



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-11

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บันทึกชนิด ปริมาณ แหล่งกำเนิดของมูลฝอยและสิ่งปฏิกูล  
และการจัดการมูลฝอยและสิ่งปฏิกูล

บันทึกปริมาณขยะมูลฝอยและกากของเสีย ประจำปี 2566

โครงการ ทำแท้งปลอดภัย บริษัท เอส.พี. อินเทอร์เน็ต จำกัด  
 จัดทำรายงานโดย [Redacted]  
 ระหว่างเดือน พฤษภาคม พ.ศ. 2566 ถึงเดือน กันยายน พ.ศ. 2566

ขยะมูลฝอย	ปริมาณขยะมูลฝอย													การกำจัดขยะมูลฝอย
	หน่วย	ม.ค.	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค.	ก.ย.	ต.ค.	พ.ย.	ธ.ค.	
ขยะทั่วไป	ลิตร	-	-	-	-	-	-	10,519	10,854	14,925	8,732	13,838	8,960	รวบรวมใส่ถังขยะทั่วไปขนาด 240 ลิตร จากนั้นรถเก็บขยะมูลฝอยขององค์การบริหารส่วนตำบลบางเตี๋ยมาจัดเก็บและขนไปกำจัดเป็นประจำ 1 วัน/สัปดาห์ ทุกวันพุธ
ขยะเปียก	ลิตร	-	-	-	-	-	-	493	509	669	409	649	420	รวบรวมใส่ถังขยะเปียกขนาด 240 ลิตร จากนั้นรถเก็บขยะมูลฝอยขององค์การบริหารส่วนตำบลบางเตี๋ยมาจัดเก็บและขนไปกำจัดเป็นประจำ 1 วัน/สัปดาห์ ทุกวันพุธ
ขยะรีไซเคิล	ลิตร	-	-	-	-	-	-	4,931	5,088	6,671	4,093	6,487	4,200	ถูกรวบรวมไว้ภายในห้องพัสดุของโครงการ เช่น ยางรถยนต์ เศษเหล็กเศษอะไหล่ เศษผ้า โลหะ และน็อต เพื่อรอการจำหน่ายต่อไป
ขยะอันตราย	กิโลกรัม	-	-	-	-	-	-	164	170	223	136	276	140	รวบรวมไว้ในถังขนาด 200 ลิตร จัดเก็บบริเวณห้องพัสดุอันตราย เมื่อมีปริมาณมากพอจะขายให้กับบริษัท เบตเตอร์เวลล์ กรีน จำกัด (มหาชน) เพื่อนำกลับไปแปรรูปหรือใช้เป็นเชื้อเพลิงทดแทน



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-12

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บันทึกสถิติข้อมูลการเจ็บป่วยด้วยโรคทั่วไปและ  
โรคระบบทางเดินหายใจของพนักงาน

## **หมวดที่ 2**

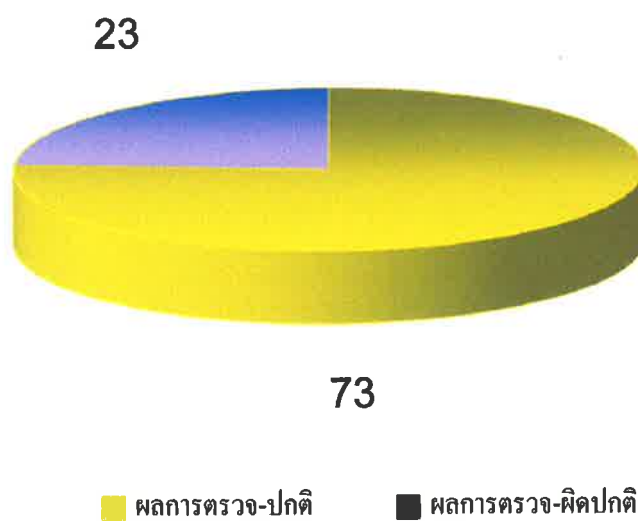
**การตรวจร่างกายทั่วไปโดยแพทย์ (PE)  
ผลการตรวจและรายชื่อผู้เข้ารับการตรวจ**



บริษัท เอส.พี.อินเตอร์ มารีน จำกัด (สาขาอยุธยา)  
การตรวจสอบสภาพทั่วไปโดยแพทย์ (PE)  
ประจำปี 2566

จำนวนผู้เข้ารับการตรวจ	96	คน
ผลการตรวจ-ปกติ	73	คน
ผลการตรวจ-ผิดปกติ	23	คน

กราฟแสดงผลการตรวจสอบสภาพทั่วไปโดยแพทย์ (PE)



**บริษัท เอส.พี.อินเตอร์ มาร์ีน จำกัด (สาขาอยุธยา)**

**รายชื่อผู้เข้ารับการตรวจสุขภาพทั่วไปโดยแพทย์ (PE) ผลการตรวจ ปกติ จำนวน 73 ท่าน มีดังนี้ คือ**

ลำดับ	ชื่อ-สกุล	น้ำหนัก	ส่วนสูง	ชีพจร	ความดันโลหิต	ผลการตรวจร่างกายโดยแพทย์
0001		67	162	77	126/77	สุขภาพทั่วไปปกติ
0002		57	169	89	130/76	สุขภาพทั่วไปปกติ
0003		55	160	88	110/75	สุขภาพทั่วไปปกติ
0005		62	163	86	120/74	สุขภาพทั่วไปปกติ
0006		87	170	91	130/89	สุขภาพทั่วไปปกติ
0008		80	164	60	100/94	สุขภาพทั่วไปปกติ
0010		57	169	80	112/68	สุขภาพทั่วไปปกติ
0012		68	164	96	130/83	สุขภาพทั่วไปปกติ
0013		82	169	74	132/90	สุขภาพทั่วไปปกติ
0016		58	161	101	137/88	สุขภาพทั่วไปปกติ
0017		63	168	101	143/88	สุขภาพทั่วไปปกติ
0018		74	173	84	133/84	สุขภาพทั่วไปปกติ
0019		69	165	81	124/86	สุขภาพทั่วไปปกติ
0020		62	163	103	131/89	สุขภาพทั่วไปปกติ
0022		64	160	65	145/86	สุขภาพทั่วไปปกติ
0023		105	178	92	142/86	สุขภาพทั่วไปปกติ
0026		51	165	108	129/91	สุขภาพทั่วไปปกติ
0028		86	169	76	136/87	สุขภาพทั่วไปปกติ
0029		58	155	62	107/73	สุขภาพทั่วไปปกติ
0031		54	163	73	112/85	สุขภาพทั่วไปปกติ
0032		65	157	86	131/90	สุขภาพทั่วไปปกติ
0033		44	155	104	96/77	สุขภาพทั่วไปปกติ
0036		51	154	84	114/73	สุขภาพทั่วไปปกติ
0039		51	157	78	108/77	สุขภาพทั่วไปปกติ
0041		88	164	85	105/78	สุขภาพทั่วไปปกติ

ลำดับ	ชื่อ-สกุล	น้ำหนัก	ส่วนสูง	ชีพจร	ความดันโลหิต	ผลการตรวจร่างกายโดยแพทย์
0042		77	170	74	143/81	สุขภาพทั่วไปปกติ
0043		61	161	92	124/88	สุขภาพทั่วไปปกติ
0044		72	161	77	119/94	สุขภาพทั่วไปปกติ
0048		95	179	74	142/85	สุขภาพทั่วไปปกติ
0049		58	168	60	111/79	สุขภาพทั่วไปปกติ
0050		101	174	89	136/89	สุขภาพทั่วไปปกติ
0051		74	172	68	133/81	สุขภาพทั่วไปปกติ
0052		68	164	74	125/74	สุขภาพทั่วไปปกติ
0053		91	180	65	124/70	สุขภาพทั่วไปปกติ
0054		72	169	78	134/84	สุขภาพทั่วไปปกติ
0055		82	178	81	132/80	สุขภาพทั่วไปปกติ
0058		51	149	91	117/69	สุขภาพทั่วไปปกติ
0061		49	159	89	118/78	สุขภาพทั่วไปปกติ
0063		73	158	81	136/91	สุขภาพทั่วไปปกติ
0064		73	168	84	103/64	สุขภาพทั่วไปปกติ
0065		73	174	64	129/75	สุขภาพทั่วไปปกติ
0066		71	166	76	123/81	สุขภาพทั่วไปปกติ
0068		97	171	73	130/78	สุขภาพทั่วไปปกติ
0069		84	166	85	121/85	สุขภาพทั่วไปปกติ
0070		83	173	78	133/96	สุขภาพทั่วไปปกติ
0074		50	157	81	118/75	สุขภาพทั่วไปปกติ
0077		72	174	111	135/91	สุขภาพทั่วไปปกติ
0078		56	164	71	130/85	สุขภาพทั่วไปปกติ
0079		69	170	72	128/83	สุขภาพทั่วไปปกติ
0080		93	167	93	133/88	สุขภาพทั่วไปปกติ
0081		58	155	99	108/66	สุขภาพทั่วไปปกติ
0082		52	158	85	106/71	สุขภาพทั่วไปปกติ
0083		52	168	96	110/72	สุขภาพทั่วไปปกติ

ลำดับ	ชื่อ-สกุล	น้ำหนัก	ส่วนสูง	ชีพจร	ความดันโลหิต	ผลการตรวจร่างกายโดยแพทย์
0084		70	168	72	109/68	สุขภาพทั่วไปปกติ
0086		48	151	86	114/80	สุขภาพทั่วไปปกติ
0087		67	159	72	139/85	สุขภาพทั่วไปปกติ
0089		73	163	89	102/83	สุขภาพทั่วไปปกติ
0090		61	162	97	140/92	สุขภาพทั่วไปปกติ
0091		61	177	74	120/77	สุขภาพทั่วไปปกติ
0092		66	173	69	133/95	สุขภาพทั่วไปปกติ
0093		59	163	76	139/95	สุขภาพทั่วไปปกติ
0094		83	174	89	129/85	สุขภาพทั่วไปปกติ
0095		78	167	80	133/85	สุขภาพทั่วไปปกติ
0096		64	163	95	141/82	สุขภาพทั่วไปปกติ
0097		61	172	81	135/77	สุขภาพทั่วไปปกติ
0098		67	169	64	141/75	สุขภาพทั่วไปปกติ
0099		72	166	96	140/86	สุขภาพทั่วไปปกติ
0100		80	169	77	135/87	สุขภาพทั่วไปปกติ
0101		61	159	96	134/87	สุขภาพทั่วไปปกติ
0102		64	165	91	144/95	สุขภาพทั่วไปปกติ
0103		75	176	62	142/92	สุขภาพทั่วไปปกติ
0104		57	165	106	120/95	สุขภาพทั่วไปปกติ
0105		73	172	67	131/73	สุขภาพทั่วไปปกติ

บริษัท เอส.พี.อินเตอร์ มารีน จำกัด (สาขาอยุธยา)

รายชื่อผู้รับการตรวจสุขภาพทั่วไปโดยแพทย์ (PE) ผลการตรวจ ผิดปกติ จำนวน 23 ท่าน มีดังนี้ คือ

ลำดับ	ชื่อ	หน้า	ส่วนสูง	ชีพจร	ความดันโลหิต	ผลการตรวจร่างกายโดยแพทย์	คำแนะนำ
0004		86	157	108	135/106	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0007		56	151	82	149/106	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0009		71	169	81	146/95	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0011		94	171	86	148/99	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0014		77	166	110	190/105	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0015		60	155	96	139/106	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0021		67	168	112	152/103	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0024		83	171	116	145/104	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0025		10	172	82	149/102	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0034		72	172	71	167/93	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0038		01	170	103	127/93	ตรวจพบประวัติเป็นโรคความดันโลหิตสูง(รักษาอยู่)	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาอย่างต่อเนื่อง
0046		65	166	82	150/86	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0047		71	171	96	116/102	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0059		65	162	104	160/95	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0060		60	158	72	176/109	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0062		69	158	74	151/103	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป

ลำดับ	ชื่อ-สกุล	น้ำหนัก	ส่วนสูง	ชีพจร	ความดันโลหิต	ผลการตรวจร่างกายโดยแพทย์	คำแนะนำ
0067		59	163	98	149/98	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0071		102	173	95	143/105	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0072		81	162	81	146/103	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0073		94	174	78	167/113	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0076		54	161	95	147/97	ตรวจพบประวัติเป็นโรคความดัน โลหิตสูง(รักษาอยู่)	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาอย่างต่อเนื่อง
0085		57	176	90	130/108	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป
0088		78	162	80	155/109	ตรวจพบความดันโลหิตสูง	ควรพบแพทย์เพื่อวัดความดันโลหิตซ้ำ และทำการรักษาต่อไป

# หมวดที่ 3

การตรวจเอ็กซเรย์ปอด (X-RAY)

ผลการตรวจและรายชื่อผู้เข้ารับการตรวจ



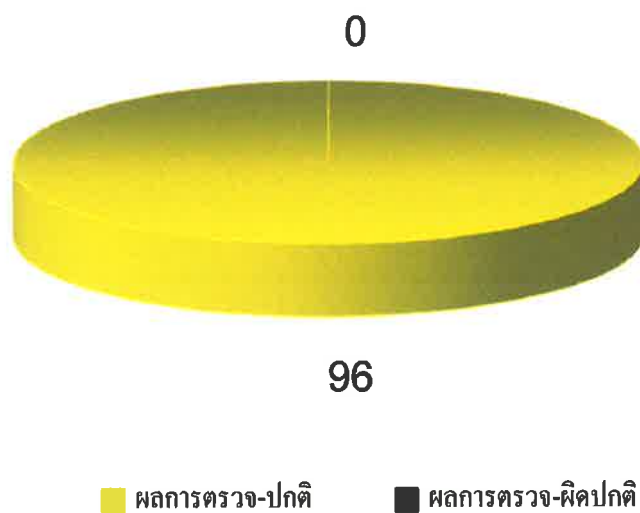
บริษัท เอส.พี.อินเตอร์ มารีน จำกัด (สาขายุทธยา)

การตรวจเอ็กซเรย์ปอด (X-RAY)

ประจำปี 2566

จำนวนผู้เข้ารับการตรวจ	96	คน
ผลการตรวจ-ปกติ	96	คน
ผลการตรวจ-ผิดปกติ	0	คน

กราฟแสดงผลการตรวจเอ็กซเรย์ปอด (X-RAY)





บริษัท เอส.พี.อินเตอร์ มาร์ีน จำกัด (สาขายุทธยา)

รายชื่อผู้เข้ารับการตรวจเอ็กซเรย์ปอด (X-RAY) ผลการตรวจ ปกติ จำนวน 96 ท่าน มีดังนี้ คือ

ลำดับ	ชื่อ-สกุล	X-RAY	สรุปผลการตรวจ
0001		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0002		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0003		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0004		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0005		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0006		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0007		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0008		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0009		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0010		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0011		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0012		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0013		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0014		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0015		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0016		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0017		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0018		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0019		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0020		ปอดปกติ(สงสัยเคยผ่าตัดเปลี่ยนลิ้นหัวใจร่วมกับหัวใจโตเล็กน้อย)	ผลการเอ็กซเรย์ปอดปกติ
0021		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0022		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0023		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0024		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0025		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0026		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0028		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0029		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0031		ปกติ	ผลการเอ็กซเรย์ปอดปกติ

ลำดับ	ชื่อ-สกุล	X-RAY	สรุปผลการตรวจ
0032		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0033		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0034		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0036		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0038		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0039		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0041		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0042		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0043		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0044		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0046		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0047		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0048		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0049		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0050		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0051		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0052		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0053		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0054		ปอดปกติ(สงสัยกระดูกไหปลาร้าด้านซ้ายหักเก่า)	ผลการเอ็กซเรย์ปอดปกติ
0055		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0058		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0059		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0060		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0061		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0062		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0063		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0064		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0065		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0066		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0067		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0068		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0069		ปกติ	ผลการเอ็กซเรย์ปอดปกติ
0070		ปกติ	ผลการเอ็กซเรย์ปอดปกติ



ลำดับ	ชื่อ-สกุล	X-RAY	สรุปผลการตรวจ
0105		ปกติ	ผลการเอ็กซเรย์ปกติ



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-13

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ผลการตรวจวัดระดับความร้อน

วันที่ 2 ตุลาคม 2566

## รายงานผลการวิเคราะห์

**ชื่อลูกค้า** : บริษัท เบสท์ เอ็นไวรอนเม้นท์ คอนซัลแทนท์ จำกัด  
**ที่อยู่ลูกค้า** : เลขที่ 659 ถนนเจริญรัตน์ แขวงคลองสาน เขตคลองสาน กรุงเทพมหานคร 10600  
**ชื่อโครงการ** : ทำเทียบเรือสินวัฒนา (บริษัท เอส.พี.อินเตอร์ มารีน จำกัด) จ.พระนครศรีอยุธยา  
**เครื่องมือเก็บตัวอย่าง/วิเคราะห์** : Heat Stress Meter S/N 0016  
**สถานที่เก็บตัวอย่าง** : บริเวณท่าเทียบเรือ **ผู้เก็บตัวอย่าง** : บริษัท เอ็นไวแล็บ จำกัด  
**วันที่เก็บตัวอย่าง** : 2 ตุลาคม 2566 **วันที่รับตัวอย่าง** : 5 ตุลาคม 2566  
**วันที่วิเคราะห์** : 5-12 ตุลาคม 2566 **วันที่พิมพ์รายงาน** : 23 ตุลาคม 2566  
**หมายเลขตัวอย่าง** : AR-23-074901 **หมายเลขรายงานผลการวิเคราะห์** : 02453/66

บริเวณที่ตรวจวัด	เวลา	ระดับความร้อน (°C)			
		T <sub>nwb</sub>	T <sub>db</sub>	T <sub>gt</sub>	WBGT
1. บริเวณหน้าท่าเทียบเรือ	10:00 - 10:30	29.9	36.4	37.7	32.0
	10:30 - 11:00	30.2	37.2	38.6	32.4
	11:00 - 11:30	33.6	39.9	40.8	35.6
	11:30 - 12:00	34.7	41.4	42.1	36.8
	ค่าเฉลี่ย	32.1	38.7	39.8	34.2*
มาตรฐาน					≤32.0

**มาตรฐาน** กฎกระทรวงแรงงาน เรื่อง กำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับความร้อน แสงสว่าง และเสียง พ.ศ. 2559 (งานปานกลาง)

\* มีค่าเกินเกณฑ์มาตรฐานกำหนด



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-14

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ผลการตรวจวัดความเข้มของแสงสว่าง

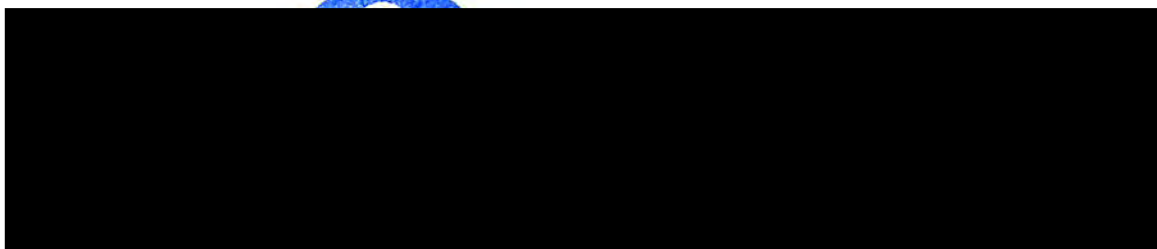
วันที่ 2 ตุลาคม 2566

## รายงานผลการวิเคราะห์

**ชื่อลูกค้า :** บริษัท เบสท์ เอ็นไวรอนเม้นท์ คอนซัลแทนท์ จำกัด  
**ที่อยู่ลูกค้า :** เลขที่ 659 ถนนเจริญรัช แขวงคลองสาน เขตคลองสาน กรุงเทพมหานคร 10600  
**ชื่อโครงการ :** ทำเทียบเรือสินวัฒนา (บริษัท เอส.พี.อินเตอร์ มารีน จำกัด) จ.พระนครศรีอยุธยา  
**เครื่องมือเก็บตัวอย่าง/วิเคราะห์ :** Digital Light Meter Model TM-720  
**สถานที่เก็บตัวอย่าง :** บริเวณหน้าท่าเทียบเรือ **ผู้เก็บตัวอย่าง :** บริษัท เอ็นไวล็บ จำกัด  
**วันที่เก็บตัวอย่าง :** 2 ตุลาคม 2566 **วันที่รับตัวอย่าง :** 5 ตุลาคม 2566  
**วันที่วิเคราะห์ :** 5-12 ตุลาคม 2566 **วันที่พิมพ์รายงาน :** 23 ตุลาคม 2566  
**หมายเลขตัวอย่าง :** AR-23-074900 **หมายเลขรายงานผลการวิเคราะห์ :** 02453/66

