



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม  
โครงการผลิตปิโตรเลียมแหล่งประดู่เตาและแหล่งเสาเดียวร่วนขยาย แปลงเอส 1 จังหวัดพิษณุโลก และสุโขทัย  
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

ภาคผนวกที่ 38  
เอกสารขึ้นทะเบียนห้องปฏิบัติการ



ที่ อก ๐๓๑๐(๑)/ ๗๓ ๒๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

### ๒๙ กรกฎาคม ๒๕๖๔

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ มีนาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ แผ่น  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖  
ซอยชินเขต ๑ ถนนงามวงศ์วาน แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

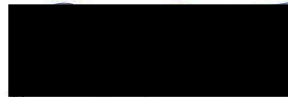
กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด  
ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๙ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนไว้วิเคราะห์ในน้ำเสีย จำนวน ๒๗ รายการ น้ำใต้ดิน  
จำนวน ๕๘ รายการ อากาศเสีย จำนวน ๒๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๒๐ รายการ และ  
ดิน จำนวน ๕๖ รายการ รวมทั้งสิ้นจำนวน ๑๘๗ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ  
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๐๐๒ ๐ ๒๒๐๒ ๔๑๔๖

โทรสาร ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ๖-๐๙๙

ที่ อก ๐๓๑๐(๑)/ ๗๓ ๒๕

ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๔

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย

- ๑) [Redacted]
- ๒) [Redacted]
- ๓) [Redacted]
- ๔) [Redacted]
- ๕) [Redacted]
- ๖) [Redacted]
- ๗) [Redacted]
- ๘) [Redacted]
- ๙) [Redacted]
- ๑๐) [Redacted]
- ๑๑) [Redacted]
- ๑๒) [Redacted]
- ๑๓) [Redacted]
- ๑๔) [Redacted]
- ๑๕) [Redacted]
- ๑๖) [Redacted]

- ทะเบียนเลขที่ ๖-๐๙๙-ค-๒๕๑๔  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๓๐๐๒  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๕๕๐๐  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๗๐๒๓  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๗๖๖๔  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๗๖๖๕  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๗๖๖๖  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๗๖๖๗  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๑  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๒  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๓  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๔  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๕  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๖  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๗  
ทะเบียนเลขที่ ๖-๐๙๙-ค-๘๘๐๘

เอกสารแนบท้ายหนังสือรับคํออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ว-๐๙๙  
ที่ อก ๐๓๑๐(๑)/ ลงวันที่

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ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๙ ราย

๑)	ทะเบียนเลขที่	ว-๐๙๙-จ-๕๔๐๒
๒)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๒๖
๓)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๒๙
๔)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๓๗
๕)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๔๒
๖)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๔๔
๗)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๔๕
๘)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๕๐
๙)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๕๔
๑๐)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๐๕๖
๑๑)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๖๗๑
๑๒)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๖๗๒
๑๓)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๖๗๓
๑๔)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๖๗๕
๑๕)	ทะเบียนเลขที่	ว-๐๙๙-จ-๗๖๗๖
๑๖)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๐
๑๗)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๒
๑๘)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๓
๑๙)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๕
๒๐)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๖
๒๑)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๗
๒๒)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๘
๒๓)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๑๙
๒๔)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๒๑
๒๕)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๒๓
๒๖)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๒๔
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๓๔)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๓
๓๕)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๔

๓๖)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๕
๓๗)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๖
๓๘)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๗
๓๙)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๘
๔๐)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๓๙
๔๑)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๐
๔๒)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๑
๔๓)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๒
๔๔)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๔
๔๕)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๕
๔๖)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๗
๔๗)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๘๔๘
๔๘)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๕๒๑
๔๙)	ทะเบียนเลขที่	ว-๐๙๙-จ-๘๕๒๒

๓๖) นายรอมชี...

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
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ที่ ออก ๐๓๑๐(๑)/ ลงวันที่

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘๗ รายการ

น้ำเสีย จำนวน 27 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	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
5	Chemical Oxygen Demand	Closed Reflux, Titrimetric Method <sup>[3]</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
7	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[3]</sup>
8	Copper	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
9	Cyanide	Distillation, Colorimetric method <sup>[3]</sup>
10	Formaldehyde	Distillation, Colorimetric Method <sup>[2]</sup>
11	Free Chlorine	1) Iodometric Method <sup>[3]</sup> 2) DPD Colorimetric Method <sup>[3]</sup>
12	Hexavalent Chromium	Colorimetric Method <sup>[3]</sup>
13	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
14	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
15	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[3]</sup>
16	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
17	Oil & Grease	Liquid-Liquid, Partition-Gravimetric Method <sup>[3]</sup>
18	pH	Electrometric Method <sup>[3]</sup>
19	Phenols	Distillation, Direct Photometric Method <sup>[3]</sup>
20	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
21	Sulfide	Iodometric method <sup>[3]</sup>

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
22	Temperature	Laboratory and Field Methods <sup>[3]</sup>
23	Total Dissolved Solids	Dried at 180 °C <sup>[3]</sup>
24	Total Kjeldahl Nitrogen	1) Macro Kjeldahl Method <sup>[3]</sup> 2) Semi-Micro Kjeldahl Method <sup>[3]</sup>
25	Total Suspended Solids	Dried at 103-105 °C <sup>[3]</sup>
26	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[3]</sup>
27	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>

น้ำใต้ดิน จำนวน 58 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acetone	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method <sup>[3]</sup>
2	Antimony	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
3	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
4	Barium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
5	Benzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
6	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
7	Bromodichloromethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
8	Bromoform	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
9	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
10	Carbon Disulfide	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
11	Carbon Tetrachloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
12	Chlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
13	Chlorodibromomethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>

ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน  
เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการ

22 Temperature...

ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน  
เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการ

14 Chloroform...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
14	Chloroform	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
15	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
16	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[3]</sup>
17	Chromium (VI)	Colorimetric Method <sup>[3]</sup>
18	Cyanide	Colorimetric Method <sup>[3]</sup>
19	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
20	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
21	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
22	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
23	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
24	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
25	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
26	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
27	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
28	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
29	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
30	Ethylbenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
31	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>



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32 Lead...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
32	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
33	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
34	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[3]</sup>
35	Methyl Bromide	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
36	Methylene Chloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
37	Methyl Tert-Butyl Ether	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
38	Naphthalene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
39	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
40	pH	Electrometric method <sup>[3]</sup>
41	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[3]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
42	Silver	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
43	Styrene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
44	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
45	Tetrachloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
46	Toluene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
47	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
48	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
49	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>



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50 Trichloroethylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
50	Trichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
51	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
52	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>
53	Vinyl Chloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
54	m-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
55	o-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
56	p-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
57	Xylene (Total)	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>[3]</sup>
58	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[3]</sup>

อากาศเสีย (ปล่อยระบาย) จำนวน 26 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) 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	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>[4]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[4]</sup>

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7 Chromium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
7	Chromium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
8	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
9	Copper	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
10	Dioxin/Furans	Isokinetic Sampling <sup>[4]</sup>
11	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>[4]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[4]</sup>
12	Hydrogen Fluoride	1) Absorption Sampling, Ion Chromatographic Method <sup>[4]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[4]</sup>
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[4]</sup>
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>[4]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
15	Manganese	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup>
17	Nickel	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
18	Opacity	Ringelmann's Method <sup>[1]</sup>
19	Oxide of Nitrogen	1) Absorption Sampling, Phenolcislulfonic acid Method <sup>[4]</sup> 2) Instrumental Analyzer Method <sup>[4]</sup>
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>

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21 Sulfur...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[4]</sup> 2) Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[4]</sup> 3) Instrumental Analyzer Method <sup>[4]</sup>
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[4]</sup>
23	Tin	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
24	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[4]</sup>
25	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>[4]</sup>
26	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>[4]</sup>

**สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 20 รายการ**

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

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	pH	Electrometric Method <sup>[14]</sup>
16	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[5,12]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
17	Silver	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
18	Thallium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
19	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
20	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>

**ดิน จำนวน 56 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
2	Antimony	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
3	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[5,9]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
4	Barium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
5	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
6	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
7	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
8	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
9	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
10	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
11	Carbon Tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
12	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
13	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
14	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
15	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
16	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation Method <sup>[5,7,9,11]</sup>
17	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>[7,11]</sup>
18	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
19	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
20	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
21	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
22	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
23	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
24	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
25	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
26	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
27	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
28	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
29	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
30	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
31	Lead	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
32	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[11]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
35	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
36	Methyl Tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
37	Naphthalene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
38	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>[5,12]</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
40	Silver	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
41	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
42	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
43	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
44	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
45	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
46	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
47	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
48	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
49	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>
50	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>[5,8]</sup>
51	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[7,13]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
52	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
53	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
54	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
55	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
56	Zinc	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>

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และประเมินภัยสุขภาพ



ที่ อก ๐๓๑๐(๑)/ ๒๐๓๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๐ กุมภาพันธ์ ๒๕๖๕

เรื่อง เปลี่ยนแปลงสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๔ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด จำนวน ๑ แผ่น

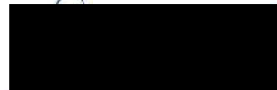
ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ว-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖ ซอยจีนเขต ๑ ถนนงามวงศ์วาน  
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงสารมลพิษที่วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้วให้ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี  
จำกัด เพิ่มขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในดิน ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๗๓๒๕ ลงวันที่ ๒๔ กรกฎาคม ๒๕๖๔ คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่น  
คำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติการตามมติที่กรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ว-๐๙๙

ที่ อก ๐๓๑๐(๑)/ ๒๐๓๕

ลงวันที่ ๑๐ กุมภาพันธ์ ๒๕๖๕

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓ รายการ

ดิน จำนวน 3 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	TPH (C <sub>5</sub> - C <sub>6</sub> )	Purge and Trap, Gas Chromatographic Method <sup>[2,3]</sup>
2	TPH (C <sub>8</sub> - C <sub>16</sub> )	Ultrasonic Extraction, Gas Chromatographic Method <sup>[1,3]</sup>
3	TPH (C <sub>&gt;16</sub> - C <sub>35</sub> )	Ultrasonic Extraction, Gas Chromatographic Method <sup>[1,3]</sup>

เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Ultrasonic Extraction. SW-846 Method 3550C, 2007.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Closed System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Sample. SW-846 Method 5035A, 2002.
3. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Nonhalogenated Organics Using GC/FID. SW-846 Method 8015D, 2003

ที่ อก ๐๓๑๐(๑)/ ๑๑๕๖๗



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๔ สิงหาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง ๑. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๑ สิงหาคม ๒๕๖๕

๒. หนังสือบริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ลงวันที่ ๑๑ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง ๑ และ ๒ บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๕๕/๑๑๔ หมู่ที่ ๖ ซอยชินเขต ๑  
ถนนงามวงศ์วาน แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์  
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๙ ราย

๑)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๕๕
๒)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๑
๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๒
๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๔
๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๖
๖)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๘
๗)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๗
๘)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๘
๙)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๙๕๒๑

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๕ ราย

๑)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๑
๒)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๒
๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๓
๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๔
๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๕
๖)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๖
๗)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๗
๘)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๘
๙)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๐๙
๑๐)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๐

๑๑) นายพงศ์ปวีร์...

- ๒ -

๑๑)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๑
๑๒)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๒
๑๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๓
๑๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๔
๑๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๕

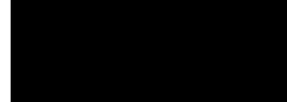
๓. ให้เปลี่ยนชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาววาสนา ชื่นเงิน ทะเบียน  
เลขที่ ๖-๐๙๙-จ-๘๘๐๖ เป็น นางสาวกิริณี ชื่นเงิน

๔. ให้เปลี่ยนชื่อ-สกุลเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาวเปรมวดี ปุริโรสง  
ทะเบียนเลขที่ ๖-๐๙๙-จ-๕๔๐๒ เป็น นางเดชนี สืบเสระ

อนึ่ง หนังสือฉบับนี้จะมีผลต่ออายุ/ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๓๒๒๕ ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๕ คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติการตามฉบับที่กรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔  
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"





ที่ อก ๐๓๑๐(๑)/ ๑๑๕๕๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๗ สิงหาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๙ มิถุนายน ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์  
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖ ซอยชินเขต ๑ ถนนงามวงศ์วาน  
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ ความละเอียด  
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย

ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๐๖

๒. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

๑) ทะเบียนเลขที่ ๖-๐๙๙-๙-๗๐๕๖  
๒) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๑๐  
๓) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๑๓  
๔) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๑๗  
๕) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๒๕  
๖) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๓๔  
๗) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๔๒  
๘) ทะเบียนเลขที่ ๖-๐๙๙-๙-๘๘๕๒  
๙) ทะเบียนเลขที่ ๖-๐๙๙-๙-๐๐๐๑  
๑๐) ทะเบียนเลขที่ ๖-๐๙๙-๙-๐๐๐๖  
๑๑) ทะเบียนเลขที่ ๖-๐๙๙-๙-๐๐๑๑  
๑๒) ทะเบียนเลขที่ ๖-๐๙๙-๙-๐๐๑๔

๓. ให้เพิ่มขอบข่าย...

- ๒ -

๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์  
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th





เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ว-๐๙๙

ที่ อก ๐๓๑๐(๑)/ ๑๑๙๔๙

ลงวันที่ ๑๗ สิงหาคม ๒๕๖๖

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๔ รายการ

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 18 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
2	Barium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
3	Beryllium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
4	Cadmium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
5	Chromium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
6	Chromium (III)	Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation <sup>[1,2,3,4]</sup>
7	Chromium (VI)	Waste Extraction, Colorimetric Method <sup>[1,4]</sup>
8	Cobalt	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
9	Copper	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
10	Lead	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
11	Mercury	Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[1,2,5]</sup>
12	Molybdenum	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
13	Nickel	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
14	Selenium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>

- ๒ -

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Silver	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
16	Thallium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
17	Vanadium	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>
18	Zinc	Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,2,3]</sup>

#### เอกสารอ้างอิง

1. กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2548. เรื่อง การกำจัดสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว.ราชกิจจานุเบกษา. 25 มกราคม 2549. เล่มที่ 123 ตอนพิเศษ 11ง.
2. United States Environmental Protection Agency. **Test Methods for Evaluation Solid Waste Physical/Chemical Methods. SW-846, 1997.**
3. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Inductively Coupled Plasma-Optical Emission Spectrometry. SW-846 Method 6010D, 2018.**
4. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Chromium, Hexavalent (Colorimetric). SW-846 Method 7196A, 1992.**
5. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. **Mercury in Liquid Waste (Manual Cold-Vapor Technique). SW-846 Method 7470A, 1994.**

15 Silver...



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม  
โครงการผลิตปิโตรเลียมแหล่งประดู่เตาและแหล่งเสาเดียวร่อนขยาย แปลงเอส 1 จังหวัดพิษณุโลก และสุโขทัย  
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

ภาคผนวกที่ 39  
เอกสารสอบเทียบเครื่องมือ



ព្រះឥសាន

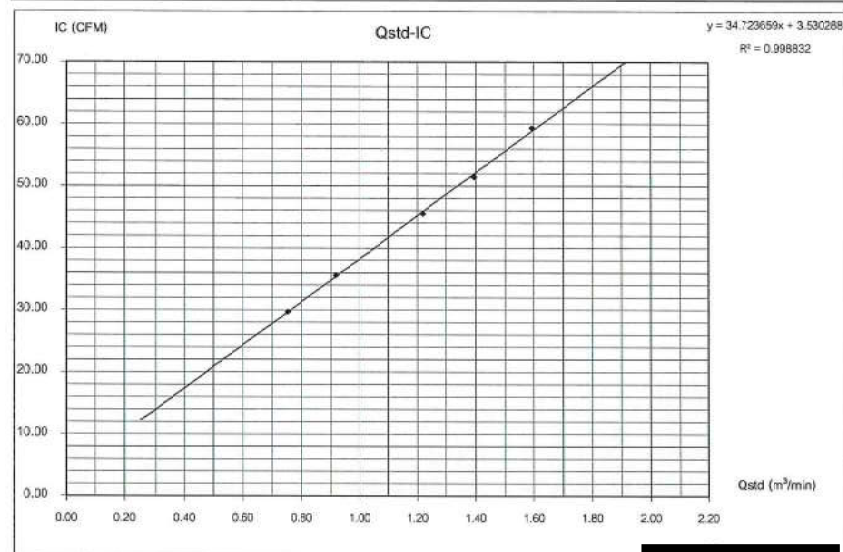
### TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01033	Date	December 13, 2023
Sampler Location	Thung Song Hong	Start Time	2:16 PM
Sampler Number	TSP No. A30	Transfer Standard Type	Office
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-6025A
Motor Serial Number	2213	Calibrator Serial Number	2716
Recorder Serial Number	2135	Calibrated By	

Rate	(Delta H)	(A)	(X)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (in H <sub>2</sub> O)	$[\Delta H_{H_2O} / (Pa \cdot P_{std} / T_{std} / T_{air})]^{1/2}$	$Q_{std} = (1/m) [(A-b)]$	Sample Flow Rate Indicator	IC = $[(Pa \cdot P_{std} / (T_{std} / T_{air}))^{1/2}]$	Pressure	Meter	Meter
	Positive	Negative	$\Delta H_{H_2O}$	$(m^3/min)$	$(m^3/min)$	(°K = °C + 273)	(mmHg)	
5	1.2	1.2	2.4	153332	0.75153	303.0	757.0	
7	1.8	1.8	3.5	187793	0.91748	303.0	757.0	
10	3.2	3.2	6.4	250391	1.21895	303.0	757.0	
13	4.2	4.2	8.4	266658	1.30457	303.0	757.0	
18	5.5	5.5	11.0	328265	1.59398	303.0	757.0	
Linear Regression Y ON X: Y = mX + b					Average	303.0	757.0	
1	Slope (m)	2.07647	Linear Equation		r <sup>2</sup>	0.998832	Pstd(mmHg)	760.0
2	Intercept (b)	-0.02720	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.9994158	T <sub>std</sub> (°C)	298.0
3	Correlation Coefficient (r)	0.99954	Final Set Flow Rate = (1)	0	(Pa/Pstd)*(Tstd/Tair)	0.97961612		
Result					C = (Pa/Pstd)*(Tstd/Tair)*0.5	0.98975586		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 02, June 1, 2019

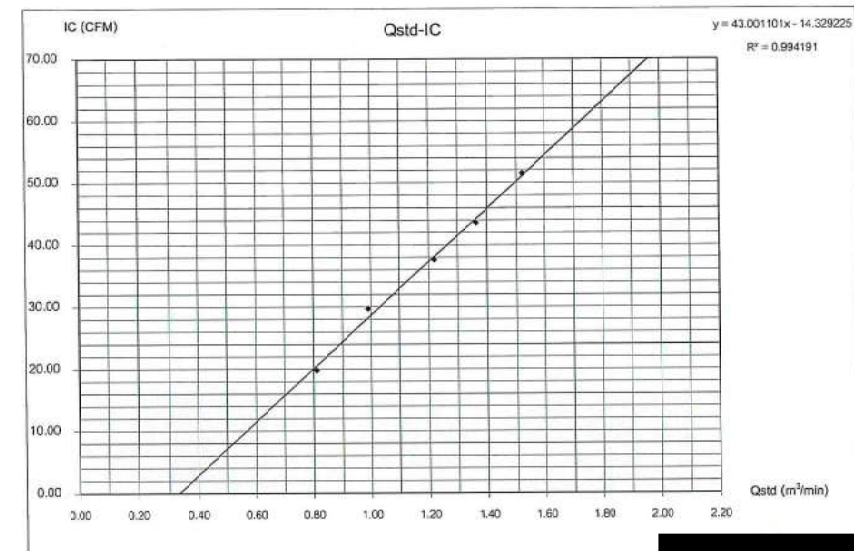
### PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01033	Date	December 13, 2023
Sampler Location	Thung Song Hong	Start Time	2:26 PM
Sampler Number	PM-10 No. 21	Transfer Standard Type	Office
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-6025A
Motor Serial Number	2132	Calibrator Serial Number	2716
Recorder Serial Number	2392	Calibrated By	

Rate	(Delta H)	(A)	(X)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (in H <sub>2</sub> O)	$[\Delta H_{H_2O} / (Pa \cdot P_{std} / T_{std} / T_{air})]^{1/2}$	$Q_{std} = (1/m) [(A-b)]$	Sample Flow Rate Indicator	IC = $[(Pa \cdot P_{std} / (T_{std} / T_{air}))^{1/2}]$	Pressure	Meter	Meter
	Positive	Negative	$\Delta H_{H_2O}$	$(m^3/min)$	$(m^3/min)$	(°K = °C + 273)	(mmHg)	
5	1.4	1.4	2.8	1.65618	0.81069	303.0	757.0	
7	2.1	2.1	4.2	2.02860	0.98995	303.0	757.0	
10	3.2	3.2	6.4	2.50331	1.21895	303.0	757.0	
13	4.0	4.0	8.0	2.79945	1.36128	303.0	757.0	
18	5.0	5.0	10.0	3.12986	1.52041	303.0	757.0	
Linear Regression Y ON X: Y = mX + b					Average	303.0	757.0	
1	Slope (m)	2.07647	Linear Equation		r <sup>2</sup>	0.994191	Pstd(mmHg)	760.0
2	Intercept (b)	-0.02720	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.9970913	T <sub>std</sub> (°C)	298.0
3	Correlation Coefficient (r)	0.99954	Final Set Flow Rate = (1)	0	(Pa/Pstd)*(Tstd/Tair)	0.97961612		
Result					C = (Pa/Pstd)*(Tstd/Tair)*0.5	0.98975586		

COMMENT

Andersen Instruments, Inc.



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Technician

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Environmental Scientist

F-AB-028, Rev. 02, June 1, 2019

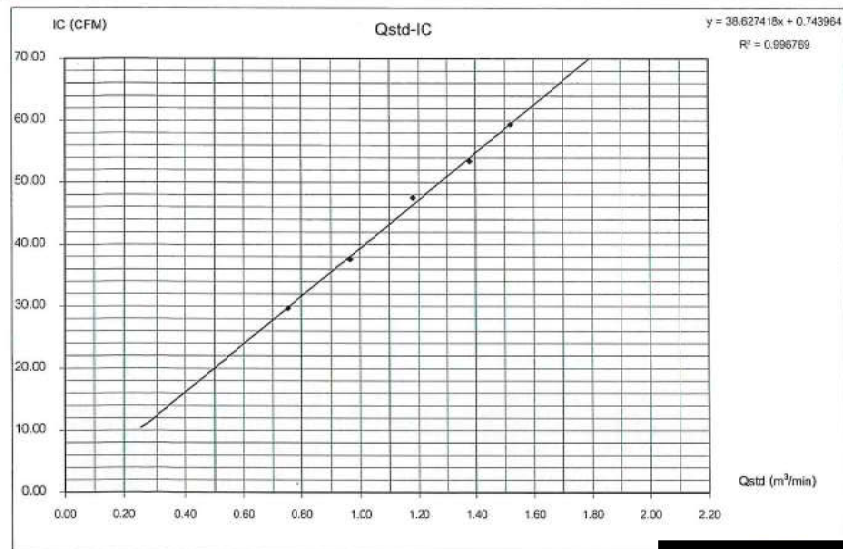
### TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01033	Date	December 13, 2023
Sampler Location	บ้านเลขที่ 2/5	Start Time	3:28 PM
Sampler Number	TSP No.A23	Transfer Standard Type	Office
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	2055	Calibrator Serial Number	2716
Recorder Serial Number	2186	Calibrated By	

Rate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (H <sub>2</sub> O)			$\Delta H_2O(P_{atm}/T_{atm})^{1.5}$	$Q_{std} = (1/m)(\Delta A \cdot b)$	Sample Flow Rate Indicator	$C = [(P_{atm}/T_{atm})^{1.5}]^{1/2}$	(°K = °C+273)	Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_2O$		(m <sup>3</sup> /min)	(s <sup>3</sup> /min)			(mmHg)			
5	1.2	1.2	2.4	1.53332	0.75153	30.0	29.69	303.0	757.0			
7	2.0	2.0	4.0	1.97951	0.96641	36.0	31.61	303.0	757.0			
10	3.0	3.0	6.0	2.42440	1.18056	48.0	41.51	303.0	757.0			
13	4.1	4.1	8.2	2.83423	1.37603	54.0	53.45	303.0	757.0			
16	5.0	5.0	10.0	3.12988	1.52041	60.0	59.38	303.0	757.0			
Linear Regression Y ON X: Y = mX + b							Average	303.0	757.0			
1	Slope (m)			2.07647	Linear Equation			r <sup>2</sup>	0.996769	Pstd(mmHg)	760.0	
2	Intercept (b)			-0.02720	Set Point Flow Rate (X) (m <sup>3</sup> /min)		-	1.133	r	0.9983632	T <sub>app</sub>	298.0
3	Correlation Coefficient (r)			0.99954	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.97951612		
Result								C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.989755596			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-A8-025, Rev. 02, June 3, 2019

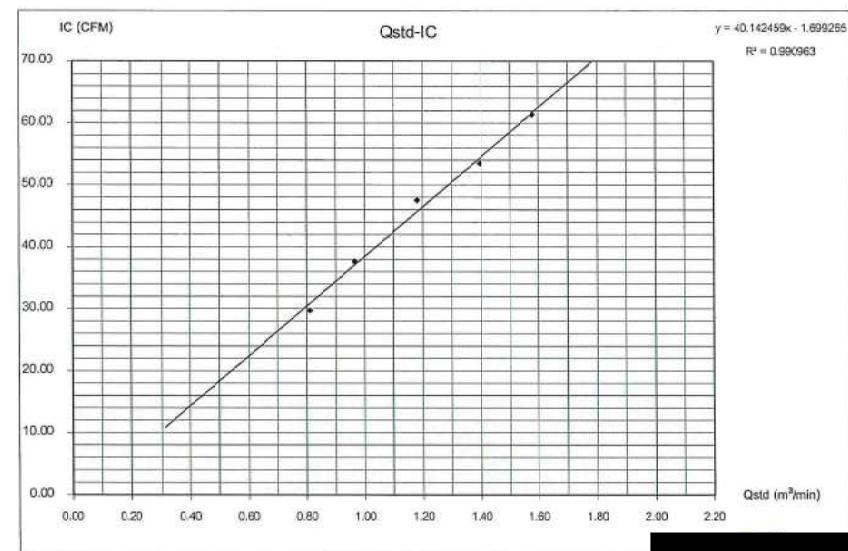
### PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01033	Date	December 13, 2023
Sampler Location	บ้านเลขที่ 2/5	Start Time	3:18 PM
Sampler Number	PM-10 No.29	Transfer Standard Type	Office
Instrument Model	HIVOL-BM8BE	Calibrator Model	TE-5025A
Motor Serial Number	2614	Calibrator Serial Number	2716
Recorder Serial Number	2213	Calibrated By	

Rate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop		
	Pressure Drop Across Orifice (h <sub>H<sub>2</sub>O</sub> )			$[\Delta h_{H_2O}(P_{app}/P_{std})(T_{std}/T_a)]^{1/2}$	$2\text{std} = (1/m)[\Sigma(A/b)]$	single Flow Rate Indicator	$[\Sigma (P_{app}/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	Pressure	Meter	Meter		
	Positive	Negative	ΔH <sub>2</sub> O		(m <sup>3</sup> /min)	(L <sup>3</sup> /min)			(mmHg)				
5	1.4	1.4	2.8	1.65616	0.81059	36.0	29.69	303.0	757.0				
7	2.0	2.0	4.0	1.97951	0.96641	36.0	37.61	303.0	757.0				
10	3.0	3.0	6.0	2.42440	1.18056	48.0	47.51	303.0	757.0				
13	4.2	4.2	8.4	2.83856	1.39457	54.0	53.45	303.0	757.0				
16	5.4	5.4	10.8	3.25267	1.57954	62.0	61.36	303.0	757.0				
Linear Regression Y ON X : Y = mX + b								Average	303.0	757.0			
1	Slope (m)			2.07847	Linear Equation			r <sup>2</sup>	0.990963	Pstd(mmHg)	760.0		
2	Intercept (b)			-0.02720	Set Point Flow Rate (X) (m <sup>3</sup> /min)			1.133	r	0.9954712	T <sub>app</sub>	298.0	
3	Correlation Coefficient (r)			0.99954	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.97961612			
Result								C=(Pa/Pstd)*(Tstd/Ta)*0.5					0.98975566

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-A8-025, Rev. 02, June 3, 2019



## CERTIFICATE OF CALIBRATION

Certificate No. : CL-006-66

Page 1 of 2 Pages

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

: Top Load Orifice  
: TISCH  
: TE-5025A  
: 2716  
: -  
: Used item  
: Environment Research & Technology Co., Ltd.  
25/114 Moo 6 Soi Chinakiet 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

**RECEIVED DATE** : 21 Mar 2023  
**MEASUREMENT DATE** : 07 Apr 2023  
**ISSUE DATE** : 07 Apr 2023

**ENVIRONMENTAL CONDITIONS:**

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010 ± 10 hPa

**CALIBRATION CONDITION:**

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 24.4 °C and 62.0%RH.

**TABULATION OF RESULTS:**

The table on next page give the measured values.

**Calibration procedure:**

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Root's Meter) Model G65/IMC/VW2-dp. The WI-CL-C04 was used as a calibration guideline.

**Traceability:**

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

**Uncertainty of Measurement:**

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Continuation of Certificate of Calibration Number CL-006-66

Page 2 of 2 Pages

**MEASUREMENT RESULTS:**

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.701	754.759	24.59	24.15	53.063	1.773	1.328	0.649
2	0.999	754.747	24.68	24.23	56.842	3.507	1.867	0.920
3	1.125	754.738	24.15	23.97	40.867	4.758	1.177	1.060
4	1.166	754.757	24.46	24.26	29.829	5.265	2.289	1.115
5	1.415	754.783	24.27	24.08	30.001	7.812	2.789	1.354

Slope (m): 2.07647  
Intercept (b): -0.02720  
Correlation coefficient (r): 0.99954  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_Orifice inH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.701	754.759	24.59	24.15	53.063	1.773	0.836	0.652
2	0.999	754.747	24.68	24.23	56.842	3.507	1.176	0.925
3	1.125	754.738	24.15	23.97	40.867	4.758	1.369	1.064
4	1.166	754.757	24.46	24.26	29.829	5.265	1.441	1.121
5	1.415	754.783	24.27	24.08	30.001	7.812	1.754	1.360

Slope (m): 1.30058  
Intercept (b): -0.01713  
Correlation coefficient (r): 0.99953  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min



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

**Calibrated by:**

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittrarn Lertsomphol



**Approved signatory**




Calibration Department Manager

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+662 723 0382  
MT-TH.ServiceSupport@mt.com



# Accuracy Calibration Certificate

## Customer

Company: Environment Research & Technology Co., Ltd.  
Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong  
City: Laksi Contact: Ramita Taengthai  
Zip / Postal: 10210  
State / Province: Bangkok  
Order Number: 

## Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S Asset Number: ERTC-L4N-0048  
Serial No.: 1123103723 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 4 Terminal Asset No.: N/A  
Room: 406

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

## Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.  
The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.  
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 25.4 °C	End: 25.3 °C	Start: 36.4 %	End: 34.9 %
As Left	Start: 25.3 °C	End: 25.2 °C	Start: 34.9 %	End: 34.1 %

As Found Calibration Date: 15-Jan-2024 Calibrator:  
As Left Calibration Date: 15-Jan-2024  
Issue Date: 15-Jan-2024  
Approved Signatory:

Technical Manager / Head of Calibration Center

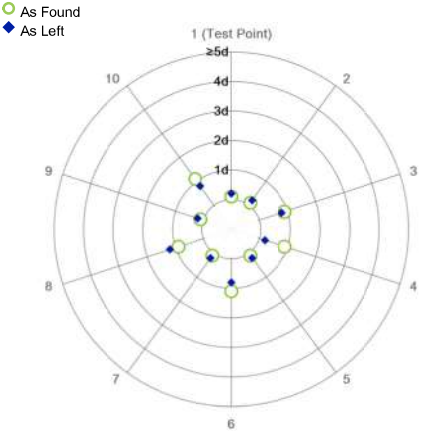
## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9993 g	100.0002 g
2	99.9993 g	100.0002 g
3	99.9992 g	100.0003 g
4	99.9992 g	100.0002 g
5	99.9993 g	100.0002 g
6	99.9994 g	100.0003 g
7	99.9993 g	100.0002 g
8	99.9992 g	100.0001 g
9	99.9993 g	100.0002 g
10	99.9994 g	100.0003 g

Standard Deviation 0.00007 g 0.00006 g



The "d" in the graph represents the readability of the range/interval in which the test was performed.

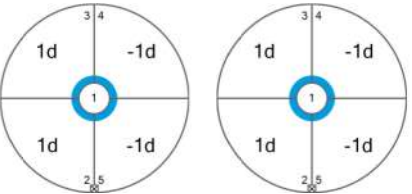
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9993 g	100.0002 g
2	99.9994 g	100.0003 g
3	99.9994 g	100.0003 g
4	99.9992 g	100.0001 g
5	99.9992 g	100.0001 g

Maximum Deviation 0.0001 g 0.0001 g



As Found As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.



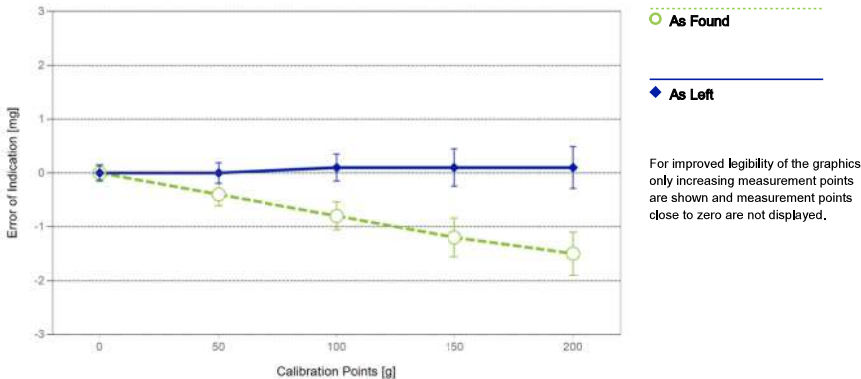
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0,0000 g	0,0000 g	0,0000 g	0,16 mg	2
2	0,0500 g	0,0501 g	0,0001 g	0,17 mg	2
3	0,1000 g	0,1000 g	0,0000 g	0,17 mg	2
4	0,5000 g	0,5001 g	0,0001 g	0,17 mg	2
5	1,0000 g	1,0000 g	0,0000 g	0,17 mg	2
6	5,0000 g	4,9999 g	-0,0001 g	0,17 mg	2
7	10,0000 g	9,9998 g	-0,0002 g	0,18 mg	2
8	50,0000 g	49,9996 g	-0,0004 g	0,21 mg	2
9	100,0001 g	99,9993 g	-0,0008 g	0,26 mg	2
10	150,0001 g	149,9989 g	-0,0012 g	0,36 mg	2
11	200,0000 g	199,9985 g	-0,0015 g	0,40 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0,0000 g	0,0000 g	0,0000 g	0,14 mg	2
2	0,0500 g	0,0500 g	0,0000 g	0,15 mg	2
3	0,1000 g	0,1000 g	0,0000 g	0,15 mg	2
4	0,5000 g	0,5000 g	0,0000 g	0,15 mg	2
5	1,0000 g	1,0000 g	0,0000 g	0,15 mg	2
6	5,0000 g	5,0000 g	0,0000 g	0,16 mg	2
7	10,0000 g	10,0000 g	0,0000 g	0,16 mg	2
8	50,0000 g	50,0000 g	0,0000 g	0,19 mg	2
9	100,0001 g	100,0002 g	0,0001 g	0,25 mg	2
10	150,0001 g	150,0002 g	0,0001 g	0,35 mg	2
11	200,0000 g	200,0001 g	0,0001 g	0,39 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.  
The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS52	Date of Issue:	22-Nov-2022
Certificate Number:	182272	Calibration Due Date:	21-May-2024

Thermo Hygrometer

Equipment No.:	IN302	Date of Issue:	11-Oct-2023
Certificate Number:	SG-H-00656/66	Calibration Due Date:	08-Oct-2024

Remarks

Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 3,0 · 10<sup>-6</sup> / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

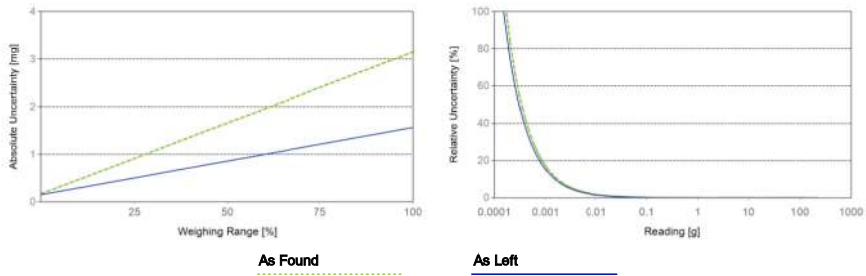
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0,0001 g	220 g	U <sub>i</sub> = 0.17 mg + 0.0136 mg/g · R	U <sub>i</sub> = 0.15 mg + 0.00644 mg/g · R

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.079%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.16 mg	0.0075%
22.0000 g	0.47 mg	0.0021%	0.29 mg	0.0013%
220.0000 g	3.2 mg	0.0014%	1.6 mg	0.00071%



GWP®

Certificate



As Found

✓

As Left

✓

The weighing device meets the given process requirements.

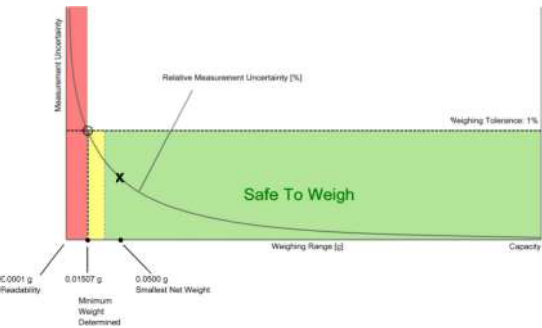
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☒ As Left

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.0500 g | Safety Factor: 2

Safe Weighing Range




While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

# Minimum Weight


As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.17097 g	0.34671 g	0.52742 g	0.90460 g	1.95110 g
0.2%	0.08490 g	0.17097 g	0.25823 g	0.43643 g	0.90460 g
0.5%	0.03382 g	0.06783 g	0.10202 g	0.17097 g	0.34671 g
1%	0.01689 g	0.03382 g	0.05080 g	0.08490 g	0.17097 g
2%	0.00844 g	0.01689 g	0.02535 g	0.04231 g	0.08490 g
5%	0.00337 g	0.00675 g	0.01013 g	0.01689 g	0.03382 g

 Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15153 g	0.30504 g	0.46056 g	0.77780 g	1.60910 g
0.2%	0.07552 g	0.15153 g	0.22803 g	0.38254 g	0.77780 g
0.5%	0.03015 g	0.06038 g	0.09068 g	0.15153 g	0.30504 g
1%	0.01507 g	0.03015 g	0.04525 g	0.07552 g	0.15153 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07552 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 g

 Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.







The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.




Notes on minimum weight values in above table:

- If "N/A" is shown above, no appropriate value could be calculated.
- METTLER TOLEDO is not responsible for the definition of the process requirements.











# Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found			
As Left			

 = Passed  
 = Failed  
 = Safety Factor not met













Repeatability

		As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0,00007 g*	N/A	0,00006 g*	N/A
0.2%	0.00005 g				
0.5%	0.00013 g				
1%	0.00025 g				
2%	0.00050 g				
5%	0.00125 g				

\*The calculated standard deviation value is below the rounding error of the balance. The 0.41\*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

		As Found		As Left	
Tolerance	Control Limit	Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g		0.0001 g	
0.2%	0.1000 g				
0.5%	0.2500 g				
1%	0.5000 g				
2%	1.0000 g				
5%	2.5000 g				

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

## Attachment to Calibration Certificate:

TH3067-067-011524-ACC-TH

GWP® Certificate

## Error of Indication

METTLER TOLEDO Service

## As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	-0.0004 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	-0.0008 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	-0.0012 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0015 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

## As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.



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E-mail : envi@enviresearch.co.th

www.enviresearch.co.th

Head Office/Tax ID 0105 542 864 981

## Calibration Data of NOx Analyzer

## Analyzer Performance Test

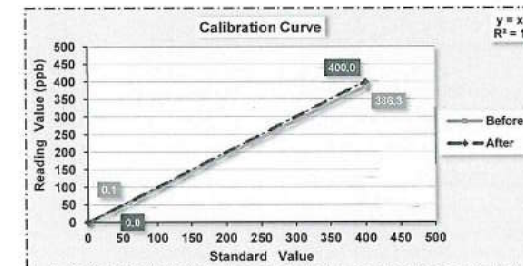
Equipment	Gas Analyzer ( NOx )	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2023-01033
Serial No.	TNTLC359	Calibration Date	November 26, 2023
Analyzer Unit	ppb	Time	1:34 PM

## Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	070C419829
Dynamic Dilution Calibrator	Tanabyte	300	C155
Standard Gas Components	CO = 4.516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

## Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value						% Abs Error		
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )			Stability	
		Before	After	Before	After	Before	After		Before	After
Zero	0	-2.3	0.0	0.1	0.0	-2.4	0.0	-	-	-
Span	400	393.2	400.0	398.3	400.0	6.9	0.0	-	-	3.4



## STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL APNA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal NO	mV	0.9	0.8	Voltage of the measured NO value
Signal NOx	mV	4.7	5.3	Voltage of the measured NOx value
Detector	°C	42.2	42.2	43 °C ± 5 °C
Ambient	kPa	101.0	100.9	Current atmospheric pressure
DC 24V	V	23.6	23.5	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.02910	1.02910	0.50000 - 2.0000
NOx Slope	-	1.07830	1.07830	0.50000 - 2.0000

Calibrate By:

November 23, 2023

Checked By:

November 25, 2023



### Calibration Data of NOx Analyzer

#### Analyzer Performance Test

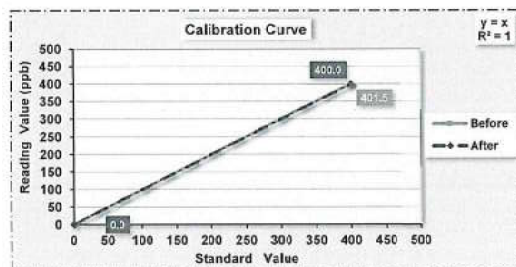
Equipment	Gas Analyzer ( NOx )	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2023-01C33
Serial No.	U65W031M	Calibration Date	November 30, 2023
Analyzer Unit	ppb	Time	4:34 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> (ppb)		NO (ppb)		NO <sub>2</sub> (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-0.1	0.0	-0.1	0.0	0.0	0.0	-	-	-
Span	400	404.1	400.0	401.5	400.0	2.6	0.0	-	-	0.4



#### STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL APNA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal NO	mV	1.5	1.3	Voltage of the measured NO value
Signal NOx	mV	20.0	19.8	Voltage of the measured NOx value
Detector	°C	42.3	42.2	43 °C ± 5 °C
Ambient	kPa	101.6	101.6	Current atmospheric pressure
DC 24V	V	23.6	23.8	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.09860	1.09760	0.50000 - 2.00000
NOx Slope	-	1.02150	1.02010	0.50000 - 2.00000

Calibrate By :

November 30, 2023

Checked By :

November 30, 2023

### Calibration Data of SO<sub>2</sub> Analyzer

#### Analyzer Performance Test

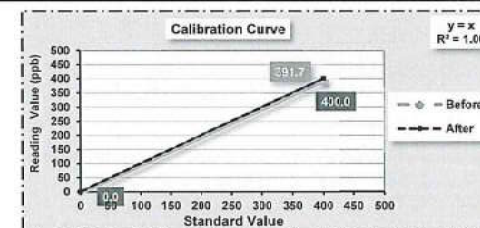
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	Vision E.
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2023-01C33
Serial No.	ETSTKURU	Calibration Date	November 30, 2023
Analyzer Unit	ppb	Time	4:14 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-4.1	0.0	-	-	-
Span	400	391.7	400.0	-	-	2.1



#### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL APSA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal (SO <sub>2</sub> )	mV	27.1	29.2	Voltage of the measured SO <sub>2</sub> value
LAMP	mV	477.8	477.8	200 mV - 1200 mV
CELL	°C	34.4	34.5	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	41.7	41.8	65 kPa or less
AMBIENT	kPa	100.9	100.7	Current atmospheric pressure
DC 24V	V	24.0	24.0	24 V ±0.5 V
DC 5V	V	5.0	5.0	5 V ±0.5 V

Calibrate By :

November 30, 2023

Checked By :

November 30, 2023



### Calibration Data of SO<sub>2</sub> Analyzer

#### Analyzer Performance Test

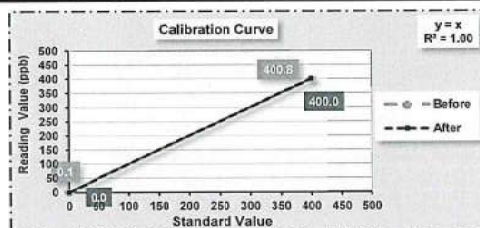
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	Vision E.
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2023-01033
Serial No.	ETSTKURU	Calibration Date	November 30, 2023
Analyzer Unit	ppb	Time	11:02 AM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.515 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.1	0.0	-	-	-
Span	400	400.8	400.0	-	-	0.2



#### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL APSA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal (SO <sub>2</sub> )	mV	7.9	7.8	Voltage of the measured SO <sub>2</sub> value
LAMP	mV	336.6	333.9	200 mV - 1200 mV
CELL	°C	35.5	34.9	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	43.3	43.1	65 kPa or less
AMBIENT	kPa	101.2	100.9	Current atmospheric pressure
DC 24V	V	23.9	23.9	24 V ±0.5 V
DC 5V	V	5.0	5.0	5 V ±0.5 V

Calibrate By :

November 30, 2023

Checked By :

November 30, 2023

### Calibration Data of CO Analyzer

#### Analyzer Performance Test

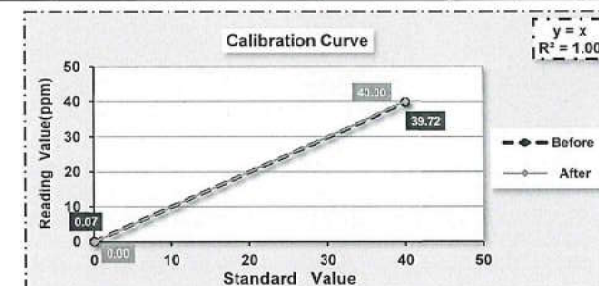
Equipment	Gas Analyzer ( CO )	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01033
Serial No.	4N02XP27	Calibration Date	November 30, 2023
Analyzer Unit	ppm	Time	4:18 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.487 ppm		
Cylinder No : EB0123013	NO = 46.1 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 46.0 ppm		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.07	0.00	-	-	-
Span	40	39.72	40.00	-	-	0.70



#### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	7.6	7.4	Voltage of the measured CO Value
SIGNAL (COMP)	mV	1.0	0.8	Voltage of the interference component Value
CELL	°C	26.6	6.7	Ambient + (5 to 10 °C)
PUMP	kpa	38.9	38.9	less than 65
AMBIENT	kpa	101.5	101.5	Atmospheric pressure
DC 24V	mV	23.9	23.9	24 ±0.5 V
DC 5V	mV	4.9	4.9	5 ±0.5 V

Calibrate By :

November 30, 2023

Checked By :

November 30, 2023

## Calibration Data of CO Analyzer

### Analyzer Performance Test

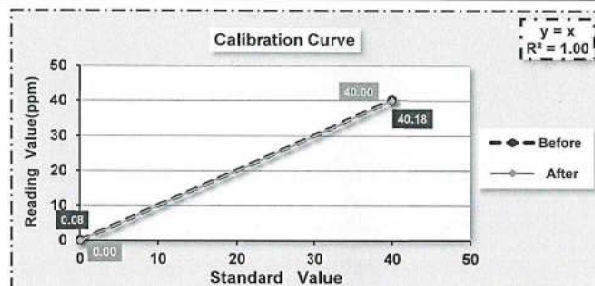
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01033
Serial No.	RBBRW0L3	Calibration Date	November 30, 2023
Analyzer Unit	ppm	Time	4:32 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	070C419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.487 ppm		
Cylinder No : EB0123013	NO = 46.1 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 46.0 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.08	0.00	-	-	-
Span	40	40.18	40.00	-	-	0.45



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	9.2	8.7	Voltage of the measured CO Value
SIGNAL (COMP)	mV	1.1	0.9	Voltage of the interference component Value
CELL	°C	36.4	36.4	Ambient + (5 to 10 °C)
PUMP	kpa	37.8	37.6	less than 65
AMBIENT	kpa	101.4	101.3	Atmospheric pressure
DC 24V	mV	23.9	23.9	24 ± 0.5 V
DC 5V	mV	4.9	4.9	5 ± 0.5 V

Calibrate By :

November 30, 2023

Checked By :

November 30, 2023

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04NI99E15A0292  
Cylinder Number: EB0123013  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12019  
Gas Code: CO, NO, NOX, SO<sub>2</sub>, BALN

Reference Number: 160-401604495-1  
Cylinder Volume: 144.4 Cubic Feet  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 66C  
Certification Date: Oct 22, 2019

Expiration Date: Oct 22, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.

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

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.9% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010429	KAL004123	97.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010429	KAL004123	97.6 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010255	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
NTRM	08012318	KAL004620	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Sep 26, 2019
MKS FTIR - NO - 000928781	FTIR	Oct 18, 2019
MKS FTIR - NOx - 000928781	FTIR	Oct 18, 2019
MKS FTIR - SO <sub>2</sub> - 000928781	FTIR	Oct 03, 2019

Triad Data Available Upon Request

NOTES: Gross Weight: 28.0 Kg, Net Weight: 4.6 Kg.



Approved for Release

Page 1 of 160-401604495-1



## Sound Level Meter Calibration Report

<b>Support Equipment Type</b>	:	Sound Level Calibrator
<b>Manufacture</b>	:	BSWA Technology
<b>Model</b>	:	CA111
<b>Serial No.</b>	:	590335
<b>Range of Calibrator</b>		
- Support Equipment Type	:	94.0
- Frequency	:	1,000 Hz.
<b>Calibrated By</b>	:	Mr.Nitad Sirichad
<b>Calibration Date</b>	:	December 13, 2023
<b>Customer Name</b>	:	Vision E. Consultants Co., Ltd. : โครงการผลิตปิโตรเลียมแหล่งประจวบฯ และแหล่งเสาดิเยอร์ส่วนขยาย แปลงเอส 1 จังหวัดพิษณุโลกและสุโขทัย (ฐานเหมืองผลิตตัวด-เออี (WME-E))

[illegible]

Checked By

### Technician

Approved By

Environmental Scientist

ฤดูฝน



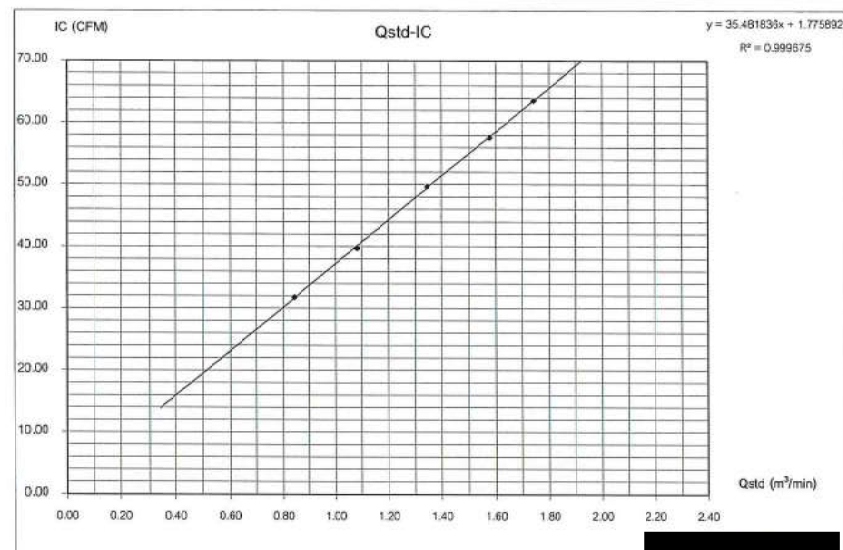
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01001	Date	July 20, 2023
Sampler Location	WME-E บ้านนาโพธิ์ 32/3	Start Time	8:33 AM
Sampler Number	TSP No A19	Transfer Standard Type	Orifice
Instrument Model	HIVOL-88CBE	Calibrator Model	TE-5025A
Motor Serial Number	2014-04	Calibrator Serial Number	3883
Recorder Serial Number	7372	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH <sub>2</sub> O)	$[\Delta H_0 / (P_a P_{std}) (T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m) [(A-b)]$	Sample Flow Rate Indicator (m <sup>3</sup> /min)	$IC = [(P_a P_{std}) (T_{std}/T_a)]^{1/2}$	(°K = °C+273)	Pressure (mmHg)	Meter	Meter
	Positive Negative $\Delta H_0$								
5	1.5 1.5 3.0	1.72226	0.84200	32.0	31.82	301.0	759.0		
7	2.5 2.5 5.0	2.22343	1.06071	40.0	39.77	301.0	759.0		
10	3.9 3.9 7.8	2.77707	1.34441	50.0	49.72	301.0	759.0		
13	5.4 5.4 10.8	3.26777	1.57813	58.0	57.67	301.0	759.0		
18	6.6 6.6 13.2	3.61295	1.74240	64.0	63.64	301.0	759.0		
Linear Regression Y ON X : Y = mx + b						Average	301.0	759.0	
1	Slope (m)	2.09951	Linear Equation			r <sup>2</sup>	0.999675	Pstd(mmHg)	760.0
2	Intercept (b)	-0.04553	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.9996379	Tstd(°C)	298.0	
3	Correlation Coefficient (r)	0.99992	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.988730547			
Result						C=(Pa/Pstd)(Tstd/Ta)*0.5	0.994345308		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 02, June 3, 2019

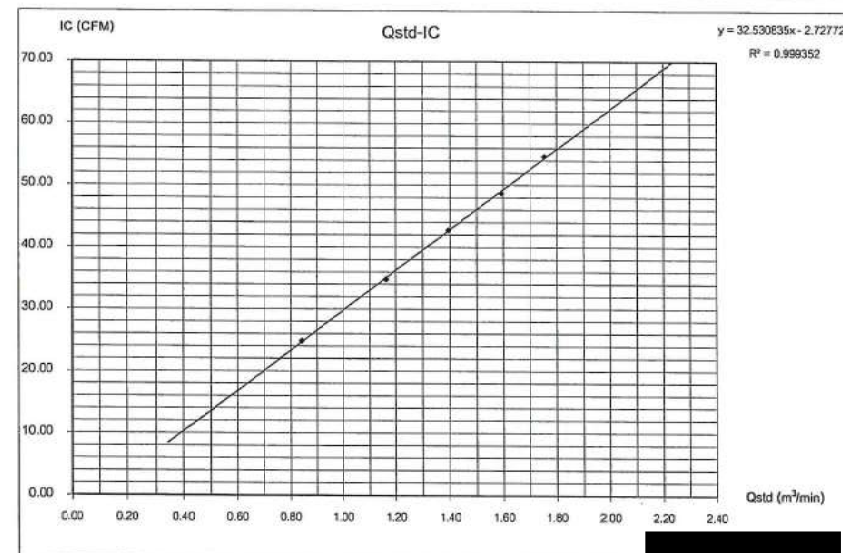
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01001	Date	July 20, 2023
Sampler Location	WME-E บ้านนาโพธิ์ 32/3	Start Time	8:44 AM
Sampler Number	PM-10 No.5	Transfer Standard Type	Orifice
Instrument Model	HIVOL-88B8E	Calibrator Model	TE-5025A
Motor Serial Number	2015-5	Calibrator Serial Number	3883
Recorder Serial Number	R-C21	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH <sub>2</sub> O)	$[\Delta H_0 / (P_a P_{std}) (T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m) [(A-b)]$	Sample Flow Rate Indicator (m <sup>3</sup> /min)	$IC = [(P_a P_{std}) (T_{std}/T_a)]^{1/2}$	(°K = °C+273)	Pressure (mmHg)	Meter	Meter
	Positive Negative $\Delta H_0$								
5	1.5 1.5 3.0	1.72226	0.84200	32.0	31.82	301.0	759.0		
7	2.5 2.5 5.0	2.22343	1.06071	40.0	39.77	301.0	759.0		
10	3.9 3.9 7.8	2.77707	1.34441	50.0	49.72	301.0	759.0		
13	5.4 5.4 10.8	3.26777	1.57813	58.0	57.67	301.0	759.0		
18	6.6 6.6 13.2	3.61295	1.74240	64.0	63.64	301.0	759.0		
Linear Regression Y ON X : Y = mx + b						Average	301.0	759.0	
1	Slope (m)	2.09951	Linear Equation			r <sup>2</sup>	0.999675	Pstd(mmHg)	760.0
2	Intercept (b)	-0.04553	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.9996379	Tstd(°C)	298.0	
3	Correlation Coefficient (r)	0.99992	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.988730547			
Result						C=(Pa/Pstd)(Tstd/Ta)*0.5	0.994345308		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 02, June 3, 2019

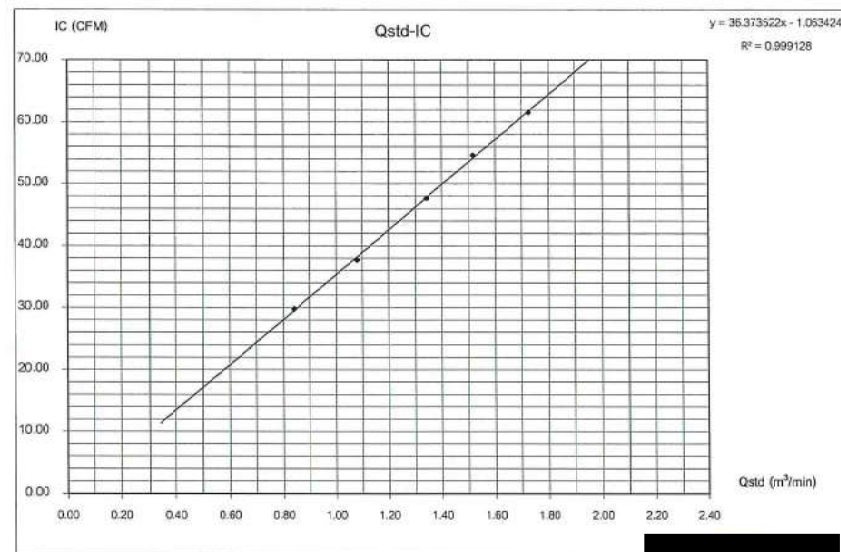
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01001	Date	July 20, 2023
Sampler Location	WME-E ฐานวัดที่ 2/5	Start Time	9:12 AM
Sampler Number	TSP No.A20	Transfer Standard Type	Office
Instrument Model	HVCL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	2142	Calibrator Serial Number	3893
Recorder Serial Number	2397	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmHg)	$[\Delta H_O(Pa/P_{atm}(T_{std}/T_a))]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indicator (m <sup>3</sup> /min)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ (°K = °C+273)	(°K = °C+273)	Pressure (mmHg)	Motor	Motor
5	1.5	1.5	3.0	1.71941	0.84064	30.0	29.78	302.0	759.0
7	2.5	2.5	5.0	2.21975	1.37860	38.0	37.72	302.0	759.0
10	3.9	3.9	7.3	2.72246	1.34222	48.0	47.65	302.0	759.0
13	5.0	5.0	10.0	3.13920	1.51069	55.0	54.60	302.0	759.0
16	6.5	6.5	13.0	3.57924	1.72548	62.0	61.55	302.0	759.0
Linear Regression Y ON X: Y = mx + b						Average	302.0	759.0	
1	Slope (m)	2.09951	Linear Equation			$\bar{r}^2$	0.999128	Pstt(mmHg)	760.0
2	Intercept (b)	-0.04553	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.999539	$T_{std}$	298.0	
3	Correlation Coefficient (r)	0.99992	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.985456605			
Result					C=(Pa/Pstd)(Tstd/Ta)^0.5	0.99270167			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 02, June 1, 2019

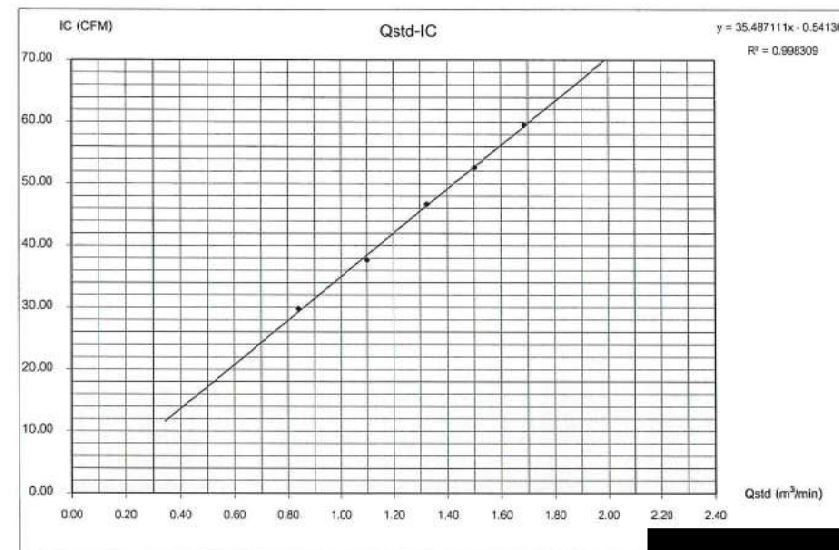
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2023-01001	Date	July 20, 2023
Sampler Location	WME-E ฐานวัดที่ 2/5	Start Time	9:23 AM
Sampler Number	PM10 No.30	Transfer Standard Type	Office
Instrument Model	HVCL-BM8BE	Calibrator Model	TE-5025A
Motor Serial Number	2208	Calibrator Serial Number	3883
Recorder Serial Number	2516	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmHg)	$[\Delta H_O(Pa/P_{atm}(T_{std}/T_a))]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indicator (m <sup>3</sup> /min)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ (°K = °C+273)	(°K = °C+273)	Pressure (mmHg)	Motor	Motor
5	1.5	1.5	3.0	1.71941	0.84064	30.0	29.78	302.0	759.0
7	2.5	2.5	5.0	2.26371	1.09989	38.0	37.72	302.0	759.0
10	3.9	3.9	7.3	2.73699	1.32518	47.0	46.65	302.0	759.0
13	4.9	4.9	9.8	3.10735	1.50186	53.0	52.61	302.0	759.0
16	6.2	6.2	12.4	3.49598	1.66668	60.0	59.55	302.0	759.0
Linear Regression Y ON X: Y = mx + b						Average	302.0	759.0	
1	Slope (m)	2.09951	Linear Equation			$\bar{r}^2$	0.998309	Pstt(mmHg)	760.0
2	Intercept (b)	-0.04553	Set Point Flow Rate (X) (m <sup>3</sup> /min)	1.133	r	0.9991541	$T_{std}$	298.0	
3	Correlation Coefficient (r)	0.99992	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.985456605			
Result					C=(Pa/Pstd)(Tstd/Ta)^0.5	0.99270167			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 02, June 1, 2019





## RECALIBRATION

DUE DATE:

January 17, 2024

## Certificate of Calibration

## Calibration Certification Information

Cal. Date: January 17, 2023 Rootsmeter S/N: 438320 Ta: 295 °K  
Operator: Jim Tisch Pa: 740.2 mm Hg  
Calibration Model #: TE-5025A Calibrator S/N: 3883

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4140	3.2	2.00
2	3	4	1	1.0110	6.4	4.00
3	5	6	1	0.9050	8.0	5.00
4	7	8	1	0.8620	8.8	5.50
5	9	10	1	0.7100	12.9	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)
0.9795	0.6927	1.4027	0.9957	0.7042	0.8928
0.9753	0.9647	1.9837	0.9914	0.9806	1.2626
0.9732	1.0753	2.2179	0.9892	1.0930	1.4117
0.9721	1.1277	2.3261	0.9881	1.1463	1.4806
0.9666	1.3615	2.8054	0.9826	1.3839	1.7856
QSTD	m=	2.09951	QA	m=	1.31468
	b=	-0.04553		b=	-0.02898
	r=	0.99992		r=	0.99992

## Calculations


Vstd= $\Delta Vol / (Pa - \Delta P) / Pstd \cdot (Tstd / Ta)$	Va= $\Delta Vol / (Pa - \Delta P) / Pa$
Qstd= $Vstd / \Delta Time$	Qa= $Va / \Delta Time$
For subsequent flow rate calculations:	
Qstd= $1/m \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} - b \right)$	Qa= $1/m \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} - b \right)$

## 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

City: Laksi  
Zip / Postal: 10210  
State / Province: Bangkok  
Order Number: 

Contact: Ramita Taengthai

## Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S Asset Number: ERTC-L-IN-0048  
Serial No.: 1123103723 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 4 Terminal Asset No.: N/A  
Room: 406

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

## Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 23.6 °C	End: 23.5 °C	Start: 34.6 %	End: 35.1 %
As Left	Start: 23.6 °C	End: 23.5 °C	Start: 35.0 %	End: 35.7 %

As Found Calibration Date: 17-Jan-2023

Calibrator:

As Left Calibration Date: 17-Jan-2023

Issue Date: 19-Jan-2023

Approved Signatory:

Technical Manager / Head of Calibration Center

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

[www.tisch-erv.com](http://www.tisch-erv.com)

TOLL FREE: (877)263-761C

FAX: (513)467-900C

Software Version: 1.23.1.11

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Page 1 of 5

Report Version: 2.16.30

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Form Number: F103C

written permission of the issuing calibration laboratory.

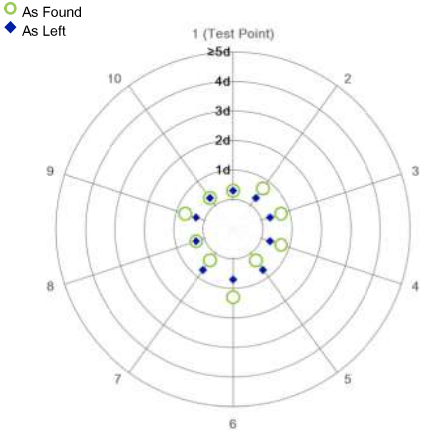
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9992 g	100.0001 g
2	99.9991 g	100.0001 g
3	99.9991 g	100.0001 g
4	99.9991 g	100.0001 g
5	99.9992 g	100.0002 g
6	99.9993 g	100.0002 g
7	99.9992 g	100.0002 g
8	99.9992 g	100.0001 g
9	99.9991 g	100.0001 g
10	99.9992 g	100.0001 g

Standard Deviation	0.00007 g	0.00005 g
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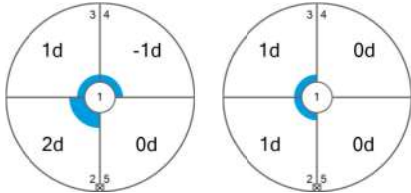
The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9991 g	100.0001 g
2	99.9993 g	100.0002 g
3	99.9992 g	100.0002 g
4	99.9990 g	100.0001 g
5	99.9991 g	100.0001 g

Maximum Deviation	0.0002 g	0.0001 g
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

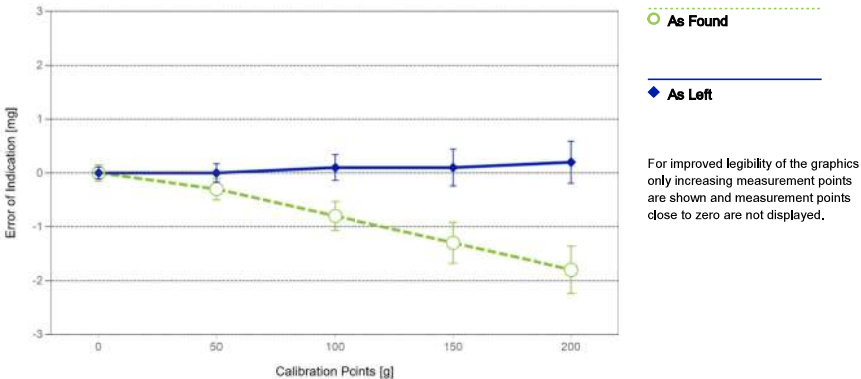
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.16 mg	2
3	0.1000 g	0.0999 g	-0.0001 g	0.16 mg	2
4	0.5000 g	0.4999 g	-0.0001 g	0.16 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.16 mg	2
6	5.0000 g	5.0001 g	0.0001 g	0.16 mg	2
7	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
8	50.0000 g	49.9997 g	-0.0003 g	0.20 mg	2
9	100.0000 g	99.9992 g	-0.0008 g	0.27 mg	2
10	150.0000 g	149.9987 g	-0.0013 g	0.38 mg	2
11	200.0000 g	199.9982 g	-0.0018 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.13 mg	2
6	5.0000 g	5.0001 g	0.0001 g	0.13 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.14 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.17 mg	2
9	100.0000 g	100.0001 g	0.0001 g	0.24 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.34 mg	2
11	200.0000 g	200.0002 g	0.0002 g	0.39 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS57	Date of Issue:	06-Jan-2022
Certificate Number:	177037	Calibration Due Date:	03-Jul-2023

Thermo Hygrometer

Equipment No.:	IN255	Date of Issue:	20-Jul-2022
Certificate Number:	22H1503	Calibration Due Date:	04-Jul-2023

Remarks

Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

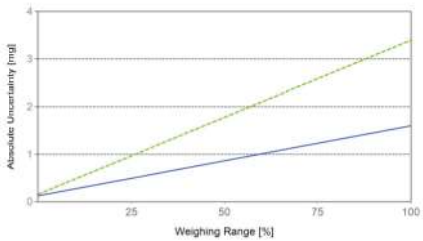
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0,0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0147 \text{ mg/g} \cdot R$	$U_1 = 0.13 \text{ mg} + 0.00671 \text{ mg/g} \cdot R$

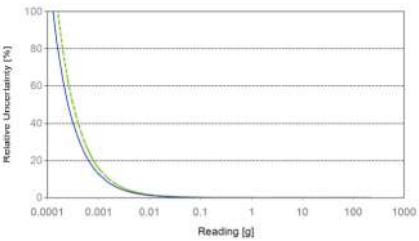
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.16 mg	0.73%	0.13 mg	0.59%
0.2200 g	0.16 mg	0.074%	0.13 mg	0.060%
2.2000 g	0.19 mg	0.0087%	0.14 mg	0.0066%
22.0000 g	0.48 mg	0.0022%	0.28 mg	0.0013%
220.0000 g	3.4 mg	0.0015%	1.6 mg	0.00073%



As Found



As Left

GWP®

Certificate

As Found

✓

As Left

✓

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☒ As Left

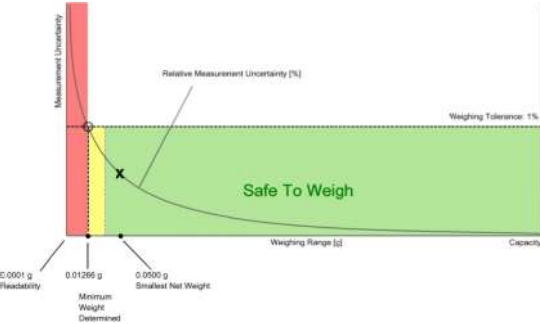
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.16012 g	0.32511 g	0.49518 g	0.85155 g	1.85026 g
0.2%	0.07947 g	0.16012 g	0.24199 g	0.40949 g	0.85155 g
0.5%	0.03165 g	0.06348 g	0.09550 g	0.16012 g	0.32511 g
1%	0.01580 g	0.03165 g	0.04754 g	0.07947 g	0.16012 g
2%	0.00789 g	0.01580 g	0.02372 g	0.03959 g	0.07947 g
5%	0.00316 g	0.00631 g	0.00947 g	0.01580 g	0.03165 g

✓

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.12735 g	0.25642 g	0.38726 g	0.65440 g	1.35584 g
0.2%	0.06346 g	0.12735 g	0.19166 g	0.32162 g	0.65440 g
0.5%	0.02533 g	0.05073 g	0.07620 g	0.12735 g	0.25642 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06346 g	0.12735 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03168 g	0.06346 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 g

✓

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

- If "N/A" is shown above, no appropriate value could be calculated.
- METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed  
✗ = Failed  
⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0,00007 g*	N/A	0,00005 g*	N/A
0.2%	0,00005 g		✗		⚠
0.5%	0,00013 g		✓		✓
1%	0,00025 g		✓		✓
2%	0,00050 g		✓		✓
5%	0,00125 g		✓		✓

\*The calculated standard deviation value is below the rounding error of the balance. The 0.41\*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0,0500 g	0,0002 g	✓	0,0001 g	✓
0.2%	0,1000 g		✓		✓
0.5%	0,2500 g		✓		✓
1%	0,5000 g		✓		✓
2%	1,0000 g		✓		✓
5%	2,5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	-0,0003 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	-0,0008 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0013 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0018 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	0,0000 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	0,0002 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

## Calibration Data of NOx Analyzer

### Analyzer Performance Test

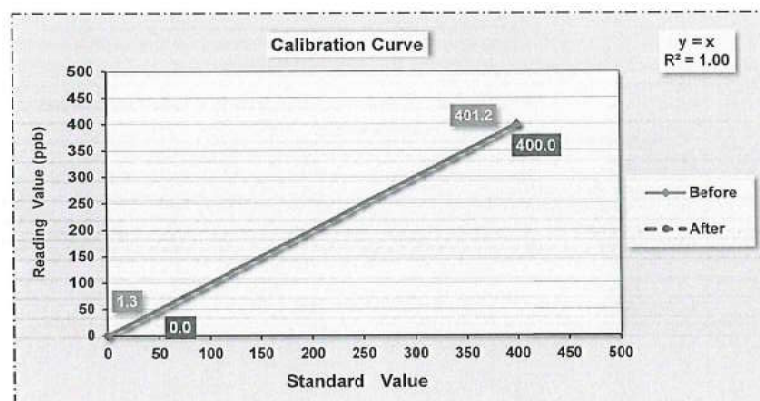
Equipment	Gas Analyzer ( NOx )	Customer Name	Vision E.
Manufacture	API	Location	Envi Research
Model	200A	Quotation	2023-01001
Serial No.	1975	Calibration Date	July 6, 2023
Analyzer Unit	ppb	Time	1:44 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> (ppb)		NO (ppb)		NO <sub>2</sub> (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	0.6	0.0	1.3	0.0	-0.7	0.0	-	-	-
Span	400	402.8	405.0	401.2	400.0	1.6	5.0	-	-	0.3



## STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL 200A

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Stability	STABIL	ppb	0.9	0.2	< 2 with zero air
Sample Flow	SAMP FL	cc / min	458.0	450.0	500 +/- 50
Ozone Flow	OZONE FL	cc / min	7.5	7.7	80 +/- 10
PMT signal	PMT	mV	45.7	46.0	0 to 5,000
Auto - Zero	AZERO	mV	35.8	36.2	-20 to 150
High Voltage Power Supply	HVPS	V	790.0	790.0	450 to 900
Reaction Cell Temperature	RCELL TEMP	°C	49.9	50.0	50 +/- 1
Box Temperature	BOX TEMP	°C	33.5	33.6	Ambient temp. +3 / -7
PMT Temperature	PMT TEMP	°C	7.1	7.1	7 +/- 1
Converter Temperature	MOLY TEMP	°C	314.9	315.0	315 +/- 5
Reaction Cell Pressure	RCEL	In - Hg - A	10.0	10.0	2 to 10 ( Constant )
Sample Pressure	SAMP	In - Hg - A	29.7	29.8	Ambient - 1 ( Constant )
NO <sub>x</sub> Slope	NO <sub>x</sub> SLOPE	-	1.2	1.2	1,000 +/- 0.300
NO <sub>x</sub> Offset	NO <sub>x</sub> OFFSET	mV	-4.2	-4.2	0 +/- 20
NO Slope	NO SLOPE	-	1.2	1.2	1,000 +/- 0.300
NO Offset	NO OFFSET	mV	-3.8	-3.8	0 +/- 20

Calibrate By :

July 6, 2023

Checked By :

July 6, 2023



### Calibration Data of NOx Analyzer

#### Analyzer Performance Test

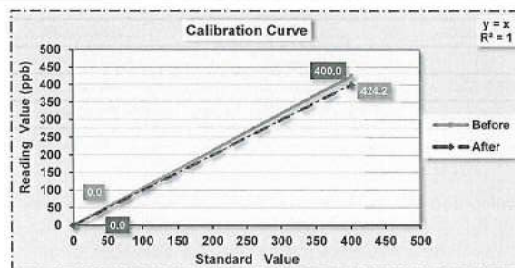
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Env Research
Model	APNA-370	Quotation	2023-01001
Serial No.	KPACV8NA	Calibration Date	July 1, 2023
Analyzer Unit	ppb	Time	1:57 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	C700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 55.3 ppm SO <sub>2</sub> = 54.9 ppm		
Cylinder No : EB0123013			
Expire Date : Oct 22, 2027			

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>2</sub> (ppb)		NO (ppb)		NO <sub>2</sub> (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-0.3	0.0	0.0	0.0	-0.3	0.0	-	-	-
Span	400	421.9	400.0	424.2	400.0	-2.3	0.0	-	-	8.1



#### STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL APNA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal NO	mV	1.0	0.6	Voltage of the measured NO value
Signal NOx	mV	9.8	13.2	Voltage of the measured NOx value
Detector	°C	42.6	42.6	43 °C ± 5 °C
Ambient	kPa	100.9	100.8	Current atmospheric pressure
DC 24V	V	23.8	23.8	24V ± 0.5
DC 5V	V	5.0	5.0	5V ± 0.5
NO Slope	-	1.17230	1.10430	0.50000 - 2.0000
NOx Slope	-	1.10120	1.04310	0.50000 - 2.0000

Calibrate By :

July 1, 2023

Checked By :

July 1, 2023

### Calibration Data of SO<sub>2</sub> Analyzer

#### Analyzer Performance Test

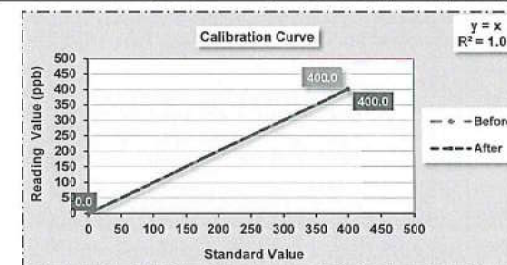
Equipment	Gas Analyzer (SO <sub>2</sub> )	Customer Name	Vision E.
Manufacture	Thermo	Location	Env Research
Model	43C	Quotation	2023-01001
Serial No.	335804022	Calibration Date	June 27, 2023
Analyzer Unit	ppb	Time	3:22 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	C700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 55.3 ppm SO <sub>2</sub> = 54.9 ppm		
Cylinder No : EB0123013			
Expire Date : Oct 22, 2027			

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-0.1	0.0	-	-	-
Span	400	400.0	400.0	-	-	0.0



#### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL 43C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Internal Temperature	INTERNAL	°C	32.3	32.1	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	44.9	44.9	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	717.1	717.0	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.388	0.388	0.350 to 1,000
Lamp Intensity	INTENSITY	Hz	24,064	24,206	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	920	923	750 to 1,200
SO2 Concentration	SO2 CONCENTRATION	ppb	1.4	1.8	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :

June 27, 2023

Checked By :

June 27, 2023

### Calibration Data of SO<sub>2</sub> Analyzer

#### Analyzer Performance Test

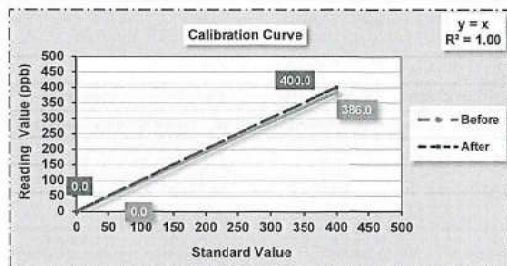
Equipment	Gas Analyzer (SO <sub>2</sub> )	Customer Name	Vision E.
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2023-01001
Serial No.	80772-328/2	Calibration Date	June 29, 2023
Analyzer Unit	ppb	Time	2:07 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 55.3 ppm SO <sub>2</sub> = 54.9 ppm		
Cylinder No :	EB0123013		
Expire Date :	Oct 22, 2027		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.0	0.0	-	-	-
Span	400	386.0	400.0	-	-	3.5



#### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL 43C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Internal Temperature	INTERNAL	°C	32.4	32.8	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	45	45	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	655.7	655.2	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.453	0.453	0.350 to 1.000
Lamp Intensity	INTENSITY	Hz	32.847	32.648	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	890	896	750 to 1,200
SO <sub>2</sub> Concentration	SO <sub>2</sub> CONCENTRATION	ppb	6.4	1.7	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By:

June 29, 2023

Checked By:

June 29, 2023

### Calibration Data of CO Analyzer

#### Analyzer Performance Test

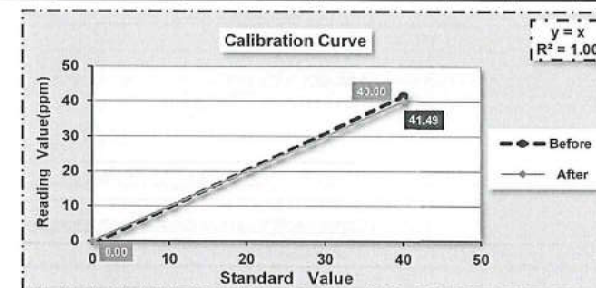
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01001
Serial No.	XRP3Y7LA	Calibration Date	June 29, 2023
Analyzer Unit	ppm	Time	3:00 PM

#### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 55.3 ppm SO <sub>2</sub> = 54.9 ppm		
Cylinder No :	EB0123013		
Expire Date :	Oct 22, 2027		

#### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-0.92	0.00	-	-	-
Span	40	41.49	40.00	-	-	3.73



#### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	2.8	3	Voltage of the measured CO Value
SIGNAL (COMP)	mV	3.7	4.1	Voltage of the interference component Value
CELL	°C	32.7	32.8	Ambient + (5 to 10 °C)
PUMP	kpa	49.9	49.9	less than 65
AMBIENT	kpa	101.0	101.0	Atmospheric pressure
DC 24V	mV	23.9	23.9	24 +/- 0.5 V
DC 5V	mV	4.9	4.9	5 +/- 0.5 V

Calibrate By:

June 29, 2023

Checked By:

June 29, 2023



## Calibration Data of CO Analyzer

### Analyzer Performance Test

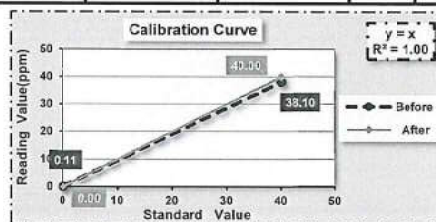
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	Thermo	Location	Envi Research
Model	48C	Quotation	2023-01001
Serial No.	0415406564	Calibration Date	July 6, 2023
Analyzer Unit	ppm	Time	1:33 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419329
Dynamic Dilution Calibrator	Tanabyte	300T	0165
Standard Gas Components	CO = 4.516	ppm	
Cylinder No : E30123013	NO = 55.3	ppm	
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9	ppm	

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.11	0.00	-	-	-
Span	40	38.10	40.00	-	-	4.75



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL 48C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppm	50	50	0 - 100 standard
Internal Temp	INTERNAL TEMP	°C	36.2	36.3	8.0 to 47.0
Chamber Temp	CHAMBER TEMP	°C	45.4	45.3	40.0 to 59.0
Pressure	PRESSURE	mmHg	730.8	730.6	250 to 1,000
Sample Flow	FLOW	LPM	0.953	0.953	0.350 to 1,500
Bias Voltage	BIAS VOLT	V	-115.4	-115.4	-130 to -100
AGC Intensity	AGC	Hz	203,064	203,182	150,000 to 300,000
Motor Speed	SPEED	%	100	100	100
Concentration	Conc.	ppm	0.553	0.584	0 to 10,000
Motherboard Status	MOTHERBOARD	-	OK	OK	OK
Interface Status	INTERFACE	-	OK	OK	OK

Calibrate By :

July 6, 2023

Checked By :

July 6, 2023

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04NI99E15A0292  
Cylinder Number: EB0123013  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12019  
Gas Code: CO,NO,NOX,SO<sub>2</sub>,BALN

Reference Number: 160-401604495-1  
Cylinder Volume: 144.4 Cubic Feet  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 66C  
Certification Date: Oct 22, 2019

Expiration Date: Oct 22, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, 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 volume/volume basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.9% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010429	KAL004123	97.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010429	KAL004123	97.6 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010255	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
NTRM	08012318	KAL004620	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Sep 26, 2019
MKS FTIR - NO - 000928781	FTIR	Oct 18, 2019
MKS FTIR - NOx - 000928781	FTIR	Oct 18, 2019
MKS FTIR - SO <sub>2</sub> - 000928781	FTIR	Oct 03, 2019

Triad Data Available Upon Request

NOTES: Gross Weight: 28.0 Kg, Net Weight: 4.6 Kg.



Approved for Release



# 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 20 August, 2022

Certification No. 339/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard II Product No. 7425

Serial No. : WC90504A18 ID No. : No.14

Customer : Environment Research & Technology Company Limited.  
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.6 hPa

### NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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 10 - 20 m/sec



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 339/22

20 August, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.2	0.82
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.3	0.74
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.2	0.82

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 20 August, 2022

Certification No. 340/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC6011CA03 ID No. : No.11

Customer : Environmant Research & Technology Company Limited.  
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 hPa

### NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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

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

Serial Number 110730029 (sensor 120629586)

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

(Authorized Signatory)  
for the Chief

Sub-Standard Instrument



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 340/22

20 August, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.2	0.82
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.3	0.74
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.8	0.22

### Wind Aloft Plotting Board.

#### US.DEPARTMENT OF COMMERCE WEATHER BUREAU

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

Calibration & Test Section  
Meteorological Instruments Bureau







THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0768

MTC No. EEL. BP. 33/0965

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

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

Acoustic Output in dB re 20 $\mu$ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0°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 2
1/2 inch Brüel&Kjaer 4180	93.91	-0.09	$\pm 0.10$	$\pm 0.75$ dB

#### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	1000.5	0.5	$\pm 1.5$	$\pm 2.0\%$

#### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	1.40	$\pm 0.50$	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Sep. 2022

Date of Issue : 26 Sep. 2022

Ref : 2011265091604083001

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.

FM.BLMTC.002 Rev.4

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH1755

Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Eutech  
Model : pHTestr 30  
Serial No. : 3066339  
ID No. : -  
Condition As-Received: Used Item  
Received Date : 27 December 2022  
Calibration Date : 27 December 2022  
Reference : 2212-0734WN-11  
Submitted by : Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Leksi, Bangkok 10210  
Ambient Temperature : (25  $\pm$  2.5) °C  
Relative Humidity : (50  $\pm$  15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

Calibrated by :

Approved by :

( ) Malee Bulkruea  
( ) Sathip Meangmai  
(✓) Ponpan Paipim

Issue Date :

28 December 2022

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.

A 0049000



Cert.No.: 22CH1755

Page.: 2 of 2

**Condition of this calibration result**

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826590	09 July 2023

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

**Calibration Results**

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor <i>k</i>
pH Electrode	4.008	4.01	N/A	0.0079	2.00
S/N.: 3066339	6.987	7.00	N/A	0.011	2.00
	10.008	10.01	N/A	0.0095	2.00

- Remark**
- pH meter does not have voltage mode.
  - Can not connect the BNC because the plug does not match with the socket.
  - N/A = Not Available

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

-000-

a 1142230



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

Cert.No.: 22TW266

Page.: 1 of 2

**Certificate of Testing**

Equipment : DO Meter  
Manufacturer : YSI  
Model : Pro20  
Serial No. : 14L101229  
ID No. : NO.4  
Received Date : 27 December 2022  
Test Date : 27 December 2022  
Reference : 2212-0734WN-5  
Submitted by : Environment Research & Technology Company Limited,  
25/114 Moo 6, Soi Chinakot 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CHS  
by Comparison Technique with Azide Modification Method  
Tested by :   
Approved by :   
( ) Malee Butkruea  
( ) Saithip Meangmai  
(✓) Warakorn Lerngagtrakul  
Issue Date : 28 December 2022

B 0303343





Cert.No.: 22TW286  
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	22MM50	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.: 14L100144

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.12	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 1142236



**Inctech Metrological Center Co.Ltd.**  
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,  
Saimai, Bangkok 10220, Thailand  
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



## Certificate of Calibration

Certificate No. : MT22-6773  
Page : 1 of 2

**Customer** : Environment Research & Technology Co., Ltd.  
**Address** : 25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

<b>Description</b>	: Incubator	<b>Order No.</b>	: 3555/22
<b>Manufacturer</b>	: Sanyo	<b>Received date</b>	: Dec 06, 2022
<b>Model</b>	: MIR-254	<b>Calibration date</b>	: Dec 12, 2022
<b>Serial No.</b>	: 1103017	<b>Environment Condition :</b>	
<b>Identification No.</b>	: ERTC-L-IN-066	<b>Temperature</b>	: (25+/-10) °C
<b>Calibration Place</b>	: Customer Laboratory	<b>Humidity</b>	: (50+/-30) %RH

**Calibration Method** : Calibration were conducted using in-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

**Reference Standard Instruments :**

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY57003222	MT22-5466	Oct 06, 2023

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

**Traceability** : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand ( NIMT )

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2$ , providing a level of confidence of not less than 95%



Calibrated by :   
Issue date : Dec 19, 2022

Approved by :

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd



**Inctech Metrological Center Co.Ltd.**  
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,  
Saimai, Bangkok 10220, Thailand  
Tel. (662) 909-8320 (Auto 10 lines) www.imcinstrument.com



Certificate No. : MT22-6773

Page : 2 of 2

Function : Temperature measurement

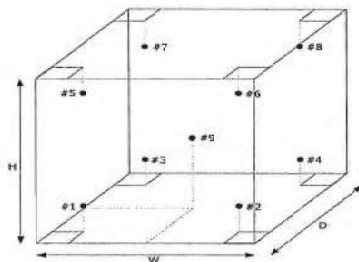
Calibration point : 20 °C

Result : Without adjustment

Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
20	19.634	19.407	19.345	19.258	19.687	19.616	19.630	19.542	19.568	0.65

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20 to 20.2	0.51	0.87	1.5



Front view

- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

UUC\* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature values between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.



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TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 22TW242

Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115  
Serial No. : 17H104220  
ID No. : ERTC-L-In.137  
Received Date : 26 October 2022  
Test Date : 27 October 2022  
Reference : 2210-0840WN-1  
Submitted by : Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity (50 ± 20) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by :

Approved by :

Approved Signatory

- (✓) Malee Butkruea
- ( ) Saithip Meangmai
- ( ) Warakorn Lerngagtrakul

Issue Date :

1 November 2022



Cert.No.: 22TW242

Page.: 2 of 2

**Condition of this result of calibration**

## 1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1123143764	14CRC004	22MM50	20 Sep 2023

## 2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

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

Dissolved Oxygen Probe No.: 15K100353

<u>Titration Method</u> (Azide Modification Method) (mg/L)	<u>DO Meter</u> <u>Reading</u> (mg/L)	<u>Standard Deviation</u> (mg/L)
8.14	8.13	0.0071

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

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a 1133339



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 23TM1

Page: 1 of 3

**Certificate of Calibration**

Equipment : Incubator

Manufacturer : Ehret

Model : BK 4106

Serial No. : 22162

ID No. : ERTC-L-In.-022

Submitted by : Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi,  
Bangkok 10210

Location : ห้องปฏิบัติการนมอาหารเลี้ยงเชื้อ (4C8/2)

Received Order : 4 January 2023

Calibration Date : 4 January 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : 

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul

(✓) Malee Butkruea

( ) Suwit Imjai

Issue Date : 17 January 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.

A 0045995





Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2301-0002ON-6

Cert. No.: 23TM1  
 Page : 2 of 3

#### Procedure Used :-

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

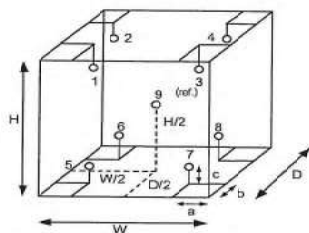
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close



#### Probe Installation Details :

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

#### Dimension of Chamber :

D = 0.50 m  
 W = 0.60 m  
 H = 0.50 m  
 Capacity = 0.15 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	26	27
REL.Humid. ( % )	49	47
AC Supply ( Volt )	221	220

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	1RTD-2/7
8	1RTD-2/8
9 (ref.)	1RTD-2/9



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2301-0002ON-6

Cert. No.: 23TM1  
 Page : 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	44.5	44.5	0.34	1.3	1.9	0.80	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
44.5	44.527	45.501	45.139	45.606	43.898	44.165	44.411	44.551	45.204

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

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.

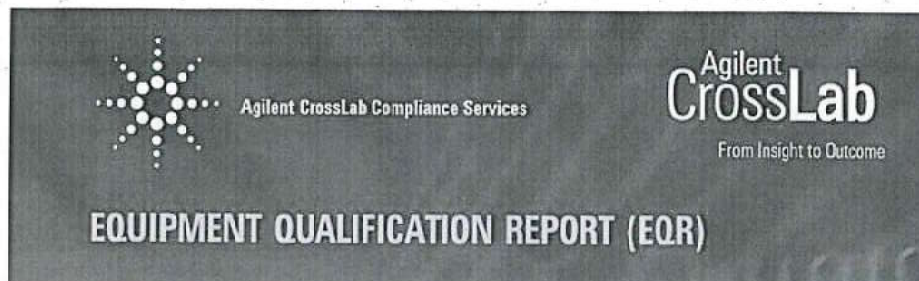
**UUC\* :** Unit Under Calibration

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

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

-o0c-



**Agilent CrossLab Compliance**

Qualification Type: ES-OQ

System ID: MY15330001

EQP Name: AgilentRecommended

EQP Revision: ES.02.50

EQP Publish Date: March 2020

Date: November 28, 2022 4:16:06 PM

Report Type: Report

Org. Name: Environment Research & Technology Co.,Ltd

Org. Location: 25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd.,Bangkok 10210

**Table of Contents**

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## Test Summary

## Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

## Details

Test	Status	Runs
Preparation : 5100 VDV	Pass	1
Instrument Tests : 5100 VCV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1

## Overall Qualification Status

Pass

## Service Details

## Purpose

This section includes local contact and delivery details for this service.

## General Details

Service Order No./Request:	6005573434
EQP Name:	AgilentRecommended
EQP Revision:	ES.02.50
Report Type:	Report

## Organization Details

Name:	Environment Research & Technology Co.,Ltd
Location:	25/114 Moo 6 Soi Chinaket, Ngamwongwan Rd.,Bangkok 10210

## Local Contact Details

Name:	Khun Raiwin Posit
Job Title:	Supervisor Scientist
Qualification Location:	ICPOES Room

## Operator Details

Name:	Worawit Timakul
Job Title:	Field Service Engineer

## Data Acquisition Details

Acquisition Software Name:	ICP Expert
Acquisition Software Revision:	7.1.0.6821

Customer Data System (CDS):	Es: ICP Expert
-----------------------------	----------------

## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

## Spectrometer 1

Manufacturer	Agilent Technologies
Name	5100 VDV
Model Number	G8011A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY15330001
Firmware Revision	2994

## Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G8481A
Serial Number	1A1560387

## Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15220240

## Vapor Generator 1

Manufacturer	Agilent Technologies
Name	VGA77P
Model Number	G8475A
Serial Number	MY15330002

## Revision Details

## Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

## Preparation

## Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

## Configuration Details

Model/Serial No.:

G8011A

MY15330001

## Results

## Criteria

Observed Result	Expected Result	Status
-----------------	-----------------	--------

Does the plasma ignite successfully in the first three attempts?

Yes

Yes

Pass

Was the detector calibration performed and completed successfully?

Yes

Yes

Pass

Was the instrument calibration performed and completed successfully?

Yes

Yes

Pass

Date: November 28, 2022 4:16:06 PM  
System ID: MY15330001

## Image Details

Image Details:

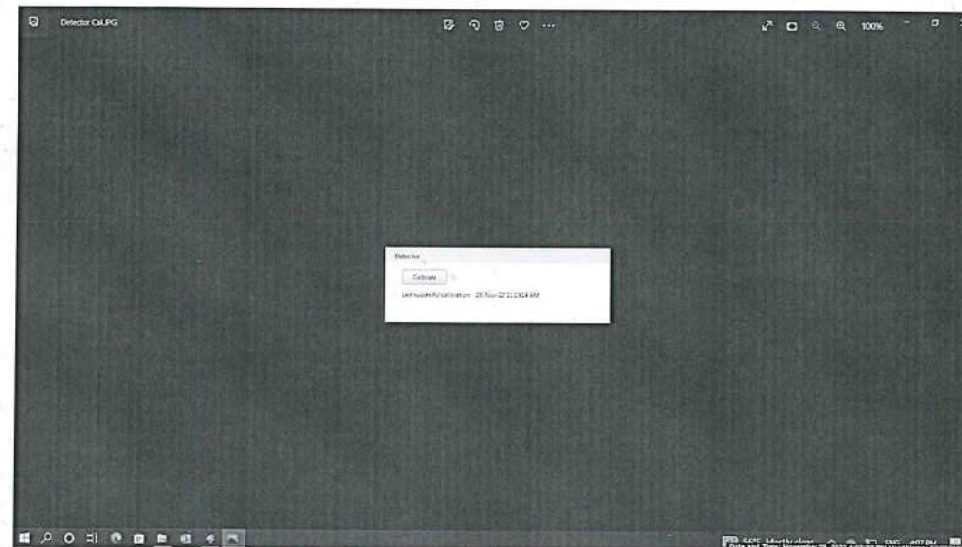
Was the detector calibration performed and completed successfully?

Date and Time:

November 28, 2022 4:07:22 PM

Host Name:

5CG0202NQ4



Date: November 28, 2022 4:16:06 PM  
System ID: MY15330001





## Autosampler Operation

## Purpose:

This test verifies that the autosampler operates properly.

## Configuration Details

Model/Serial No.:

G8410A

AU15220240

## Results

Criteria

Observed Result

Expected Result

Status

Does the autosampler successfully move to the specified location(s)?

Yes

Yes

Pass

## Overall Test Status

Pass

Runs: 1

## Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

## Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	General	Certificate of Qualification for ACE	14
EQR	General	Operator's training certificate and qualifications	15
EQR	General	Operator's training certificate and qualifications	16
EQR	General	Certificate of System Qualification	17
EQR	General	Instrument's Test Report	18
EQR	General	Software verification	21
EQR	Material	Certificate of Analysis Wavelength calibration solution	22

Go to

Document Name:

Certificate of Qualification for ACE



### Agilent Compliance Engine Self Qualification

Date: April 17, 2022 11:11:13 PM

Drive Serial #: 90593E3A

Platform Revision:

ACE 3.11.27

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GCMS	17	Conforms
Gas Chromatography	29	Conforms
Gel Permeation Chromatography	9	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	18	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	15	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status

Conforms



Gen 01

Document Name: Operator's training certificate and qualifications



## Certificate of Completion

Learner Name: Worawit Timakul

Title Of Course: ANV-CE-ICPOES-2-008-A: Agilent 5100 ICP-OES Support Neophyte Training

Completion Date: August 25, 2016

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Gen 01

Document Name: Operator's training certificate and qualifications



## Certificate of Completion

Learner Name: Worawit Timakul

Title Of Course: ANV-CE-ICPOES-2-007-C: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-OES Systems

Completion Date: October 30, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

Document Name: Certificate of System Qualification



## Certificate of Completion

Learner Name: Worawit Timakul

Title Of Course: AN-CE-SS-II-030-A: ACE 3.X User Update Training

Completion Date: July 1, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

Document Name: Instrument's Test Report

## Report Summary

Instrument Model: Agilent 5100 VDV ICP-OES  
Instrument ID: G8011A  
Instrument Serial Number: MY15330001  
Software Version: 7.1.0.6821  
Firmware Version: 2994  
Tested By: Worawit T.  
Test Completed On: 28-Nov-22 3:29:24 PM

## Result Summary

Resolution Test: Pass  
Sensitivity Test: Pass  
Precision Test: Pass

## Resolution Test Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.40
As (198.980 nm)	≤ 8.20	6.48
C (193.027 nm)	≤ 11.50	8.05
Mo (202.032 nm)	≤ 8.20	6.88
Cr (206.158 nm)	≤ 13.40	10.29
Zn (213.857 nm)	≤ 8.70	7.43
Pb (220.353 nm)	≤ 9.50	8.06
Ce (228.615 nm)	≤ 17.20	10.85
Ba (230.424 nm)	≤ 9.40	7.87
Mn (257.610 nm)	≤ 13.30	9.47
Mn (260.568 nm)	≤ 20.30	16.41
Cr (267.716 nm)	≤ 11.00	8.93
Cu (324.754 nm)	≤ 25.00	18.01
Cu (327.395 nm)	≤ 14.20	12.72
Sr (358.071 nm)	≤ 33.50	28.00
Ba (455.403 nm)	≤ 44.00	33.09
Sr (460.733 nm)	≤ 36.00	20.22
Ba (493.408 nm)	≤ 36.00	30.03
Ba (514.171 nm)	≤ 42.00	28.64
Ar (675.283 nm)	≤ 74.00	65.29
K (766.491 nm)	≤ 80.00	61.84

Document Name:

Instrument's Test Report

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	124.4	1263.4	89.1
Se (196.026 nm)	≥ 41.0	SRBR	74.4	903.6	112.9
Zn (213.857 nm)	≥ 1421.0	SRBR	4159.8	58879.6	199.0
Pb (220.353 nm)	≥ 46.0	SRBR	191.9	3092.4	223.5
Mn (257.610 nm)	≥ 3518.0	SRBR	12083.1	303064.1	626.5
Al (396.152 nm)	≥ 3.4	SBR	8.0	41307.1	4600.0
Ba (493.408 nm)	≥ 34.0	SBR	103.1	1275727.5	12253.3
K (766.491 nm)	≥ 1.8	SBR	3.9	111109.8	22733.2
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 238.0	SRBR	250.8	3667.4	192.0
Se (196.026 nm)	≥ 159.0	SRBR	172.2	2902.2	239.1
Zn (206.200 nm)	≥ 234.0	SRBR	1390.5	17846.2	168.8
Zn (213.857 nm)	≥ 1743.0	SRBR	9129.7	200493.0	480.0
Cd (214.439 nm)	≥ 4227.0	SRBR	8255.6	156439.2	357.4
Pb (220.353 nm)	≥ 320.0	SRBR	665.7	16502.1	571.0
Mn (257.610 nm)	≥ 10625.0	SRBR	39180.3	1593731.9	1651.2
Cr (267.716 nm)	≥ 1048.0	SRBR	4852.3	176423.2	1297.2
Cu (324.754 nm)	≥ 19.0	SBR	65.7	268073.8	4020.3
Al (396.152 nm)	≥ 8.0	SBR	24.3	271032.8	10722.4
Ba (493.408 nm)	≥ 80.0	SBR	275.4	8034589.3	29068.7
K (766.491 nm)	≥ 24.0	SBR	81.9	3677804.4	44370.4

Page 2 of 3

Document Name:

Instrument's Test Report

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.99
Se (196.026 nm)	≤ 2.60	1.01
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.60	0.41
Mn (257.610 nm)	≤ 1.50	0.43
Al (396.152 nm)	≤ 1.50	0.39
Ba (493.408 nm)	≤ 1.50	0.65
K (766.491 nm)	≤ 1.50	0.29
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.87
Se (196.026 nm)	≤ 1.50	0.76
Zn (206.200 nm)	≤ 1.50	0.42
Zn (213.857 nm)	≤ 1.50	0.51
Cd (214.439 nm)	≤ 1.50	0.50
Pb (220.353 nm)	≤ 1.50	0.49
Mn (257.610 nm)	≤ 1.50	0.50
Cr (267.716 nm)	≤ 1.50	0.43
Cu (324.754 nm)	≤ 1.50	0.48
Al (396.152 nm)	≤ 1.50	0.48
Ba (493.408 nm)	≤ 1.50	0.71
K (766.491 nm)	≤ 1.50	0.50

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General

Document Name: Software verification

## Software Verification Report

Date: Monday, November 28, 2022 Time: 3:44:56 PM [UTC +07:00:00] Host Name: S100VDV-HP  
Windows User Name: Admin Base Revision Number: 7.0.1 Product Name: ICP Expert  
Install Type: N/A Additional Packages: NA

Base Reference File Name: ICPReferencefile.xml

## Summary:

Overall Evaluation of Installation Check: PASS

## File Report Summary

No missing files or invalid files found

No system file difference found

## Files Registration Report Summary

Files Registration check not required for this product

## Registry Report Summary

Registry entries check not required for this product

Date: November 28, 2022 4:16:06 PM  
System ID: MY15330001

Materials

Document Name: Certificate of Analysis Wavelength calibration solution



## CERTIFICATE OF ANALYSIS

Agilent Product Name: Wavelength Calibration Solution for ICP-OES & MP-AES, 5 mg/L, 500mL  
Agilent Part No: 6611030100  
Lot No: 0012183521

## Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO <sub>3</sub> ) <sub>3</sub>	7784-27-2	5.001 ± 0.025 mg/L	Mn	Mn	7439-95-5	5.001 ± 0.025 mg/L
As	As	7440-38-2	5.001 ± 0.025 mg/L	Mo	(NH <sub>4</sub> ) <sub>2</sub> MoO <sub>4</sub>	13106-76-5	5.000 ± 0.025 mg/L
Ba	Ba(NO <sub>3</sub> ) <sub>2</sub>	10122-31-8	5.000 ± 0.025 mg/L	Ni	Ni	7440-01-0	5.000 ± 0.025 mg/L
Cd	Cd	7440-43-9	5.000 ± 0.025 mg/L	Pb	Pb	7439-92-1	5.001 ± 0.025 mg/L
Co	Co	7440-48-4	5.000 ± 0.025 mg/L	Se	Se	7782-49-2	5.000 ± 0.025 mg/L
Cr	Cr(NO <sub>3</sub> ) <sub>3</sub>	13443-38-4	5.000 ± 0.025 mg/L	Sr	Sr(NO <sub>3</sub> ) <sub>2</sub>	10043-76-3	5.000 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.000 ± 0.025 mg/L	Zn	Zn	7440-66-4	4.999 ± 0.025 mg/L
K	KNO <sub>3</sub>	7757-79-1	50.00 ± 0.25 mg/L				

Matrix: 5% HNO<sub>3</sub>

Intended Use: This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), atomic absorption spectroscopy (flame AAS or GFAAS), microwave plasma atomic emission spectroscopy (MP-AES), x-ray fluorescence spectroscopy (XRF), and other techniques for elemental analysis.

Certification & Traceability: This CRM was manufactured under a quality management system that is registered to ISO 9001, ISO 17034 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single-element concentrates that were certified using the "High Performance ICP-OES" protocol developed by NIST and are directly traceable to the NIST SRMs listed below. This solution was stabilized using high purity nitric acid (HNO<sub>3</sub>) and diluted with filtered (0.22µm), 18 M-ohm deionized water. The balances used in the preparation of this CRM are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined based upon gravimetric procedures. Secondary verification of the certified concentrations was performed using ICP-OES that was calibrated and/or referenced against NIST SRMs: 3101a, 3103a, 3104a, 3108, 3113, 3112a, 3114, 3141a, 3132, 3134, 3135, 3125, 3149, 3153a, and 3168a. The uncertainty associated with each certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

Instructions for Use: Agilent recommends that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only pre-cleaned containers and transferware, (2) avoid pipetting directly from the CRM's original container, (3) use a minimum sub-sample size of 50µL, (4) make dilutions using calibrated balances or certified volumetric class A flasks and pipettes, (5) dilute to volume using the same matrix as the original CRM, and (6) never pour used product back into the original container. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or expose to direct sunlight. Minimize exposure to moisture or high humidity.

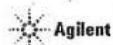
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Date: November 28, 2022 4:16:06 PM  
System ID: MY1533C001



Document Name:

Certificate of Analysis Wavelength calibration solution



**Period of Validity:** Agilent ensures the accuracy of this solution until the expiration date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

Date of release: 21 January 2022  
Date of expiration: 31 July 2023

Sample for approval:

*Chad Anderson*  
Chad Anderson, Certifying Officer

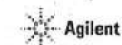
Page 2 of 3

Date: November 28, 2022 4:16:06 PM  
System ID: MY15330001

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Document Name:

Certificate of Analysis Wavelength calibration solution



**Hazard Information:** Refer to the Safety Data Sheet (SDS), which can be obtained at: [www.agilent.com/chem/sds](http://www.agilent.com/chem/sds).

**Homogeneity:** This solution was determined to be homogeneous by procedures consistent with the requirements of ISO 17034 and ISO Guide 35. Replicate samples of the finished solution were analyzed to confirm its homogeneity, in accordance with QSP 6-13.

**Assessment of Homogeneity and Stability:** To ensure homogeneity, users should not take a smaller sub-sample than specified in the instructions for use, as doing so will invalidate the certified values and uncertainties.

**Further Information:** Please contact Agilent for further information about this CRM.

**Quality Certifications:** This CRM was prepared under a quality management system that is:

- Registered to ISO 9001 – Quality Management Systems – Requirements (TUV NORD Cert. Reg. No. 44100 16580231)
- Accredited to ISO 17034 – General Requirements for the Competence of Reference Material Producers (AZLA Cert. No. 2848.02)
  - ISO 17034 references additional requirements specified in ISO Guide 31 and ISO Guide 35.
- Accredited to ISO/IEC 17025 – General Requirements for the Competence of Testing and Calibration Laboratories (AZLA Cert. No. 2648.81)
- LAC (Canada), 378 Abbey Road, Manchester, M1 101G

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Date: November 28, 2022 4:16:06 PM  
System ID: MY15330001

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## Electronic Signature

## Purpose

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

## Details

Full Name of Signer: Worawit Timakul  
 Logged On User Name: worawit.timakul@agilent.com  
 Signature Creation Date: November 28, 2022  
 Reason for Signature: Executed protocol and published this original version of document

## Regulatory Disclaimer

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

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Date: November 28, 2022 4:16:06 PM  
 System ID: MY15330001

User Name: worawit.timakul  
 Hostname: SCG0202127

System ID: MY15330001  
 Print Date: November 28, 2022 4:16:06 PM

## CQ HW ICP 5100 Envi research Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2022 4:02:15 PM	Audit	SessionCreated	Session	None
November 28, 2022 4:02:15 PM	Start	Configuration	Session	None
November 28, 2022 4:02:15 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 28, 2022 4:06:30 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Es] - File path: [ProtocolPacks/Es/Configurations/02.50/Es.02.50.eqp] EQP File Name: [Es.02.50.eqp], EQP Name: [AgilentRecommended]
November 28, 2022 4:06:32 PM	End	Configuration	Session	None
November 28, 2022 4:06:35 PM	Start	Qualification	Session	OQ
November 28, 2022 4:06:36 PM	Start	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2022 4:07:38 PM	End	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:07:39 PM	Start	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2022 4:08:52 PM	End	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

Date: November 28, 2022 4:16:06 PM  
 System ID: MY15330001



User Name: worawit.timakul  
 Hostname: 5C993030001  
 System ID: MY15330001  
 Print Date: November 28, 2022 4:15:10 PM

OQ HW ICP 5100 Envi researc Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2022 4:09:01 PM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	None
November 28, 2022 4:09:05 PM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:09:09 PM	End	Qualification	Session	OQ
November 28, 2022 4:09:09 PM	Start	Reporting	Session	None
November 28, 2022 4:14:49 PM	Audit	Reporting	Session	Report Generated : Certificate
November 28, 2022 4:15:27 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: OQ HW ICP 5100 Envi researc_20221128_Certificate_1.pdf User Name: worawit.timakul@agilent.com Full Name of Signer: Worawit Timakul Reason for signature: Executed protocol and published this original version of document
November 28, 2022 4:15:43 PM	Audit	Reporting	Session	Report Generated : Report

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# PinAAcle 900Z Preventive Maintenance Report


Company Name: ENVIRONMENT RESEARCH

Instrument Location: 25/114 M.6, THANON NGAMWONGWAN  
THUNGSONGHONG, LAKSI, BANGKOK, 10210

Instrument Serial No.: PZAS19031401

Date: 30-Jun-2023

PinAAcle 900Z Preventive Maintenance (PM)			
Company Name:	ENVIRONMENT RESEARCH		
Address (Instrument Location):	25/114 M.6, THANON NGAMWONGWAN, THUNGSONGHONG, LAKSI, BANGKOK		
Serial Number:	PZAS19031401	PM Number:	1/2
Customer Name (if applicable):	K. RAIWIN	Telephone Number:	099-182-9241
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-02273780
Date PM Performed: (DD-MMM-YYYY)	30-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	30-Dec-2023
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370144 Rev.9	A	January 2018	

#### Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

#### General Instructions:

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, including a current back-up of system software and/or data files.

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 #	Configuration Notes

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	AR



Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

## Procedure Checklist

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.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

### 2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

### 3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN
- ☒ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ☒ Check auto sampler operation.
- ☐ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function

#### 4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ 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 BM Log Viewer.

#### 5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect and clean the furnace windows, if needed.
- ☒ Inspect and clean the GFTV camera lens, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

#### 6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☒ Verify that the air filter element is dry. Replace if necessary.

#### 7. After PM Performance tests [THGA]:

##### 7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min $\pm$ 25 mL/min	255	Passed
External Flow Rate	100 mL/min $\pm$ 10 mL/min	105	Passed

##### 7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq$ 0.005 Abs.	0.0011	Passed
Standard Deviation	$\leq$ 0.005	0.0003	Passed

##### 7.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr $m_0$ Results	$\leq$ 7.0 pg/0.0044 A-s	6.6	Passed
Precision	$\leq$ 2.0 %	1.47	Passed

##### 7.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu $m_0$ Result	$\leq$ 16.5 pg/0.0044 A-s	15.4	Passed
Zeeman Ratio	0.52 $\pm$ 0.04	0.52	Passed

#### 8. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

## Additional Comments

### Additional Comments Regarding the PM

$$\begin{aligned} \text{Zeeman Ratio} &= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}} \\ &= \frac{0.1456}{0.1456 + 0.1293} \\ &= 0.52 \end{aligned}$$

## Review

*The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.*

*This PinAAcle 900Z Passes ☒ Fails ☐ the preventive maintenance.*

### Review of Preventive Maintenance:

Authorized PerkinElmer Representative:		Date: 30-Jun-2023 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 30-Jun-2023 (DD-MMM-YYYY)



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



Cert.No.: 22CH1759

Page.: 1 of 2

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : HM DIGITAL  
Model : COM-100  
Serial No. : PONPE5833548  
ID No. : NO.4  
Condition As-Received: Used Item  
Received Date : 27 December 2022  
Calibration Date : 27 December 2022  
Reference : 2212-0734WN-8  
Submitted by : Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure: In-house method :  
- CP-CH6 : based on direct measurement by  
using certified reference material (CRM)

Calibrated by :   
Approved by :   
( ) Malee Bulkruea  
( ) Saithip Meangmai  
(✓) Warakorn Lernagatrakul

Issue Date : 28 December 2022

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.



Cert.No.: 22CH1759

Page.: 2 of 2

**Condition of this result of calibration**

**1. Reference Standard Instrument :-**

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	221484	17 Apr 2023

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

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

**2. Certified Reference Materials :-**

- Conductivity calibration solution, Thermo Scientific (traceable to NIST)
- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
*100 $\mu\text{S/cm}$	Thermo Scientific	152/01	14 Apr 2023
1413.0 $\mu\text{S/cm}$	CPA Chem	823328	20 June 2023

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ )  $^{\circ}\text{C}$

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

**Calibration results**

**Function : Conductivity Measurement**

**(\*) After Adjustment at 1413.0  $\mu\text{S/cm}$**

**Conductivity Electrode Serial No.: PONPE5363548**

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
*100 $\mu\text{S/cm}$	95.6 $\mu\text{S/cm}$	96.8 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1370 $\mu\text{S/cm}$	1410 $\mu\text{S/cm}$	11 $\mu\text{S/cm}$	2.00

**Remark** - UUC\* = Unit Under Calibration  
- \* = Not NSC - ONSC Accredited

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

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a 1142233



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 23TM32

Page : 1 of 3

# Certificate of Calibration

**Equipment :** Hot Air Oven

**Manufacturer :** Memmert

**Model :** UF 110

**Serial No. :** B414.0652

**ID No. :** ERTC-L-In.-098

**Submitted by :** Environment Research & Technology Company Limited.  
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi,  
Bangkok 10210

**Location :** Laboratory (ERTC)

**Received Order :** 4 January 2023

**Calibration Date :** 4 January 2023

**Ambient Temperature :** ( $26 \pm 10$ )  $^{\circ}\text{C}$

**Relative Humidity :** ( $50 \pm 30$ ) %

**Calibrated by :** Preecha Hlahib

**Approved by :** [Redacted]  
Approved Signatory

( ) Pomthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 16 January 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.

A 0049319





Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2301-0002ON-3

Cert. No.: 23TM32

Page : 2 of 3

#### Procedure Used :-

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY57013823	22LM24	26 Feb 2023

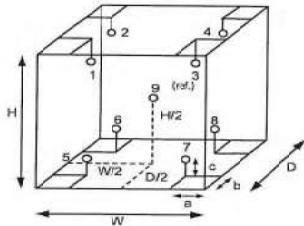
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close



#### Probe Installation Details : Dimension of Chamber :

a = 5.0 cm	D = 0.40 m
b = 5.0 cm	W = 0.56 m
c = 5.0 cm	H = 0.48 m
Capacity = 0.11 m <sup>3</sup>	

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	32
REL.Humid. ( % )	60	55
AC Supply ( Volt )	220	221

Ref. Std. ID No.: @ Calibration Point		
Position :	( 104 ) °C	( 180 ) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	19-17TC-02
3	17RTD-03	19-17TC-03
4	17RTD-04	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	17RTD-08	19-17TC-08
9 (ref.)	17RTD-09	19-17TC-09



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2301-0002ON-3

Cert. No.: 23TM32

Page : 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
104.0	104.0	104.0	0.10	0.95	1.6	0.42	2
180.0	180.0	180.0	0.29	1.8	3.3	1.1	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.630	103.574	103.239	103.951	104.422	104.052	103.192	104.041	104.039
180.0	179.591	179.816	178.321	179.612	181.116	179.997	178.605	179.735	179.503

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

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\* :** Unit Under Calibration

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

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

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Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServiceSupport@mt.com



# Accuracy Calibration Certificate

## Customer

Company: Environment Research & Technology Co., Ltd.  
Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong  
City: Laksi Contact: Ramita Taengthai  
Zip / Postal: 10210  
State / Province: Bangkok  
Order Number: 

## Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: MS204S/01 Asset Number: ERTC-L4N-088  
Serial No.: B334691537 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 5 Terminal Asset No.: N/A  
Room: 504

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

## Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 23.7 °C	End: 23.6 °C	Start: 46.5 %	End: 45.6 %

As Found Calibration Date: 17-Jan-2023  
As Left Calibration Date: N/A  
Issue Date: 19-Jan-2023

Calibrator:  
  
Approved Signator

Technical Manager / Head of Calibration Center

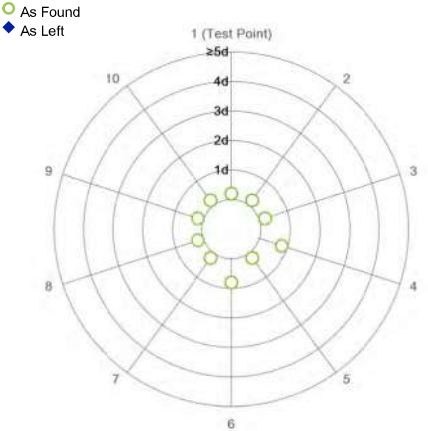
# Measurement Results

## Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	99.9999 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	99.9999 g	N/A
6	99.9998 g	N/A
7	99.9999 g	N/A
8	99.9999 g	N/A
9	99.9999 g	N/A
10	99.9999 g	N/A

Standard Deviation 0.00004 g N/A



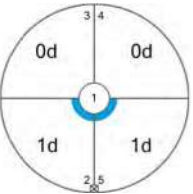
The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

## Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A

Maximum Deviation 0.0001 g N/A

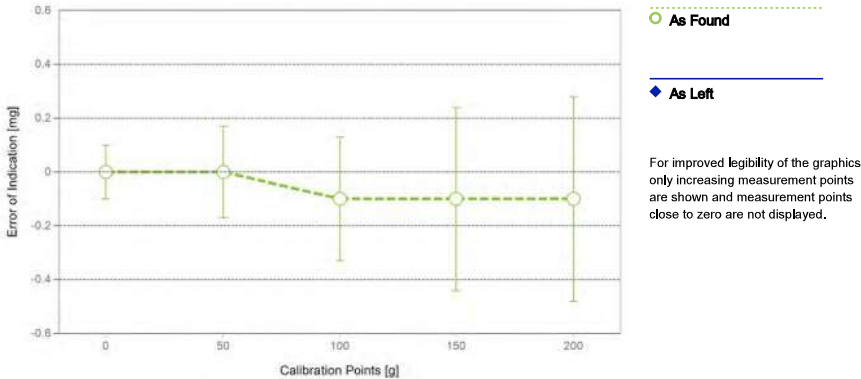


As Found  
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0,0000 g	0,0000 g	0,0000 g	0,10 mg	2
2	0,0500 g	0,0500 g	0,0000 g	0,12 mg	2
3	0,1000 g	0,1000 g	0,0000 g	0,12 mg	2
4	0,5000 g	0,5000 g	0,0000 g	0,12 mg	2
5	1,0000 g	1,0000 g	0,0000 g	0,12 mg	2
6	5,0000 g	5,0000 g	0,0000 g	0,13 mg	2
7	10,0000 g	10,0001 g	0,0001 g	0,13 mg	2
8	50,0000 g	50,0000 g	0,0000 g	0,17 mg	2
9	100,0000 g	99,9999 g	-0,0001 g	0,23 mg	2
10	150,0000 g	149,9999 g	-0,0001 g	0,34 mg	2
11	200,0000 g	199,9999 g	-0,0001 g	0,38 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS57	Date of Issue:	06-Jan-2022
Certificate Number:	177037	Calibration Due Date:	03-Jul-2023

Thermo Hygrometer

Equipment No.:	IN255	Date of Issue:	20-Jul-2022
Certificate Number:	22H1503	Calibration Due Date:	04-Jul-2023

Remarks

- FACT adjustment functionality activated
- Equipment condition: Good
- Next calibration according to customer's procedure
- Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 1,5 · 10<sup>-6</sup> / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

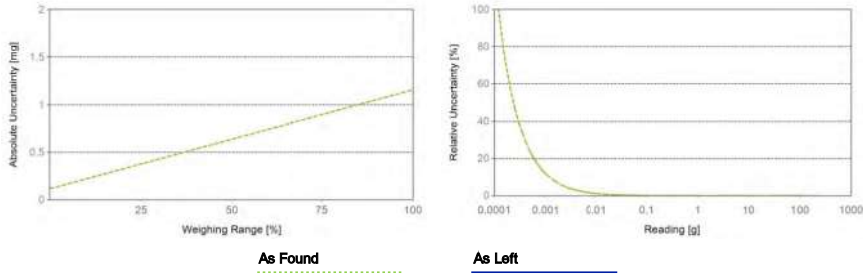
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0,0001 g	220 g	U <sub>1</sub> = 0.12 mg + 0.00474 mg/g · R	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.12 mg	0.55%	N/A	N/A
0.2200 g	0.12 mg	0.055%	N/A	N/A
2.2000 g	0.13 mg	0.0059%	N/A	N/A
22.0000 g	0.22 mg	0.0010%	N/A	N/A
220.0000 g	1.2 mg	0.00053%	N/A	N/A



# GWP® Certificate



As Found



As Left



The weighing device meets the given process requirements.

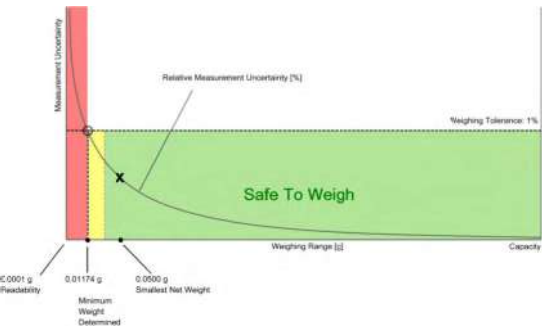
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made, As Left results correspond to As Found.

## Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.0500 g | Safety Factor: 2

Safe Weighing Range




While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.



# Minimum Weight


As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.11794 g	0.23700 g	0.35721 g	0.60113 g	1.23215 g
0.2%	0.05883 g	0.11794 g	0.17733 g	0.29696 g	0.60113 g
0.5%	0.02350 g	0.04704 g	0.07063 g	0.11794 g	0.23700 g
1%	0.01174 g	0.02350 g	0.03526 g	0.05883 g	0.11794 g
2%	0.00587 g	0.01174 g	0.01762 g	0.02938 g	0.05883 g
5%	0.00235 g	0.00470 g	0.00704 g	0.01174 g	0.02350 g

 Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.11794 g	0.23700 g	0.35721 g	0.60113 g	1.23215 g
0.2%	0.05883 g	0.11794 g	0.17733 g	0.29696 g	0.60113 g
0.5%	0.02350 g	0.04704 g	0.07063 g	0.11794 g	0.23700 g
1%	0.01174 g	0.02350 g	0.03526 g	0.05883 g	0.11794 g
2%	0.00587 g	0.01174 g	0.01762 g	0.02938 g	0.05883 g
5%	0.00235 g	0.00470 g	0.00704 g	0.01174 g	0.02350 g

 Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.







The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred, For the past, it is necessary to know that the tolerance was met, but not the safety factor, The safety factor is a proactive measure to apply for future measurements.




Notes on minimum weight values in above table:

- If "N/A" is shown above, no appropriate value could be calculated.
- METTLER TOLEDO is not responsible for the definition of the process requirements.











# Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found			
As Left			

 = Passed  
 = Failed  
 = Safety Factor not met













## Repeatability

		As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0,00004 g*	N/A	0,00004 g*	N/A
0.2%	0.00005 g				
0.5%	0.00013 g				
1%	0.00025 g				
2%	0.00050 g				
5%	0.00125 g				

\*The calculated standard deviation value is below the rounding error of the balance. The 0.41\*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

## Eccentricity

		As Found		As Left	
Tolerance	Control Limit	Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g		0.0001 g	
0.2%	0.1000 g				
0.5%	0.2500 g				
1%	0.5000 g				
2%	1.0000 g				
5%	2.5000 g				

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

Attachment to Calibration Certificate:

TH2036-003-011723-ACC-TH

GWP® Certificate

METTLER TOLEDO Service

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	0,0000 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	-0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0001 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	0,0000 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	-0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0001 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Calibration Certificate ID

TH2036-003-011723-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+66 2723 0382

MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company:	Environment Research & Technology Co., Ltd.		
Address:	25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong		
City:	Laksi	Contact:	Ramita Taengthai
Zip / Postal:	10210		
State / Province:	Bangkok		
Order Number:			

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS204S/01	Asset Number:	ERTC-L-IN-088
Serial No.:	B334691537	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	5	Terminal Asset No.:	N/A
Room:	504		

Range	Max. Capacity	Readability (d)
1	220 g	0,0001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 23.7 °C	End: 23.6 °C	Start: 46.5 %	End: 45.6 %

As Found Calibration Date:	17-Jan-2023
As Left Calibration Date:	N/A
Issue Date:	19-Jan-2023

Calibrator:	
Approved Signatory:	

Technical Manager / Head of Calibration Center

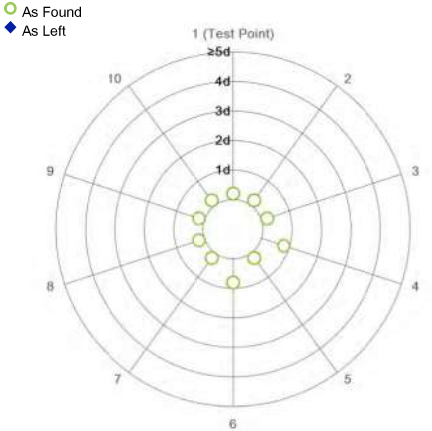
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	99.9999 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	99.9999 g	N/A
6	99.9998 g	N/A
7	99.9999 g	N/A
8	99.9999 g	N/A
9	99.9999 g	N/A
10	99.9999 g	N/A

Standard Deviation	0.00004 g	N/A
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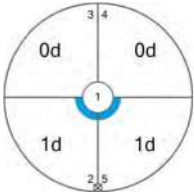
The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A
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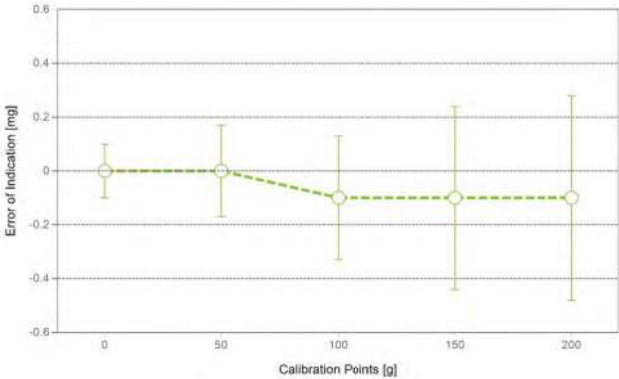


As Found  
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.12 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.12 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.12 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.12 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.13 mg	2
7	10.0000 g	10.0001 g	0.0001 g	0.13 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.17 mg	2
9	100.0000 g	99.9999 g	-0.0001 g	0.23 mg	2
10	150.0000 g	149.9999 g	-0.0001 g	0.34 mg	2
11	200.0000 g	199.9999 g	-0.0001 g	0.38 mg	2



As Found  
As Left  
For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS57	Date of Issue:	06-Jan-2022
Certificate Number:	177037	Calibration Due Date:	03-Jul-2023

Thermo Hygrometer

Equipment No.:	IN255	Date of Issue:	20-Jul-2022
Certificate Number:	22H1503	Calibration Due Date:	04-Jul-2023

Remarks

FACT adjustment functionality activated  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 1.5 · 10<sup>-6</sup> / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

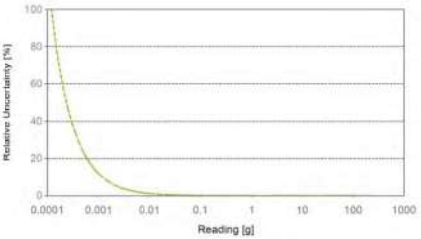
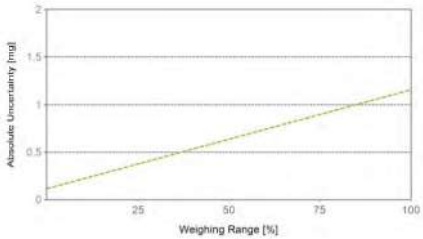
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0,0001 g	220 g	U <sub>1</sub> = 0.12 mg + 0.00474 mg/g · R	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.12 mg	0.55%	N/A	N/A
0.2200 g	0.12 mg	0.055%	N/A	N/A
2.2000 g	0.13 mg	0.0059%	N/A	N/A
22.0000 g	0.22 mg	0.0010%	N/A	N/A
220.0000 g	1.2 mg	0.00053%	N/A	N/A





GWP®

Certificate



As Found

✓

As Left

✓

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results correspond to As Found.

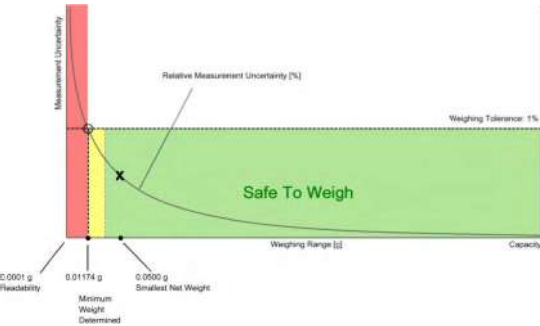
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.11794 g	0.23700 g	0.35721 g	0.60113 g	1.23215 g
0.2%	0.05883 g	0.11794 g	0.17733 g	0.29696 g	0.60113 g
0.5%	0.02350 g	0.04704 g	0.07063 g	0.11794 g	0.23700 g
1%	0.01174 g	0.02350 g	0.03526 g	0.05883 g	0.11794 g
2%	0.00587 g	0.01174 g	0.01762 g	0.02938 g	0.05883 g
5%	0.00235 g	0.00470 g	0.00704 g	0.01174 g	0.02350 g

✓

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.11794 g	0.23700 g	0.35721 g	0.60113 g	1.23215 g
0.2%	0.05883 g	0.11794 g	0.17733 g	0.29696 g	0.60113 g
0.5%	0.02350 g	0.04704 g	0.07063 g	0.11794 g	0.23700 g
1%	0.01174 g	0.02350 g	0.03526 g	0.05883 g	0.11794 g
2%	0.00587 g	0.01174 g	0.01762 g	0.02938 g	0.05883 g
5%	0.00235 g	0.00470 g	0.00704 g	0.01174 g	0.02350 g

✓

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed  
✗ = Failed  
⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0,00004 g*	N/A	0,00004 g*	N/A
0.2%	0,00005 g		✓		⚠
0.5%	0,00013 g		✓		✓
1%	0,00025 g		✓		✓
2%	0,00050 g		✓		✓
5%	0,00125 g		✓		✓

\*The calculated standard deviation value is below the rounding error of the balance. The 0.41\*d rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0,0500 g	0,0001 g	✓	0,0001 g	✓
0.2%	0,1000 g		✓		✓
0.5%	0,2500 g		✓		✓
1%	0,5000 g		✓		✓
2%	1,0000 g		✓		✓
5%	2,5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	0,0000 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	-0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0001 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0,0000 g	0,0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50,0000 g	0,0000 g	0,0250 g	0,0500 g	0,1250 g	0,2500 g	0,5000 g	1,2500 g
100,0000 g	-0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0001 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

# Agilent CrossLab Start Up Services

## Agilent 8890 Gas Chromatograph

### Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

## Introduction

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 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.

### Important Customer Web Links

- For more information about [Agilent Technologies services](http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair), please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the [Agilent YouTube](https://www.youtube.com/user/agilent) channel at <https://www.youtube.com/user/agilent>.

## 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 "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance 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
- Complete the total number of pages field in the Service Completion section
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

## Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

## System Information

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

Instrument System Name and ID	ERTC-L-In-175	US2125A011
Instrument System Site and Location	Environment Research	Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. 64513 A	US2125 CN2195125
2. 64514 A	CN21207024
3. 64515 A	US2125A011
4.	
5.	
6.	
7.	
8.	
9.	
10.	

## 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, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.



## Preventive Maintenance Procedure

### Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

### Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the Ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

### Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

## ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

## Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

## Signature Page

### Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ 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 with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

### PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	286.6
Back detector output	N/A	249.2
AUX 1 detector output	N/A	282.1
AUX 2 detector output CFPD+	N/A	282.1 126
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	pass
Leak and Restriction Test after back inlet maintenance	Pass	pass
Leak and Restriction Test after front inlet Split Vent Trap replacement	Pass	pass
Leak and Restriction Test after back inlet Split Vent Trap replacement	Pass	pass
Front inlet pressure decay test	Pass	pass
Back inlet pressure decay test	Pass	pass

### PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	8890 GC	2
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Teflon Guide	5182-9748	8890 GC	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	8890 GC	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	1
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

## Service Engineer Comments

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

## Service Completion

Service request number 60590679 Date service completed 12-13 June 2023Agilent signature  Customer signature \_\_\_\_\_Total number of pages in this document 9 pages

## Agilent CrossLab Start Up Services

### Agilent 7890 Gas Chromatograph

### Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

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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 procedures.
- 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.

### Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- **Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- **7890B Manuals** are also available on Agilent.com:
  - **Safety**  
[https://www.agilent.com/cs/library/usermanuals/public/7890B\\_Safety.pdf](https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf)
  - **Installation and First Startup**  
[https://www.agilent.com/cs/library/usermanuals/Public/7890B\\_Installation.pdf](https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf)
  - **Operation Manual**  
[https://www.agilent.com/cs/library/usermanuals/Public/7890B\\_Operation.pdf](https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf)
  - **Maintaining Your GC**  
[https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B\\_Maintaining%20Guide.pdf](https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf)

## 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 "**Section not applicable**" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance 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
- Complete the total number of pages field in the Service Completion section
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

### Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.



## System Information

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

Instrument System Name and ID	2840B/5477B
Instrument System Site and Location	Environmental Research & Technology, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440B	CN16493976
2. G4513A	CN16500132
3. G4514A	CN18330130
4.	
5.	
6.	
7.	
8.	
9.	
10.	

## 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, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

## Preventive Maintenance Procedure

### Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

### Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

### Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

## ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

## Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

## Signature Page

### Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ 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 with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

### 7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	∫	∫
AUX detector output		
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

## 7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	
PP Inlet PM kit	5188-6498	7890A/B	
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	
MMI Cleaning Kit	G3510-60820	7890A/B	
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	2
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	

## Service Engineer Comments

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

## Service Completion

Service request number 6005643176 Date service completed 25 Nov 2022

Agilent signature  Customer signature \_\_\_\_\_

Total number of pages in this document \_\_\_\_\_



## Agilent CrossLab Start Up Services

### Agilent GCMS Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

## Introduction

Select the appropriate PM to be done and then perform the checklist under that section

- ☐ Interim Preventive Maintenance 6 months
- ☒ Major Preventive Maintenance Yearly

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

## Customer Information

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



## Important Customer Web Links

- For more information about *Agilent Technologies services*, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access *Agilent University*, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful *Agilent Resource Center* web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our *Support Home page* at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections:  
Join the *Agilent Community* at <https://community.agilent.com/welcome>

## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section 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.
- Ask the customer to sign the **Service Completion** section including the customer's and your signature.

## Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

## System Information

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

Instrument System Name and ID	7810B / 5477B
Instrument System Site and Location	Environmental Research & Technologies, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. 617077B	U51707M011
2.	
3.	
4.	
5.	
6.	
7.	
8.	

## 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 settings as defined by current Service Notes
- ☒ Check for firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

## Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

## Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

**Note:** it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

## Definition of the Task/Recommended items within the document

Task	Recommended	
Yes	No	Interim / Major / As needed
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Yes** selected means that the task was done or the part was required.

**No** selected means that the task was not done or the part was not required.

**Interim** selected means that this task is recommended to be done at 6-month intervals.

**Major** selected means that this task is recommended to be done yearly, if the customer would like a service to be done at the 6-month interval then the service could be purchased.

**As needed** selected means that the task was done or the part was used as needed. For example, there could be two types of filters that could be used and this was the one selected.

## Preventive Maintenance Procedures

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

Yes/No	Interim/Major	GCMS
Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Record Instrument model no. 670378
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Record Instrument serial no. 151403M011
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Record Rough Vacuum N/A
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Record Manifold Vacuum N/A
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Type of Column installed DB-124 VJ, PE 624 VJ

Yes/No	Interim/Major	System Checks
Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Visually inspect calibrant levels – PFTBA PFTD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input type="checkbox"/> No <input type="checkbox"/>

Yes/No	Interim/Major	Wet Mechanical vacuum pumps
Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.
Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Diaphragm
Yes/No	Interim/Major	Description
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Clear air flow paths of dust.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Scroll
Yes/No	Interim/Major	Description
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the tips seal on the IDP pump.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the Exhaust Filter if required.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Yes/No	Interim/Major	Cleaning System and Filters
Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Fans
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Remove dust from fans and vent covers
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Source cleaning
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Re-install source and close analyzer.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Filters
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSH-2 Helium gas filter – if applicable
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSN-2 Nitrogen gas filter – if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSHY-2 Hydrogen gas filter – if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8"; Mount and Filter – if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CP17973 – Gas Clean Filter, Replacement Filter – if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	5190-9071 – Methane Gas Filter – if applicable

**Guidance:** If gas filter is replaced, write the change date on the filter using a permanent marker.



System post-check			
Yes/No	Interim/Major	Description	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system in manual tune
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Compare against previous tune file report(s)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	EI Autotune Performed

**Guidance:** If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument setup 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 Comment box. Systems in a compliant environment may need additional documentation.

## Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result

## Agilent Consumed Parts List Table

☐ Section not applicable

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

## Signature Page

### Service Engineer Comments (optional)

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

### Service Completion

Service request number 6005643176 Date service completed 25 Nov 2022

Agilent signature [Signature] Customer signature [Signature]

Total number of pages in this document       

## Parts – As needed as part of the PM

Common MS Filters and Seals – 5973/5975/5977/7000/7010/7200/7250 Series

Yes/No	Interim/Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Helium gas filter – if required	RMSH-2
<input type="checkbox"/>	<input type="checkbox"/>	Nitrogen gas filter – if required	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	Big Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2
<input type="checkbox"/>	<input type="checkbox"/>	Gas Clean Carrier Gas Kit for 7390 for Nitrogen or Helium, Bracket, Mount and Filter – if required	CP17988
<input type="checkbox"/>	<input type="checkbox"/>	Gas Clean Filter Kit GC/MS 1/8 in (complete replacement kit) – if required	CP17974
<input type="checkbox"/>	<input type="checkbox"/>	Gas Clean GS/MS Filter – if required	CP17973
<input type="checkbox"/>	<input type="checkbox"/>	Chemical Ionization Gas Purifier (CI systems) – if required	5190-9071
<input type="checkbox"/>	<input type="checkbox"/>	Agilent AVF Platinum, 1 quart	5191-5851

Gas filters need to be changed only if required

MS Maintenance Supplies for 5973/5975/5977 Series

Yes/No	Interim/Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Diffusion pump fluid (Diffusion Pump Models)	6C40-0809 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Pump Models)	G7077-67018
<input type="checkbox"/>	<input type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (no tools – CSD P/N)	5190-9561
<input type="checkbox"/>	<input type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (no tools – VPD P/N)	IDP3TS
<input type="checkbox"/>	<input type="checkbox"/>	Filter element for IDP-3	REPLSLRFILTER2
<input type="checkbox"/>	<input type="checkbox"/>	DS42 Oil Mist Eliminator 3/4C & 3/8	SR03705556
<input type="checkbox"/>	<input type="checkbox"/>	Exhaust oil mist trap (thread) Edwards/Pfeiffer	G1099-80039

MS Maintenance Supplies for 7000/7010 Series

Yes/No	Interim/Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Nitrogen gas filter	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models)	G7004-67023
<input type="checkbox"/>	<input type="checkbox"/>	IDP-10 Tip Seal Replacement Kit (no tools – VPD P/N)	X3807-67000
<input type="checkbox"/>	<input type="checkbox"/>	Oil Mist Filter RV5	G6600-80043
<input type="checkbox"/>	<input type="checkbox"/>	Filter element for the IDP-10	REPLSLRFILTER1

MS Maintenance Supplies for 7200/7250 Series

Yes/No	Interim/Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Nitrogen gas filter – if required	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	RIS Probe Maintenance Kit (7200 Series only)	G7005-60170
<input type="checkbox"/>	<input type="checkbox"/>	DS202 Oil Mist Eliminator	SR03706800
<input type="checkbox"/>	<input type="checkbox"/>	IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Pump Models)	5190-9613
<input type="checkbox"/>	<input type="checkbox"/>	IDP-15 Tip Seal Replacement Kit (no tools – VPD P/N)	X3815-67000
<input type="checkbox"/>	<input type="checkbox"/>	Filter element, for SH-110/SH-112/IDP-15 exhaust silencer	REPLSLRFILTER
<input type="checkbox"/>	<input type="checkbox"/>	DS 3/8 MAG. PLUG AND GASKET	SR03701824

MS Maintenance Supplies for JetClean

Yes/No	Interim/Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>		



<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Big Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2
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## Consumable Parts Reference – Purchasable by customer, not included as part of PM

Common MSD Maintenance Supplies 5973/5975/5977/7000/7010/7200/7250 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	El High Temperature Filaments	G70C5-60061 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	HES El Filaments	G70C2-600C1
<input type="checkbox"/>	<input type="checkbox"/>	LE-El Filaments	G3850-60021
<input type="checkbox"/>	<input type="checkbox"/>	Cl High Temperature Filament – all MSDs	G70C5-60072
<input type="checkbox"/>	<input type="checkbox"/>	PFTBA GCMS Tuning Standard calibrant	05971-60571
<input type="checkbox"/>	<input type="checkbox"/>	PFTD calibrant, 1 mL	8500-8510
<input type="checkbox"/>	<input type="checkbox"/>	PFET, IRM calibrant for GC QTOF 0.5 mL	5190-0531

MSD Maintenance Supplies 5973/5975/5977 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal (tip and spring combo)	G1999-60412
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal (tip only)	G3870-20542
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal spring (spring only)	G1999-20C23
<input type="checkbox"/>	<input type="checkbox"/>	Repeller insulator	G1099-20133 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	Lens insulator/holder (HES)	G7002-20C74
<input type="checkbox"/>	<input type="checkbox"/>	Ring heater/sensor assembly (HES)	G7002-60043
<input type="checkbox"/>	<input type="checkbox"/>	Ceramic insulator for Extractor (HES)	G7002-20064
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Cap, Threaded	G3870-20547
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Base, Threaded	G3870-20548

MS Maintenance Supplies for 7000/7010 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal - 7000	G1999-60412
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal - 7010	G7002-60412
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal (tip only)	G3870-20542
<input type="checkbox"/>	<input type="checkbox"/>	Cl Interface tip seal spring (spring only)	G1999-20C23
<input type="checkbox"/>	<input type="checkbox"/>	Repeller insulator - 7000	G1099-20133 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	Lens insulator/holder (HES)	G7002-20074
<input type="checkbox"/>	<input type="checkbox"/>	Ring heater/sensor assembly (HES)	G7002-60043
<input type="checkbox"/>	<input type="checkbox"/>	Ceramic insulator for Extractor (HES)	G7002-20064
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Cap, Threaded	G3870-20547
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Base, Threaded	G3870-20548

MS Maintenance Supplies for 7200 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Extractor Lens Insulator	G7005-20133
<input type="checkbox"/>	<input type="checkbox"/>	Ion Focus Insulator	G7005-20442
<input type="checkbox"/>	<input type="checkbox"/>	Ring Heater/Sensor Assembly	G7005-60110
<input type="checkbox"/>	<input type="checkbox"/>	RIS Xfer Tip	G7005-20542
<input type="checkbox"/>	<input type="checkbox"/>	RIS Xfer Tip Spring	G7005-20024

MS Maintenance Supplies for 7250 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Lens insulator/holder (HES)	G7002-20074
<input type="checkbox"/>	<input type="checkbox"/>	Ring heater/sensor assembly (HES)	G7002-60043
<input type="checkbox"/>	<input type="checkbox"/>	Ceramic insulator for Extractor (HES)	G7002-20064
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Cap, Threaded	G3870-20547
<input type="checkbox"/>	<input type="checkbox"/>	Transfer-Line Tip Base, Threaded	G3870-20548
<input type="checkbox"/>	<input type="checkbox"/>	El Extractor Transfer Tip	G3870-20542
<input type="checkbox"/>	<input type="checkbox"/>	Cl Tip Compression Spring	G1999-20023

MS Maintenance Supplies for Intuvo 9000 MS Systems

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Swaged MS Tail - Packaged	G459C-60009
<input type="checkbox"/>	<input type="checkbox"/>	Swaged MS Tail (HES) - Packaged	G459C-60109

Common MS Maintenance Supplies

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Abrasive paper, 30 um	5061-5896
<input type="checkbox"/>	<input type="checkbox"/>	Alumina powder	393705201
<input type="checkbox"/>	<input type="checkbox"/>	Cloths, clean (pkg of 15)	05980-60051
<input type="checkbox"/>	<input type="checkbox"/>	Cloths, cleaning (pkg of 300)	9310-4828
<input type="checkbox"/>	<input type="checkbox"/>	Cotton swabs (pkg of 100)	5080-54C0
<input type="checkbox"/>	<input type="checkbox"/>	Gloves, clean, large	8650-0030
<input type="checkbox"/>	<input type="checkbox"/>	Gloves, clean, small	8650-0029

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.chem.agilent.com/en-us/products/services/pages/default.aspx>

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

### Service Engineer's Responsibilities

- Only complete/printout 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 a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

### System Information

#### Guidance

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

Instrument system name and ID		ATOMX	
Instrument system site and location		Environmental Research & Technologies, Bangalore	
List system component product numbers		List the serial numbers of each component	
1.	TMX - ATOMX	1.	US17013 007
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	
7.		7.	
8.		8.	
9.		9.	
10.		10.	

### Preparation

- ☒ Discuss any specific issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform general inspection of system for cleanliness
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc
- ☒ Check for required firmware updates and verify with customers if they would like it installed.



### Check External Supplies

- ☐ Section NOT Applicable
- ☒ Verify the gas source is supplying an input pressure of 50 - 100 psi to the ATOMX. If the customer is using a gas cylinder, verify the cylinder is at 500+ psi.
- ☒ Verify that the waste container has sufficient volume to contain the waste generated. