI through CPA chem Ltd.,  
ANAB-ASQ National Accreditation Board, Accredited No. AN-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lange GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034203	27 Sep 2025

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

Calibration Results

Function: pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.718)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (mV)	Coverage factor k
pH Electrode	4.008	4.028	174.6	0.0044	2.00
SN: 230473042902	6.999	7.014	14	0.0084	2.00
	10.010	10.010	-172.8	0.0066	2.00

Remark: - Can not connect the BNC because the plug does not match with the socket.

Cert.No.: 24CH1295 Page: 3 of 3

Calibration Results

Function: Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe:

- Model: PHC281

- Serial No.: 230473042902

Dimension of probe

- Length: 103 mm.

- Diameter: 12 mm.

- Immersion Depth: 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	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 %.

-000-

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

Certificate of Calibration Cert.No.: 24CO9062 Page: 1 of 2

Equipment: Burette

Capacity: 50 mL

Serial No.: -

ID No.: BKK\_EN0171

Manufacturer: Wieg

Made in: Germany

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanasarn Rd.,  
Khuang Phatthanasarn, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature: (20 ± 2.5) °C

Relative Humidity: (50 ± 10) %

Barometric Pressure: 760 mmHg

Calibration Procedure: ASTM E 542 - 01

Calibrated by: Natcha Chayingsriwong

Approved by: Sathap  
Approved Signatory

Issue Date: 27 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Bureau  
Received Date : 23 February 2024  
Condition As-Received : New Item  
Calibration Date : 27 February 2024  
Reference : 2402-075/DSC-1

Cert.No.: 24C0962  
Page: 2 of 2

#### Condition of this result of calibration

- Reference Standard Instruments:

Instruments	Model	Serial No.	ID No.	Certificate No.	Traceability	Due date
1) Balance	XP205DR	1126143764	140RC004	23MM538	TPA	15 Sep 2024
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer	-	0634181	140EC005	23V48	TPA	10 Aug 2024

This certification is traceable to SI Unit
- The certificate is valid only to the item calibrated on date and place of calibration.
- True value is converted to true volume at the standard temperature of 20 °C

#### Calibration result:

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	50.0032	0.010	2.00

Remark mL = cm<sup>3</sup>

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 %.

-000-

Sartorius (Thailand) Co., Ltd.  
101 Siam Road, Bangkok, Thailand 10100  
Tel: +66 204 800 000, e-mail: service@thailand.sartorius.com



## Certificate of Calibration

Model Number: MS27245-100-02  
Description: Analytical Balance  
Serial Number: 002740005  
ID No.: BSK\_EN0003  
Manufacturer: Sartorius  
Certificate No.: 24C0379  
Issued Date: Monday, August 05, 2024  
Reference No.: 240342  
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40/Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250

Calibrated Place: Lab Room

Calibrated By: Mr Chuchai Ichikawa  
Calibration Date: Friday, August 02, 2024  
Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number (IM-003) Based on UKAS LMS 14: 2019

Measurement data:  
Capacity: 220 g Repeatability: 0.0021 g  
Ambient Conditions:  
Temperature: 23.0 °C ± 0.5 °C  
Humidity: 55.0 % RH ± 10.0 % RH  
Pressure: hPa  
Equipment Condition: All Good Operation All Fine

Measurement Method UKAS Publication Ref J4 14

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). The calibration certificate documents the traceability to National Standards, which define the unit of measurement according to the International System of Units (SI). Report of Uncertainty can be found in the Calibration Certificate.

#### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC011-020-00	Standard weight on line, 100N (0.025011-001-00)	ITS	M23081875	23-Aug-2025
Synfo 124 R	Thermo-Hygrograph, Synfo 124 R	INTON	NET 6613033661140	12-Nov-2024

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

SOP FM 13 03 February 2022

Mr Chuchai Ichikawa (Technical Manager)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 EQUIPMENT CALIBRATION AND TESTING SERVICES  
104/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2718-9484



## Certificate of Calibration

Cert. No.: 24TM1618  
Page: 1 of 3

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE29  
Serial No.: L622.0282  
ID No.: BKK\_EN3439  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Organic Preparation Lab  
Received Order : 29 October 2024  
Calibration Date : 29 October 2024  
Ambient Temperature : (20 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by: Man Pattanasongsaiboon  
Approved by: Kunchit  
Approved Signatory  
Issue Date : 30 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2410-075/DSC-4  
Procedure Used :>

Cert. No.: 24TM1618  
Page: 2 of 3

Calibration was conducted using in-house calibration procedure CP-0704 Based on ASTM E715 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

- Reference standard instrument:

Instrument	Serial No.	Cert. No.	Traceability	Due Date
1) Data Acquisition	MV57013711	24LM115	TPA	13 Jul 2025
- 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.

Remark : TPA : Technology Promotion Association (Thailand - Japan)  
Result of Calibration : (°C) Without Adjustment  
Function of UUC : Temperature Source  
Heat transfer medium used : Water

	Environmental (°C)	%R.H.	AC Voltage Supply (Volt)
Beginning of Calibration	25	54	222
Finished of Calibration	25	57	226

Position	Ref. Std. ID No.:
1	4803688-001
2	4803688-002
3	4803688-003
4	4803688-004
5 (ref.)	4803688-005



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2410-075/DSC-4  
Result of Calibration : (°C) Without Adjustment  
Function of UUC : Temperature Source

Cert. No.: 24TM1618  
Page: 3 of 3

Calibration point (°C)	UUC <sup>*</sup> Setting (°C)	UUC <sup>*</sup> Reading (°C)	Average <sup>*</sup> Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
55.0	55.0	55.0	55.133	55.012	55.150	54.983	55.066	0.22

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
55.0	0.21	0.13	2

Average<sup>\*</sup> : The average of 50 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 pattern 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<sup>\*</sup> : 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 %.

-000-





Certificate No. T240742

Page 1 of 5

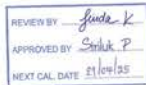
### Certificate of Calibration

Equipment : Digestion Unit  
Manufacturer : SCP Science  
Model : DigIPRER HT  
Serial No. : HTC1120480658  
Customer Code : BKK\_EN0366  
ID No. : T2635A5  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab 1  
Date of Receipt : 11 April 2024  
Calibrated By : Sujjar Nakkred (Site Calibration Manager)  
Approved By : / Boonchai Suriyawong (Site Calibration Manager)  
Date of Issue : 02 MAY 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 Metrological Center.

F54-L13 88670-05-57



Certificate No. T240742

Page 2 of 5

### Calibration Report

Equipment : Digestion Unit  
Date of Calibration : 21 April 2024  
Environment : Temperature : 23.9 - 26.3 °C  
Line Voltage : 221.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to W7-T16.  
was based on ITS - 90.
- Reference Standard Instrument :  
Instrument Model Instrument No. Certificate No. Due Date  
TC Type S T230886  
DATA LOGGER 34970A T47 T230886 09 May 2024
- This certificate is traceable to :  
National Institute of Metrology (Thailand) through Metrological Center (NIST-TIS-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 1 Hour 6 Minute At 380 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By:

F54-L13 88670-05-57



Certificate No. T240742

Page 3 of 5

### Calibration Report



FRONT

Measurement Results		Reading		STD	Position of Standards at Block									
Cal. Point	Setting	Reading	STD	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading
380.0	380.0	379.2 - 380.3			Max °C	378.7	378.6	377.8	378.7	380.3	379.0	378.7	377.6	
					Min °C	378.2	378.9	377.3	378.2	380.1	379.3	378.3	378.6	
					Average °C	378.4	378.7	377.7	378.4	380.2	379.6	378.9	377.9	
					Stability °C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	

Approved By:

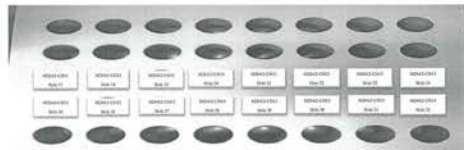
F54-L13 88670-05-57



Certificate No. T240742

Page 4 of 5

### Calibration Report



FRONT

Measurement Results		Reading		STD	Position of Standards at Block									
Cal. Point	Setting	Reading	STD	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading
380.0	380.0	379.2 - 380.3			Max °C	378.9	378.2	379.5	380.1	382.1	381.0	378.9	377.8	
					Min °C	378.2	378.6	378.1	378.6	381.7	380.2	378.1	377.2	
					Average °C	378.5	378.9	378.7	378.9	381.9	380.6	378.6	377.5	
					Stability °C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	

Approved By:

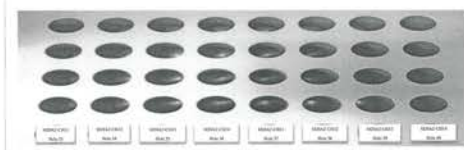
F54-L13 88670-05-57



Certificate No. T240742

Page 5 of 5

### Calibration Report



FRONT

Measurement Results		Reading		STD	Position of Standards at Block									
Cal. Point	Setting	Reading	STD	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Reading
380.0	380.0	379.2 - 380.3			Max °C	378.3	377.0	378.7	378.3	381.6	380.5	378.6	378.6	
					Min °C	378.0	377.6	378.4	378.1	381.2	380.0	378.1	377.4	
					Average °C	378.1	377.8	378.6	378.2	380.4	380.3	378.3	377.9	
					Stability °C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	

The expanded uncertainty of temperature measurement was ± 1.87 °C

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=2, providing a level of confidence of approximately 95 %.

Approved By:

F54-L13 88670-05-57



Certificate No. T240742

Page 1 of 5

### Certificate of Calibration

Equipment : DIGESTION UNIT  
Manufacturer : Environmental Express  
Model : TKN100  
Serial No. : 2017TKNBC142  
Customer Code : BKK\_EN0223  
ID No. : T6773A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab1

Date of Receipt : 15 May 2024

Calibrated By : Sujjar Nakkred (Site Calibration Manager)

Approved By : / Preecha Phisawatthikol (Temperature Calibration Manager)

Date of Issue : 28 MAY 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 Metrological Center.

F54-L13 88670-05-57





Certificate No. T240977

Page 2 of 5

### Calibration Report

Equipment : DIGESTION UNIT  
Date of Calibration : 24 May 2024  
Environment : Temperature : 28.7 - 30.0 °C  
Line Voltage : 222.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to W1-710.
- Reference Standard Instrument :  
Instrument Model Instrument No. Certificate No. Due Date  
TC M20A1-CH17-CH30 T240714 23 April 2025  
DATA LOGGER 34970A T149 T240714 23 April 2025
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 ).
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 2 Hour 2 Minute At 380 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By:

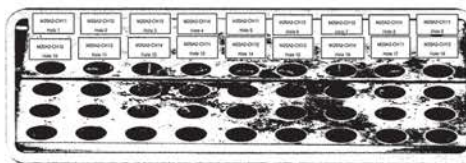
FM-L13 10830-05-57



Certificate No. T240977

Page 3 of 5

### Calibration Report



DISPLAY CONTROL (FRONT)

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	277.24	280.04	282.02	283.28	285.01	279.04	281.11	279.62	279.24			
			Stability °C	0.21	0.27	0.26	0.22	0.24	0.27	0.23	0.20	0.22			

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	277.64	281.17	282.38	282.11	282.24	281.84	280.23	281.48	281.41			
			Stability °C	0.21	0.24	0.20	0.24	0.21	0.23	0.23	0.20	0.22			

Approved By:

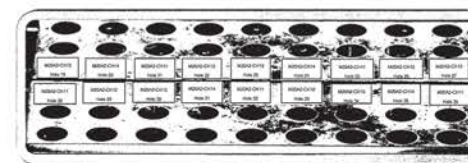
FM-L13 10830-05-57



Certificate No. T240977

Page 4 of 5

### Calibration Report



DISPLAY CONTROL (FRONT)

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	276.27	281.29	282.28	282.04	281.88	280.47	281.28	280.27	279.21	280.27		
			Stability °C	0.21	0.26	0.21	0.22	0.23	0.23	0.23	0.23	0.21	0.22		

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	277.24	280.04	282.02	283.28	285.01	279.04	281.11	279.62	279.24			
			Stability °C	0.21	0.27	0.26	0.22	0.24	0.27	0.23	0.20	0.22			

Approved By:

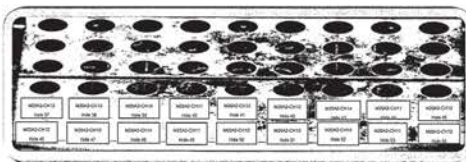
FM-L13 10830-05-57



Certificate No. T240977

Page 5 of 5

### Calibration Report



DISPLAY CONTROL (FRONT)

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	280.28	279.04	280.07	281.41	279.21	282.27	281.28	279.62	279.24			
			Stability °C	0.21	0.14	0.17	0.22	0.19	0.24	0.19	0.21	0.22			

Measurement Results				Position of Standard at Block											
Cal. Pos.	Setting	Reading	ITS	1	2	3	4	5	6	7	8	9	10	11	12
1°C	1°C	1°C	Reading	28.81	28.82	28.83	28.84	28.85	28.86	28.87	28.88	28.89	28.90	28.91	28.92
300.0	300.0	279.0 - 300.0	Average °C	277.29	281.24	282.01	279.21	282.08	280.01	281.41	282.24	282.24			
			Stability °C	0.22	0.41	0.28	0.24	0.22	0.23	0.24	0.26	0.28			

The expanded uncertainty of temperature measurement was ± 1.65 °C.  
The calibration result apply only the above calibrated items.  
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=2, providing a level of confidence of approximately 95 %.

Approved By:

FM-L13 10830-05-57



Certificate No. T240994

Page 1 of 3

### Certificate of Calibration

Equipment : Chamber ( Oven )  
Manufacturer : Memmert  
Model : UF 450  
Serial No. : B717.0531  
Customer Code : BKK\_EN0273  
ID No. : T8042A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

194 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory (Oven Room)

Date of Receipt : 08 May 2024

Calibrated By : Preecha Phisassuthikul ( Temperature Calibration Manager )

Approved By : / Nuafun Sungchum (Metrology Manager)

Date of Issue : 23 MAY 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 10918-08-66



Certificate No. T240994

Page 2 of 3

### Calibration Report

Equipment : Chamber ( Oven )  
Date of Calibration : 14 May 2024  
Environment : Temperature : 26.5-28.1 °C  
Line Voltage : 226.7-229.8 V  
Relative Humidity : 51 - 57 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber, the other one resistance thermometer detector use for ambient temperature measurement. The calibration was done in according to W1-710 ( 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.
- Reference Standard Instrument :  
Instrument Model Instrument No. Certificate No. Due Date  
RTD 100 ohm 7231955 17 November 2024  
DATA LOGGER 34970A T121 7231955 17 November 2024
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 ).
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 1 Hour 30 Minute At 104 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By:

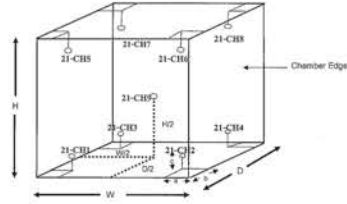
FM-L13 10918-08-66



Certificate No. T246994

Page 3 of 3

### Calibration Report



Remark :  
Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number 21-CH1 to 21-CH10 :  $\phi = 5$  cm.,  $\lambda = 5$  cm. and  $\alpha = 5$  cm.  
Size of Installed Standard sensor number 21-CHP : W/2 = 164 cm./2, H/2 = 72 cm./2 and D/2 = 60 cm./2

Average Standard Reading at each position (°C)									
Calibration Point	21-CH1	21-CH2	21-CH3	21-CH4	21-CH5	21-CH6	21-CH7	21-CH8	21-CH9
104	103.4	105.8	103.7	103.6	101.3	104.6	103.3	104.0	103.9
180	179.5	181.1	179.2	179.5	179.8	181.3	179.8	179.9	180.2

Chamber (Over)		Temperature Distribution					
Reading (°C)		Average (°C)		Stability (°C)	Uniformity (°C)	Uncertainty (°C)	Coverage Factor
Min, Max	Average	Average (°C)	Stability (°C)	Uniformity (°C)	Uncertainty (°C)	Coverage Factor	
104.0	103.9, 104	104.0	103.85	0.14	1.27	0.44	2.00
180.0	179.9, 180.1	180.0	179.94	0.39	2.29	0.76	2.00

\* The quoted uncertainty excludes "repeatability".  
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 distribution, providing a level of confidence of approximately 95 %.

End of Certificate

Approved By:

PM-L111818-08-46



### Certificate of Calibration

Equipment: CONDUCTIVITY METER  
Model: ORION STAR A215  
Serial No. (or ID.): X58031  
Manufacturer: Thermo Scientific  
Electrode Serial No.: VV1-18416  
Condition: In Condition

Certificate No.: C2432092  
Issued Date: 25 December 2023  
Job No.: WO-00012862  
Page: 1 of 2  
Model: ORION 013005MD  
Brand: Thermo Scientific

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

APPROVED BY:

Environment Condition: Temperature 21.7 °C ± 0.1 °C  
Humidity 53.7 %RH ± 0.1 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Srisopon Srijan  
Calibration Date: 25 December 2023  
The Method used: In house method, CAL-WH-48, base on ASTM D 1125-14 and D 5391-14  
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST (SRM) through CPA Chem Co., Ltd. (ISO/IEC 17034) Certificate No. 890590, 890591, 890592

Person in charge:   
Authorized signatory:

\* This certificate is issued for the sole purpose of measurement according to the International System of Units (SI). It provides traceability of measurement to international standards and is not intended for use as evidence of compliance with any other standard or specification.  
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).  
These results may be affected by deviations from specified conditions. This result refers only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKS Technology Limited.

Delivering Growth - In Asia and Beyond.

CAL-PM-C24-08: 12 Sep 2022



### Certificate of Calibration

Equipment: pH METER  
Model: TitrLine 7000  
Serial No. (or ID.): 10013506  
Manufacturer: SI Analytics  
Electrode Serial No.: BW1-13563  
Condition: In Condition

Certificate No.: C07340035  
Issued Date: 26 December 2024  
Job No.: WO-0005677  
Page: 1 of 3  
Model: B1570NMD  
Brand: Thermo Scientific

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

APPROVED BY:

Environment Condition: Temperature 20.8 °C ± 0.1 °C  
Humidity 62.8 %RH ± 0.1 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Pongsawat Suebcharitha  
Calibration Date: 26 December 2024  
The Method used: In house method, CAL-WH-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units. Sample Test is assured through primary measurement method NIST SRM 9070a, through CPA Chem Co., Ltd. (ISO/IEC 17034) Certificate No. 890701, 890704, 890707 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA2024067EA

Person in charge:   
Authorized signatory:

\* This certificate is issued for the sole purpose of measurement according to the International System of Units (SI). It provides traceability of measurement to international standards and is not intended for use as evidence of compliance with any other standard or specification.  
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).  
These results may be affected by deviations from specified conditions. This result refers only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKS Technology Limited.

Delivering Growth - In Asia and Beyond.

CAL-PM-C07-14: 9 Apr 2024



Certificate No.: C2432092 Page: 2 of 2

### Calibration Results:

Before Adjustment					
Standard	Unit Under Calibration	Reading	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution					
84.000 µS/cm	82.64 µS/cm	-0.640 µS/cm	2.00	0.68 µS/cm	
1413.0 µS/cm	1403 µS/cm	-10.0 µS/cm	2.00	11 µS/cm	
12.880 mS/cm	12.81 mS/cm	-0.070 mS/cm	2.00	0.10 mS/cm	

After Adjustment : 84.0 µS/cm, 1413 µS/cm, 12.88 mS/cm					
Standard	Unit Under Calibration	Reading	Correction	Coverage Factor (k)	Uncertainty (±)
Conductivity Solution					
84.000 µS/cm	84.03 µS/cm	-0.030 µS/cm	2.00	0.68 µS/cm	
1413.0 µS/cm	1414 µS/cm	-1.0 µS/cm	2.00	11 µS/cm	
12.880 mS/cm	12.86 mS/cm	0.020 mS/cm	2.00	0.098 mS/cm	

The End of Certificate



### ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

CONDUCTIVITY METER		ORION STAR A215		Serial No. X58031	
ตรวจสอบ (No)	รายการตรวจสอบ	ตรวจสอบ (Yes/No)	ตรวจสอบ (Yes/No)	ตรวจสอบ (Yes/No)	ตรวจสอบ (Yes/No)
25 Dec 2023	General				
1	1. การสอบเทียบ				
2	2. การสอบเทียบ (อุณหภูมิ, ความดัน, ความชื้น)				
3	3. การสอบเทียบ (On-Off Switch)				
4	4. ปุ่มกด (Keypad)				
5	5. หน้าจอ (Display, Screen Contrast)				
6	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC				
7	7. ความถี่การสอบเทียบ (Wavelength Control)				
8	8. ความถี่การสอบเทียบ (Wavelength Check)				
9	9. เวลาการสอบเทียบ (UV < 3,000 hour)				
10	10. เวลาการสอบเทียบ (Visible < 5,000 hour)				
11	11. หน่วยความจำ (Calculated Module)				
12	12. สายเคเบิล (Electrode and Connection Cable)				
13	13. สายเคเบิลเชื่อมต่อ Electrode (Level KCI)				
14	14. ฝาปิดป้องกัน Electrode (Dust Protection Hood)				
15	15. ขาตั้งเครื่อง (Stand)				
16	16. ฟังก์ชันการวัด (No Sample)				
17	17. ฟังก์ชันการวัด (No Sample)				
18	18. ฟังก์ชันการวัด (No Sample)				
19	19. ฟังก์ชันการวัด (No Sample)				
20	20. ฟังก์ชันการวัด (No Sample)				

Mr. Srisopon Srijan  
Service Engineer

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CAL-PM-A21-05: 20 Jul 2022



Certificate No.: C0724935 Page: 2 of 3

### Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
(mV)	(mV)	Error (mV)	(pH)		
414.12	413.8	-0.32	0.004	0.065	2.00
354.96	354.7	-0.26	1.003	0.065	2.00
295.8	295.6	-0.20	2.001	0.065	2.00
236.64	236.4	-0.24	3.003	0.065	2.00
177.48	177.3	-0.18	4.002	0.065	2.00
118.32	118.3	-0.02	5.002	0.065	2.00
59.16	59.1	-0.06	6.003	0.065	2.00
0	0.1	0.10	7.000	0.065	2.00
-59.16	-59.1	0.06	8.000	0.065	2.00
-118.32	-118.2	0.12	9.000	0.065	2.00
-177.48	-177.3	0.18	10.002	0.065	2.00
-236.64	-236.6	0.04	11.001	0.065	2.00
-295.8	-295.6	0.20	12.001	0.065	2.00
-354.96	-354.6	0.38	13.001	0.065	2.00
-414.12	-413.9	0.22	14.002	0.065	2.00

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CAL-PM-C07-14: 9 Apr 2024

Practical slope and zero point\*

The three-point calibration using three standard buffer solutions; pH 4.008, pH 6.986 and pH 9.997  
 - During calibration, display of pH meter can adjust to reading; pH 4.008, pH 6.986 and pH 9.997  
 The practical slope of the pH electrode, 55.55 (mV/pH), 98.97%  
 The zero point of the pH electrode, 6.55 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (K)
4.008	4.024	0.016	0.0070	2.63
6.986	6.969	0.003	0.0093	2.00
9.997	10.002	0.005	0.013	2.00

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

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชื่อเครื่องวัด: pH METER รุ่น: TitroLine 7000 หมายเลขเครื่อง: 10013626

ตรวจสอบ (ปี)	รายการตรวจเช็ค	ตรวจสอบ (ปี)	หมายเหตุ
26 Dec 2024		26 Dec 2024	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
<b>General</b>			
<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายในแบตเตอรี่)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	3. สวิตช์ On - เปิดเครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	
<b>Spectrophotometer</b>			
<input checked="" type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	11. เซอร์คuits ที่ตรวจ (Circuit Module)	<input checked="" type="checkbox"/>	
<b>pH Meter and Conductivity Meter</b>			
<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	13. จุดสัมผัสเกลือ Electrode (Level KG)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	14. ฝาปิดป้องกัน Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	
<b>Turbidimeter</b>			
<input checked="" type="checkbox"/>	16. ตัวอย่างที่ว่าง (No Sample)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	17. ขั้วการวัดที่ว่างเปล่า (>= 2.5 ไมครอน 3.0)	<input checked="" type="checkbox"/>	
<b>Automatic Titrator</b>			
<input checked="" type="checkbox"/>	18. สวิทช์ Piston Burette	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	20. ระบบควบคุมการเติมตัวอย่างอัตโนมัติ	<input checked="" type="checkbox"/>	

เซ็นเซอร์วัดค่า:

Mr Pongsakut Subchantha  
 Service Engineer

Certificate of Calibration



Equipment: Digital Thermometer with Probe  
 Model: TitroLine 7000  
 Serial No.: 10013826  
 Manufacturer: SI Analytics  
 ID No.: -

Certificate No.: C15241274  
 Issued Date: 26 December 2024  
 Job No.: WO-09055577  
 Page: 1 of 2  
 Condition: In Condition

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Soi Patanakarn 40, Patanakarn Rd.,  
 Suan-Luang, Bangkok 10250 Thailand

Environment Condition: Temperature: 30 °C ± 10 °C  
 Humidity: 55 %RH ± 25 %RH  
 Voltage: 220 VAC ± 10 %

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Wt Chemistry Lab 2)  
 104 Soi Patanakarn 40, Patanakarn Rd.,  
 Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Kaewkan Suradech  
 Calibration Date: 26 December 2024

The Method used: In house method, CAL-WI-08, by comparison with standard thermometer  
 Traceability: This certificate is traceable to the International System of Unit maintained by: Quality Reborn Co., Ltd. (QRI)

(Mr. Kaewkan Suradech)

(Mr. Teewong Thairang)

Person in charge  
 This certificate is issued to the user of measurement according to the International System of Unit (SI), to ensure traceability of measurement to international or national standard or other designated national standard laboratory.  
 The measurement uncertainty stated in the expanded uncertainty column 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 apply only to the same tested, calibrated as described. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Reference standard equipment:

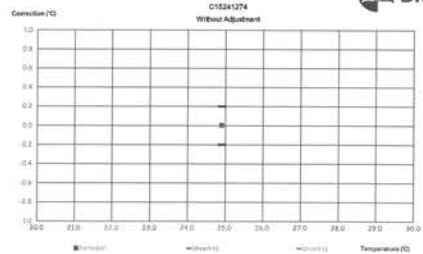
Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-3149	26 November 2024	26 November 2025

Calibration Results:

Without Adjustment

Sensor Type: RTD	Electrode Serial No.: BW1-13553	Channel: -		
Diameter (mm): 12	Length (mm): 120	Immersion (mm): 120		
Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
25.0	24.904	24.9	0.004	0.20

The End of Certificate



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ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment: Digital Thermometer with Probe  
 Serial No.: 10013826

Certificate No.: C15241274  
 Model: TitroLine 7000

ตรวจสอบ (ปี)	รายการตรวจเช็ค	ตรวจสอบ (ปี)	หมายเหตุ
26-Dec-2024		26-Dec-2024	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
<b>General</b>			
<input checked="" type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	3. การตั้งค่า Main Switch	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	4. การตั้งค่า Selector Key	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	5. การแสดงผล Display	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	6. Battery	<input checked="" type="checkbox"/>	ไม่
<input checked="" type="checkbox"/>	7. สายไฟ Sensor	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	8. สายไฟ Sensor (In / Ex)	<input checked="" type="checkbox"/>	

เซ็นเซอร์วัดค่า:

Mr. Kaewkan Suradech  
 Service Engineer





## Certificate of Calibration

**Equipment:** CONDUCTIVITY METER  
**Model:** ORION STAR A215  
**Serial No. (or ID):** X58031  
**Manufacturer:** Thermo Scientific  
**Electrode Serial No.:** YV1-19418  
**Condition:** In Condition

**Certificate No.:** C24240300  
**Issued Date:** 26 December 2024  
**Job No.:** WO-00055577  
**Page:** 1 of 2  
**Model:** ORION 013005MD  
**Brand:** Thermo Scientific

**Customer:** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

**Calibration Place:** ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

**Calibration By:** Mr. Pongprut Suebchartha  
**Calibration Date:** 26 December 2024  
**The Method used:** In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 990789, 990790, 990791

*(Signature)*  
(Mr. Pongprut Suebchartha)

*(Signature)*  
(Miss Kaewkan Suradech)  
Authorized signatory

This certificate is issued for the purpose of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard in other recognized national standard laboratories.  
The measurement uncertainty stated in this certificate is calculated 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).  
These results may be affected by deviations from specified conditions. The results may only be used for the same factors, substances or materials. The report shall not be reproduced except in full without approval of DKSH Technology Limited.  
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CAL-FM-C24-09: 12 Sep 2022

Certificate No.: C24240300 Page: 2 of 2

### Calibration Results:

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading		( k )	
84.003 µS/cm	94.79 µS/cm	-10.787 µS/cm	2.00	0.58 µS/cm
1413.1 µS/cm	1427 µS/cm	-13.9 µS/cm	2.00	9.3 µS/cm
12.880 mS/cm	13.02 mS/cm	-0.140 mS/cm	2.00	0.062 mS/cm

After Adjustment : at 84.003 $\mu$ S/cm, 1413.1 $\mu$ S/cm, 12.880 mS/cm					
Standard	Unit Under Calibration	Reading	Correction	Coverage Factor (k)	Uncertainty (±)
Conductivity Solution					
84.003 $\mu$ S/cm	84.01 $\mu$ S/cm	-0.007 $\mu$ S/cm	2.00	0.58 $\mu$ S/cm	
1413.1 $\mu$ S/cm	1413 $\mu$ S/cm	0.1 $\mu$ S/cm	2.00	9.3 $\mu$ S/cm	
12.880 mS/cm	12.87 mS/cm	0.010 mS/cm	2.00	0.062 mS/cm	

The End of Certificate

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CAL-FM-C24-09: 12 Sep 2022



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

CONDUCTIVITY METER		ORION STAR A215		หมายเลขเครื่อง: X58031	
ตรวจสอบ (ปี)	รายการตรวจเช็ค	ตรวจสอบ (ปี)	ตรวจสอบ (ปี)	ตรวจสอบ (ปี)	ตรวจสอบ (ปี)
26 Dec 2024		26 Dec 2024			
วันที่	ไม่พบ	วันที่	ไม่พบ		
General					
<input type="checkbox"/>	1. การเชื่อมต่อเครื่อง	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	2. การเชื่อมต่อ (หรือปลั๊กอิน, ภาชนะบรรจุเครื่อง)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	3. สวิตช์ On-Off (On-Off Switch)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input type="checkbox"/>	<input type="checkbox"/>		
Spectrophotometer					
<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) > 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	7. ตัวกรองแสงความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	9. แหล่งกำเนิดแสง (λ < 3,000 nm)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 8,000 nm)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	11. เซลล์แสงอาทิตย์ (Solar Cell Module)	<input type="checkbox"/>	<input type="checkbox"/>		
pH Meter and Conductivity Meter					
<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	13. ระดับความสูงอิเล็กโทรด (Level KG)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	14. ฝาปิดอิเล็กโทรด (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>		
Turbidimeter					
<input type="checkbox"/>	16. การตรวจสอบโฟลว์ (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	17. ขั้วไฟฟ้าอิเล็กโทรด (± 2.5 ไมครอน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>		
Automatic Rinsing					
<input type="checkbox"/>	18. สวิทช์ Rinse Burette	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	20. ระบบการล้างและเติมสารละลาย	<input type="checkbox"/>	<input type="checkbox"/>		

ตรวจสอบโดย: วิศวกรจาก DKSH

Mr. Pongprut Suebchartha  
Service Engineer

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CAL-FM-R21-02: 20 Jul 2022



## Certificate of Calibration

**Equipment:** Digital Thermometer with Probe  
**Model:** ORION STAR A215  
**Serial No.:** X58031  
**Manufacturer:** Thermo Scientific  
**ID No.:** -  
**Condition:** In Condition

**Certificate No.:** C15241275  
**Issued Date:** 26 December 2024  
**Job No.:** WO-00055577  
**Page:** 1 of 2

**Customer:** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

**Environment Condition:** Temperature 30 °C ± 10 °C  
Humidity 55 %RH ± 25 %RH  
Voltage 220 VAC ± 10 %

**Calibration Place:** ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)  
104 Soi Pattanakarn 40, Pattanakarn Rd.,  
Suan Luang, Bangkok 10250 Thailand

**Calibration By:** Ms. Kaewkan Suradech  
**Calibration Date:** 26 December 2024  
**The Method used:** In house method, CAL-WI-69, by comparison with standard thermometer  
**Traceability:** This certificate is traceable to the International System of Unit maintained by: Quality Reborn Co., Ltd. (QRI)

*(Signature)*  
(Miss Kaewkan Suradech)

*(Signature)*  
(Mr. Teewong Theinhang)  
Authorized signatory

This certificate is issued for the purpose of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard in other recognized national standard laboratories.  
The measurement uncertainty stated in this certificate is calculated 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).  
These results may be affected by deviations from specified conditions. The results may only be used for the same factors, substances or materials. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C15-14: 06 Dec 2022



Certificate No.: C15241275  
Page: 2 of 2

### Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-3149	28 November 2024	28 November 2025

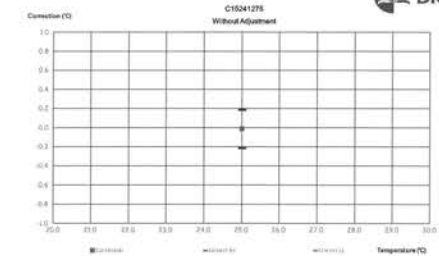
### Calibration Results:

Without Adjustment				
Sensor Type: RTD	Electrode Serial No.: YV1-19418	Channel: -		
Diameter (mm): 15	Length (mm): 120	Immersion (mm): 120		
Calibrate Point (°C)	STD. Reading (°C)	UUC Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
25.0	24.988	25.0	-0.012	0.20

The End of Certificate

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CAL-FM-C15-14: 06 Dec 2022



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## ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment : Digital Thermometer with Probe  
Serial No. : X59031Certificate No. : C15241275  
Model : ORION STAR A21

การสอบ (ปี)	รายการตรวจเช็ค	การสอบ (ปี)	หมายเหตุ
26-Dec-2024		26-Dec-2024	
ผ่าน	ไม่ผ่าน	ผ่าน	ไม่ผ่าน
<b>General</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. Adapter / Power supply 220 / 110 VAC	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การทำงาน Balancer Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 6. Battery	<input checked="" type="checkbox"/>	ไม่
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. สายส่งแรงดัน	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. สาย Sensor ( In / Ex )	<input checked="" type="checkbox"/>	<input type="checkbox"/>

เซ็นเซอร์:

Mr. Kaewkan Suradech  
Service EngineerDKSH Business Unit Ltd. (BU)  
DKSH Technology Limited  
250 Sukhumvit Road, Bangkok, Thailand 10110  
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## ใบตรวจสอบสภาพเครื่องมือวัดสิ่งแวดล้อม

Serial No. : WO-0005577

การสอบ (ปี)	รายการตรวจเช็ค	การสอบ (ปี)	หมายเหตุ
26 Dec 2024		26 Dec 2024	
ผ่าน	ไม่ผ่าน	ผ่าน	ไม่ผ่าน
<b>General</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายเชื่อมต่อเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. สายเชื่อมต่อ ( เซลล์อิเล็กโทรด, การไหลของน้ำ )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. สวิตช์ On - Off เครื่อง ( 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"/>
<b>Spectrophotometer</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 6. แบตเตอรี่ ( Battery Backup ) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. การควบคุมความยาวคลื่น ( 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. เวลาทำงาน ( UV < 3,000 hour )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 10. เวลาทำงาน ( Visible < 5,000 hour )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 11. เซลล์โฟโตอิเล็กทริก ( Caroussel Module )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>pH Meter and Conductivity Meter</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 12. อิเล็กโทรด ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 13. ขั้วไฟฟ้าอ้างอิง ( Reference Electrode (Level KCl) )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 14. ฝาปิดป้องกัน ( Electrode (Dust Protection Hood) )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 15. ขั้วไฟฟ้า ( Sound )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Turbidimeter</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 16. ความบริสุทธิ์ ( No Sample )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/> 17. ขั้วไฟฟ้าของสารละลาย ( >= 2.5 ไมครอน 3.0 )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Automatic titrator</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 18. สาย Piston Burette	<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. ขั้วไฟฟ้าของสารละลาย ( >= 2.5 ไมครอน )	<input checked="" type="checkbox"/>	<input type="checkbox"/>

เซ็นเซอร์:

Mr. Atatch Ngernchanat  
Service EngineerDKSH Business Unit Ltd. (BU)  
DKSH Technology Limited  
250 Sukhumvit Road, Bangkok, Thailand 10110  
Phone: +66 201 1000 Email: info@dksh.com Website: www.dksh.com/thailand  
Delivering Growth - in Asia and Beyond.

CAL-FRM-01-01: 01 Nov 2022

## Certificate of Calibration

Equipment: Automatic Titrator  
Model: TitroLine 7000  
Serial No.: 10013826  
Type of Titration: Motor - driven  
Exchange Unit Model: WA-20  
Burettes Model: TZ 3600  
Manufacturer: SI Analytics  
Condition: In condition

Certificate No.: C32240068  
Issued Date: 27 December 2024  
Job No.: WO-0005577  
Page: 1 of 2  
Exchange Unit S/N: 10045524  
S/N, Nr.: 007734 Nominal Vol.: 20 ml

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakom 40, Pattanakom Rd.,  
Suan Luang, Bangkok 10250 ThailandEnvironment Condition: Temperature: 22 °C ± 0.2 °C  
Relative Humidity: 60 %RH ± 1.5 %RH  
Atmospheric Pressure: 1014 mbar ± 0.4 mbarCalibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakom 40, Pattanakom Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Atatch Ngernchanat

Calibration Date: 26 December 2024

The Method used: In house method, CAL-WI-67, base on ISO 8655:2002

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C01243206

(Mr. Atatch Ngernchanat)

Person in charge

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

(Miss Kaewkan Suradech)

Authorized signatory

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Delivering Growth - in Asia and Beyond.

CAL-FRM-02-11: 07 Nov 2022

## Certificate of Calibration

Equipment: Automatic Titrator  
Model: TitroLine 7000  
Serial No.: 10013826  
Type of Titration: Motor - driven  
Exchange Unit Model: WA-20  
Burettes Model: TZ 3600  
Manufacturer: SI Analytics  
Condition: In condition

Certificate No.: C32240069  
Issued Date: 27 December 2024  
Job No.: WO-0005577  
Page: 1 of 2  
Exchange Unit S/N: 10045489  
S/N, Nr.: 007773 Nominal Vol.: 20 ml

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Soi Pattanakom 40, Pattanakom Rd.,  
Suan Luang, Bangkok 10250 ThailandEnvironment Condition: Temperature: 21 °C ± 0.3 °C  
Relative Humidity: 61 %RH ± 1.8 %RH  
Atmospheric Pressure: 1014 mbar ± 0.6 mbarCalibration Place: ALS Laboratory Group (Thailand) Co., Ltd. ( Wet Chemistry Lab 2 )  
104 Soi Pattanakom 40, Pattanakom Rd.,  
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr. Atatch Ngernchanat

Calibration Date: 26 December 2024

The Method used: In house method, CAL-WI-67, base on ISO 8655:2002

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C01243206

(Mr. Atatch Ngernchanat)

Person in charge

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

(Miss Kaewkan Suradech)

Authorized signatory

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Delivering Growth - in Asia and Beyond.

CAL-FRM-02-11: 07 Nov 2022

Certificate No.: C32240068 Page: 2 of 2

## Calibration Results:

Nominal Volume 20 ml  
Piston burettes of volumetric apparatus for automatic titrator

Volume (%)	Volume (ml)	Measurement Volume (V <sub>0</sub> ) (ml)	Systematic error (biasness) μe (%)	μe (μl)	CV (%)	S <sub>r</sub> (μl)	Measurement Uncertainty μd (μl)	k
10%	2.0000	2.0005	0.003	0.5	0.003	0.6	0.69	2.03
50%	10.0000	10.0077	0.030	7.7	0.003	0.7	0.82	2.05
100%	20.0000	20.0061	0.240	6.1	0.009	1.7	1.8	2.05

ISO 8655-3:2002(E) Table 1 - Maximum permissible errors for motor-driven piston burettes

Nominal volume ml	Maximum permissible systematic error	Maximum permissible random error
μl	± %	± μl
1	0.6	0.1
2	0.5	0.1
5	0.3	0.1
10	0.2	0.07
20	0.2	0.07
25	0.2	0.07
50	0.2	0.05
100	0.2	0.03

a) Expressed as the deviation of the mean of tenfold measurement from the nominal volume or from the selected volume (see ISO 8655-6:2002, 6.4)

b) Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 6.5)

c) Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 6.5)

The End of Certificate

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Delivering Growth - in Asia and Beyond.

CAL-FRM-02-11: 07 Nov 2022

Certificate No.: C32240069 Page: 2 of 2

## Calibration Results:

Nominal Volume 20 ml  
Piston burettes of volumetric apparatus for automatic titrator

Volume (%)	Volume (ml)	Measurement Volume (V <sub>0</sub> ) (ml)	Systematic error (biasness) μe (%)	μe (μl)	CV (%)	S <sub>r</sub> (μl)	Measurement Uncertainty μd (μl)	k
10%	2.0000	1.9988	-0.007	-1.4	0.003	0.6	0.70	2.03
50%	10.0000	9.9932	-0.034	-6.9	0.003	0.6	0.80	2.05
100%	20.0000	19.9915	-0.042	-8.5	0.002	0.5	1.5	2.00

ISO 8655-3:2002(E) Table 1 - Maximum permissible errors for motor-driven piston burettes

Nominal volume ml	Maximum permissible systematic error	Maximum permissible random error
μl	± %	± μl
1	0.6	0.1
2	0.5	0.1
5	0.3	0.1
10	0.2	0.07
20	0.2	0.07
25	0.2	0.07
50	0.2	0.05
100	0.2	0.03

a) Expressed as the deviation of the mean of tenfold measurement from the nominal volume or from the selected volume (see ISO 8655-6:2002, 6.4)

b) Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 6.5)

c) Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 6.5)

The End of Certificate

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CAL-FRM-02-11: 07 Nov 2022





Certificate No. T241495

Page 2 of 4

### Calibration Report

Equipment : Chamber ( Incubator )  
Date of Calibration : 22 August 2024 ( Finished Time 11:19 AM )  
Environment : Temperature 22.3-23.0 °C  
Line Voltage 222.5-227.5 V

#### Condition of this results of test :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WJ-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986. )  
All data show below were final values and the initial data may be obtained upon request.  
The temperature scale used was based on ITS - 90.

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-CH1-10	T240709	19 April 2025
RTD	100 ohm	28-CH1-10	T240709	19 April 2025
DATA LOGGER	34975A	T149	T240709	19 April 2025

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244. )

#### 4. Condition of calibrated item : good

##### UUC Description :

Time Constant ☐ Hour ☒ 38 Minute At ☐ 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Result of test :

( ) without adjustment ( X ) after adjustment

Approved By: \_\_\_\_\_

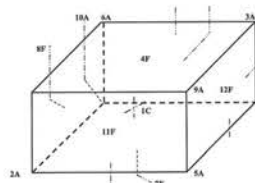
PM-L15 11018-08-46



Certificate No T241495

Page 3 of 4

### Calibration Report



C = Centre, F = Centre of Face, A = Corner, I = Centre of Edge

1C = 27-CH1	11F = 28-CH1
2A = 27-CH2	12F = 28-CH2
3A = 27-CH3	
4F = 27-CH4	
5A = 27-CH5	
6A = 27-CH6	
7F = 27-CH7	
8F = 27-CH8	
9A = 27-CH9	
10A = 27-CH10	

Approved By: \_\_\_\_\_

PM-L15 11018-08-46



Certificate No. T241495

Page 4 of 4

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9	27-CH10
20.0	20.32	20.32	20.29	20.23	20.30	20.34	20.40	20.16	20.34	19.62
	28-CH1	28-CH2								
	19.70	19.63								

Chamber ( Incubator )		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (°C)	Uniformity (°C)	Uncertainty (°C)
	Min, Max	Average				
20.0	19.9, 20.1	20.0	20.01	0.04	0.19	0.38
						2.00

\* The quoted uncertainty exclude "uniformity"

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: \_\_\_\_\_

PM-L15 11018-08-46



Certificate No.T240741

Page 1 of 5

### Certificate of Calibration

Equipment : HOT BLOCK  
Manufacturer : Environmental Express  
Model : B3000-240  
Serial No. : 2017CODW116  
Customer Code : BKK\_EN0222  
ID No. : T6769A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab2

Date of Receipt : 11 April 2024

Calibrated By : Sance Musikawan ( Site Calibration Manager )

Approved By : \_\_\_\_\_ / Sujjar Nakkakred (Site Calibration Manager)

Date of Issue : 23 APR 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 is 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-L15 10930-05-57



Certificate No.T240741

Page 2 of 5

### Calibration Report

Equipment : HOT BLOCK  
Date of Calibration : 22 April 2024  
Environment : Temperature : 22.9-24.4 °C  
Line Voltage : 222.7-227.8 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 WJ-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	TN21-TN30	T240235	17 February 2025
TC	TYPE T	TN31-TN40	T240235	17 February 2025
DATA LOGGER	34975A	T195	T240235	17 February 2025

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244. )

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant ☐ Hour ☒ 10 Minute At ☐ 150 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By: \_\_\_\_\_

PM-L15 10930-05-57



Certificate No.T240741

Page 3 of 5

### Calibration Report



Row	Hole															
R7	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09	H09
R6	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16
R5	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16
R4	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16
R3	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16
R2	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16
R1	H01	H02	H03	H04	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16

#### II: STANDARD THERMOCOUPLE TYPE T

H1	=	TN21	H9	=	TN29	H17	=	TN37	H25	=	TN35	H33	=	TN33	H41	=	TN23	H49	=	TN29
H2	=	TN23	H10	=	TN30	H18	=	TN38	H26	=	TN26	H34	=	TN34	H42	=	TN22	H50	=	TN30
H3	=	TN23	H11	=	TN31	H19	=	TN39	H27	=	TN27	H35	=	TN35	H43	=	TN23	H51	=	TN31
H4	=	TN24	H12	=	TN32	H20	=	TN40	H28	=	TN28	H36	=	TN36	H44	=	TN24	H52	=	TN32
H5	=	TN25	H13	=	TN33	H21	=	TN41	H29	=	TN29	H37	=	TN37	H45	=	TN25	H53	=	TN33
H6	=	TN26	H14	=	TN34	H22	=	TN42	H30	=	TN30	H38	=	TN38	H46	=	TN26	H54	=	TN34
H7	=	TN27	H15	=	TN35	H23	=	TN43	H31	=	TN31	H39	=	TN39	H47	=	TN27	H55	=	TN35
H8	=	TN28	H16	=	TN36	H24	=	TN44	H32	=	TN32	H40	=	TN40	H48	=	TN28	H56	=	TN36

Approved By: \_\_\_\_\_

PM-L15 10930-05-57





Certificate No. T240741

Page 4 of 5

## Calibration Report

### Measurement Results

		Average Standard Reading at each position (°C)									
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26	TN27	TN28	TN29	TN30
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55
150 ±0.9	Max	150.38	149.75	150.12	150.36	150.56	150.06	150.40	150.23	150.56	149.59
	Min	150.13	149.47	149.87	150.16	150.31	149.71	150.23	150.02	149.41	149.41
	Average	150.25	149.59	150.56	150.24	150.41	149.87	150.36	150.12	150.45	149.55

Approved By:

EN-4.13 00030-05-07



Certificate No. T240741

Page 5 of 5

## Calibration Report

### Measurement Results

		HOT BLOCK		Temperature Distribution	
Setting (°C)	Reading (°C)			Stability (°C)	Uncertainty (°C)
		Min, Max	Average		
150.0	150.1, 150.1	150.0		0.20	0.83

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=2, providing a level of confidence of approximately 95 %.

Approved By:

EN-4.13 00030-05-07

BKK\_EL0026



### Customer Contact:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
104 Phatthanakan Rd, Phatthanakan Rd  
Khuang Phatthanakan, Khet Suan  
TAX ID: 01954000000  
Chattaporn Inyuan@agilent.com  
77007000

### Invoice To:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
104 Phatthanakan Rd, Phatthanakan Rd  
Khuang Phatthanakan, Khet Suan

### SERVICE REPORT

Customer Number: 75371913	Customer Number: 75371913
Service Request: 75371913	Service Request Date: 75371913
Service Order: 75371913	Service Confirmation: 75371913

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 12/01/2015

### Delivery Site:

ALS Laboratory Group (Thailand) Co.  
Ltd.  
Head Office  
104 Phatthanakan Rd, Phatthanakan Rd  
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Location:  
Room:  
Bldg:  
Lab:  
Dept:

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Page 1 of 3

Service Confirmation Number: 090530001  
Service Confirmation Date: 12.12.2023

### Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Percent Asset
315-00-7700-E	ICP-MS 7700 System Enhanced		ICP-MS 7700 (HPLC)	
6131A	1200 ThermoStar Column Compensation	DEACN1200	ICP-MS 7700 (HPLC)	315-00-7700-E
613200	1200 Standard Autosampler	DEACN1200	ICP-MS 7700 (HPLC)	315-00-7700-E
613110	1200 Standard Pump	DEACN1200	ICP-MS 7700 (HPLC)	315-00-7700-E
61311A	Agilent 7700 ICP-MS	JPT201812	ICP-MS 7700 (HPLC)	315-00-7700-E

### Service Items:

Item	Service/Part #	Description	Qty	Estimate	Service Start	Service End
1000	EQD	Enterprise Operational Qualification	1.00	Agreement 100 % control	12.12.2023	12.12.2023
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement 100 % control		

### Additional Information:

Service Confirmation Number: 090530001  
Service Confirmation Date: 12.12.2023

### Service Information:

Problem Description:  
WU-DO-MS/HPLC-7700-5301143131  
Service Provided:  
Perform OQ Hardware control test OQ Inogen, Autosampler, IIS, Aque, and Stability. After done the instrument BKK\_EL0026 calibrated pass all.

Service Overview Code:  
Reason Code: Scheduled Service  
Diagnosis Code: Scheduled Service  
Resolution Code: Scheduled Service

Reported Hours:  
1.0

Customer Field Service Representative Name:  
Pattaporn Kongsakul

Customer Name:  
Sapichon Mak

Customer Signature:

Date:  
12 Dec 2023

Date:  
12 Dec 2023

Additional Comments:

Page 3 of 3



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. : T5306A3

Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khuang Phatthanakan,  
Khet Suan Loang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 13 September 2023

Calibrated By : Sanee Musikawan (Site Calibration Manager)

Approved By : / Sujar Naknared (Site Calibration Manager)

Date of Issue : 18 SEP 2023

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

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 12/01/25

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the capability of the laboratory and its traceability in 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.

EN-4.13 00030-05-07

Page 2 of 3



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-720.  
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 ( NSC-TIS-TIS 17025 CALIBRATION 0244 )

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant : 2 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. \_\_\_\_\_

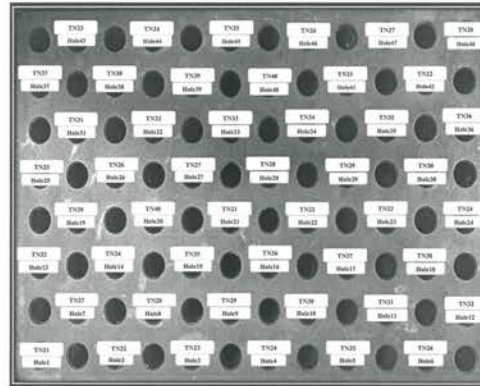
FM-L13 00670-05-57



Certificate No. T231676

Page 3 of 6

### Calibration Report



FRONT CONTROL

Approved By. \_\_\_\_\_

FM-L13 00670-05-57



Certificate No T231676

Page 4 of 6

### Calibration Report

Measurement Results		Average Standard Reading at each position (°C)					
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26
R1 Hole1-Hole6	Max	95.03	94.41	95.29	95.41	94.31	95.17
	Min	94.87	95.95	94.75	94.92	94.80	94.72
	Average	94.79	94.18	94.98	95.17	94.26	94.95
R2 Hole7-Hole12	Max	95.36	95.43	95.19	95.19	95.35	94.97
	Min	94.94	94.95	94.72	94.71	94.90	94.57
	Average	95.15	95.19	94.96	94.94	95.13	94.77
R3 Hole13-Hole18	Max	95.37	95.36	95.27	95.21	95.23	95.13
	Min	94.99	95.09	94.78	94.82	94.89	94.86
	Average	95.18	95.30	95.00	95.02	95.11	95.11
R4 Hole19-Hole24	Max	95.39	94.40	94.21	94.22	94.23	94.24
	Min	95.21	94.06	94.13	93.88	94.28	94.27
	Average	95.40	94.24	94.17	94.06	94.47	94.47
R5 Hole25-Hole30	Max	95.19	95.36	95.83	95.39	95.14	95.03
	Min	94.83	95.03	95.36	94.93	94.79	94.76
	Average	95.01	95.26	95.75	95.12	94.96	94.87
R6 Hole31-Hole36	Max	94.63	94.90	94.77	94.31	94.24	93.87
	Min	94.24	94.55	94.44	93.98	93.92	93.56
	Average	94.43	94.72	94.60	94.14	94.08	93.71
R7 Hole37-Hole42	Max	94.30	94.84	94.04	93.81	94.89	95.23
	Min	93.92	94.07	93.67	93.48	94.39	94.90
	Average	94.13	94.24	93.86	93.65	94.64	95.12
R8 Hole43-Hole48	Max	95.99	95.63	95.28	95.29	95.45	94.87
	Min	95.27	95.17	94.82	94.84	94.99	94.48
	Average	95.78	95.29	95.05	95.07	95.22	94.68

Approved By. \_\_\_\_\_

FM-L13 00670-05-57



Certificate No T231676

Page 5 of 6

### Calibration Report

Measurement Results		Average Standard Reading at each position (°C)					
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26
R1 Hole1-Hole6	Max	105.27	104.35	105.47	105.25	104.44	105.27
	Min	104.94	105.95	105.17	105.04	104.31	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.06	104.92	104.97
	Average	105.20	105.02	105.07	105.11	105.03	105.06
R3 Hole13-Hole18	Max	105.31	105.31	105.31	105.31	105.31	105.31
	Min	105.17	105.17	105.17	105.17	105.17	105.17
	Average	105.27	105.27	105.27	105.27	105.27	105.27
R4 Hole19-Hole24	Max	105.31	104.43	104.41	104.71	105.63	105.82
	Min	105.08	104.22	104.15	104.41	105.37	105.56
	Average	105.19	104.31	104.26	104.56	105.50	105.69
R5 Hole25-Hole30	Max	104.93	104.26	104.26	104.26	104.26	104.26
	Min	104.67	103.96	103.08	103.56	103.36	103.68
	Average	104.81	104.11	103.21	103.91	103.31	103.47
R6 Hole31-Hole36	Max	104.71	104.86	104.86	105.30	104.50	104.29
	Min	104.54	104.63	104.63	105.00	104.32	104.18
	Average	104.63	104.75	104.69	105.15	104.41	104.29
R7 Hole37-Hole42	Max	104.30	104.90	104.85	104.65	104.80	104.81
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48	Max	105.71	105.85	105.39	105.61	105.42	105.19
	Min	105.45	105.41	105.54	105.27	105.18	104.94
	Average	105.58	105.71	105.47	105.44	105.30	105.07

Approved By. \_\_\_\_\_

FM-L13 00670-05-57



Certificate No. T231676

Page 6 of 6

### Calibration Report

#### Measurement Results:

Setting (°C)	HEATING BLOCK		Temperature Distribution	
	Reading (°C)		Stability (°C)	Uncertainty (°C)
	Min, Max	Average		
100.0	100.3, 100.3	100.4	0.26	0.81
107.0	107.0, 107.3	107.3	0.19	0.78

\* The quoted uncertainty exclude "uncertainty"

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-L13 00670-05-57



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
284 PATTANAKARN ROAD 301 15, BANGKOK, THAILAND 10110  
TEL: 02-2751-300-07 FAX: 02-2751-0881



Cert. No.: 23T81408  
Page: 1 of 4

### Certificate of Calibration

Equipment : Autoclave  
Manufacturer : TOMY  
Model : SX-700  
Serial No. : 48134190  
ID No. : BKK\_ML0041  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Media Preparation Room  
Location :  
Received Order : 03 October 2023  
Calibration Date : 04 October 2023  
Ambient Temperature : ( 20 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Khit Rutanaprasachai  
Approved by : \_\_\_\_\_  
( ) Ponnthip Tameyapud  
( ) Ponnpan Papiam  
( ) Suttit Jirapit  
Issue Date : 11 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0053272



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0000OC-6  
Page : 2 of 4

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T  
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) Data Acquisition MY07013823 23A.M66 TPA 29 Mar 2024
  2. This certificate is valid only to the item calibrated on date and place of calibration.
  3. This certificate is traceable to the International System of Unit.
  4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*
- \* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclave for use with material infected with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.  
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source



	Environmental		
	( °C )	( %RH )	( Volt )
Beginning of Calibration	26	64	221
Finished of Calibration	27	67	222

Position	Description	Ref. Std. ID No.
1 =	Center of chamber	19-17TC-08
2 =	Temperature sensor	19-17TC-08
3 =	Exhaust port	19-17TC-10

1184533



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0000OC-6  
Page : 3 of 4

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 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 Serial No. Cert. No. Traceable Due Date  
1) Data Acquisition MY49001451 23LM27 TPA 25 Feb 2024
  2. This certificate is valid only to the item calibrated on date and place of calibration.
  3. This certificate is traceable to the International System of Unit.
- Remark : TPA : Technology Promotion Association (Thailand - Japan )

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor
108	108	1	108.952	0.12	0.04	0.90	2
		2	108.263				
		3	108.140				

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

1184532



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0000OC-6  
Page : 4 of 4

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T  
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) Data Acquisition MY07013823 23A.M66 TPA 29 Mar 2024
  2. This certificate is valid only to the item calibrated on date and place of calibration.
  3. This certificate is traceable to the International System of Unit.
  4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*
- \* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclave for use with material infected with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.  
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor
121	121	1	121.188	0.17	0.11	0.91	2
		2	121.082				
		3	120.980				

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

1184531



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
104 PATANAPONG ROAD RT.18, BANGKOK, THAILAND 10250  
TEL: 02-571-8880-20 FAX: 02-571-8884



Cert. No.: 23TM1146  
Page : 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : SHEL-LAB  
Model : 1915A  
Serial No. : Q200599  
ID No. : BKK\_M0010  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khuwong Phatthanakan, Khut Suan Luang,  
Bangkok 10250 Thailand  
Location : Incubation & Micrological Reading  
Received Order : 17 July 2023  
Calibration Date : 17 July 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongseaboon

REVIEW BY :   
APPROVED BY :   
NEXT CAL DATE : 17/1/25

Approved by :   
( ) Pornthippa Tameyakul  
( / ) Maidee Butkruas  
( ) Suwit Imjai

Issue Date : 24 July 2023

The Uncertainty are for a confidence probability of approximately 95%

This certificate may not be reproduced other than to ASL, except with the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services

1055489



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Page : 2 of 3

#### Procedure Used :-

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.

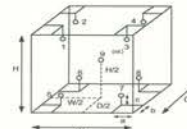
#### Condition of this result of calibration

1. Reference standard instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Data Acquisition MY49001451 23LM27 TPA 25 Feb 2024
  2. This certificate is valid only to the item calibrated on date and place of calibration.
  3. This certificate is traceable to the International System of Unit.
- Remark : TPA : Technology Promotion Association (Thailand - Japan )

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 = 8.50 m  
W = 0.75 m  
H = 1.2 m  
Capacity = 0.45 m³

Environment during calibration	
	Beginning
Temp. ( °C )	24
REL.Humid. ( % )	54
AC Supply ( Volt )	221

Position	Ref. Std. ID No.
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

1172189



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Page : 3 of 3

#### Procedure Used :-

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 Serial No. Cert. No. Traceable Due Date  
1) Data Acquisition MY49001451 23LM27 TPA 25 Feb 2024
  2. This certificate is valid only to the item calibrated on date and place of calibration.
  3. This certificate is traceable to the International System of Unit.
- Remark : TPA : Technology Promotion Association (Thailand - Japan )

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor
35.0	35.0	35.0	0.055	0.30	0.44	2

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 %.

1172188



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration** Cert. No.: 24TM567  
Page: 1 of 3

Equipment: Hot Air Oven  
Manufacturer: Binder  
Model: ED 240/E2  
Serial No.: 00-15533  
ID No.: BKK\_ML0013  
Submitted by: ALS Laboratory Group (Thailand) Co.Ltd.  
104 Phraethanank 40, Phraethanank Rd.,  
Khwang Phraethanank, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location: Media Preparation Room  
Received Order: 23 April 2024  
Calibration Date: 23 April 2024  
Ambient Temperature: (26 ± 1) °C  
Relative Humidity: (50 ± 30) %  
Calibrated by: Tawatchai Pama  
Approved by: Approved Signatory  
( ) Porpan Palpin  
(✓) Suwit Injai  
( ) Kunchit Promprat  
Issue Date: 26 April 2024

The Uncertainties are for a confidence probability of approximately 95%  
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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration** Cert. No.: 24TM567  
Page: 2 of 3

Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2404-0439OC-8  
Procedure Used >  
Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Thermocouple Type 1.  
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  
1.1) Data Acquisition MY49001451 24L454 TPA 17 Mar 2025  
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 of UUC: Temperature Source  
Fresh air setting: Close

Environment during calibration  
Temp. (°C) Beginning Finished  
REL Humid. (%) 65 65  
AC Supply (V/Hz) 223 222

Position: Ref. Std. ID No.  
1 24-19TC-01  
2 24-19TC-02  
3 24-19TC-03  
4 24-19TC-04  
5 24-19TC-05  
6 24-19TC-06  
7 24-19TC-07  
8 24-19TC-08  
9 (ref) 24-19TC-09

Probe Installation Details: Dimension of Chamber:  
a = 10 cm D = 0.50 m  
b = 10 cm W = 0.60 m  
c = 10 cm H = 0.80 m  
Capacity = 0.24 m³

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 %.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration** Cert. No.: 24TM567  
Page: 3 of 3

Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2404-0439OC-8  
Result of Calibration: ( ) Without Adjustment  
Function of UUC: Temperature Source  
Fresh air setting: Close

Calibration Point (°C)	UUC Reading (°C)	UUC Setting (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
180	180	180	0.64	2.7	3.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (°C)
	1	2	3	4	5	6	7	8	9 (ref)	
180	181.009	181.511	180.922	181.359	181.217	183.609	181.664	181.886	181.474	1.5

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 %.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration** Cert. No.: 24CH1171  
Page: 1 of 2

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenGo pH  
Serial No.: C117620932  
ID No.: BKK\_LG0044  
Condition As-Received: Used Item  
Received Date: 19 September 2024  
Calibration Date: 20 September 2024  
Reference: 2409-0699DSC-11  
Submitted by: ALS Laboratory Group (Thailand) Co.Ltd.  
104 Phraethanank 40, Phraethanank Rd.,  
Khwang Phraethanank, Khet Suan Luang,  
Bangkok 10250 Thailand  
Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 15) %  
Calibration Procedure: In-house method  
- CP-CHS by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
Calibrated by: Wanikom Lengagrakul  
Approved by: Approved Signatory  
( ) Unnophol Marachai  
( ) Porpan Palpin  
(✓) Suwit Injai  
( ) Kunchit Promprat  
Issue Date: 23 September 2024

The Uncertainties are for a confidence probability of approximately 95%  
This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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**Certificate of Calibration** Cert. No.: 24CH1171  
Page: 2 of 2

Condition of this calibration result  
1. Reference Standard Instrument  
Instrument Serial No. ID No. Cert. No. Due Date  
1) Document Process Calibrator 56070044 70RC340 22E1978 17 Jun 2023  
- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)  
2. Certified Reference Materials: The measurement results are traceable to SI through Hach Lange GmbH Ltd.,  
Deutsche Akkreditierungsgesellschaft, Accredited No.D-RI-15194-01-00  
The measurement results are traceable to SI through CPA chem Ltd.,  
ANB-ADQ National Accreditation Board, Accredited No. AN-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.006	Hach Lange GmbH	C03146	23 Feb 2026
pH 7.000	Hach Lange GmbH	C03200	13 Dec 2024
pH 9.997	CPA chem	970853	25 Apr 2025

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 Document Process Calibrator at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement (mV)	Coverage factor k	
pH Meter S/N: C117620932	pH	mV	mV	pH		
	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

Function: pH Measurement  
Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of Measurement (pH)	Coverage factor k
pH Electrode S/N: 3223910	4.006	4.01	181	0.0077	2.00
	7.000	7.00	5	0.0084	2.00
	9.997	10.00	-171	0.0062	2.00


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 %.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration** Cert. No.: 24LM152  
Page: 1 of 2

Equipment: pH Meter with Sensor  
Manufacturer: Mettler Toledo  
Model: SevenGo pH  
Serial No.: C117620932  
ID No.: BKK\_LG0044  
Submitted by: ALS Laboratory Group (Thailand) Co.Ltd.  
104 Phraethanank 40, Phraethanank Rd.,  
Khwang Phraethanank, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location: TPA On Site Calibration Laboratory  
Received Order: 19 September 2024  
Calibrated Date: 20 September 2024  
Ambient Temperature: (26 ± 1) °C  
Relative Humidity: (50 ± 30) %  
AC Line Voltage: (220 ± 22) V  
Calibrated by: Wanikom Lengagrakul  
Approved by: Approved Signatory  
( ) Unnophol Marachai  
( ) Porpan Palpin  
(✓) Suwit Injai  
( ) Kunchit Promprat  
Issue Date: 26 September 2024

The Uncertainties are for a confidence probability of approximately 95%  
This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2409-0699DSC-12  
Procedure Used :-  
Calibration was conducted using in-house calibration procedure CP-0701 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.  
The temperature scale used was based on ITS-90.

Cert. No.: 24LM152  
Page: 2 of 2


**Condition of this result of calibration**  
1. Reference standard instrument:  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Digital Thermometer 2188060 231210 TPA 11 Oct 2024  
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: 3223010

Calibration Point ( ° C )	Immersion Depth ( mm )	Standard Temperature ( ° C )	UUC <sup>1</sup> Reading ( ° C )	Error ( ° C )	Uncertainty ( ± ° C )	Coverage Factor #
20.0	100	20.003	20.0	-0.003	0.19	2.00
25.0	100	25.000	25.0	0.000	0.19	2.00
30.0	100	30.002	30.1	0.098	0.19	2.00
35.0	100	35.004	35.1	0.095	0.19	2.00
40.0	100	40.003	40.1	0.097	0.19	2.00
45.0	100	45.004	45.1	0.096	0.19	2.00
50.0	100	50.004	50.1	0.096	0.19	2.00

UUC<sup>1</sup> : 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 %.

-000-




REVIEW BY: Arthachawan S.  
APPROVED BY: Tanyaporn P.  
NEXT CAL. DATE: 12 Jan 2025


**Certificate of Calibration**  
ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated  
by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977  
AS-HV S/N: 5450A36659

For  
**ALS Laboratory Group (Thailand) Co., Ltd.**

  
Operator Signature: (Signature) Date: Jan 12, 2024  
(Mr. Nirdanal Laekhwan)  
Application Chemist




Agilent CrossLab Start Up Services  
**Agilent 5100 5110 ICP-OES Preventive Maintenance**

REVIEW BY: Thirachai K.  
APPROVED BY: Sara K. M.  
NEXT CAL. DATE: 21/01/2025

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to ensure reliable operation and the accuracy of your results.  
Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.  
This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Revision A-02, Issued 21 January 2022  
Document Number: 09014-90075  
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Page 3 of 37



Agilent 5100, 5110 Preventive Maintenance Checklist



**Introduction**

**Customer Information**

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.

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Page 1 of 37



Agilent 5100, 5110 Preventive Maintenance Checklist



**Important Customer Web Links**

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/in-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- Need to place a service call?** Flexible Repair Options | Agilent

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Page 2 of 37



Agilent 5100, 5110 Preventive Maintenance Checklist



**Service Engineer's Responsibilities**

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.

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Document Number: 09014-90075  
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Page 3 of 37



## Instrument Maintenance

### System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	G/S101A / MY112100005
Instrument System Site and Location	RLS Laboratory Group (Freiburg) C <sub>6</sub> LTD

List System Component Product Numbers	List the Serial Numbers of each Component
1. #F20106	PLY 112100005
2. #S101A	PLU1544-0114
3. #2H41-80201	L2014-00114
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	<u>Electrode</u> (Chelated) (Conical) (Other)
Spray Chamber	Cyclonic (Single Pass) (Cyclonic Double Pass) (Other)
Torch	Radial (Dual View) (Other)
Torch Type	One Piece (Semi Removable) (Fully Removable) (Other)
Injector Diameter	2.0mm (1.8mm) (1.6mm) (0.8mm) (Other)
Injector Material	<u>Quartz</u> (Ceramic) (Other)

### Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☒ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it, if =.
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window.
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☒ Replace high capacity air inlet dust filter element if installed.
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

### SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

### SPS 4 Auto sampler

- ☐ Service not applicable
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☒ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☒ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☒ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

### ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

### Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests:
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

## Restore Instrument

- ☒ For HF applications, ask the customer to reinstall their sample introduction system.
- ☒ Leave system in an idle state, on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

### Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.



## Test Results

## Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
2x 213.957 nm (SRM)	1511.1	3441.3	1511.0	3441.2
4x 257.815 nm (SRM)	1351.1	1351.1	1351.1	1351.1
4x 366.152 nm (SRM)	8.2	15.0	8.1	14.9
K-766-491 nm (SRM)	8.2	15.0	8.1	14.9

\* Axial result is not applicable for G8016AA, G8012AA Radial View Instruments.

## Instrument Test Results Table

Note: This Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	PASS
Air Flow	PASS
Water Flow	PASS
Gas Flow	PASS
RF Generator	PASS
Camera Test	PASS
Optics Test	PASS
Reflector Test	PASS

## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Main Voltage	215.33 V	215.15 V
Main Current	0.04 A	0.11 A
Instrument Temperature	11.1 °C	25.2 °C
RF Air Flow (sensor speed)	19.0 HL	19.0 HL
Plasma Exhaust Temperature	No measurement	50.1 °C
Water Flow Operator	No measurement	1.10 L/min
Water Flow Detector	1.14 L/min	1.01 L/min
Water Inlet Temperature	11.1 °C	13.4 °C
Polychromator Temperature	11.0 °C	18.0 °C
CCD Temperature	-40.1 °C	-40.0 °C
Thermal Stabilizer	11.1 °C	13.4 °C
Argon Supply Pressure	1.14 MPa	1.14 MPa
Purge Gas Supply Pressure†	1.14 MPa	1.14 MPa
Option Gas Supply Pressure†	— MPa	— MPa
Nebulizer Flow	No measurement	0.50 L/min
Nebulizer Back Pressure	No measurement	2.16 MPa
Plasma Gas Flow	No measurement	11.44 L/min
Auxiliary Gas Flow	No measurement	1.01 L/min
RF Power	No measurement	1100 W
RF Supply Current	No measurement	5.14 A
RF Supply Voltage	No measurement	11.1 V

†1 If option installed

## Consumed PM Parts

Part Description	Part Number	Product or Model where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8016AA/G8015A	1
Radial Pre-Optic Window	G8010-68015	AR	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	1
Purge Gas Filter	G8010-60136	AR	1
Air inlet filter	G8000-68002	AR	1
High Capacity Air Filter	G8010-60149	Optional	—
Rotor seal for 6/7 port valve for A100/7	G8494-60002	G8494A/G8495	—
Rotor seal for 4 port valve for A104	G8493-60002	G8493A	—
Back connector 2.5mm x 1.5mm 40	G8410-80123	SPS 4	1
PVC waste tubing 5mm od x 3mm id 3m	G8410-80122	SPS 4	1

## Additional Parts may be required from engineer's stock:

8 axis drive belt	5410047000	SPS 3	—
2 axis drive belt	5410047000	SPS 3	—
Peristaltic pump tubing, PVC SolusFlex 3 3/8	3710049000	SPS 4	—

Consumed Parts Reference  
(Purchased by customer, not included as part of PM)

☒ Section Not Applicable

Part Description	Part Number	Product or Model where used	Quantity consumed
------------------	-------------	-----------------------------	-------------------

## Signature Page

## Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

## Service Verification

Service Request Number:  
6004401534  
Service Engineer Name:  
Niklas Ljungberg  
Service Engineer Signature:  
[Signature]  
Total number of pages in this document:  
16

Date Service Completed:  
Feb 25, 2024  
Customer Name:  
[Signature]  
Customer Signature:

BKK\_EL0128

Performance Verification Certificate  
for Mercury Analyzer

PRODUCT ID Quicktrace M-8000 - Teledyne Leeman Labs

Equipment ID BKK\_EL0128 Mercury Analyzer  
S/N: US22133002

BKK\_EL0129 Autosampler  
S/N: 052222A560

Customer Name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Pattana 4th, Pattana Rd. Sam Luang, Sam Luang Bangkok 10250 Thailand

Date of Qualified December 6, 2023

Next Due date December 6, 2024

This certifies for products which was performed in acceptable criteria specifications

Autosampler & Sample Introduction PASSED  
Analyzer PASSED  
Gas Liquid Separator & Dryer PASSED  
CVAFS Detector PASSED  
Electronics/Mechanical PASSED  
Data station/PC PASSED  
Analytical test PASSED

Provided by

Scientist Instrument Co., Ltd.  
113 Soi Sathat 44, Sathat Road  
Khlong Bang Phru, Bangkok  
Bangkok 10150 Thailand

Certified by [Signature]  
Thunraphol Sakdayas  
Service Engineer

ภาคผนวก จ

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สำเนาหนังสืออนุญาตขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน







ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(3)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(4)</sup> 2) DPD Colorimetric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
36	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Hexavalent Chromium	Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

40 Manganese...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup> 2) Soxhlet Extraction Method <sup>(4)</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
49	pH	Electrometric Method <sup>(4)</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
52	Sulfide	Iodometric Method <sup>(4)</sup>
53	Temperature	Laboratory and Field Methods <sup>(4)</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>(4)</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>(4)</sup>
56	Total Phosphorous	Digestion, Colorimetric Method <sup>(4)</sup>
57	Total Suspended Solids	Dried from 103-105 °C <sup>(4)</sup>
58	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
60	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

น้ำดื่ม...

## น้ำดื่ม จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>

36 Chrysene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

56 1,3-Dichloropropene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

76 γ-HCH...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Digestion, Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
84	Methanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

94 N-Nitrosodiphenylamine...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup> 3) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>9</sub> -C <sub>10</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,25)</sup>

110 TPH (C<sub>8</sub>-C<sub>10</sub>)...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
110	TPH (C <sub>8</sub> -C <sub>16</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[9,22]</sup>
111	TPH (C <sub>18</sub> -C <sub>33</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[9,22]</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>
120	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
121	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[4]</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>

จากภาคเสีย...

จากภาคเสีย (ปล่อยระบาย) จำนวน 28 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
3	Beryllium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
4	Cadmium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
5	Carbon Monoxide	1) Instrumental Analyzer Method <sup>[5]</sup> 2) Sampling Bag Non-Dispersive Infrared Method <sup>[5]</sup>
6	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
7	Chromium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
8	Cobalt	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
9	Copper	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
10	Cresol	Absorption Sampling, Gas Chromatographic Method <sup>[5]</sup>
11	Dioxins	Isokinetic Sampling <sup>[5]</sup>
12	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
13	Hydrogen Fluoride	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>

15 Lead...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Lead	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
16	Manganese	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
17	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[5]</sup>
18	Nickel	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
19	Opacity	Ringelmann's Method <sup>[2]</sup>
20	Oxides of Nitrogen	1) Absorption Sampling, Phenolsulfonic Acid Method <sup>[5]</sup> 2) Absorption Sampling, Alkaline Permanganate/Colorimetric Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
21	Selenium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
22	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[5]</sup>
23	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup>
24	Tellurium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
25	Tin	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
26	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method <sup>[5]</sup> 2) Paired Train, Isokinetic Sampling, Gravimetric Method <sup>[5]</sup>

27 Vanadium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Vanadium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[5]</sup>
28	Xylene	Absorption Sampling, Gas Chromatographic Method <sup>[5]</sup>

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,24]</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[10,24]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[11,24]</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,14]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,17]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,14]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,17]</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,14]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,17]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,14]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,17]</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,14]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,17]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,14]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,17]</sup>

5 Beryllium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.14,19)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.17,19)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.14,19)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.17,19)</sup>

10 Chromium (VI)...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1.6.19)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8.19)</sup>
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup>

2) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>

22 Mercury...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1.6.20)</sup> 2) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1.6.30)</sup> 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 4) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(30)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(21)</sup>
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7.17)</sup>
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10.24)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11.24)</sup>

- 2-Chlorobiphenyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	- 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup> Electrometric Method <sup>(23,24)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 5) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 6) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 7) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
29	pH	
30	Selenium	

31 Silver...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
35	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

ดิน...

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
2	Acetone	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
4	Anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
9	Benz(a)anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>

11 Benzo(b)fluoranthene

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Benzo(b)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
12	Benzo(k)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
13	Benzoic acid	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
14	Benzo(a)pyrene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
15	Benzo(g,h,i)perylene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
17	Bis(2-chloroethyl)ether	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
18	Bis(2-ethylhexyl)phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,25)</sup>
22	Butyl Benzyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>

23 Cadmium...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
24	Carbazole	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
28	p-Chloroaniline	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
32	2-Chlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,19)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,17,19)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,19)</sup>

36 Chrysene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
36	Chrysene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(27,28,29)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
42	Dibenz(a,h)anthracene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
43	Di-n-Butyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
47	3,3-Dichlorobenzidine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>

49 1,2-Dichloroethane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
53	2,4-Dichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
58	Diethyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
59	2,4-Dimethylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
60	2,4-Dinitrophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
61	2,4-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
62	2,6-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

63 Di-n-Octyl Phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
63	Di-n-Octyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
67	Fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
68	Fluorene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
70	Heptachlor epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
73	n-Hexane	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13)</sup>

73 n-Hexane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
77	Hexachlorocyclopentadiene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
78	Hexachloroethane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
79	Indeno(1,2,3-cd)pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
80	Isophorone	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(21)</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>

84 Methanol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13,25)</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
88	2-methylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
89	2-Methylnaphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
91	Naphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
93	Nitrobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
94	N-Nitrosodiphenylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
95	N-Nitrosodi-n-propylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

96 Polychlorinated biphenyls (PCBs)

ลำดับที่	สารเคมี	วิธีวิเคราะห์
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3',3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl - Pentachlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
97	Phenanthrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

99 Phenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
99	Phenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
100	Pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
108	TPH (C <sub>5</sub> -C <sub>9</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
109	TPH (C <sub>10</sub> -C <sub>16</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
110	TPH (C <sub>17</sub> -C <sub>35</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>

115 2,4,5-Trichlorophenol...





อนึ่ง หนังสือฉบับนี้จะมีผลใช้บังคับเมื่อพ้นกำหนดอายุที่ระบุไว้ข้างต้นเป็นอันขาดนับตั้งแต่วันที่ ๒ กันยายน ๒๕๖๔

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพิชัย กัณกรอง)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๔

ไปรษณีย์อิเล็กทรอนิกส์ sarabangdw@mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๑๑๐/๑๒๓๖๘

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๘ ธันวาคม ๒๕๖๓

เรื่อง ยกเลิกบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒ ธันวาคม ๒๕๖๓


ตามคำขอที่อ้างถึง บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอยกเลิกบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย ได้แก่

๑) นายประจักษ์ วรณชัย	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๐๖๐
๒) นายจิรณัฐ ขวาลอ	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๐๗๒
๓) นายพิรุณ กาคำ	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๐๘๘
๔) นางสาวอรุษา คำคอง	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๑๓๔
๕) นายกิตติพงศ์ แซ่ลิ	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๑๔๔
๖) นายจิรเมธ ประเสริฐศิริพงศ์	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๑๖๐
๗) นายภัทรพงษ์ มนต์หาทอง	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๑๖๖
๘) นางสาวจารุวรรณ กระจำพันธุ	ทะเบียนเลขที่ ๖-๒๐๔-๑-๐๑๘๑

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายธีรศักดิ์ อิศรางกูร ณ อยุธยา)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๔

ไปรษณีย์อิเล็กทรอนิกส์ sarabangdw@mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๑๑๐/ ๑๔๓๘

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๔ สิงหาคม ๒๕๖๓

เรื่อง ต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๗ พฤษภาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๓ แน่น

ตามคำขอที่อ้างถึง บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้คู่ อำเภอลำปาง จังหวัดลำปาง ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบริทอรี่ กรุ๊ป (ประเทศไทย) จำกัด ต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน

๑) นายเดช ช้างชน	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๑
๒) นางวิลาวัลย์ บริรักษ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๒
๓) นายสุพจน์ สลามเต๊ะ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๓

ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน

๑) นายณัฐพงษ์ เพ็ชรนา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๑
๒) นางสาวกัญจนา รักษ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๒
๓) นางสาวจุฑาทิพย์ สิริทองกลาง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๓
๔) นางสาวจิตสุภา ประเทืองสุข	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๔
๕) นายสรวิชัย คุ้มภัย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๕
๖) นายณัฐพงษ์ ออมทรัพย์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๖
๗) นายจิตรกร สีระสา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๗
๘) นายสิทธิพงษ์ สุวรรณรัตน์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๘
๙) นายสิทธิพงษ์ เสนาชี	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๙
๑๐) นายอนุวัฒน์ เสงมา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๐
๑๑) นายสุวิทย์ นราพงษ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๑
๑๒) นายณัฐพล เขียววิงค์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๒
๑๓) นายชานนท์ บุญชื่น	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๓
๑๔) นายณัฐกานต์ วงศ์อินทร์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๔
๑๕) นายอานนท์ โพธิ์พระทอง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๕

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๑

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๒

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๓

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๑

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๒

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๓

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๔

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๕

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๖

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๗

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๘

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๐๙

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๐

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๑

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๒

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๓

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๔

ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๕

๑๖) นายณัฐพล...

๑๖) นายณัฐพล อัครกลาง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๖
๑๗) นายศุภณัฐ พิสิทธิ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๗
๑๘) นายสันต์ คันทิ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๘
๑๙) นายวิญญู อิมพาลี	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๑๙
๒๐) นายศุภณัฐ สกุลกิตติวงศ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๐
๒๑) นายเอกชัย อ้นทอง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๑
๒๒) นายพงษ์เทพ สิทธิลา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๒
๒๓) นายพิภกร กุมากร	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๓
๒๔) นางสาวนันทยา เบลูชัย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๔
๒๕) นายสิทธิชัย อ้นพิมาย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๕
๒๖) นางสาวภาณิศา พลอดทอง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๖
๒๗) นางสาวพจนา สีดา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๗
๒๘) นางสาวธิดา กุลศิริวงศ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๘
๒๙) นายพิทยา ทองแดง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๒๙
๓๐) นางสาวชลธิชา สูงเกษ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๐
๓๑) ว่าที่ร้อยตรี รณชัย ม่วงมา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๑
๓๒) นายวรวิทย์ หันหา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๒
๓๓) นายศักดิ์รินทร์ จรัสกาย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๓
๓๔) นายสุศักดิ์ สาขิน	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๔
๓๕) นายสุภากร อาแก้ว	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๕
๓๖) นายสุทธิศักดิ์ โชคปิตินันท์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๖
๓๗) นายวิมลภา พันไชยแก้ว	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๗
๓๘) นางสาวนาถิ์ เจริญศรีตระกูล	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๘
๓๙) นายอนันต์ วงศ์ไชย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๓๙
๔๐) นายชัยยุทธ เลิศนันทกุลชัย	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๐
๔๑) นายสุจิตา เขียวแสง	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๑
๔๒) นายณัฐพล มณีสัมพันธ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๒
๔๓) นายอภิรักษ์ อธิจินดา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๓
๔๔) นายสุชัย วงศ์สุริยา	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๔
๔๕) นายโสภณ คันทิ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๕
๔๖) นางสาวกิตติยา สันติราษฎร์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๖
๔๗) นางสาวอริสรา คันทิ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๗
๔๘) นายพิพัฒน์ นิพัทธ์เศรษฐ์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๘
๔๙) นายศิริวิทย์ เรืองสม	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๔๙
๕๐) นายปารเมศ สัตยาคุณ	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๕๐
๕๑) นายณัฐพล ธรรมะโร	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๕๑
๕๒) นางสาวศุภรัตน์ โสจันทร์	ทะเบียนเลขที่ ๖-๒๐๓-๑-๐๐๕๒

๕๓) นายพชร...

๕๒) นายพรกร เจ็งเจริญ ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๔  
 ๕๓) นายวิภากร เชื้อมาก ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๕  
 ๕๔) นายอนุวัช ทองขจรศักดิ์ ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๖  
 ๕๕) นายอภิชาติ วิลาส ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๗  
 ๕๖) นายจิรวิทย์ ศรีรักษา ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๘  
 ๕๗) นายประสาธน์ สอนเพชร ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๕๙  
 ๕๘) นายภาณุวัฒน์ วัชรัง ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๖๐  
 ๖๐) นายสันติ ชัยชนะ ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๖๑  
 ๖๑) นายทินกร กุลชาติ ทะเบียนเลขที่ ๖-๑๒๓-๖-๐๐๖๒

ค. ขอบข่ายชนิดสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย ตามสิ่งส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒๘ มิถุนายน ๒๕๖๑ หากประสงค์จะต่ออายุหนังสือ รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๖๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายพรศักดิ์ กนกนกรอง)  
 รองอธิบดี ปฏิบัติราชการแทน  
 อธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
 โทร. ๐ ๓๓๑๓ ๖๐๕๔ ต่อ ๕๐๐๑-๒  
 ไปรษณีย์อิเล็กทรอนิกส์ [eww@dw.ri.go.th](mailto:eww@dw.ri.go.th)



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
 บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๑๒๓  
 ที่ กก ๐๓๒๐/ ๗ ๕๓ ๘ ลงวันที่ ๐๔ สิงหาคม ๒๕๖๗

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ  
 น้ำเสีย จำนวน ๑๔ รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method <sup>[2]</sup> 2) 5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
2	Chemical Oxygen Demand	1) Open Reflux, Titrimetric Method <sup>[2]</sup> 2) Closed Reflux, Colorimetric Method <sup>[2]</sup> 3) Closed Reflux, Titrimetric Method <sup>[2]</sup>
3	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[2]</sup>
4	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
5	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
6	Free Chlorine	DPD Ferrous Titrimetric Method <sup>[2]</sup>
7	Oil and Grease	Liquid-Liquid, Partition-Gravimetric Method <sup>[2]</sup>
8	pH	Electrometric Method <sup>[2]</sup>
9	Phenols	1) Distillation, Chloroform Extraction Method <sup>[2]</sup> 2) Distillation, Direct Photometric Method <sup>[2]</sup>
10	Sulfide	ZnS Precipitation, Iodometric Method <sup>[2]</sup>
11	Temperature	Field Method <sup>[2]</sup>
12	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
13	Total Kjeldahl Nitrogen	Semi-Macro Kjeldahl Method <sup>[2]</sup>
14	Total Suspended Solids	Dried at 103-105 °C <sup>[2]</sup>

น้ำได้ดิน จำนวน 3 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
2	pH	Electrometric Method <sup>[2]</sup>
3	Phenols	Distillation, Direct Photometric Method <sup>[2]</sup>

อากาศเสีย...

อากาศเสีย (ปล่อยระบาย) จำนวน 7 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>[3]</sup> 2) Instrumental Analyzer Method <sup>[9]</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[2]</sup>
3	Opacity	Ringelmanns Method <sup>[3,4]</sup>
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[8]</sup> 2) Instrumental Analyzer Method <sup>[10]</sup>
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Acid Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[11]</sup>
6	Sulfuric Acid	Isokinetic Sampling, Barium - Titrimetric Method <sup>[6]</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[7]</sup>

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๐๙ ตุลาคม ๒๕๖๗

เรื่อง แก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง หนังสือ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขที่ Env 2024/005  
ลงวันที่ ๓๐ สิงหาคม ๒๕๖๗

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ว-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้คู อำเภอบลุกแดง  
จังหวัดระยอง ขอแก้ไขเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน เนื่องจากมีความคลาดเคลื่อน ความละเอียด  
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรม ได้รับทราบและดำเนินการแก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการ  
วิเคราะห์เอกชน จำนวน ๕ ราย ตามที่แจ้งเรียบร้อยแล้ว เป็นดังนี้

- ลำดับที่ ๒๗ นางพจนา สีดา
- ลำดับที่ ๒๘ นางสาวอนิศา กุลสุวิวงศ์
- ลำดับที่ ๓๐ นางชลธิชา สุนทร
- ลำดับที่ ๓๖ นายสุทธิดำรง โชติวิรัตน์
- ลำดับที่ ๔๒ นายกันตภณ มณีสัมพันธ์

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพรยศ กสิกรอง)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
โทร. ๐ ๓๓๑๓ ๖๐๕๙ ต่อ ๕๐๐๑-๒  
ไปรษณีย์อิเล็กทรอนิกส์ elrw@dlw.mail.go.th







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