ลำดับ	บริเวณที่ตรวจวัด	ลักษณะงาน	ปริมาณความเข้มแสง (LUX)			มาตรฐาน (LUX)		
			พื้นที่ 1	พื้นที่ 2	พื้นที่ 3	พื้นที่ 1	พื้นที่ 2	พื้นที่ 3
1	โต๊ะทำงานคุณบุญเลิศ	เอกสาร	3,784	3,556	3,201	2,000-5,000	≥600	≥300
2	โต๊ะทำงานคุณประจักษ์	เอกสาร	470	-	-	≥400	-	-
3	โต๊ะทำงานคุณสุนทรณ	เอกสาร	457	-	-	≥400	-	-
4	โต๊ะทำงานคุณเทวรักษ์	เอกสาร	989	-	-	≥400	-	-
5	โต๊ะทำงานคุณเนพดล	เอกสาร	404	-	-	≥400	-	-
6	โต๊ะทำงานคุณณรงค์	เอกสาร	3,102	3,003	3,210	2,000-5,000	≥600	≥300

**มาตรฐาน** ประกาศกรมสวัสดิการและคุ้มครองแรงงาน เรื่อง มาตรฐานความเข้มของแสงสว่าง พ.ศ. 2561







รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-15

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ผลการตรวจวัดระดับเสียงเฉลี่ย 8 ชั่วโมง

วันที่ 2 ตุลาคม 2566

## รายงานผลการวิเคราะห์

ชื่อลูกค้า	: บริษัท เบสท์ เอ็นไวรอนเม้นท์ คอนซัลแทนท์ จำกัด		
ที่อยู่ลูกค้า	: เลขที่ 659 ถนนเจริญรัช แขวงคลองสาน เขตคลองสาน กรุงเทพมหานคร 10600		
ชื่อโครงการ	: ทำเทียบเรือสินวัฒนา (บริษัท เอส.พี.อินเตอร์ มารีน จำกัด) จ.พระนครศรีอยุธยา		
เครื่องมือเก็บตัวอย่าง/วิเคราะห์	: Sound Level Meter PULSAR Model 44 S/N 1812		
อ้างอิงวิธีการ	: Sound Level Meter		
สถานที่เก็บตัวอย่าง	: บริเวณท่าเทียบเรือ	ผู้เก็บตัวอย่าง	: บริษัท เอ็นไวแล็บ จำกัด
วันที่เก็บตัวอย่าง	: 2 ตุลาคม 2566	วันที่รับตัวอย่าง	: 5 ตุลาคม 2566
วันที่วิเคราะห์	: 5-12 ตุลาคม 2566	วันที่พิมพ์รายงาน	: 23 ตุลาคม 2566
หมายเลขตัวอย่าง	: AR-23-074899	หมายเลขรายงานผลการวิเคราะห์	: 02453/66

ช่วงเวลา (น.)	ระดับเสียงเฉลี่ย (dB(A))	ระดับเสียงสูงสุด (dB(A))
09:00 - 10:00	70.6	88.3
10:00 - 11:00	70.9	89.4
11:00 - 12:00	72.5	86.9
12:00 - 13:00	71.4	87.0
13:00 - 14:00	73.3	83.4
14:00 - 15:00	73.2	82.2
15:00 - 16:00	67.8	88.1
16:00 - 17:00	70.8	89.5
ระดับเสียงเฉลี่ย 8 ชั่วโมง (Leq 8 hr.)	71.6	
ระดับเสียงสูงสุด (Lmax)	89.5	
มาตรฐานเสียงเฉลี่ย 8 ชั่วโมง	ไม่เกิน 85 <sup>1/</sup>	
มาตรฐานเสียงสูงสุด	ไม่เกิน 140 <sup>2/</sup>	

- มาตรฐาน 1/ ประกาศกรมสวัสดิการและคุ้มครองแรงงาน เรื่อง มาตรฐานระดับเสียงที่ยอมให้ลูกจ้างได้รับเฉลี่ยตลอดระยะเวลาการทำงานในแต่ละวัน พ.ศ.2561
- 2/ ประกาศกระทรวงอุตสาหกรรม เรื่อง มาตรการคุ้มครองความปลอดภัยในการประกอบกิจการโรงงานเกี่ยวกับสภาวะแวดล้อมในการทำงาน พ.ศ. 2546



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

## ภาคผนวก 3-16

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หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการ



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2566

หนังสืออนุญาตห้องปฏิบัติการเอกชน



แบบ กษช/สมอ.๒

## ใบรับรองห้องปฏิบัติการ

อาศัยอำนาจตามความในพระราชบัญญัติการมาตรฐานแห่งชาติ พ.ศ. ๒๕๕๑

เลขาธิการสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

ออกใบรับรองฉบับนี้ให้

บริษัท เอ็นไวแล็บ จำกัด

มีห้องปฏิบัติการตั้งอยู่เลขที่

ได้รับการรับรองความสามารถห้องปฏิบัติการทดสอบ

ตามมาตรฐานเลขที่

ข้อกำหนดทั่วไปว่าด้วยความสามารถห้องปฏิบัติการทดสอบและสอบเทียบ

หมายเลขการรับรองที่

โดยมีสาขาการรับรองตามรายละเอียดแนบท้ายใบรับรอง

ตั้งแต่วันที่ ๒๓ พฤศจิกายน พ.ศ. ๒๕๖๓

ถึง วันที่ ๒๒ พฤศจิกายน พ.ศ. ๒๕๖๖

ออกให้ ณ วันที่ - ๙ ธ.ค. ๒๕๖๓



กระทรวงอุตสาหกรรม สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

ภาคผนวก 3-16-1

1/8

รายละเอียดแนบท้ายใบรับรองห้องปฏิบัติการทดสอบ

ชื่อห้องปฏิบัติการ  
ที่อยู่

ห้องปฏิบัติการทดสอบ บริษัท เอ็นไวแล็บ จำกัด

หมายเลขการรับรองที่

สถานภาพห้องปฏิบัติการ

☒ ถาวร

☐ นอกสถานที่

☐ชั่วคราว

☐เคลื่อนที่

สาขาการทดสอบ	รายการทดสอบ	วิธีทดสอบ
สาขาสิ่งแวดล้อม น้ำและน้ำเสีย (water and wastewater)	- Total suspended solids (TSS) 5 mg/l to 500 mg/l  - Total dissolved solids (TDS) 50 mg/l to 5 000 mg/l	- Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 23 <sup>rd</sup> edition, 2017, Part 2540 D  - Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 23 <sup>rd</sup> edition, 2017, Part 2540 C  - In-house method : WI-18-1-3 based on  • Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 23 <sup>rd</sup> edition, 2017, Part 2540 C  • ประกาศกระทรวงทรัพยากร ธรรมชาติและ สิ่งแวดล้อม เรื่องกำหนด มาตรฐานควบคุมการระบายน้ำทิ้ง จากอาคารบางประเภทและบางขนาด ลงวันที่ 7 พฤศจิกายน 2548

ออกให้ ณ วันที่ - ๙ ธ.ค. ๒๕๖๓

ฉบับที่ 1 ตั้งแต่วันที่ 23 พฤศจิกายน 2563

หน้า 1/1

กระทรวงอุตสาหกรรมสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๐ กันยายน ๒๕๖๖

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวแล็บ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๐ กรกฎาคม ๒๕๖๖

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ แผ่น  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๔ แผ่น

กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอ็นไวแล็บ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๓ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ ๔๗ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล  
หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๔ กรกฎาคม ๒๕๖๙ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ  
กรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"

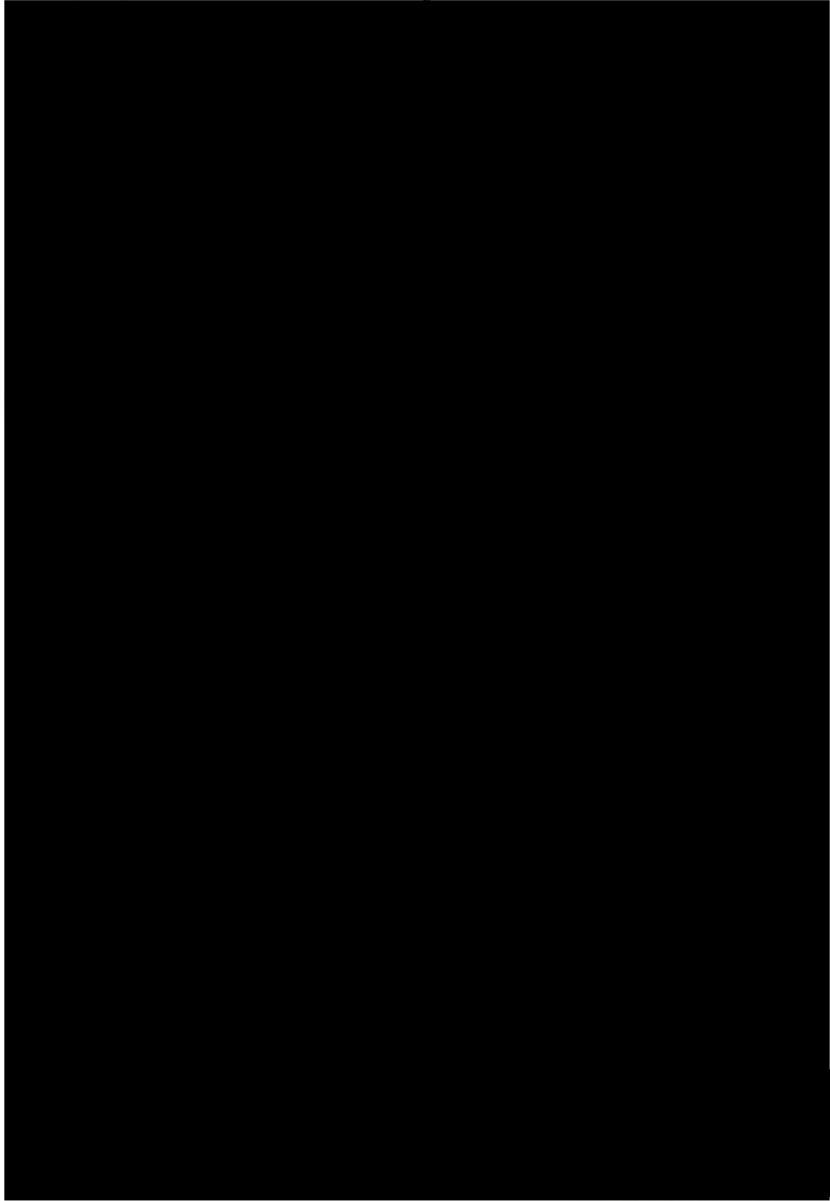


สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

สิ่งที่ส่งมาด้วย ๒

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน



- ๒ -



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๙๙ รายการ

น้ำเสีย จำนวน 23 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
2	Barium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
3	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method <sup>[3]</sup> 2) 5-Day BOD Test, Membrane Electrode Method <sup>[3]</sup>
4	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
5	Chemical Oxygen Demand	Closed Reflux, Titrimetric Method <sup>[3]</sup>
6	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[3]</sup>
7	Copper	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
8	Free Chlorine	Iodometric Method <sup>[3]</sup>
9	Hexavalent Chromium	Colorimetric Method <sup>[3]</sup>
10	Lead	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
11	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
12	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[3]</sup>
13	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
14	Oil & Grease	Liquid-Liquid, Partition-Gravimetric Method <sup>[3]</sup>
15	pH	Electrometric Method <sup>[3]</sup>
16	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
17	Sulfide	Iodometric Method <sup>[3]</sup>
18	Temperature	Laboratory and Field Methods <sup>[3]</sup>
19	Total Dissolved Solids	Dried at 180°C for 1 hour

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
20	Total Kjeldahl Nitrogen	1) Macro-Kjeldahl Method <sup>[3]</sup> 2) Semi-Micro-Kjeldahl Method <sup>[3]</sup>
21	Total Suspended Solids	Dried at 103-105 °C <sup>[3]</sup>
22	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[3]</sup>
23	Zinc	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>

น้ำใต้ดิน จำนวน 17 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
3	Barium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
4	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
5	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
7	Chromium (II)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[3]</sup>
8	Chromium (VI)	Colorimetric Method <sup>[3]</sup>
9	Lead	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
10	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
11	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[3]</sup>
12	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
13	pH	Electrometric Method <sup>[3]</sup>
14	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
15	Silver	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
16	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
17	Zinc	1) Digestion, Direct Air-Acetylene Flame Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>

**อากาศเสีย (ปล่อยระบาย) จำนวน 24 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
2	Arsenic	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
3	Beryllium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
4	Cadmium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
5	Carbon monoxide	Instrumental Analyzer Method <sup>[4]</sup>
6	Chromium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
8	Copper	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
9	Cresol	Adsorption Sampling, Gas Chromatographic Method <sup>[4]</sup>
10	Dioxins/Furans	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) <sup>[4]</sup>
11	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[4]</sup>
12	Lead	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
13	Manganese	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
14	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Method <sup>[4]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Nickel	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
16	Opacity	Ringelmann's Method <sup>[2]</sup>
17	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method <sup>[4]</sup> 2) Instrumental Analyzer Method <sup>[4]</sup>
18	Selenium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
19	Sulfur dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[4]</sup> 2) Instrumental Analyzer Method <sup>[4]</sup>
20	Sulfuric acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[4]</sup>
21	Tin	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
22	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[4]</sup>
23	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
24	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>[4]</sup>

**สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 19 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
2	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[1,5,11]</sup> 2) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[6,11]</sup>
3	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
4	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
5	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[1,5,10]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,10]</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
6	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
7	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation <sup>[1,5,8,12]</sup> 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[6,7,8,12]</sup>
8	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>[1,12]</sup> 2) Alkaline Digestion, Colorimetric Method <sup>[8,12]</sup>
9	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
10	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[1,5,10]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,10]</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
11	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[1,5,10]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,10]</sup> 4) Dig

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
12	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[1,5,13]</sup> 2) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[14]</sup>
13	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
14	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
15	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[1,5,15]</sup> 2) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[6,15]</sup>
16	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
17	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
18	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>
19	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>[1,5,10]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,5,9]</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,10]</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>[6,9]</sup>

ดิน จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[6,7,11]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
3	Barium	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
4	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
5	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,7,10]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
7	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>[6,7,8,9,12]</sup>
8	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>[8,12]</sup>
9	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,7,10]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
10	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[14]</sup>
11	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
12	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
13	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[6,7,15]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
16	Silver	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
18	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>
19	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>[6,7,10]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[6,7,9]</sup>

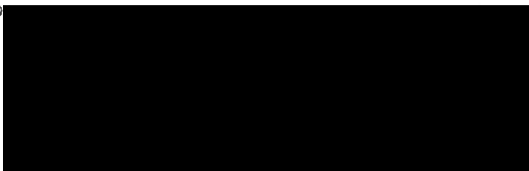
เอกสารอ้างอิง...

เอกสารอ้างอิง

- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2548. เรื่อง การกำจัดสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว. ราชกิจจานุเบกษา. 25 มกราคม 2549. เล่มที่ 123 ตอนพิเศษ 11ง.
- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณเขม่าควันที่เจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำโรงสีข้าวที่ใช้ถ่านกลเป็นเชื้อเพลิง. ราชกิจจานุเบกษา. 4 ธันวาคม 2549. เล่มที่ 123 ตอนพิเศษ 125ง.
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- United States Environmental Protection Agency. *Test Methods for Evaluation Solid Waste Physical/Chemical Methods*. *Mercury in Liquids*. SW-846 Method 7470A, 1994.

14. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Mercury in Solid or Semisolid Wastes (Manual Cold-Vapor Technique). SW-846 Method 7471B**, 2007.

15. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Selenium (Atomic Absorption, Borohydride Reduction).** SW-846 Method 7742, 199





รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินวัฒนา ฉบับประจำเดือนกรกฎาคม-ธันวาคม 2566

## เอกสารผลการสอบเทียบเครื่องมือวัด



### TSP High Volume Sampler Calibration

Verification Report No.  
AO2300036-E002 -TSP 01

☐ PM ☒ Onsite  
Site: หน้าท่าเทียบเรือสวัสดิ์ใหญ่  
UTM: 47P N 1596522 E 672270  
Sampler: ETS#40  
Recorder: ECRDS016339508

Date: 29 Sep 23  
Technical: Sarawut W.  
Approval: Wisan R.

## CONDITIONS

Barometric Press. (hPa): 1008.0	Corrected Pressure (mm Hg): 756.1
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

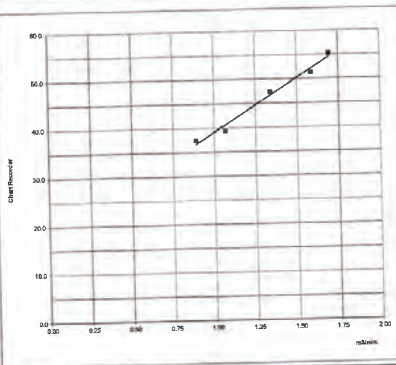
Brand: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 759

Qstd Slope:	2.03736
Qstd Intercept:	-0.03733
Date Certified:	18 Jan 23

## CALIBRATIONS

Plate or Test #	H <sub>2</sub> O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.98	1.693	56.0	55.21
2	10.46	1.583	52.0	51.27
3	7.44	1.338	48.0	47.32
4	4.69	1.086	40.0	39.44
5	3.22	0.887	38.0	37.46

LINEAR REGRESSION	
Slope =	22.1668
Intercept =	17.0224
Corr. coeff. =	0.9920
of Observations:	5
Range of Chart	42
1 - 1.7 m <sup>3</sup> /min.	55



Calibrated by :

**Approved by :**

www.evltesting.com

Environmental responsibility with accuracy measurement

EL-MNT-29 Rev 02/01/08/63

### TSP High Volume Sampler Calibration

Verification Report No.  
AO2300036-E002 -TSP 02

☐ PM ☒ Onsite  
Site: หลังท่าเหียบเรือส่วสี่โพมุลย์  
UTM : 47P N 1596617 E 672167  
Sampler: ETSP#39  
Recorder: ECRAN000031071

Date: 29 Sep 23  
Technical: Sarawut W.  
Approval: Wisan R.

## CONDITIONS

Barometric Press. (hPa): 1008.0	Corrected Pressure (mm Hg): 756.1
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

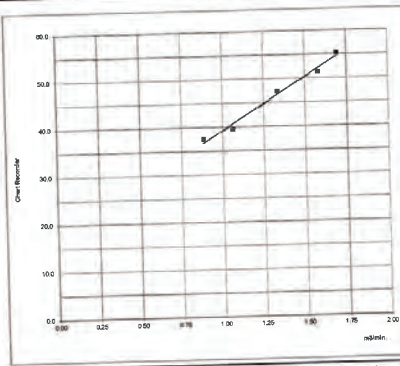
Brand: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 759

Qstd Slope:	2.03736
Qstd Intercept:	-0.03733
Date Certified:	18 Jan 23

## CALIBRATIONS

Plate or Test #	H <sub>2</sub> O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)
1	11.56	1.664	56.0	55.21
2	10.69	1.600	52.0	51.27
3	7.55	1.348	46.0	45.35
4	4.99	1.099	40.0	39.44
5	3.32	0.900	36.0	35.49

LINEAR REGRESSION	
Slope =	24.8306
Intercept =	12.5181
Corr. coeff.=	0.9927
# of Observations:	5
Range of Chart	41
t 1 - 1.7 m3/min.	55



Calibrated by :

Approved by :

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- Environmental responsibility with accuracy measurement

EX-MNT.29 May 00-01/DB/6

TSP High Volume Sampler Calibration				
Verification Report No. AO2300034-E002 -TSP 03				
<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> PM   <input checked="" type="checkbox"/> Onsite            Site: โรงเรียนวัดละมุด            UTM : 47P N 1597414 E 672616            Sampler: ETSP#27            Recorder: ECRAN000031071         </div> <div>           Date: 29 Sep 23            Technical: Sarawut W.            Approval: Wisan R.         </div> </div>				
CONDITIONS				
Barometric Press. (hPa): 1008.0 Temperature (deg C): 31.0 Average Press. (hPa): 1013.0 Average Temp. (deg C): 30.0		Corrected Pressure (mm Hg): 756.1 Temperature (deg K): 304.0 Corrected Avg.Press. (mm Hg): 759.8 Average Temp. (deg K): 303.0		
CALIBRATION ORIFICE				
Brand: Tisch Environmental, Inc Model: TE-5025A Serial#: 759		Qstd Slope: 2.03736 Qstd Intercept: -0.03733 Date Certified: 18 Jan 23		
CALIBRATIONS				
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.89	1.690	54.0	53.33
2	10.43	1.584	50.0	49.38
3	7.54	1.349	46.0	45.43
4	4.78	1.078	40.0	39.50
5	3.44	0.917	34.0	33.58
LINEAR REGRESSION				
Slope = 23.8234				
Intercept = 12.7080				
Corr. coeff. = 0.9923				
# of Observations: 5				
Range of Chart at 1.1 - 1.7 m3/min.	40 53			

TSP High Volume Sampler Calibration				
Verification Report No. AO2300034-E002 -TSP 04				
<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> PM   <input checked="" type="checkbox"/> Onsite            Site: บ้านเกาะกลางน้ำ (หมู่ 1 บ้านเกาะกลางน้ำ)            UTM : 47P N 1596484 E 672426            Sampler: ETSP#3            Recorder: ECRDS016339512         </div> <div>           Date: 29 Sep 23            Technical: Sarawut W.            Approval: Wisan R.         </div> </div>				
CONDITIONS				
Barometric Press. (hPa): 1007.0 Temperature (deg C): 32.0 Average Press. (hPa): 1013.0 Average Temp. (deg C): 30.0		Corrected Pressure (mm Hg): 755.3 Temperature (deg K): 305.0 Corrected Avg.Press. (mm Hg): 759.8 Average Temp. (deg K): 303.0		
CALIBRATION ORIFICE				
Brand: Tisch Environmental, Inc Model: TE-5025A Serial#: 759		Qstd Slope: 2.03736 Qstd Intercept: -0.03733 Date Certified: 18 Jan 23		
CALIBRATIONS				
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.76	1.677	56.0	55.18
2	10.65	1.597	52.0	51.24
3	7.39	1.333	46.0	45.33
4	4.91	1.090	38.0	37.45
5	3.32	0.900	32.0	31.53
LINEAR REGRESSION				
Slope = 29.4203				
Intercept = 5.3319				
Corr. coeff. = 0.9972				
# of Observations: 5				
Range of Chart at 1.1 - 1.7 m3/min.	39 56			



## PM10 High Volume Sampler Calibration

Verification Report No.  
AO2300036-E002 -PM 01

☒ PM ☐ Onsite  
Site: หน้าท่าเรือบริเวณวัดโพธิ์  
Date: 29 Sep 23  
UTM : 47P N 1596622 E 672270  
Technical: Sarawut W.  
Sampler: EPM#42  
Approval: Wisan R.  
Recorder: ECRDS016180801

## CONDITIONS

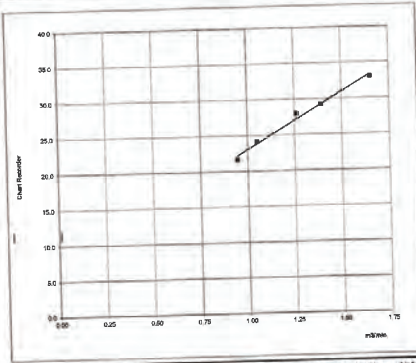
Barometric Press. (hPa): 1008.0  
Temperature (deg C): 32.0  
Average Press. (hPa): 1013.0  
Average Temp. (deg C): 30.0  
Corrected Pressure (mm Hg): 756.1  
Temperature (deg K): 305.0  
Corrected Avg. Press. (mm Hg): 759.8  
Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 759  
Slope: 1.27576  
Intercept: -0.02337  
Date Certified: 18 Jan 23

## CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	10.73	1.649	52.0	33.03	Slope = 15.8412
2	7.59	1.390	46.0	29.22	Intercept = 7.2432
3	6.23	1.261	44.0	27.95	Corr. coeff = 0.9929
4	4.28	1.048	38.0	24.14	SFR = 1.143
5	3.47	0.946	34.0	21.59	SSP = 39.91
					# of Observations: 5
					Range of Chart: 38
					at SFR ±10% 42



Calibrated by :

Approved by :

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Environmental responsibility with accuracy measurement

REV 01-20 Rev.0012/04/19

## PM10 High Volume Sampler Calibration

Verification Report No.  
AO2300036-E002 -PM 02

☒ PM ☐ Onsite  
Site: หน้าท่าเรือบริเวณวัดโพธิ์  
Date: 29 Sep 23  
UTM : 47P N 1596617 E 672167  
Technical: Sarawut W.  
Sampler: EPM#29  
Approval: Wisan R.  
Recorder: NCRT1500904859

## CONDITIONS

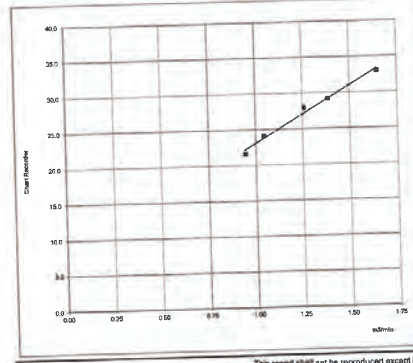
Barometric Press. (hPa): 1008.0  
Temperature (deg C): 32.0  
Average Press. (hPa): 1013.0  
Average Temp. (deg C): 30.0  
Corrected Pressure (mm Hg): 756.1  
Temperature (deg K): 305.0  
Corrected Avg. Press. (mm Hg): 759.8  
Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc  
Model: TE-5025A  
Serial#: 759  
Slope: 1.27576  
Intercept: -0.02337  
Date Certified: 18 Jan 23

## CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	10.98	1.668	52.0	33.03	Slope = 15.3558
2	7.89	1.417	48.0	30.49	Intercept = 7.9384
3	6.61	1.298	44.0	27.95	Corr. coeff = 0.9943
4	4.45	1.069	38.0	24.14	SFR = 1.143
5	3.12	0.898	34.0	21.59	SSP = 40.14
					# of Observations: 5
					Range of Chart: 38
					at SFR ±10% 42



Calibrated by :

Approved by :

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REV 01-20 Rev.0012/04/19



# PM10 High Volume Sampler Calibration

Verification Report No.  
AO2300034-E002 -PM 03

☒ PM ☐ Onsite  
 Site: โรงเรียนวัดหนอง  
 UTM : 47P N 1597414 E 672616  
 Sampler: EPM#11  
 Recorder: ECRDS016303492  
 Date: 29 Sep 23  
 Technical: Sarawut W.  
 Approval: Wisan R.

## CONDITIONS

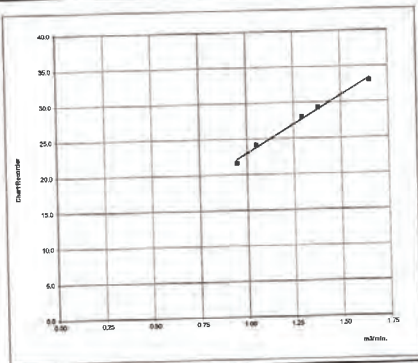
Barometric Press. (hPa): 1008.0  
 Temperature (deg C): 31.0  
 Average Press. (hPa): 1013.0  
 Average Temp. (deg C): 30.0  
 Corrected Pressure (mm Hg): 756.1  
 Temperature (deg K): 304.0  
 Corrected Avg. Press. (mm Hg): 759.8  
 Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc  
 Model: TE-5025A  
 Serial#: 759  
 Slope: 1.27576  
 Intercept: -0.02337  
 Date Certified: 18 Jan 23

## CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	10.54	1.632	52.0	32.97	Slope = 18.1008
2	7.76	1.403	48.0	30.44	Intercept = 4.0480
3	6.12	1.248	42.0	26.63	Corr. coeff = 0.9928
4	4.91	1.120	38.0	24.10	SFR = 1.139
5	3.19	0.906	32.0	20.29	SSP = 38.91
					# of Observations: 5
					Range of Chart at SFR ±10% 37
					41



Calibrated by :

Approved by :

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PM10 Cal. Rev.07 / Iss Date: Mar 17, 2020

# PM10 High Volume Sampler Calibration

Verification Report No.  
AO2300034-E002 -PM 04

☐ PM ☒ Onsite  
 Site: บ้านเกาะกลางน้ำ (หมู่ 1 บ้านเกาะปากกัน)  
 UTM : 47P N 1596484 E 672426  
 Sampler: EPM#41  
 Recorder: ECRDS016180800  
 Date: 29 Sep 23  
 Technical: Sarawut W.  
 Approval: Wisan R.

## CONDITIONS

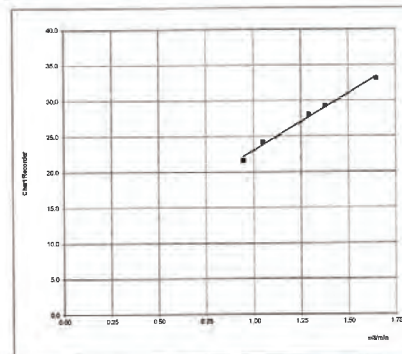
Barometric Press. (hPa): 1007.0  
 Temperature (deg C): 32.0  
 Average Press. (hPa): 1013.0  
 Average Temp. (deg C): 30.0  
 Corrected Pressure (mm Hg): 755.3  
 Temperature (deg K): 305.0  
 Corrected Avg. Press. (mm Hg): 759.8  
 Average Temp. (deg K): 303.0

## CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc  
 Model: TE-5025A  
 Serial#: 759  
 Slope: 1.27576  
 Intercept: -0.02337  
 Date Certified: 18 Jan 23

## CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	10.62	1.642	52.0	33.04	Slope = 17.3497
2	7.68	1.399	48.0	30.50	Intercept = 5.2450
3	6.77	1.314	44.0	27.96	Corr. coeff = 0.9913
4	4.49	1.074	38.0	24.15	SFR = 1.144
5	3.12	0.898	32.0	20.33	SSP = 39.49
					# of Observations: 5
					Range of Chart at SFR ±10% 37
					42



Calibrated by :

Approved by :

www.evltesting.com

Environmental responsibility with accuracy measurement

PM10 Cal. Rev.07 / Iss Date: Mar 17, 2020

PM10-28 Rev.00.0/06/03

**Verification Test Report**

Report No.:

AO2300036-E002 -SLM 01

☒ PM☐ Onsite UTM

47P 1596509 672279

Calibrated Date: 29 September 2023

Site : หน้าท่าเทียบเรือสวัสดีโพ้นาลัย

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0024

Environment: Temperature 25 °C Humidity 69 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,Bruel&amp;Kjaer

Serial No.1351075

Date of Calibration : 16 March 2023

**Result of Test**

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.66	-0.12	93.78

Calibrated By: [REDACTED]

Date: [REDACTED]

Approve By: [REDACTED]

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**Verification Test Report**

Report No.:

AO2300034-E002 -SLM 02

☐ PM☒ Onsite UTM

47P N 1597423 E 672664

Calibrated Date: 29 September 2023

Site : โรงเรียนวัดละมุด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0013

Environment: Temperature 31 °C Humidity 72 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,Bruel&amp;Kjaer

Serial No.1351075

Date of Calibration : 16 March 2023

**Result of Test**

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.57	-0.21	93.78

Calibrated By: [REDACTED]

Date: [REDACTED]

Approve By: [REDACTED]

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**Verification Test Report**

Report No.:

AO2300034-E002 -SLM 03

☒ PM ☒ Onsite UTM : 47P N 1596474 E 672416

Calibrated Date: 29 September 2023

Site : บ้านเกาะกลางน้ำ หมู่ 1 บ้านเกาะปากจั่น

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0015

Environment: Temperature 31 °C Humidity 72 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,Bruel&amp;Kjaer

Serial No.1351075

Date of Calibration : 16 March 2023

**Result of Test**

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.57	-0.21	93.78

Calibrated By:

Date:

Approve By:

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**Verification Test Report**

Report No.:

AO2300036-E021 -SLM 01

☒ PM ☐ Onsite UTM 47P 1514457 654222

Calibrated Date: 4 October 2023

Site : บริษัท เเอ็นไวแล้น จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1842

Environment: Temperature 25 °C Humidity 66 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,Bruel&amp;Kjaer

Serial No.1351075

Date of Calibration : 16 March 2023

**Result of Test**

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	95.50	1.72	93.78

Calibrated By:

Date:

Approve By:

This report shall not be rep





RECALIBRATION  
DUE DATE:  
January 18, 2024

# Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 18, 2023	Rootsometer S/N: 438320	Ta: 294 °K	
Operator: Jim Tisch		Pa: 750.1 mm Hg	
Calibration Model #: TE-5025A	Calibrator S/N: 0759		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3960	3.2	2.00
2	3	4	1	0.9950	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8450	8.8	5.50
5	9	10	1	0.6990	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
0.9961	0.7135	1.4145	0.9957	0.7133	0.8854
0.9918	0.9968	2.0004	0.9915	0.9964	1.2521
0.9897	1.1183	2.2365	0.9893	1.1179	1.3999
0.9886	1.1700	2.3456	0.9883	1.1695	1.4683
0.9833	1.4067	2.8289	0.9829	1.4062	1.7708
QSTD		m= 2.03736 b= -0.03733 r= 0.99997	QA		m= 1.27576 b= -0.02337 r= 0.99997

Calculations	
$V_{std} = \Delta Vol((Pa - \Delta P)/P_{std})(T_{std}/T_a)$	$V_a = \Delta Vol((Pa - \Delta P)/P_a)$
$Q_{std} = V_{std}/\Delta Time$	$Q_a = V_a/\Delta Time$
For subsequent flow rate calculations:	
$Q_{std} = 1/m \left( \sqrt{\Delta H \left( \frac{Pa}{P_{std}} \right) \left( \frac{T_{std}}{T_a} \right)} - b \right)$	$Q_a = 1/m \left( \sqrt{\Delta H \left( \frac{T_a}{Pa} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30

Tisch Environmental, Inc.  
145 South Miami Avenue  
Village of Cleves, OH 45002

www.tisch-env.com  
TOLL FREE: (877)263-7610  
FAX: (513)467-9009

Tel: (02) 964-6211 Fax: (02) 964-5155, e-mail: calibratech.co@gmail.com, calibratech.co@bangkok.go.th

## Certificate of Calibration

Certificate No. : 66-200066-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.  
540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : Electronic Balance  
Manufacturer : Sartorius Model : SECURA125-1S  
Serial No. : 0034606552 ID No. : ELABBALANCEN05  
Capacity : 120 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.  
Ambient Temperature : (21.7 to 22.0) °C  
Relative Humidity : (47.0 to 47.1) %  
Air Pressure : (1015.0 to 1016.0) mbar

Date of Received : 01 March 2023

Date of Calibration : 01 March 2023

Date of Issue : 04 March 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14  
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E264	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

# Certificate of Calibration

Certificate No. : 66-200066-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

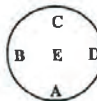
Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.1	0.0000	0.000083
0.5	0.0000	0.000084
1	0.0000	0.000085
2	0.0000	0.000099
5	0.0000	0.000110
10	0.0000	0.000092
20	0.0000	0.000120
50	0.0000	0.00012
100	0.0000	0.00020
120	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

Eccentric error

Load test : 20 g  
A B C D E  
0.0001 0.0001 0.0000 0.0000 0.0000 g



Repeatability

Load test : 100 g  
Stdev. : 0.00004 g

- o0o -

# Certificate of Calibration

Certificate No. : 66-410024-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.  
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Digital Thermo-Hygrometer  
Manufacturer : Jedto Model : HTC-1  
Range Temperature : N/A °C Resolution : 0.1 °C  
Range Humidity : N/A %R.H. Resolution : 1 %R.H.  
Serial No. : PONPE5852094 ID No. : ELABTMHTC10003

Environment : Ambient Temperature : (23 ± 2) °C  
Relative Humidity : (50 ± 15) %

Date of Received : 08 March 2023

Date of Calibration : 09 March 2023

Date of Issue : 09 March 2023

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4013 by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

Reference Standard Instruments : This certification is traceable to the International System of Units

Digital Indicator with Standard Probe Temp&Hum

ID No.	Cert. No.	Due Date	Traceability
400034 & 400036	SG-H-00021/66	11 Jul 2023	Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

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 calibration body.



CAL-F0031-03

3-1-6-2

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CAL-F0031-03



# Certificate of Calibration

Certificate No. : 66-410024-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
25.01	25.0	0.0	0.46

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty (± %R.H.)
50.00	49	1	2.2

Remark

UUC : Unit Under Calibration

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

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

- o0o -

# CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04NI99E15A00V3  
Cylinder Number: EB0140762  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12021  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402021734-1  
Cylinder Volume: 144.4 Cubic Feet  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Feb 19, 2021

Expiration Date: Feb 19, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.68 PPM	G1	+/- 1.4% NIST Traceable	02/12/2021, 02/19/2021
NITRIC OXIDE	45.00 PPM	44.62 PPM	G1	+/- 1.4% NIST Traceable	02/12/2021, 02/19/2021
SULFUR DIOXIDE	45.00 PPM	45.34 PPM	G1	+/- 1.1% NIST Traceable	02/12/2021, 02/19/2021
CARBON MONOXIDE	4500 PPM	4500 PPM	G1	+/- 1.0% NIST Traceable	02/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200811-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%	Feb 02, 2025
PRM	12386	D665025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Jan 27, 2021
Nicolet IS60 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicolet IS50 FTIR AUP2010245 NO2	FTIR	Jan 21, 2021
Nicolet IS50 FTIR AUP2010245 SO2	FTIR	Jan 21, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.4 Kg

Net Weight: 4.5 Kg

PO# 5221000405



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QALAF00311-03



## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609003

Page:1/1

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20000109
---	---

### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.66 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 25.1 °C

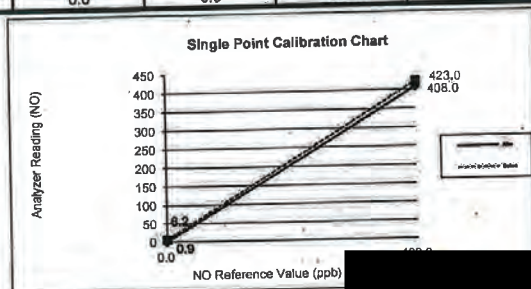
Humidity: 51 %RH

### Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	4.6	0.0	4.6	420.0	400.0	2.4
NO <sub>2</sub>	1.6	0.0	1.6	3.0	0.0	0.4
NOx	6.2	0.0	6.2	423.0	400.0	2.8

### Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	405.0	400.0	0.6
NO <sub>2</sub>	0.6	0.0	0.6	3.0	0.0	0.4
NOx	0.9	0.0	0.9	408.0	400.0	1.0



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## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609003

Page:1/1

Calibrated Date: 1-Sep-23

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Page:2/2

Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Sep-23				
Time	10:10				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500 +/- 50	cc/min	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	619	619	
DCPS	2500 +/- 200	mV	-	-	
RCCELL TEMP	50 +/- 1	Dreagee C	50	50	
BOX TEMP	20-35	Dreagee C	33.7	32.9	
PMT TEMP	7 +/- 1	Dreagee C	7.1	7.1	
IZS TEMP	50 +/- 4	Dreagee C	-	-	
MOLY Temp	315 +/- 5	Dreagee C	314.4	315.0	
RCCL PRES	4-10 constant	IN-Hg-A	10	10	
SAMP PRES	20-30 constant	IN-Hg-A	29.0	29.4	
NO Slope	1 +/- 0.3		0.820	0.801	
Nox Slope	1 +/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
Span and Cal Values					
Zero Value	NO	0	ppb	4.6	0.3
	NOx	0	ppb	6.2	0.9
Span Value	NO	400	ppb	420.0	405.0
	NOx	400	ppb	423.0	408.0

Date: 1-Sep-23

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## SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6609006

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: NSOESAAF32E453
---	---

### Calibration System

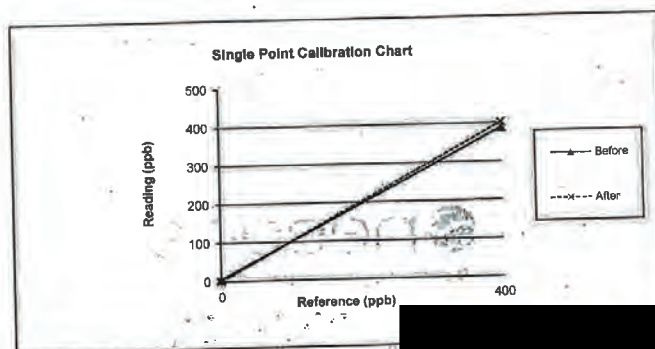
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NO Conc: 44.68 PPM SO2 Conc: 45.34 PPM CO Conc: 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.5 °C

Humidity: 50 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	4.0	4.0	400.0	388.0	-1.5
After	0.0	0.5	0.5	400.0	402.0	0.2



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## SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6609006

Calibrated Date: 1-Sep-23

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Analyzer Signal Values					
Date	1-Sep-23	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4088	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	UV lamp	44.3	mA
+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref. ratio	0		Mees ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	Inst. meas.	22.8	ppb
UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

Calibrate By:

Date:

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## CO Analyzer Verification Test Report

Calibration Report No.: TD-C6609009

Calibrated Date: 1-Sep-23

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### Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: T300	Manufacturer: API S/N: ECOAIT3000098
---	---

### Calibration System

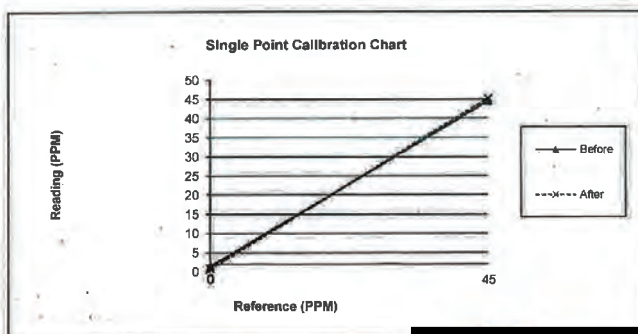
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 24.5 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.3	1.3	45.0	44.5	-0.6
After	0.0	0.7	0.7	45.0	45.2	0.2



## CO Analyzer Verification Test Report

Calibration Report No.: TD-C6609009

Calibrated Date: 1-Sep-23

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Detail	Range	Unit	Before	After	Note
Date	8-Jun-22				
Time	10:51				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.04	0.2	
CO Measure	2500 - 4800 MV.	mV	4465.6	4431.3	
CO Reference	2500 - 4800 MV.	mV	3768.5	3730.2	
MR Ratio	1.2 +/- 0.5		1.19	1.20	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.7	28.6	
Sample Flow	720 - 880 cc/min	cc/min	904	898	
Sample Temp	44 - 52 deg.C	deg.C	48.5	43.3	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	33.3	34.8	
PHT drive	250 - 4750 mv.	mV	2912.3	2913.5	
Slope	0.800 - 1.200		1.197	1.138	
Offset	0.05 +/- 0.2		-0.015	-0.016	
<b>Gas Test Response</b>					
Zero Gas	0	PPM	1.3	0.7	
Span Gas	45	PPM	44.5	45.2	± 5% of Range

Calibrate By:

Date: 1 Sep 23

Date: 1-Sep-23

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## NOx Analyzer Verification Test Report

Calibration Report No.: SV-W6609004

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Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: AC32e	Manufacturer: Environnement SA, France S/N: NNOESAAC32E277
--	---

### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.4 °C

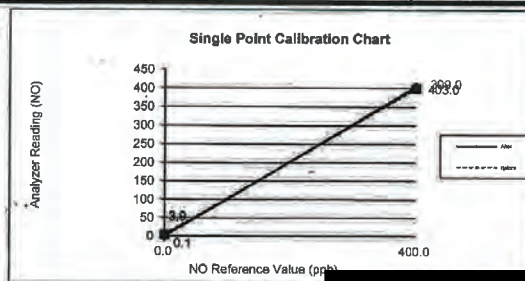
Humidity: 50 %RH

### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.903	0.0	2.9	396.0	400.0	-0.5
NO <sub>2</sub>	0.953	0.0	1.0	3.0	0.0	0.4
NOx	3.856	0.0	3.9	399.0	400.0	-0.1

### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.056	0.0	0.1	400.0	400.0	0.0
NO <sub>2</sub>	0.034	0.0	0.0	3.0	0.0	0.4
NOx	0.090	0.0	0.1	403.0	400.0	0.4



## NOx Analyzer Verification Test Report

Calibration Report No.: SV-W6609004

Page:1/1

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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Analyzer Signal Values					
Date	1-Sep-23	Time	13:00		
Voltage					
+24 V (23-25)	24.0	V	+ 24V (1.5-3)	2.4	A
+12 V	12.0	V	I Peltier (0.5-1.2)	1.2	A
+5 V	5.0	V	I O3 (40-100)	90.7	mA
+4 V	4.0	V			
+3.3 V	3.3	V	PMT V (450-750)	633.0	V
Sensor					
Chamber T (39-61)	80.0	deg.C	Cham P(140-230)	199.0	hPa
Converter T (338-342)	340.0	deg.C	Sam P(850-1150)	992	hPa
Internal T (10-50)	30.5	deg.C	Flow (39-46)	40.00	Nl/h
PM T (-0.5+0.5)	0.0	deg.C			
Calculation					
Dark PM sig(20-150)	79.66	mV			

Calibrate By

Date

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## SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6609005

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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### Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: NSOESAAF32E454
---	---

### Calibration System

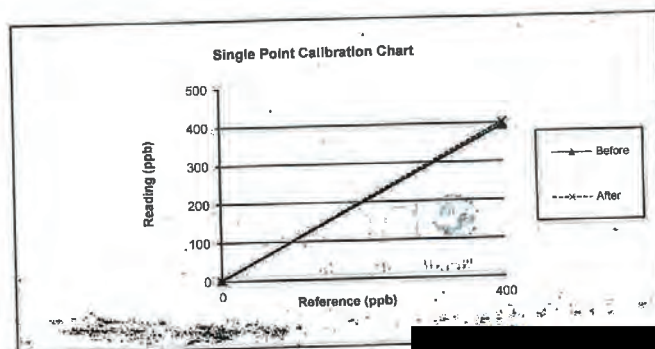
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 24.5 °C

Humidity: 50 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.9	1.9	400.0	394.0	-0.8
After	0.0	0.7	0.7	400.0	402.0	0.2



## SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6609005

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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Analyzer Signal Values					
Date	1-Sep-23	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4068	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	UV lamp	44.3	mA
+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref.ratio	0		Meas ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	inst.meas.	22.8	ppb
UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

Calibrate By:

Date:

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## CO Analyzer Verification Test Report

Calibration Report No.: 6609010

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

### Instruments Information

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Analyzer Type: CO Analyzer Model: 48C	Manufacturer: Thermo S/N: ECOTE48C064377
--	---

### Calibration System

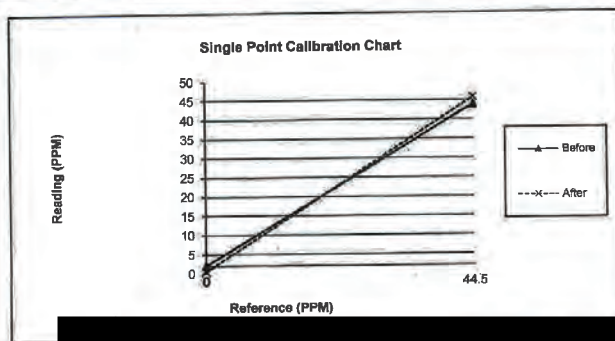
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM
ZERO AIR Generator ZAG7001 S/N: 644	Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 24.8 °C

Humidity: 52 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.0	2.0	44.5	43.9	-0.7
After	0.0	0.5	0.5	45.4	45.7	0.3



Calibrated By

Date

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## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609005

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer: API S/N: ENOAI200E02788
---	--

### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM
ZERO AIR Generator ZAG7001 S/N: 644	Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 24.3 °C

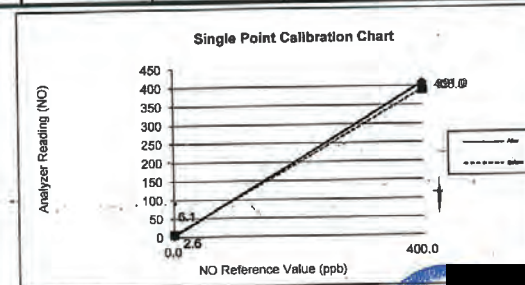
Humidity: 50 %RH

### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.7	0.0	3.7	387.0	400.0	-1.7
NO <sub>2</sub>	2.4	0.0	2.4	4.0	0.0	0.5
NOx	6.1	0.0	6.1	391.0	400.0	-1.1

### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.7	0.0	1.7	405.0	400.0	0.6
NO <sub>2</sub>	0.9	0.0	0.9	408.2	0.0	0.4
NOx	2.6	0.0	2.6	408.0	400.0	1.0



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## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609005

Calibrated Date: 1-Sep-23

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Sep-23				
Time	10:10				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500±50	cc/min	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	819	819	
DCPS	2500 ±/- 200	mV	-	-	
RCCELL TEMP	50±/- 1	Degree C	50	50	
BOX TEMP	20-35	Degree C	33.7	32.9	
PMT TEMP	7 ±/- 1	Degree C	7.1	7.1	
IZS TEMP	50±/- 4	Degree C	-	-	
MOLY Temp	315 ±/- 5	Degree C	314.4	315.0	
RCCL PRES	4-10 constant	IN-Hg-A	10	10	
SAMP PRES	20-30 constant	IN-Hg-A	29.0	29.4	
NO Slope	1 ±/- 0.3		0.820	0.801	
Nux Slope	1 ±/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
<b>Span and Cal Values</b>					
Zero Value	NO	0	ppb	3.7	1.7
	NOx	0	ppb	6.1	2.6
Span Value	NO	400	ppb	387.0	405.0
	NOx	400	ppb	391.0	408.0

Calibrate By :

Date: 1-Sep-23



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## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S66089004

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10003032
--	---

### Calibration System

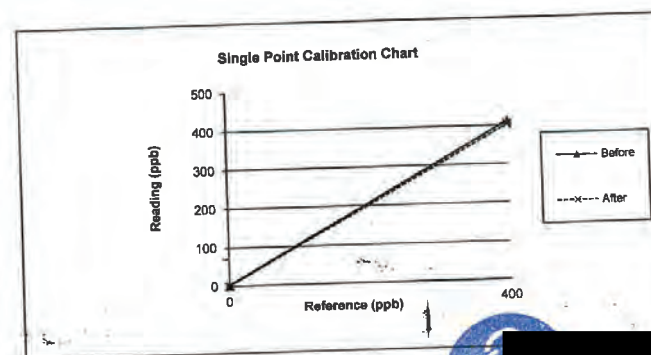
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 25.2 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.4	1.4	400.0	410.1	1.2
After	0.0	0.6	0.6	400.0	402.6	0.3



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## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S66089004

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Sep-23				
Time	8:30				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	≤ 0.2	PPB	0.4	0.2	
Sample Flow	650 (+/- 50)	cc/min	666	662	
PMT Detector	0 - 5000	mV	24.3	28.2	
Norm PMT Detector	0 - 5000	mV	31.4	34.3	
HVPS	400-900 constant	V	725	725	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreagee C	50	50	
BOX TEMP	20-40	Dreagee C	32.6	35.1	
PMT TEMP	7 (+/- 1)	Dreagee C	8.3	8.3	
UV lamp	1000-1900	mV	3251	3251	
Lamp Ratio	30-120	%	87.4	87.4	
STR. Light (Zero Gas)	≤ 100	PPB	38.5	38.5	
Dark PMT	(-50) - (+200)	mV	27.6	27.6	
Dark lamp	(-50) - (+200)	mV	3.6	3.6	
SAMP PRES	20-30 constant	IN-Hg-A	26.9	27.3	
<b>Electric Test/Optic Test</b>					
PMT Volts	2000 (+/- 500)	mV	2010	2006	
SO2 Conc	1000 (+/- 250)	PPB	1005	1003	
SO2 Slope	1 (+/- 0.3)	-	1.054	1.053	
SO2 Offset	≤ 250	mV	94.7	90.4	
Stability at Zero	≤ 0.2	PPB	0.1	0.1	
Stability at Span	≤ 2 ppb @ 400 ppb	PPB	0.4	0.2	
<b>Gas Test Response</b>					
Zero Gas (0.00 PPB)	0	ppb	1.4	0.6	± 5% of Range
Span Gas (400 PPB)	400	ppb	410.1	402.6	

Calibrate By:

Date:

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## CO Analyzer Verification Test Report

Calibration Report No.: ES-C6609003

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA., France S/N: ECOESACO12E203
--	--

### Calibration System

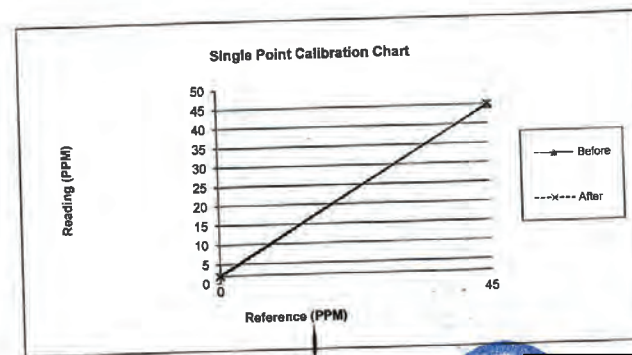
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.7 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.096	2.1	45.0	44.89	-0.1
After	0.0	1.783	1.8	45.0	45.00	0.0



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## CO Analyzer Verification Test Report

Calibration Report No.: ES-C6609003

Calibrated Date: 1-Sep-23

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Analyzer Signal Values					
Date	1-Sep-23	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By :

Date: 1-Sep-23

Date: 1-Sep-23

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## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609006

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer API S/N: ENOAI200E03407
---	---

### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 24.3 °C

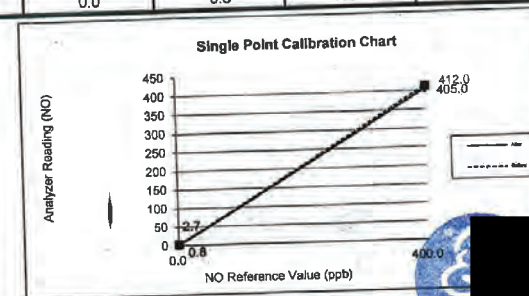
Humidity: 50 %RH

### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.8	0.0	1.8	408.0	400.0	1.0
NO <sub>2</sub>	0.9	0.0	0.9	4.0	0.0	0.5
NOx	2.7	0.0	2.7	412.0	400.0	1.5

### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	403.0	400.0	0.4
NO <sub>2</sub>	0.4	0.0	0.4	2.0	0.0	0.2
NOx	0.8	0.0	0.8	405.0	400.0	0.6



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## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6609006

Calibrated Date: 1-Sep-23

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Sep-23				
Time	10:10				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	≤ 0.2	PPB	0.5	0.2	
Sample Flow	500±/- 50	cc/min	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	819	819	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50±/- 1	Dreagee C	50	50	
BOX TEMP	20-35	Dreagee C	33.7	32.9	
PMT TEMP	7 ±/-1	Dreagee C	7.1	7.1	
IZS TEMP	50±/- 4	Dreagee C	-	-	
MOLY Temp	315 ±/- 5	Dreagee C	314.4	315.0	
RCEL PRES	4-10 constant	IN-Hg-A	10	10	
SAMP PRES	20-30 constant	IN-Hg-A	29.0	29.4	
NO Slope	1 +/- 0.3		0.820	0.801	
Nox Slope	1 +/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
<b>Span and Cal Values</b>					
Zero Value	NO	0	ppb	1.8	0.4
	NOx	0	ppb	2.7	0.8
Span Value	NO	400	ppb	408.0	403.0
	NOx	400	ppb	412.0	405.0

Calibrate By:

Date: 1-Sep-23

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## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6609002

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10003031
--	---

### Calibration System

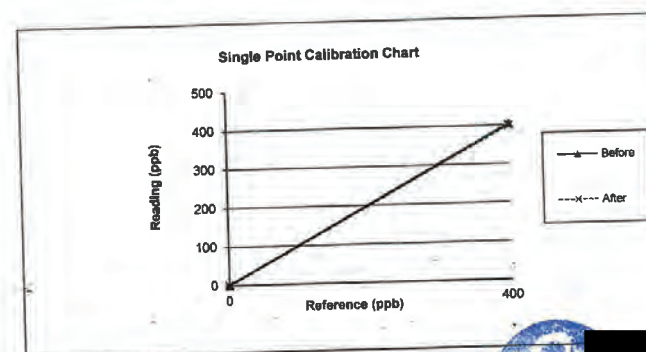
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 25.3 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.0	1.0	400.0	403.0	0.4
After	0.0	0.3	0.3	400.0	400.0	0.0



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## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6609002

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Sep-23				
Time	15:20				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	637	620	
PMT Detector	0 - 5000	mV	24.2	24.2	
Norm PMT Detector	0 - 5000	mV	19.3	40.5	
HVPS	400-900 constant	V	632	630	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Degree C	50	50	
BOX TEMP	20-40	Degree C	35.4	36.0	
PMT TEMP	7 (+/-1)	Degree C	8.5	8.0	
UV lamp	1000-4900	mV	2900	2900	
Lamp Ratio	30-120	%	82.9	82.9	
STR. Light (Zero Gas)	<100	PPB	25.4	25.4	
Dark PMT	(-50) - (+200)	mV	12.5	12.5	
Dark lamp	(-50) - (+200)	mV	1.5	1.5	
SAMP PRES	20-30 constant	IN-Hg-A	27.8	28.3	
<b>Electric Test/Optic Test</b>					
PMT Volts	2000 (+/- 500)	mV	2010	2022	
SO2 Conc	1000 (+/- 250)	PPB	1005	1011	
SO2 Slope	1 (+/- 0.3)	-	1.040	0.824	
SO2 Offset	< 250	mV	51.9	145.5	
Stability at Zero	< 0.2	PPB	0.2	0.6	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
<b>Gas Test Response</b>					
Zero Gas (0.00 PPB)	0	ppb	1.0	0.3	
Span Gas (400 PPB)	400	ppb	403.0	400.0	± 5% of Range

Calibrate By:

Date:

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## CO Analyzer Verification Test Report

Calibration Report No.: ES-C6609004

Calibrated Date: 1-Sep-23

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### Instruments Information

Analyzer Type: CO Analyzer  
Model: CO12E

Manufacturer: Environnement SA, France  
S/N: ECOESACO12E204

### Calibration System

Calibrator Unit  
Dilutor Model: ESA MGC101  
S/N: 792  
ZERO AIR Generator: ZAG7001  
S/N: 644

Standard Gas  
NO Conc: 44.68 PPM  
SO2 Conc: 45.34 PPM  
CO Conc: 4500 PPM  
Expire Date: Feb 19, 2024 EB0140762

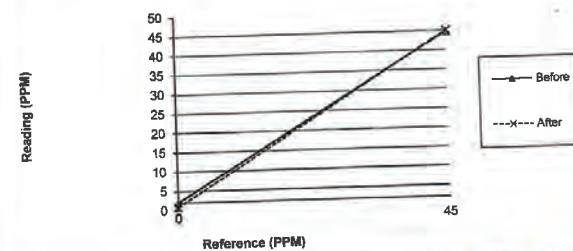
Environment: Temperature: 24.7 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.001	2.0	45.0	44.78	-0.2
After	0.0	0.861	0.9	45.0	45.02	0.0

Single Point Calibration Chart



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## CO Analyzer Verification Test Report

Calibration Report No.: ES-C6609004

Calibrated Date: 1-Sep-23

☒ PM ☐ Onsite

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Analyzer Signal Values					
Date	1-Sep-23	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By:

Date: 1-Sep-23

Date: 1-Sep-23

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## Verification Report of Ambient Air Sampling

☒ PM ☐ Onsite UTM:

Report No: 6609004

Instrument: PM-2.5 Sampler SINGLE

Validation Date: 1-Sep-23

Manufacturer: Tisch Environmental

Model: TE-Wilbur 2.5

Serial/ID No.: EP2TIWILBU0451

Environment:

Humidity(%RH): 60 Temperature (°C): 26.2 Pressure (mmHg): 745

Reference Standard:

Temperature Calibrator: DIGICON, model: CC-VTR-SH, Serial No.091109269

Flow Calibrator: Mesalabs Defender, model: 520-H, Serial No.164578

Leak Test: Pass

Diagnostic Check:

PM-10 Inlet	PM-2.5 Size Selective	Filter Cassette	Fan	Valve	Pump %
Pass	Pass	Pass	Pass	Pass	Pass

Result of Instrument Validation:

Calibrator Simulator					Temperature Measurement	
Temperature Audit and Adjust with Calibrator (°C)					Instrument	Reference
Set point	-10.0	0.0	20.0	45.0	Reading (Avg.)	TC Reading
ambient	-10.0	0.0	20.0	45.0	25.0	24.9
Filter	-10.0	0.0	20.0	45.0	29.6	29.5

Flow Control:

Calibration mode: AMB Flow Device

Flow set: 16.67 LPM

Avg. Pressure at Ref.: 746 mmHg.

Flow Measure (Avg.)	Flow Calibrator (Avg.10)	Flow Difference
16.67 LPM	16.70 LPM	-0.03 LPM

Engineer:

Issu Date: 1-Sep-23

Date: 1-Sep-23

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0381 MTC No. EEL. BP. 70/0366

## CALIBRATION CERTIFICATE

Submitted by : Envilab Co., Ltd.  
Address : 540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok 10160.  
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,  
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :  
Description : Sound Level Calibrator  
Manufacturer : Bruel & Kjaer  
Model : 4230  
Serial No. : 1351075

Ambient Environment  
Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.  
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.  
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.  
4. Digital Multimeter Agilent 34401A S/N MY44005560.  
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.  
6. Audio Analyzer Keithley 2015-P S/N 4106495.  
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Mar. 2023

Date of Calibration : 16 Mar. 2023

The results relate only to the items tested/calibrated or value assigned.  
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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
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Office  
196 Prachin  
Thailand  
Tel. (66)  
Fax. (66)  
E-mail :  
Envilab Co., Ltd.



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0381 MTC No. EEL. BP. 70/0366

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

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

Acoustic Output in dB re 20 $\mu\text{Pa}$ , Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$  and 50 %RH

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.78	-0.22	$\pm 0.10$	$\pm 0.40 \text{ dB}$

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.0	-1.0	$\pm 1.5$	$\pm 1.0\%$

### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.05	$\pm 0.50$	$\pm 3.0\%$

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

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 2011266031401056001

End of Certificate

2 / 2

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

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

Office  
196 Prachin  
Thailand  
Tel. (66)  
Fax. (66)  
E-mail :  
Envilab Co., Ltd.

FM.BLMTC.002 Rev.4

# CERTIFICATE OF CALIBRATION

ISSUED BY Pulsar Instruments Plc  
DATE OF ISSUE 22 February 2023 CERTIFICATE NUMBER 187971



Pulsar Instruments Plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

## Sound Level Meter : IEC 61672-3:2013

### Instrument Information

Manufacturer: Pulsar Instruments Plc Notes:  
Model: Model 45  
Serial number: PP0024  
Class: 1  
Firmware version: 2.6.0.328

### Test summary

Date of calibration: 21 February 2023  
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.  
The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

### Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.



# CERTIFICATE OF CALIBRATION

Certificate Number:  
187971  
Page 2 of 2

### Environmental conditions

The following conditions were recorded at the time of the test:  
Before Pressure: 100.79 kPa Temperature: 22.4 °C Humidity: 44 %  
After Pressure: 100.75 kPa Temperature: 22.5 °C Humidity: 44.6 %

### Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TG4001	327881
Attenuator	Cirrus Research	ZE:952	93467
Environmental Monitor	Comet	T7510	16986334

### Additional instrument information

Instruction manual:  
Reference level range: Single range  
Pattern approval: No  
Source of pattern approval: -  
Preamplifier  
Model: PA40  
Serial number: 2380  
Microphone  
Model: PM1  
Serial number: 012381D

### Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies





# CERTIFICATE OF CALIBRATION

ISSUED BY Pulsar Instruments Plc

DATE OF ISSUE 22 February 2023 CERTIFICATE NUMBER 187975



Pulsar Instruments Plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

## Sound Level Meter : IEC 61672-3:2013

### Instrument information

Manufacturer: Pulsar Instruments Plc  
Model: Model 45  
Serial number: PP0013  
Class: 1  
Firmware version: 2.6.0.328

Notes:

### Test summary

Date of calibration: 21 February 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

### Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%.



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# CERTIFICATE OF CALIBRATION

Certificate Number:

187975

Page 2 of 2

### Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 100.82 kPa Temperature: 22.3 °C Humidity: 44 %  
After Pressure: 100.80 kPa Temperature: 22.4 °C Humidity: 44 %

### Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TG4001	327881
Attenuator	Cirrus Research	ZE:952	93467
Environmental Monitor	Comet	T7510	16968334

### Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

### Preamplifier

Model: PA40

Serial number: 2409

### Microphone

Model: PM1

Serial number: 012396D

### Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies



Envilab Co., Ltd.

## CERTIFICATE OF CALIBRATION

ISSUED BY **Pulsar Instruments Plc**  
DATE OF ISSUE **22 February 2023** CERTIFICATE NUMBER **187986**



Pulsar Instruments Plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

### Microphone

#### Microphone capsule

Manufacturer: Pulsar Instruments  
Model: PM1  
Serial Number: 012396D

#### Calibration procedure

Date of calibration: 21 February 2023  
Open circuit: 46.5 mV/Pa  
Sensitivity at 1 kHz: -26.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

#### Environmental conditions

Pressure: 100.80 kPa  
Temperature: 23.0 °C  
Humidity: 36.0 %



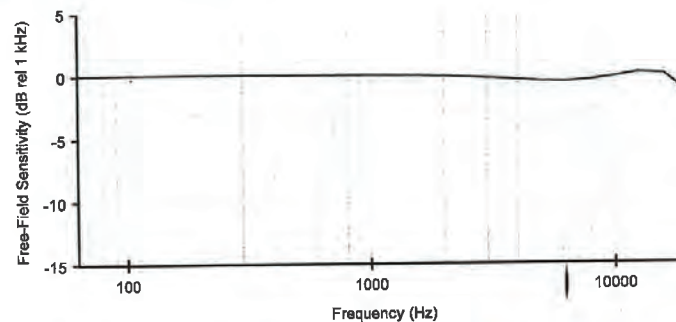
## CERTIFICATE OF CALIBRATION

Certificate Number:  
**187986**  
Page 2 of 2

#### Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.04	-0.21
80	0.06	-0.09
100	0.07	-0.02
125	0.07	0.02
160	0.07	0.05
200	0.06	0.06
250	0.05	0.05
315	0.08	0.06
400	0.06	0.06
500	0.05	0.05
630	0.04	0.03
800	0.02	0.01
1 000	0.00	-0.03
1 250	-0.03	-0.07
1 600	-0.05	-0.17
2 000	-0.10	-0.30
2 500	-0.17	-0.48
3 150	-0.28	-0.78
4 000	-0.39	-1.21
5 000	-0.52	-1.77
6 300	-0.56	-2.52
8 000	-0.45	-3.53
10 000	-0.21	-4.91
12 500	0.11	-6.40
16 000	0.00	-7.96
20 000	-1.43	-10.49

#### Free-Field Frequency Response : Graphical





## CERTIFICATE OF CALIBRATION

ISSUED BY Pulsar Instruments Plc

DATE OF ISSUE 29 June 2023

CERTIFICATE NUMBER 194457



Pulsar Instruments Plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

### Sound Level Meter : IEC 61672-3:2013

#### Instrument Information

Manufacturer: Pulsar Instruments Plc  
Model: Model 45  
Serial number: PP0015  
Class: 1  
Firmware version: 2.6.0.328

Notes:

#### Test summary

Date of calibration: 28 June 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.  
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%.



EnviLab Co., Ltd.

## CERTIFICATE OF CALIBRATION

ISSUED BY Pulsar Instruments Plc

DATE OF ISSUE 22 June 2023

CERTIFICATE NUMBER 194461



Pulsar Instruments Plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

### Microphone

#### Microphone capsule

Manufacturer: Pulsar Instruments

Model: PM1

Serial Number: 012382D

#### Calibration procedure

Date of calibration: 22 June 2023

Open circuit: 49.5 mV/Pa

Sensitivity at 1 kHz: -26.1 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

#### Environmental conditions

Pressure: 101.20 kPa

Temperature: 21.0 °C

Humidity: 55.0 %



EnviLab Co., Ltd.



## Service Report

Instrument Manufacturer: Pulsar Instruments Plc  
Job Reference Number: 84203  
Instrument Type: Model 45  
Serial Number: PP0015

Customer Name: Neediss Supply Instrument Co., Ltd.  
Customer Address: 536, Soi Bangkhao 7  
Bangkhao  
Thailand  
10160

Issue	Action	Result	Engineer
Cannot turn on this meter using USB cable or batteries.	Meter was partially powering on but cf card had been corrupted causing the meter to crash. Reformatted the cf card. Powers up ok now	Recal ok tag	Terry Goodrich

Engineer

Date:

We hope that you are satisfied with the service you have received from Pulsar Instruments plc.  
If you have any concerns, would like further information or have any feedback do not hesitate to contact us.

Pulsar Instrument Plc, Acoustic House, Bridlington Road, Hunmanby, YO14 0PH  
Telephone: +44 (0) 1723 518011 Fax: +44 (0) 1723 518043  
Email: sales@pulsarinstruments.com



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## Calibration Certificate

Issued by : Calibration & Test Section Meteorological Instruments Bureau

Date of Issue 21 February, 2023

Certification No. 065/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130150 ID No. : EWSDCMS1200150

Customer : Envilab Co., Ltd. (Head Office)  
540.540/1 Soi Bangkhao 7, Bangkhao, Bangkok  
Bangkok 10160, Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.918802

: Model 120629586 Vehicle Type 120629586 No. 120629586





## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 065/23

21 February, 2023

Serial No. 1224

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	m/sec	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	10.9	0.11
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calibrated by  
M



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor Presure Model TPH-1 C

Serial No. 6275

Certification No. 065/23

21 February, 2023

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1015.44	1013.8	1.64
1012.89	1011.2	1.69
1012.60	1010.9	1.70
1012.46	1010.8	1.66
1011.79	1010.2	1.59
1011.30	1009.7	1.60
1009.87	1008.3	1.57
1009.66	1008.1	1.56
1009.40	1007.8	1.60
1008.71	1007.2	1.51
1009.00	1007.4	1.60
1009.28	1007.7	1.58
1009.94	1008.3	1.64
1010.66	1009.0	1.66
1011.21	1009.5	1.71
1013.01	1011.1	1.91
1013.40	1011.7	1.70
1012.91	1011.2	1.71
1012.44	1010.8	1.64
1008.09	1006.5	1.59



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

### The Result of Calibration

Sensor Temperature Model TPH-1 C Certification No. 065/23

21 February, 2023

Serial No. 6275

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45.3	-0.2
30.2	30.3	-0.1
15.6	15.7	-0.1



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

### The Result of Calibration

Sensor Humidity Model TPH-1 C Certification No. 065/23

21 February, 2023

Serial No. 6275

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
88.5	80.5	8.0
61.4	57.8	3.6
41.2	38.8	2.4





Date of Issue 21 February, 2023

Certification No. 065/23

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis แบบ TIPPING BUCKET Model 7342.026 ID No.EWSDCMS1200150 ทำการสอบเทียบกับแก้วฝนแบบแก้วดวง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ ( 0.2 mm./TIP)



วิศวกรชำนาญการ



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 2 September, 2022

Certification No. 314/22

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2507

Customer : Envilab Co.,Ltd.(Head Office)  
540.540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae  
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor model

EWSNV110WS2507

Certification No. 314/22

2 September, 2022

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.1	-0.09
13.01	-	-	-	13.2	-0.19
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.2	-0.18
20.02	-	-	-	20.5	-0.48

#### Wind Aloft Plotting Board.

US.DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor model

EWSNV110WS2507

Certification No. 314/22

2 September, 2022

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1010.31	1009.89	0.42
1010.60	1010.16	0.44
1010.38	1009.89	0.49
1010.23	1009.63	0.60
1009.93	1009.34	0.59
1009.66	1009.09	0.57
1009.41	1009.09	0.32
1009.13	1008.83	0.30
1008.96	1008.56	0.40
1008.58	1008.29	0.29
1008.25	1008.03	0.22
1007.57	1007.23	0.34
1007.27	1006.96	0.31
1007.04	1006.70	0.34
1006.63	1006.43	0.20
1010.02	1009.63	0.39
1008.77	1008.29	0.48
1008.67	1008.03	0.64
1007.63	1007.50	0.13
1007.40	1007.23	0.17

Average

Mechanical Engineer





## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor model EWSNV110WS2507 Certification No. 314/22

2 September, 2022

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.4	0.1
30.5	30.4	0.1
15.2	15.2	0.0

Calibrat



Mechanical Engineer



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### The Result of Calibration

Sensor model EWSNV110WS2507 Certification No. 314/22

2 September, 2022

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.6	83.4	2.2
60.4	60.0	0.4
42.3	43.4	-1.1

Calibrat



Mechanical Engineer



Envilab Co., Ltd.





Date of Issue 2 September, 2022

Certification No. 314/22

Page : 6 of 6

### ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis แบบ TIPPING BUCKET Model 7342.026 ID No.EWSNV110WS2507 ทำการสอบเทียบกับแก้วฝนแบบแก้ว ตวง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องวัด (0.2 mm/ TIP)



วิศวกรชำนาญการ



ผู้จัดการฝ่ายควบคุมคุณภาพ

**THAI METEOROLOGICAL DEPARTMENT**  
4353 Sukhumvit, Bangna, Bangkok 10260 Tel.081-454-2804,0-2399-0469  
**Calibration Certificate**

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 21 February, 2023

Certification No. 068/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2501

Customer : ENVILAB Co.,Ltd. (Head Office)  
540, 540/1 Soi Bangkhuae 7, Bangkhuae,  
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

: Ultrasonic Anemometer N.I.S.T. Test Reference Number 731/241460

Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.918802

STANDARD THERMOMETER

ometer Vaisala Type W220015

(Authorised Signatory)

Mechanical Engineer





# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 068/23

21 February, 2023 Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inch H <sub>2</sub> O	inch H <sub>2</sub> O	m/sec	m/sec	m/sec
1.00	-	-	-	0.3	0.70
3.02	-	-	-	2.5	0.52
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.8	0.21
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	21.0	-0.98

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calib

Mechanical Engineer



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2501

Certification No. 068/23

Page : 3 of 6

21 February, 2023

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1015.44	1015.32	0.12
1012.89	1013.30	-0.41
1012.60	1012.71	-0.11
1012.46	1012.41	0.05
1011.79	1011.81	-0.02
1011.30	1011.21	0.09
1009.87	1009.71	0.16
1009.66	1009.42	0.24
1009.40	1009.12	0.28
1008.71	1008.52	0.19
1009.00	1008.82	0.18
1009.28	1009.12	0.16
1009.94	1009.71	0.23
1010.66	1010.61	0.05
1011.21	1011.21	0.00
1013.01	1013.60	-0.59
1013.40	1013.90	-0.50
1012.91	1013.30	-0.39
1012.44	1012.70	-0.26
1008.09	1007.92	0.17

Average

Calib

Mechanical Engineer



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ





# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 068/23

21 February, 2023

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	44.8	0.3
30.2	30.1	0.1
15.6	15.5	0.1



Mechanical Engineer



รับรองสำเนาถูกต้อง  
ผู้จัดการฝ่ายควบคุมคุณภาพ



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 068/23

21 February, 2023

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
88.5	85.3	3.2
61.4	58.5	2.9
41.2	39.4	1.8

Calibration



Mechanical Engineer



ผู้จัดการฝ่ายควบคุมคุณภาพ



Date of Issue 21 February, 2023

Certification No. 068/23

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชีพ้อ Davis แบบ TIPPING BUCKET  
ID No.EWSNV110WS2501 ทำการสอบเทียบกับแก้วฝนแบบแก้วดวง GAUGE  
DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No 71082 และ  
สามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ ( 0.2 mm / TIP )



วิศวกรชำนาญการ



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 21 February, 2023

Certification No. 069/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2503

Customer : ENVILAB Co.,Ltd. (Head Office)  
540, 540/1 Soi Bangkhuae 7, Bangkhuae,  
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.918802

ometer Vaisala type PTB220 No. 120015

Mechanical Engineer



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

### The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 069/23

21 February, 2023

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	m/sec	inches H <sub>2</sub> O	inches H <sub>2</sub> O	m/sec	m/sec
1.00				0.4	0.60
3.02				2.8	0.22
5.00				4.5	0.50
7.04				7.0	0.04
9.02				9.0	0.02
11.01				11.0	0.01
13.01				12.8	0.21
15.01				14.8	0.21
17.02				16.8	0.22
20.02				20.3	-0.28

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated

Mechanical Engineer



## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

### The Result of Calibration

Sensor model EWSNV110WS2503

Certification No. 069/23

21 February, 2023

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1015.44	1015.91	-0.47
1012.89	1013.72	-0.83
1012.60	1013.45	-0.85
1012.46	1013.11	-0.65
1011.79	1012.63	-0.84
1011.30	1012.09	-0.79
1009.87	1010.71	-0.84
1009.66	1010.44	-0.78
1009.40	1010.16	-0.76
1008.71	1009.89	-1.18
1009.00	1010.16	-1.16
1009.28	1010.44	-1.16
1009.94	1010.71	-0.77
1010.66	1011.53	-0.87
1011.21	1011.81	-0.60
1013.01	1013.45	-0.44
1013.40	1014.27	-0.87
1012.91	1013.45	-0.54
1012.44	1013.17	-0.73
1008.09	1009.34	-1.25

Average

Calibrated

Mechanical Engineer



ภาคผนวก 3-16-2

37/76



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 069/23

21 February, 2023

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.1	0.4
30.2	30.1	0.1
15.4	15.6	-0.2

Ca

Mechanical Engineer



ผู้จัดการฝ่ายควบคุมคุณภาพ



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 069/23

21 February, 2023

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
83.5	79.5	4.0
62.4	59.9	2.5
42.5	41.2	1.3

Calibra

Mechanical Engineer



ผู้จัดการฝ่ายควบคุมคุณภาพ





Date of Issue 21 February, 2023

Certification No. 069/23

Page : 6 of 6

## ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis แบบ TIPPING BUCKET  
ID No.EWSNV110WS2503 ทำการสอบเทียบกับแก้วฝนแบบแก้วดวง GAUGE  
DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No 71082 และ  
สามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ ( 0.2 มม.)



วิศวกรชำนาญการ



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-420026-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.  
540,540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : pH Meter with electrode  
pH meter  
Manufacturer : Horiba Model : F-74BW-G  
Range : N/A pH Resolution : 0.001 pH  
Serial No. : B41J0001 ID No. : ELABPHHB74BW01  
Electrode  
Model : 9615S Serial No. : 9X1K0003

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.  
Ambient Temperature : (23.8 to 24.8) °C  
Relative Humidity : (54 to 57) %

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 24 March 2023

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator  
and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61270213	879344	13 Mar 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	879345	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	879346	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-P0031-03

Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ





## Certificate of Calibration

Certificate No. : 66-420026-1

Page : 2 of 2

### Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement  
pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage ( mV )	Nominal Value ( pH )	UUC Reading		Correction ( mV )	Uncertainty ( ± mV )
			( pH )	( mV )		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.6	0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer ( pH )	UUC Reading ( pH )	Correction ( pH )	Uncertainty ( ± pH )
4, 7, 10	4.008	4.006	0.002	0.0084
	6.986	7.000	-0.014	0.0094
	10.010	10.008	0.002	0.014

### Remark

UUC : Unit Under Calibration

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

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

- o o -

## Certificate of Calibration

Certificate No. : 66-400477-1

Page : 1 of 2

Submitted by :

Envilab Co.,Ltd.

540 , 540/1 Soi Bangkhac 7, Bangkhac ,Bangkok 10160

Equipment :

Water Bath

Manufacturer : LAUDA

Model : A 24

Range : N/A °C

Resolution : 0.1 °C

Serial No. : CN21001882

ID No. : ELABWBALPHA241

Environment :

On site calibration was carried out at the Laboratory,ENVILAB CO.LTD

Ambient Temperature : (22.5 to 23.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (228.0 to 230.1) V

Date of Received : 25 August 2023

Date of Calibration : 25 August 2023

Date of Issue : 25 August 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80  
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400024

66-400184-2

06 Oct 2023

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL-P0031-03

ภาคผนวก 3-16-2

40/76

CAL-P0031-03



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Approv



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## Certificate of Calibration

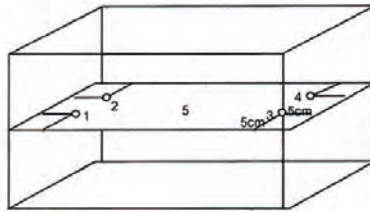
Certificate No. : 66-400477-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			1	2	3	4	5			
44.5	44.5	44.5	44.52	44.50	44.50	44.50	44.50	0.18	0.06	0.01

**Remark** The uncertainty is not combine uniformity of the water bath

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

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

- oOo -



EnviLab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL-F00331-03



## PinAacle 900F Preventive Maintenance Report

PinAacle 900F Preventive Maintenance (PM)									
Company Name:	ENVILAB COLLTD								
Address (Instrument Location):	540-540/1, SOI BANGKHAE 7, BANGKHAE, BANGKOK, 10160,								
Serial Number:	PFB520011403			PM Number:		3/4			
Customer Name (If applicable):	K. JENJIRA			Telephone Number:		095-550-0510			
Customer Support (If applicable):	K. DUANG			Service Order Number:					
Engineer Name:	Oct 5, 2023			Next PM Due Date:		Apr 5, 2024			
Date PM Performed: (to include PM)				Standard Labor Hours to Complete PM :		5 hours			

Part Number	Revision	Publication Date
03370345	Rev.9	January 2018

**Scope**  
The purpose of this PM is to ensure the continued functionality of the PinAacle 900F by inspecting and verifying the instrument's condition and performance. This service should only be performed by a trained representative of PerkinElmer.  
The customer should save their method before the PM begins.

#### General Information

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.  
Always check with the customer before making any changes that may affect the customer's analysis or calibration.  
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.  
Update the PM sticker and instrument logbook as required.

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Company Name: ENVILAB CO.,LTD

Instrument Location: 540-540/1, SOI BANGKHAE 7, BANGKHAE

K. 10160,

Serial No.: PFB520011403

05-Oct-2023

PinAacle 900F Preventive Maintenance Report (PM)

Page 1 of 7

## Component List

Component / Specific Model	Serial #	Configuration Notes

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
89551696	Fan Filters	N/A
N3160135	O-Ring kit for Sampling Introduction (Stainless Steel Nebulizer)	N/A
N3160137	O-Ring Kit for Sampling Introduction (Plastic Nebulizer)	N/A
N3301714	Replacement Acrylonitrile Fiber Cartridge	N/A
T000022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Expiry Date (month)
89900188	1000 mg/L Copper Standards	AR	27-06-2024

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Expiry Date (month)
N/A	DI Water	250 mL	AR
	0.5% HNO <sub>3</sub>	250 mL	AR

Pre-Audit 900P Preventive Maintenance Report (PM)

Page 5 of 7

## Procedure Checklist

Use (\*) to check off those steps in the checklist that have been completed.

- General:
    - ✓ Review the instrument performance with the customer and document any recent problems.
    - ✓ Inspect the customer log book and make any appropriate PM entries.
    - ✓ Perform general inspection of system for cleanliness.
  - PC Instrument Software:
    - ✓ Instrument Software user files/databases archived, backed, and/or deleted as needed.
  - Mechanical:
    - ✓ Inspect and clean all fans and filters. Replace filters if necessary
    - ✓ Inspect all gas lines for leaks and/or wear. Replace if needed.
    - ✓ Clean exterior of the instrument.
    - ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
    - ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking cloth width.
    - ✓ Replace if out of specification
    - ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
    - ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
    - ✓ Visually check for proper flame conditions when lighting the Air-C2H4 and N2O-C2H2 flames (if applicable).
  - Electrical:
    - ✓ Inspect PC boards. Clean if necessary.
    - ✓ Check/replace all internal and external cable connections.
    - ✓ Check instrument firmware revisions upgrade to current levels (if necessary)
    - ✓ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer 3M Log Viewer.
  - Optics:
    - ✓ Inspect and clean the sample compartment windows, if needed.
    - ✓ Inspect optics. Clean or replace if necessary.
- cc:   
 Verify that the Gases supplied to the instrument are within the pressure and purity specifications of the instrument. Verify that the instrument is properly calibrated. Verify that the dryflow filling and all filter elements is dry. Replace if necessary.

Pre-Audit 900P Preventive Maintenance Report (PM)

Page 4 of 7

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MGO-252
N1013002	0.0A Neutral density filter	1	MGO-358
33030937	System 2 ECL Driver	1	03032997
N3505605	AS System 2 ECL	1	16148
N3505721	Co Lumina HCL	1	092216-010730
N3505709	R8 Lumina HCL	1	102416-940760
N3505739	X Lumina HCL	1	110716-010660
N3505832	N Lumina HCL	1	100516-030190

Pre-Audit 900P Preventive Maintenance Report (PM)

Page 3 of 7

## 7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Burner Sensor	Air/C <sub>2</sub> H <sub>4</sub> flame correctly shut down	Active	Passed
Dry Gas Sensor	Air/C <sub>2</sub> H <sub>4</sub> flame correctly shut down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>4</sub> flame correctly shut down	Active	Passed
Co Pressure Sensor	Air/C <sub>2</sub> H <sub>4</sub> flame correctly shut down	Active	Passed
R Pressure Sensor	Air/C <sub>2</sub> H <sub>4</sub> flame correctly shut down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shut down	Active	Passed

## 8. After PM Performance tests:

## 8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Confidence Index at 553.8 nm (nm)	Test Results	Pass/Fail
1.0 A NO Filter	± 5% High Cert	0.9798	0.9915	Passed
0.2 A NO Filter	± 5% from Cert	0.2042	0.2037	Passed

## 8.2 Baseline Noise of 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0014	Passed

## 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.002	0.0004	Passed

Pre-Audit 900P Preventive Maintenance Report (PM)

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8.4 D<sub>2</sub> Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤0.020	0.0091	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Passed

8.6 AA-66 Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0025	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 µg/L Sensitivity (5 µg/L if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity (2 mg/L if applicable)	> 0.250 Abs.	0.3421	Passed

Review:  
I have reviewed with the customer PM work performed.  
I have reviewed with the customer routine maintenance procedures.  
I have reviewed with the customer recommended customer supplied materials to have on hand in PM sticker.



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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and / applicable performance tests for theAAbs 900F have been completed.

This PM/AAbs 900F: ☒ Passed ☐ Failed ☐ the preventive maintenance.

Review of Preventive Maintenance:	Date:
Authorized PerkinElmer Representative:	05-Oct-2023 (20:00:00:0000)
Authorized Customer Representative:	11-Oct-23 (00:00:00:0000)

Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)					
Company Name:	ENVILAB CO.,LTD				
Address (Instrument Location):	640-6401, SOI BANGKHAE 7, BANGKHAE, BANGKOK, 10160,				
Room Number:	-				
Asset Number (if applicable):	-				
Service Engineer Name:	K DUANG	Customer System ID:	KJENJIRA		
Date PM Performed: (yy-mm-dd)	05-Oct-2023	Service Order Number:	-		
		Next PM Due Date: (yy-mm-dd)	05-Apr-2024		

Part Number	Release	Publication Date	PerkinElmer
09373005	C	January 2013	

Scope  
The purpose of this PM is to ensure the continued functionality of the Atomic Absorption/FIAS 100/400 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained PerkinElmer service technician. The PM sticker should only be used if the customer should save their method before the PM begins.

General Instructions:  
The customer should save their method before making any changes that may affect the customer's analysis or calibration.  
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.  
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes

Parts Lists

Parts Included with the PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot #
9050-2705	Fan Filter	1	

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot #
	Digital Volt Meter	1	
Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot #



Use (✓) to check off those steps in the checklist that have been completed.

Use (✓) to check off those steps in the checklist that have been completed.

1. **General:**  
☒ Review the instrument performance with the customer and document any recent problems.

Is the Working Environment Acceptable? If not, document.

1

Visual Damage (If yes, describe)

Visual

- ☒ Check incoming AC line voltage for proper levels and grounding.
- ☒ Verify voltage switch on back of instrument is correct.
- ☒ Perform general inspection of system for cleanliness. Clean if needed.
- ☒ Gas supply cylinders secured, lines leak checked and argon or nitrogen supply pressure verified (45 – 58 psig).
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Fan checked and filter cleaned.
- ☒ Heating mantle or Universal Cell Holder checked.

2. Instrument components
- ☒ Non-return valve checked/repaired/replaced if needed (B019 8111). Clean the valve if there is any liquid in it. Replace the rubber sleeve (B013 5123) if it is worn. Check the flow meter for any signs of fluid in it. Clean the flow meter if needed.

- ✓ Verify condition of pump pressure adjustment levers (B050 7794 - look for cracks or problems with the springs), pump rollers (B300 0251 check for wear), and thumb screws (B050 7796).
- ✓ Check the Multiport valve for proper switching, flow, and insure there are no leaks. Clean valve parts and replace o-rings if needed (large o-ring: B050 1250, small o-ring: B004 5055). Use a squirt bottle & fishing line to try to dislodge clogs.
- ✓ Firmware Version checked. Latest is 2.20.

### Mixing/Separation Assembly & Pump Tubing:

- ☒ Mixing separator assembly checked
- ☒ Filter/membrane checked (R050 8306)
- ☒ Condition of the pump tubing (replace if necessary), correct pump tubing for the solutions being run. Make sure the correct magazines are being used. R050 7791 for 0.13 - 1.80 mm tubing; R050 7792 for 1.60 - 3.18 mm tubing.

Additional Comments Regarding this PIR

## Document History

Revision	Description of Change	Page(s)	Date
A	First release		May 2008
B	Addition of Batch/Lot Number, Expiration Date, and Report Fields	2,7	February 2009
C	Update to new format	All	January 2013

## Review

**The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.**

**This FIAS 100/400 Passes ☒ Fails ☐ the preventive maintenance.**

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Authorized PerkinElmer Representative:	2	Date:
--	---	-------

0530

	Authorized Customer Representative:	Date:
--	-------------------------------------	-------

Authorized Customer Representative: \_\_\_\_\_ Date: \_\_\_\_\_

192497 05-Oct-2022

656789  
1234567890



PerkinElmer TruQ

PerkinElmer Number: N9300183  
 Element and Matrix: 100 µg/L Copper in 2% HNO<sub>3</sub>  
 Starting Material: 062201C  
 Starting Material Lot No.:  
 Density: 1.917 g/mL @ 20°C

Lot No: 26-87CUV1  
 Certification Date: JUL -- 2022  
 Expiration Date: JAN 3 0 2024

## Trace Metallic Impurities in the Actual Solution via ICP-MS Analysis:

Element	µg/mL	Element	µg/mL	Element	µg/mL
Ag	0.002	Dy	<0.001	Li	<0.001
Al	<0.001	Er	<0.001	Mg	<0.001
Au	<0.002	Eu	<0.001	Mn	0.002
B	<0.002	Fe	<0.001	Rh	<0.001
Br	<0.001	Ca	<0.001	Ru	<0.001
Ba	<0.001	Ce	<0.001	Sb	<0.001
Bi	<0.001	Cl	<0.001	Se	<0.001
Bo	<0.001	Cr	<0.001	Si	<0.001
Ca	<0.001	Hf	<0.001	Sn	<0.001
Cd	<0.001	Hg	<0.001	Sr	<0.001
Co	<0.001	In	<0.001	Ta	<0.001
Cu	<0.001	K	<0.001	Te	<0.001
Cr	<0.001	La	<0.001	Th	<0.001
				Ti	<0.001
				Tm	<0.001
				U	<0.001
				V	<0.001
				W	<0.001
				Xe	<0.001
				Y	<0.001
				Zn	<0.001
				Zr	<0.001

## Traceability Documentation for Solution Standard:

1001 µg/mL 5.0 µg/mL (refer to side 2)

Certified Value:

NIST SRM #3114

\* Classical Wet Assay:

1000 µg/mL

EDTA method using PAN as indicator EDTA method against PerkinElmer NIST SRM #309

Method:

Measurement Analysis using ICP Spectrometer: 1001 µg/mL  
 NIST SRM #3114

Measurement of PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to  $\pm 0.5\%$  of certified concentration. The standards are kept tightly capped and stored under normal laboratory conditions. This value is the average of three measurements. The standards are kept tightly capped and stored under normal laboratory conditions. This value is the average of three measurements. The standards are kept tightly capped and stored under normal laboratory conditions. This value is the average of three measurements.



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## Secondary Spectrometric Calibration Standards

### Certificate of Calibration

## Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength	Standard 1	M60-382	0.2762	0.2489	0.2104
Standard 1	M60-382	0.2762	0.2489	0.2104	0.1812

The uncertainty of the given absorbance values is  $\pm 0.003$  A at the given wavelengths. The uncertainty of the given absorbance values is  $\pm 0.003$  A at the given wavelengths. The uncertainty of the given absorbance values is  $\pm 0.003$  A at the given wavelengths. The uncertainty of the given absorbance values is  $\pm 0.003$  A at the given wavelengths.

## Conditions of Calibration

The following settings were used on the Lambda 900 UV/VIS/NIR Spectrometer employed to obtain the calibration data quoted on this certificate:

## Measurement of Calibration

Absorbance

SR UV/VIS

1 m

5 %

SR NIR

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

Solve

Gain

2

# CERTIFICATE OF COMPLETION

This is to certify that

**Duang Hiransuk**

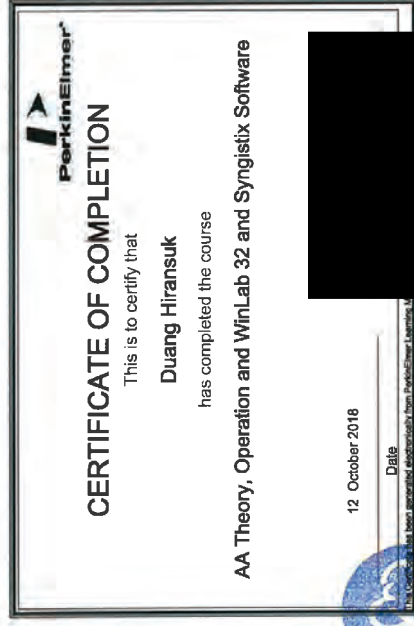
has completed the course

**AA PinAde 900 T, H, Z, F and 500, S10/SA93+ and AS900**

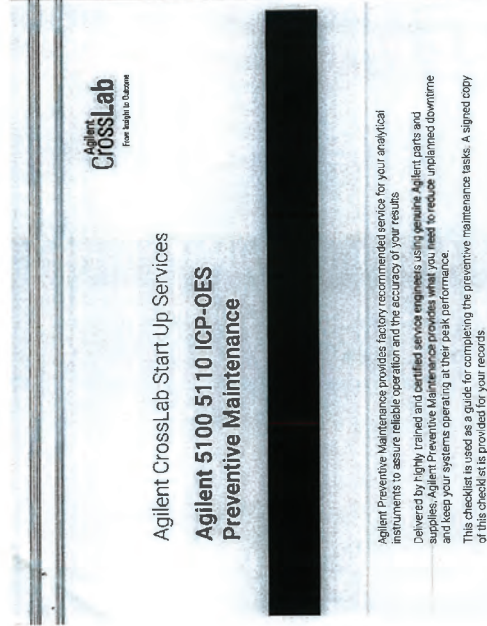
26 October 2018

Date

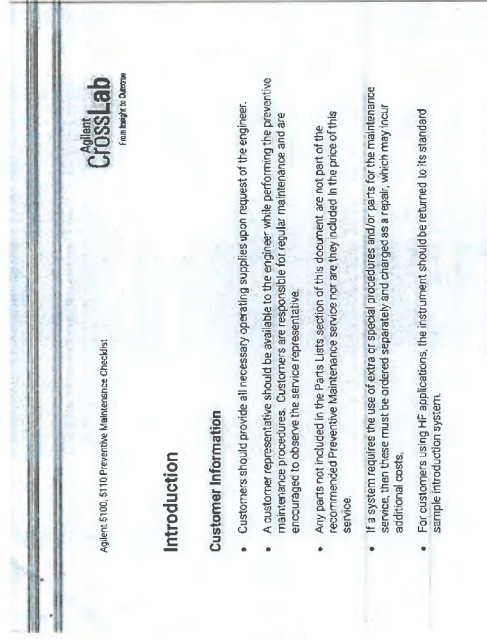
The Certificate has been prepared electronically from PerkinElmer Lambda 900



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## 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 service. Customers 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.



### Important Customer Web Links

- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include on-line, 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/learn/usagilentresources>. 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 share your own experiences and videos relevant to Agilent technologies. Visit <https://community.agilent.com/webinars>
- Watch 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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### Instrument Maintenance

#### System Information

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

Instrument System Name and Address		5110 NDU ICP-OES	Available to company limited
List System Components, Connection Numbers, and any Serial Numbers and other information			
1.	G 5015 A	PN 174-90002	
2.	G 9410 A	PN 173-93769	
3.	G 9410-90002	1709-05327	
4.			
5.			
6.			
7.			
8.			
9.			



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### 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 filed in the Service Completion section
- Ask the customer to sign the Service Verification section including the customer's and your signature.

### 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 Notices
- Check for required firmware/software updates and verify with customers if they would like them installed.
- For ICP application systems, if standard sample introduction system was not installed, ask the customer to install it with.
- Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.



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### 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-QES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas line 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-QES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the radial 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 in 1 hr.
- ☒ 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.

the cooling system Air filter and the condenser.



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#### 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 media 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 3 Auto sampler

- ☒ Service not applicable
- ☒ Clean the split tray, rack location mat, and 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 bottle(s). Check the tubing for leaks.
- ☒ 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

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#### 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



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#### Restore Instrument

- ☒ For HF applications, ask the customer to reinstall their sample introduction system, N18
- ☒ 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.

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## Test Results

## Instrument Performance Test Results Table

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

Item	PERM. SENSITIVITY CHECK		PERM. SENSITIVITY CHECK	
	Result	Actual	Spec'd	Unit
Zr-713877 nm SRR	1073.1	5582.6	6349.2	6129.9
Mn-252.010 nm SRR	9945.0	1648.0	10144.1	39075.2
Al-594.132 nm SRR	7.0	16.0	8.5	25.3
K-766.491 nm SRR	6.2	67.3	4.3	85.6

\* Actual result is not applicable for G8016AA, G8017AA Radial View Instruments.

## Instrument Test Results Table

Note: The 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 Flows		Pass
ICP Generator		Pass
Camera Test		Pass
Cooler Test		Pass
Purge Test		Pass



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## ICP-OES Status Results Table

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

Measurement		Specify Mode	Plasma On
Main Voltage	219.311	VAC	219.454
Main Current	0.0932	A	0.093
Instrument Temperature	23.5	°C	23.1
RF Ar Flow (torr speed)	13.0	Hz	11.0
Plasma Exhaust Temperature	No measurement		36.4
Water Flow Oxidizer	No measurement		1.31
Water Flow Detector	1.0A	L/min	1.06
Water Inlet Temperature	16.9	°C	16.1
Polychromator Temperature	36.0	°C	36.0
ICD Temperature	-39.6	°C	-39.4
Thermal Stabilizer	68.0	°C	68.0
Argon Supply Pressure	614.13	hPa	500.12
Purge Gas Supply Pressure*1	616.63	hPa	593.43
Optical Gas Supply Pressure*1	-	hPa	-
Nebulizer Flow	No measurement		0.70
Nebulizer Back Pressure	No measurement		293.13
Plasma Gas Flow	No measurement		11.9%
Auxiliary Gas Flow	No measurement		1.00
RF Power	No measurement		199.1
RF Supply Current	No measurement		9.190
RF Supply Voltage	No measurement		194.953

\*1 If option installed

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## Consumed PM Parts

Part Description	Part Number	Product or Model#	Quantity Consumed
Aspiral Pre-Optic Window	G8010-60074	ASPIRAL G8017A G8016-60074	1
Radial Pre-Optic Window	G8010-60075	All	1
Agilent Cool Clear Oxidant Fluid	5799-2037	Agilent Vapor Oxidant Fluid	1
Purge Gas Filter	G8010-60126	All	1
Air Inlet Filter	G8010-60022	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6.7 port valve for AVEB7	G8454-60022	G8454-60022	-
Rotor seal for 4 port valve for AVEB4	G8453-60022	G8453A	-
Ringer solution to mine dilutor 3.5mm ID x 1m	G8410-60123	SPS 4	-
Beak connector 3.5mm ID	G8410-60124	SPS 4	-
PVC waste tubing 1/4" x 5mm ID, 2m	G8610-60122	SPS 4	-
Additional Parts may be required from engineer's stock			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Relaxation pump tubing, PVC SoluFilex, 3' long	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#	Quantity Consumed
------------------	-------------	-------------------	-------------------



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## 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


 Date Service Completed: 21 May 2023  
 Customer Name: บริษัท  
 Customer Signature: บริษัท

 Issued: 21 January 2022  
 Document Number: G8014-90075  
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Page 16 of 14





Report Summary	
Instrument Model	Agilent 5100S110 VDV / CIP-OFES
Instrument ID	G8011AGS015A
Instrument Serial Number	MY1749002
Software Version	7.4.0 10/980
Firmware Version	3392
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:22:01 PM
Test Completed On	5/31/2023 12:26:21 PM

Subsystem Communications Test	
Air Flow Test	Pass
Water Flow Test	Skipped
Gas Flow Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Subsystem Communications Test	
Resolution Test	Pass

Precision Test	
Resolution Test	Pass



Precision Test			
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.72	
As (188.980 nm)	≤ 8.20	6.49	
C (193.027 nm)	≤ 11.50	8.01	
Mo (202.032 nm)	≤ 8.20	6.43	
Cr (206.158 nm)	≤ 13.40	8.50	
Zn (213.857 nm)	≤ 8.70	7.16	
Pb (220.353 nm)	≤ 9.50	7.51	
Co (228.615 nm)	≤ 17.20	11.32	
Ba (230.424 nm)	≤ 9.40	7.50	
Mn (257.610 nm)	≤ 13.30	9.78	
Mn (260.568 nm)	≤ 20.30	13.88	
Cr (267.716 nm)	≤ 11.00	9.09	
Cu (324.754 nm)	≤ 25.00	18.89	
Cu (327.395 nm)	≤ 14.20	12.41	
Sr (338.071 nm)	≤ 33.50	24.27	
Ba (455.403 nm)	≤ 44.00	34.07	
Sr (460.733 nm)	≤ 38.00	22.56	
Ba (493.408 nm)	≤ 36.00	27.79	
Ba (614.171 nm)	≤ 42.00	27.97	
Ar (675.263 nm)	≤ 74.00	62.41	
K (766.491 nm)	≤ 80.00	65.95	

Precision Test					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	108.0	934.0	64.8
Se (196.026 nm)	≥ 41.0	SRBR	110.2	1159.4	93.6
Zn (213.857 nm)	≥ 1421.0	SRBR	2348.2	23581.0	96.8
Pb (220.353 nm)	≥ 46.0	SRBR	96.7	1075.1	98.0
Mn (257.610 nm)	≥ 3518.0	SRBR	10768.1	218704.5	411.0
Al (396.152 nm)	≥ 3.4	SRBR	8.5	40909.0	4326.8
Ba (493.408 nm)	≥ 34.0	SRBR	111.9	1395218.4	12367.4
K (766.491 nm)	≥ 1.8	SRBR	4.7	108985.7	16075.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 203.0	SRBR	257.6	3134.3	126.3
Se (196.026 nm)	≥ 159.0	SRBR	294.6	4159.5	194.0
Zn (213.857 nm)	≥ 234.0	SRBR	495.4	1165.9	5.5
Pb (220.353 nm)	≥ 1743.0	SRBR	6129.9	92298.3	225.6
Cu (214.439 nm)	≥ 4277.0	SRBR	16698.9	48382.7	8.1
Pb (220.353 nm)	≥ 320.0	SRBR	416.4	6520.1	228.4
Mn (257.610 nm)	≥ 10625.0	SRBR	39073.2	1331904.6	1159.9
Cr (267.716 nm)	≥ 1048.0	SRBR	5985.5	203686.5	1144.7
Cu (324.754 nm)	≥ 18.0	SRBR	77.1	388900.7	4891.6
Al (396.152 nm)	≥ 6.0	SRBR	25.7	268775.7	10073.7
Ba (493.408 nm)	≥ 60.0	SRBR	293.9	5244793.3	27957.8
K (766.491 nm)	≥ 24.0	SRBR	83.6	3030541.1	35817.8



Precision Test			
Radial			
Element Wavelength	Specification	Measured Value	% RSD
As (188.980 nm)	≤ 2.80	2.80	0.75
Se (196.026 nm)	≤ 2.80	2.80	0.69
Zn (213.857 nm)	≤ 1.50	1.50	0.27
Pb (220.353 nm)	≤ 2.60	2.60	1.06
Mn (257.610 nm)	≤ 1.50	1.50	0.30
Al (396.152 nm)	≤ 1.50	1.50	0.27
Ba (493.408 nm)	≤ 1.50	1.50	0.99
K (766.491 nm)	≤ 1.50	1.50	0.25
Axial			
Element Wavelength	Specification	Measured Value	% RSD
As (188.980 nm)	≤ 1.50	1.50	0.54
Se (196.026 nm)	≤ 1.50	1.50	0.48
Zn (213.857 nm)	≤ 1.50	1.50	1.06
Pb (220.353 nm)	≤ 1.50	1.50	0.48
Cu (214.439 nm)	≤ 1.50	1.50	0.33
Pb (220.353 nm)	≤ 1.50	1.50	0.37
Mn (257.610 nm)	≤ 1.50	1.50	0.77
Cr (267.716 nm)	≤ 1.50	1.50	0.62
Cu (324.754 nm)	≤ 1.50	1.50	0.45
Al (396.152 nm)	≤ 1.50	1.50	0.45
Ba (493.408 nm)	≤ 1.50	1.50	0.80
K (766.491 nm)	≤ 1.50	1.50	0.51

Report Summary	
Instrument Model	Agilent 5100B/110 VDV/ICP-OES
Instrument ID	GB0114/GB015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3682
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:34:17 PM
Test Completed On	5/31/2023 12:46:55 PM
Test Results	
Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flow Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped
Subsystem Communications Test	
Pass	Pass
Air Flow Test	
30% Air Flow (relative speed)	12.00
75% Air Flow (relative speed)	18.00
Water Flow Test	
Camera Water Flow (L/min)	1.05
Water Inlet Temperature (°C)	18.78

Page 1 of 2



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Gas Flow Test	
Nebulizer Target Flow (l/min)	0.71
Actual Flow	0.71
Back Pressure	280.77
Auxiliary Target Flow	2.00
Actual Flow	2.00
Back Pressure	30.84
Makeup Test	
Target Flow	2.00
Actual Flow	1.99
Back Pressure	95.26
RF Generator Test	
RF Power Supply (V)	147.418
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.951
Work Coil Current (A)	45.326
RF Power Supply Current (A)	2.000
Camera Test	
Integration Time (ms)	1000
Standard Deviation	5.120
Electronic Offset Test	1000
Array Test	5
Linearity Test	0.015
	0.122
Status	Passed
	Passed
	Passed

Page 2 of 2

## Certificate of Calibration

Page : 1 of 2

Certificate No. : 66-400546-1

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 100613-1

ID No. : ELABBODC140N01

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Pennpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD Probe

ID No. Cert. No. Due Date Traceability

400029 &amp; 400048 66-400454-1

05 Feb 2024

National Institute of Metrology Thailand (NIMT)

Approved by



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

The Uncertainties are for a confidence probability of approximately 95%

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CAL-R00031-03





## Certificate of Calibration

Certificate No. : 66-400546-1

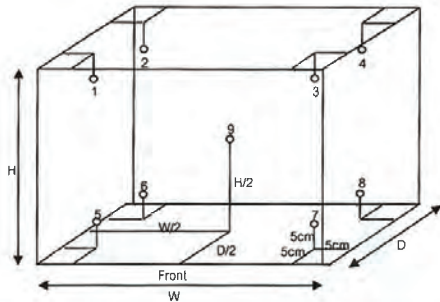
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber  
 W = 0.38 m  
 D = 0.35 m  
 H = 1.15 m  
 Capacity = 0.15 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature ( °C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	20.18	19.98	20.08	19.97	20.39	20.36	20.20	20.18	20.28	0.30

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.35	0.03	0.47

**Remark** The uncertainty is not combine uniformity of the air chamber

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

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

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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



GAIR-00031-03



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

Cert.No.: 23TW79

Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
 Manufacturer : Hanna  
 Model : HI9146-04  
 Serial No. : G00007931  
 ID No. : ELABDOHI914601  
 Received Date : 17 March 2023  
 Test Date : 20 March 2023  
 Reference : 2303-0651DN-1  
 Submitted by : Envilab Co.,Ltd (Head office)  
 540, 540/1 Soi Bangkhao 7,  
 Bangkhao, Bangkhao, Bangkok 10160

Laboratory Condition : Temperature ( 25 ± 5 ) °C  
 Humidity (50 ± 20) %  
 Test Procedure : In - house method : CP-CH9  
 by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirirthean

Approved by :   
 Approved Signatory

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

Issue Date : 23 March 2023



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

B 0310344

ภาคผนวก 3-16-2

52/76



Cert.No.: 23TW79  
Page.: 2 of 2

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MMS0	20 Sep 2023

##### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: KC1A01TAF

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.14	8.16	0.0084

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

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a 1154259



CERTIFICATE No.: 2318361  
REFERENCE No.: 68967-2

PAGE: 1 OF 2

#### Certificate of Calibration

EQUIPMENT	:	COD TESTER
MANUFACTURER	:	HANNA
MODEL	:	HI839800
SERIAL No	:	6480043101
ID No	:	ELABH183980002
SUBMITTED BY	:	ENVILAB CO., LTD. 540, 540/1 SOI BANGKHAE 7, BANGKHAE, BANGKHAE, BANGKOK 10160

CALIBRATED BY

CALIBRATION DATE

30-Aug-23

APPROVED BY

ISSUED DATE

30-Aug-23

RECEIVED DATE

24-Aug-23

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



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



CERTIFICATE No.: 23T3851

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD TESTER  
 MANUFACTURER : HANNA MODEL : HI839800  
 ID NUMBER : ELABH183980002 SERIAL NUMBER : 6480043101  
 RECEIVED DATE : 24-Aug-23 CALIBRATION DATE : 30-Aug-23  
 AMBIENT TEMPERATURE : 31°C ± 1°C RELATIVE HUMIDITY : 55 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7903007	23T6639	10-Jul-24

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
 NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller temperature (°C)	150.0
Indicating Temperature	150.0
1	150.2
2	150.4
3	150.3
4	150.3
5	150.3
6	150.5
7	150.3
8	150.5
9	150.4
10	150.4
11	150.5
12	150.4
13	150.4
14	150.3
15	150.4
16	150.4
17	150.5
18	150.5
19	150.4
20	150.5
21	150.3
22	150.4
23	150.5
24	150.4
25	150.3
Uncertainty of Measurement (± °C)	1.2

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-400156-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB 14

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L412.2222

ID No. : ELABWBWNB14N01

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (25.5 to 26.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 25 March 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400031	65-400549-1	22 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



## Certificate of Calibration

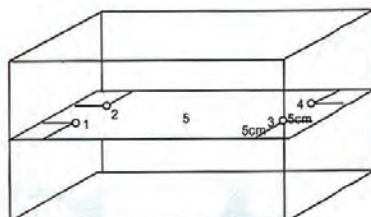
Certificate No. : 66-400156-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			1	2	3	4	5			
95.0	94.5	94.5	95.35	95.49	95.20	95.20	95.42	0.21	0.32	0.09

**Remark** The uncertainty is not combine uniformity of the water bath

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

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

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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL-F0031-03

## Certificate of Calibration

Certificate No. : 66-400156-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UF 75

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B319.0600

ID No. : ELABHAOVEN0600

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (30.0 to 30.8) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 25 March 2023

Calibrated by : Pempon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

**Reference Standard Instruments :** This certification is traceable to the International System of Units

Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400548-1	26 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03





## Certificate of Calibration

Certificate No. : 66-400156-2

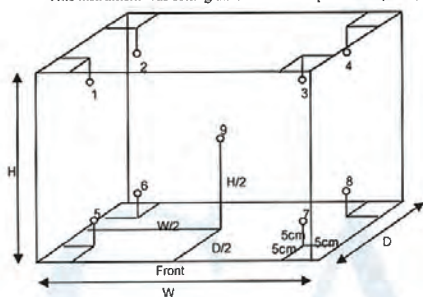
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber  
W = 0.40 m  
D = 0.33 m  
H = 0.56 m  
Capacity = 0.07 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	103.5	103.5	104.3	104.3	104.3	104.2	104.3	104.1	103.7	104.0	104.3	0.70
110.0	109.5	109.5	110.3	110.3	110.3	110.3	110.3	110.1	109.7	110.0	110.3	0.71
180.0	179.0	179.0	179.4	180.1	180.3	180.1	180.6	179.9	179.2	179.6	180.4	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	103.5	103.5	0.7	0.1	0.8
110.0	109.5	109.5	0.8	0.1	1.0
180.0	179.0	179.0	1.4	0.2	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

GAI-P0031-03

## Certificate of Calibration

Certificate No. :

66-200066-2

Page : 1 of 2

Submitted by :

Envilab Co., Ltd.

540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment :

Electronic Balance

Manufacturer : METTLER TOLEDO Model : XSR205DU

Serial No. : B911363567 ID No. : ELABBALANCEN06

Capacity : 220 g Resolution : 0.00001g/81g, 0.0001g/220g

Environment :

On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.

Ambient Temperature : (24.6 to 24.9) °C

Relative Humidity : (57.0 to 67.8) %

Air Pressure : 1015.0 mbar

Date of Received :

01 March 2023

Date of Calibration :

01 March 2023

Date of Issue :

04 March 2023

Calibrated by :

Akaradath Thippichai

Calibration Method :

In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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GAI-P0031-03



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-200066-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.1	0.00000	0.000014
0.5	0.00002	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00004	0.00011
100	-0.00001	0.00020
150	-0.00001	0.00038
200	-0.00002	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.07$ , providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.00000 0.00000 0.00001 0.00001 0.00000 g

C	D
E	
B	A

Repeatability

Load test : 200 g

Stdev. : 0.000042 g

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## Certificate of Calibration

Certificate No. : 66-200066-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

Equipment : Electronic Balance

Manufacturer : Sartorius

Model : SECURA125-1S

Serial No. : 0034606552

ID No. : ELABBALANCEN05

Capacity : 120 g

Resolution : 0.0001 g

Environment :

On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.

Ambient Temperature : (21.7 to 22.0) °C

Relative Humidity : (47.0 to 47.1) %

Air Pressure : (1015.0 to 1016.0) mbar

Date of Received : 01 March 2023

Date of Calibration : 01 March 2023

Date of Issue : 04 March 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.

Cert. No.

Due Date

Traceability

E261-E2624

C02222345

10 Nov 2023

National Institute of Metrology (Thailand), (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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ภาคผนวก 3-16-2

57/76

## Certificate of Calibration

Certificate No. : 66-200066-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

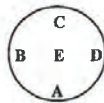
Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.1	0.0000	0.000083
0.5	0.0000	0.000084
1	0.0000	0.000085
2	0.0000	0.000099
5	0.0000	0.000110
10	0.0000	0.000092
20	0.0000	0.000120
50	0.0000	0.00012
100	0.0000	0.00020
120	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

Eccentric error Load test : 20 g

A	B	C	D	E
0.0001	0.0001	0.0000	0.0000	0.0000 g



Repeatability Load test : 100 g

Stdev. : 0.00004 g

- 000 -

## Certificate of Calibration

Certificate No. : 65-300656-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Measuring Pipette

Manufacturer : KIMAX

Capacity : 25 ml Graduation : 0.1 ml

ID No. : B-WW-001/15

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

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

Air Pressure : 1005.8 mbar.

Date of Received : 23 November 2022

Date of Calibration : 29 November 2022

Date of Issue : 29 November 2022

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	65-200172-4	02 Dec 2022	National Institute of Metrology (Thailand) (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-E0031-03

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ภาคผนวก 3-16-2

58/76

CAL-E0031-03



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 65-300656-1

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 2.19 sec.

Nominal Volume ( ml )	Measuring Volume ( ml )
5	5.0011
15	14.9694
25	24.9866

Uncertainty of measurement with in  $\pm$  0.0067 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

- o0o -

ภาคผนวก 3-16-2

59/76

CAL-R0031-03

Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

Cert.No.: 23CHO128

Page.: 1 of 3

## Certificate of Calibration

Equipment : Spectrophotometer

Manufacturer : Agilent

Model : Cary60 (G6860A)

Serial No. : MY17490026

ID No. : ELABSPECTRO002

Condition As-Received: Used Item

Received Date : 09 March 2023

Calibration Date : 09 March 2023

Reference : 2303-0046ON-1

Submitted by : Envilab Co.,Ltd (Head office)  
540, 540/1 Soi Bangkhuae 7, Bangkhuae,  
Bangkhuae, Bangkok 10160

Calibration Place : B301 CO-THC ROOM

Ambient Temperature : ( 23.6 - 22.5 ) °C (On-Site)

Relative Humidity : ( 75 - 77 ) % (On-Site)

Calibration Procedure : In - house method :  
CP-OCH4 based on ASTM E 275-01

Calibrated by : Uthen Kankawi

Approved by :

( / ) Malee Butkruea  
( ) Salthip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 15 March 2023

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.

Envilab Co.,Ltd.

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Cert. No. : 23CHO128

Page : 2 of 3

**Condition of calibration result**

**1. Reference Standard Material :**

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	32588	103225	08 July 2024
2. Absorbance Standard set	32592	104226	04 Aug 2024
3. Absorbance Standard set	39130	106269	10 Oct 2024
4. Wavelength Standard set	29829	94776	02 Sep 2023
5. Wavelength Standard set	29829	94777	02 Sep 2023

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 maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 1.5 nm  
Scan Speed : 18 nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

Certified Values of Reference Material ( nm )	UUC Reading ( nm )	Uncertainty of Measurement ( ± nm )	Coverage Factor k
241.72	242.0	0.13	2.00
360.93	360.5	0.13	2.00
536.59	536.6	0.15	2.05
740.72	741.3	0.16	2.05
879.28	879.2	0.16	2.05



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a 1152950



Cert. No. : 23CHO128

Page : 3 of 3

**Calibration Results : without adjustment**

**Photometric Accuracy**

Wavelength ( nm )	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( ± Abs )	Coverage Factor k
350.0	Zero	0.0000	0.0046	2.00
	0.4253	0.4249	0.0051	2.00
	Zero	0.0000	0.0050	2.00
	0.6389	0.6388	0.0056	2.00
420.0	Zero	0.0000	0.0028	2.00
	0.5796	0.5790	0.0028	2.00
	0.7105	0.7102	0.0028	2.00
	1.0186	1.0171	0.0028	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5281	0.5277	0.0028	2.00
	0.6962	0.6963	0.0028	2.00
	0.9984	0.9978	0.0028	2.00

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.

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 %.

-o-o-



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a 1152949

## Certificate of Calibration

Certificate No. : 66-300140-2 Page : 1 of 2

Submitted by : Envilab Co.,Ltd.  
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Cylinder  
Manufacturer : PYREX Class : A  
Capacity : 50 ml Graduation : 1 ml  
ID No. : C-WW-003/23

Environment : Ambient Temperature :  $(23 \pm 2)$  °C  
Relative Humidity :  $(50 \pm 15)$  %  
Air Pressure : 1009.9 mbar.

Date of Received : 15 March 2023  
Date of Calibration : 20 March 2023  
Date of Issue : 20 March 2023  
Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	65-200370-1	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-300140-2 Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume ( ml )	Measuring Volume ( ml )
30	29.98
50	50.12

Uncertainty of measurement with in  $\pm$  0.054 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$  ,  
providing a level of confidence of approximately 95%

- o0o -

CAL-P0031-03

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-300140-3

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 100 ml

Graduation : 1 ml

ID No. : C-WW-002/22

Environment : Ambient Temperature :  $(23 \pm 2)$  °C

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

Air Pressure : 1009.9 mbar.

Date of Received : 15 March 2023

Date of Calibration : 20 March 2023

Date of Issue : 20 March 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	65-200370-1	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-300140-3

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume ( ml )	Measuring Volume ( ml )
50	49.82
100	99.84

Uncertainty of measurement with in  $\pm$  0.063 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

- o0o -



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CAL-F0031-03

ภาคผนวก 3-16-2

62/76





# AIRFLOW CALIBRATION CO.,LTD.

## CERTIFICATION OF TEST REPORT

Equipment : Biological Safety Cabinet (Class II)  
Manufacturer : Heal Force  
Model : Hfsafe 1200LC  
Serial Number : EX042012LC5497  
Identification Number : ELABMICROBSC01  
Report Number : B223337  
Issued Date : 9 March 2023  
Job Number : B223337  
Page : 1 of 7 Pages

Customer : ENVILAB CO.,LTD. (HEAD OFFICE)  
540, 540/1 Soi Bangkhao 7, Bangkhao, Bangkhao, Bang 10160

Environment Condition : Temperature: 24.9 °C ± 0.8 °C  
Humidity: 51.9 %RH ± 0.6 %RH  
Voltage: 221.5 VAC ± 0.3 VAC

Test Place : ENVILAB CO.,LTD. (HEAD OFFICE) Laboratory Floor 3

Test By : Mr.Achira Kaewpaitoon

Test Date : 1 March 2023

Due Date : 1 March 2024

Test Procedure : EN 12469: 2000 Biotechnology performance criteria for microbiological safety cabinet  
AS 1807.23: 2000 Determination of intensity of radiation from germicidal ultraviolet lamp

Traceability : Velocity test is traceable to TAT Certificate Number :TTH-0-59155  
Leak test of HEPA filter is traceable to NIST Certificate Number :ST673/0922  
Illumination test is traceable to TIC Certificate Number :E-2302026  
Ultraviolet Radiation test is traceable to EEI Certificate Number :CO20220115EA  
Sound test is traceable to SP Certificate Number :SPR22030177-1

This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

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51/104 Moo 9, Ladsewai, Lamukha Phatunthani 12150 Thailand  
Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175 Fax : 0 2152 8351  
http://www.airflowcalibration.com E-mail : bm.airflow@gmail.com , noppairflow@gmail.com

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# AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number: B223337

Page 2 of 7 Pages

## Primary Test Results

### 1. Downflow Velocity Test

Test equipment used

• Thermo anemometer • Brand: Testo • Model: 425  
• Serial number: 3101751 • Calibration due: 31-Oct-2023

**Instruction:** Work opening in normal positions. With the anemometer inside the MSC, make air velocity measurements in horizontal plane 50 mm to 100 mm above the top edge of the front aperture. Make measurements over a period of at least 1 min in each position. Measure in 2 rows along a line 1/4 of the depth of the working space forward of the rear wall and along a line the same distance behind the

Back			
0.36	0.35	0.36	0.37
0.37	0.37	0.36	0.37
Front			

### Characteristic of downflow velocities

• Mean downflow velocity to achieve product protection  
: 0.25 m/s - 0.50 m/s. All measurements should be  
within ±20 % of mean values.

0.37	0.37	0.35	0.29	-	0.44
------	------	------	------	---	------

Result Summary : Pass

51/104 Moo 9, Ladsewai, Lamukha Phatunthani 12150 Thailand  
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http://www.airflowcalibration.com E-mail : bm.airflow@gmail.com , noppairflow@gmail.com

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Continuation of the Certificate of Test Report Number : B223337

Page 3 of 7 Pages

## 2. Inflow Velocity Test

### Test equipment used

- Thermo anemometer    ● Brand: Testo    ● Model: 425  
● Serial number: 3101751    ● Calibration due: 31-Oct-2023

### Exhaust Measurement

**Instruction:** The alternative procedure to determine inflow velocity uses a thermoanemometer in a constricted window access opening of 3 inches (76mm) with the armrest removed. Inflow air velocity is measured in the center of the constricted opening 1-1/2 inches (38mm) below the top of the work access opening on the following specified grid. Use the correction factor table to calculate the inflow velocity.

1.39	1.35	1.37	1.38	1.37	1.39	1.38	1.39	1.35	1.38	1.38
------	------	------	------	------	------	------	------	------	------	------

#### Characteristic of air velocities in the work opening

Designation	Mean inflow velocity (m/s)
• Mean inflow velocity to achieve product protection : $\geq 0.40$ m/s.	0.53

**Result Summary :** **Pass**

### Adjustments Required

Fan speed		Damper
✓ No Change		✓ No Change

51/104 Moo 9, Ladsawai, Lam Lukka Phatumthani 12150 Thailand

Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175 Fax : 0 2152 8348  
<http://www.airflowcalibration.com> E-mail : [bm.airflow@gmail.com](mailto:bm.airflow@gmail.com) , [nop.airflow@gmail.com](mailto:nop.airflow@gmail.com)

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Continuation of the Certificate of Test Report Number : B223337

Page 4 of 7 Pages

### 3. Leak Test of HEPA Filters

### Test equipment used

- Aerosol Photometer    ● Brand:    ATI    ● Model:    2H  
● Serial number:    20627    ● Calibration due:    23-Sep-2023

Test equipment used:

- Aerosol Generator      ● Brand:    ATI              ● Model:    6C  
● Serial number:    20554              ● Calibration date: -

**Instruction:** The aerosol through the "Challenge" valve to the backside of HEPA filter and maximum local penetration: 0.01 % of upstream concentration. (PAO test substitute for DOP test)

### Characteristic of PAO test

Characteristic of PAO test		
Concentration of test substance in water (mg/L)	22	µg/l
Concentration of PAO in water (mg/L)	0.001	%
Concentration of test substance in water (mg/L)	0.001	%

### Main HEPA Filter

### Leak position

[illegible]

 : 10 cm. x 10 cm.    X : Media leak position    G : Gasket leak position    M : Maximum leak position

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Tel: 0 2152 8350, 0 2152 8348, 0 2152 8070, 08 4360 2558, 09 2265 3115 Fax: 0 2152 8350  
http://www.airflowcalibration.com E-mail: [bm.airflow@gmail.com](mailto:bm.airflow@gmail.com), [neo.airflow@gmail.com](mailto:neo.airflow@gmail.com)

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# AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B223337

Page 5 of 7 Pages

## Exhaust HEPA Filter

Leak position


□ : 10 cm x 10 cm X : Media leak position G : Gasket leak position M : Maximum leak position

Result Summary : Pass

## 4. Airflow Patterns

### Test equipment used

Smoke Generator

**Instruction :** The purpose of the test is to verify that no smoke escapes from the working space to the room, and that smoke will be drawn into the working space from the room.

Pass the smoke in an easy movement along the front opening outside the cabinet. The smoke must be drawn into the cabinet without visible turbulence.

Test the laminarity of the downflow and along the side and back wall. No smoke must come out in the room and only small Turbulence must be observed.

### Result Summary :

Downflow Pattern Test

Pass

View Screen Retention Test

Pass

Work Opening Edge Retention Test

Pass

Sash/Window Seal Test

Pass

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http://www.airflowcalibration.com E-mail : bna.airflow@gmail.com , nnp.airflow@gmail.com

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# AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B223337

Page 6 of 7 Pages

## 5. Site Installation

5.1 Sash Alarm

Pass

5.2 Interlocks

N/A

5.3 Exhaust System Alarm

Pass

## 6. Soap Solution

**Instruction:** Comprising 25g/l soft soap in tepid distilled water prepared in grease free vessel.

Result Summary : Absence of soap bubbles.

Pass

## Secondary Test Results

### 7. Illumination Test

**Instruction:** Take readings at approximately 300 mm centres across the full front width of the work floor surface, starting approximately 150 mm in from each side.

#### Test equipment used

● Lux meter

● Brand: Digicon

● Model: LX-73

● Serial number: T.034913

● Calibration due: 9-Feb-2024

Back

1050	1214	1225	1025
797	910	867	847

Front

Lighting should be adequate for safe working within the cabinet, Illumination measured at the work surface should be at least 750 lux.

Result Summary : Pass

51/104 Moo 9, Ladsewai, Lamlukko Phatunthani 12150 Thailand  
Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175 Fax : 0 2152 8144  
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# AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B223337

Page 7 of 7 Pages

## 8. Ultraviolet Radiation Test

**Instruction:** Take readings at approximately 300 mm centres across the full front width of the work floor surface, starting approximately 150 mm in from each side.

### Test equipment used

● UVC Light Meter ● Brand: SPER SCIENTIFIC ● Model: 850010  
● Serial number: 0908314302 ● Calibration due: 1-Sep-2023

Back			
2020	2420	2720	1970
1990	2680	2230	2130
Front			

Ultraviolet radiation where UV lamps are fitted, the intensity of radiation at a wave length of 254 nm shall be not less than 400 mW/m<sup>2</sup> when measured at the work floor surface.

Result Summary : Pass

## 9. Sound levels Test

**Instruction:** Sound levels in a cabinet should be low enough not to distract a worker. When tested in accordance with EN ISO 3744 using a sound level meter situated 1.0 m from the centre of the front aperture of the cabinet, or 1.0 m from any part of the installation within the laboratory, the A-weighted sound pressure level generated by the cabinet should not exceed 65 dB when the A-weighted sound pressure level of the background is less than 55 dB. If the background noise exceeds 55 dB then the corrected cabinet A-weighted sound pressure level should not exceed 65 dB.

### Test equipment used

● Sound Meter ● Brand: Daiichi ● Model: SL332  
● Serial number: 130108517 ● Calibration due: 14-Mar-2023

\* Sound pressure level of the background: 49.6 dBA

\* Sound levels: 60.4 dBA

Result Summary : Pass

End of Certificate of Test Report

51/04 Moo 9, Ladswai, Lanluika Phatunthani 12150 Thailand  
Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175 Fax : 0 2152 8351  
http://www.airflowcalibration.com E-mail : bna.airflow@gmail.com napanairflow@gmail.com

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasri 3 Rd., Bangpood, Pakkred, Nonthaburi 11120  
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



## Certificate of Calibration

Certificate No. : 66-400056-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.  
540,540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : Autoclave  
Manufacturer : Tomy Model : SX-500  
Range : N/A °C Resolution 1 °C  
Serial No. : 55133094 ID No. : N/A

Environment : On site calibration was carried out at the Laboratory,  
Ambient Temperature : (26.0 to 28.0) °C  
Relative Humidity : (50 to 55) %  
Line Voltage : (224.0 to 225.0) V

Date of Received : 02 February 2023

Date of Calibration : 02 February 2023

Date of Issue : 04 February 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4007 based on  
BS 2646 Part5 : 1993  
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Temperature Data Logger with RTD pt 100

ID No.	Cert. No.	Due Date	Traceability
400039	66-400026-1	19 Jul 2023	National Institute of Metrology Thailand (NIMT)
400040	66-400026-2	19 Jul 2023	National Institute of Metrology Thailand (NIMT)
400041	66-400026-3	19 Jul 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

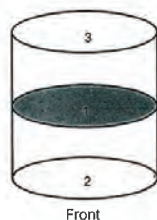
Certificate No. 66-400056-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.			Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)	Sterilizing Time (minute)	Pressure Gauge Reading (MPa)
			1	2	3					
121	121	121	121.8	121.4	121.3	0.82	1.0	0.3	15	0.11

### Remark

- UUC : Unit Under Calibration
- Pressure Gauge reading are out of accreditation's scope.

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

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

- o0o -



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## Certificate of Calibration

Certificate No. : 66-300030-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Piston Pipette

Manufacturer : sartorius

Model : N/A

Serial No. : 4538900217

ID No. : N/A

Capacity : 100 µl to 1000 µl

Resolution: 5 µl

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Air Pressure : (1013.7 to 1013.9) mbar.

Date of Received : 18 January 2023

Date of Calibration : 24 January 2023

Date of Issue : 24 January 2023

Calibrated by : Wipa Tovadce

Calibration Method : In-house method CAL-M3002 base on ISO 8655-6 : 2002-09-15

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

ID.No. Cert.No. Due Date Traceability

241003

65-200370-2

02 Jun 2023

National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## Certificate of Calibration

Certificate No. : 66-300030-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Test Volume ( µl )	Measuring Volume at 20 °C ( µl )	Systematic error ( e <sub>s</sub> % )	Coeff. of Variation ( CV % )	Uncertainty ( ± µl )
100	99.92	0.01	0.05	0.69
500	500.09	0.01	0.02	0.69
1000	1000.17	0.02	0.01	0.69

e<sub>s</sub> : Systematic error (%)

CV : Coefficient of variation (%)

UUC Calibrated by : White Tip

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2.00 , providing a level of confidence of approximately 95%

- o0o -

## Certificate of Calibration

Certificate No. : 66-400101-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhao 7, Bangkhao, Bangkok 10160

Equipment : Air Chamber (Incubator)

Manufacturer : Memmert

Model : IF 110

Range : N/A °C

Resolution : 0.1 °C

Serial No. : D419.0525

ID No. : ELABINCUBATOR1

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (24.0 to 24.6) °C

Relative Humidity : (55 to 60) %

Line Voltage : (224.5 to 226.0) V

Date of Received : 21 February 2023

Date of Calibration : 21 February 2023

Date of Issue : 21 February 2023

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400042	66-400066-1	02 Aug 2023	National Institute of Metrology Thailand (NIMT)

Appro

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

ภาคผนวก 3-16-2

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CAL-F0031-03

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



## Certificate of Calibration

Certificate No. : 66-300140-5

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume ( ml )	Measuring Volume ( ml )
250	250.53
500	499.90

Uncertainty of measurement with in  $\pm$  0.12 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

-o0o-

ภาคผนวก 3-16-2

70/76

GAL-F0031-03



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

## Certificate of Calibration

Customer : Envilab Co.,Ltd.

Item :

Model /Type : hs-32

Serial Number : MCH110039

Manufacturer : METROSONICS

Date of Request : 6 February 2023

Date of Calibration : 22 February 2023

The certifies the above equipment was calibrated in accordance with the recognised International Standard ISO/IEC 17025:2017 and the operation according to procedure no. WI.CP.18.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95 %.

C

Ref. No : 2012266020600526002

Issued Date : 8 March 2023

Page 1 of 4

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Office/Laboratory  
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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

Office  
184 Phai  
Thailand  
Tel. (66)  
Fax. (66)  
E-mail :

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

FM.BL.MTC.002 Rev.4



Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

**Description of Unit Under Calibration :**

Customer : Envilab Co.,Ltd.  
Address : 540, 540/1 Soi Bangkhac7, Bangkhac, Bangkok, 10160  
Item : Thermo-Hygrometer (Area Heat Stress Monitor)  
Serial Number : MCH110039  
Calibration Required : Temperature at (20, 30, 40) °C  
Ambient Condition : Ambient temperature (23 ± 3) °C  
Relative humidity (55 ± 20) %  
Laboratory Address : Photometry and Temperature Standards Laboratory  
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

**Reference Standard :**

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 0786/65.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

**Calibration Procedure :**

The certifies the above equipment was calibrated according to procedure no. WICP.18.

**Support Equipment :**

Temperature & Humidity Controlled Chamber, Model : 9141-5110, S/N : 1205101

**Adjustments :** NONE

Page 2 of 4

P.T.

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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Fax (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Results of Calibration :- ( / ) Without Adjustment ( ) After Adjustment

**Table : Temperature Measurement @ Wet Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.50
30.0	30.0	0.0	0.51
40.0	40.2	-0.2	0.50

**Table : Temperature Measurement @ Dry Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	19.9	0.0	0.50
30.0	29.9	0.1	0.51
40.0	40.1	-0.1	0.50

Page 3 of 4

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Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.3	-0.4	0.50
30.0	29.8	0.2	0.51
40.0	40.1	-0.1	0.50

- Note :
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
  2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...

Page 4 of 4

PT

FM.BI.MTC.002 Rev.4

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E-mail :  
[Redacted]

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No.: CP20230179EA

Operation No.: CP2023030029

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Pulsar Instruments Plc

Model/Type: 44 (Meter), PM2 (Microphone), PA40 (Preamplifier)

Serial No.: PN1842 (Meter), 022722D (Microphone), 1769 (Preamplifier)

ID No.: NSMPUMD44N1842

Customer: Envilab Co., Ltd.

Address: 540,540/1 Soi Bangkhae 7, Bangkhae,  
Bangkhae, Bangkok 10160

Received Date: 16 March 2023

Calibrated Date: 29 March 2023 - 4 April 2023

Issued Date: 5 April 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: [Redacted]

Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except

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Page 1 of 6



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ภาคผนวก 3-16-2

72/76



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230179EA

Calibration Report

Equipment: Sound Level Meter  
Manufacturer: Pulsar Instruments Plc  
Model/Type: 44 (Meter), PM2 (Microphone), PA40 (Preamplifier)  
Serial No.: PN1842 (Meter), 022722D (Microphone), 1769 (Preamplifier)  
ID No.: NSMPUMD44N1842  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-  
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20220059EA	19 June 2023
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024	20/3/20224
			CD20220164EA	24 July 2023
6) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA	14 February 2024
			CK20220080EA	8 September 2023

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

3. This certification is traceable to the International system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230179EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
17.0

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	Under-range
C-weighting	18.1
Z-weighting	26.6

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Deviation from various Frequency Weighting Response Curve				
Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.5	0.3	0.3	±1.5
1000	0.3	0.3	0.4	±1.0
8000	1.0	1.0	0.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Deviation from various Frequency Weighting Response Curve				
Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.4	0.4	0.3	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230179EA

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
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



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ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230179EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
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	38.8	-0.2	±1.1
34.0	33.8	-0.2	±1.1
29.0	28.9	-0.1	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±1.0
	2	118.9	-0.1	+1.0 ; -2.5
	0.25	109.8	-0.2	+1.5 ; -5.0
Slow	200	129.6	0.0	±1.0
	2	110.0	0.0	+1.0 ; -5.0
	0.25	130.0	0.0	±1.0
LAE	200	130.0	0.0	+1.0 ; -2.5
	2	110.0	0.0	+1.0 ; -2.5
	0.25	100.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	135.1	-0.3	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.8	142.8	0.0	±1.5



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ





ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230179EA

Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
  2. The acceptance limit is for the deviated value.
  3. Acceptance limits was IEC61672-3:2013 Class 2.
  4. The coverage factor  $k = 2.00$

-- End of Report --



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

## CALIBRATION CERTIFICATE

Issued date: 18 April 2023

Client Name : ENVILAB CO., LTD.

Address : 540,540/1 Soi Bangkhæ 7, Bangkhæ, Bangkhæ, Bangkok 10160.

Request No : C-2304 - 168

Laboratory No.: CAL- 168

Date of Request: 12 April 2023.

Date of Calibration: 17 April 2023.

1. Unit Under Calibration (UUC) :

Nomenclature : Digital Lux Meter

Serial No.: 160300230

Maker : TENMARS

Model : TM-720

2. Place of Calibration: Photometry Standard Laboratory, INTERNATIONAL TESTING SERVICE CO., LTD.

3. Range of Calibration: 1 Range

4. Condition of Laboratory: Ambient temperature:  $(25 \pm 2) ^\circ\text{C}$  and relative humidity  $(60 \pm 20) \%$ .

5. Reference Standard: Standard Tungsten Halogen Lamp, Serial No.: 504011, which was calibrated on 5 October 2022, can be traceable to International System of Unit (SI) through National Institute of Metrology (Thailand), Certificate No.: TP-1024-22.

6. Support Equipment:

1. Photometric bench, 6.3 meter long.
2. DC. power supply, Serial No.: EJ 19A 009, Model: GPR-25H 300, Maker: GW INSTR.
3. Digital Multimeter, Model: 34401A, S/N: MY44011212 and MY44011215.
4. Foot Candle / Lux Meter, Model: 407026, S/N: Q 558437, Maker: EXTECH.

7. Calibration Procedure:

The measurement was done in accordance with WI-CP-01. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %.

The Results shown in this certification report refer only to the equipment(s) calibrated.  
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Request No: **C-2304 - 168**

Serial No.: 160300230

Laboratory No.: **CAL - 168**

**Results :**

UUC Range	Standard (lx)	UUC Reading (lx)		Correction (lx)	Uncertainty of Measurement ( $\pm$ lx)
		Before adjust	After adjust		
Auto	0	0.0	0.0	0.0	0.1
	100	86.2	102.0	- 2.0	2.0 % of Reading
	500	427.4	505.2	- 5.2	
	1000	842.2	1003	- 3	
	1500	1255	1493	+ 7	
	2000	1665	1979	+ 21	

Note: 1. The results relate only to the items calibrated.  
2. Zero adjust before used.

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The Results shown in this certification report refer only to the equipment(s) calibrated.  
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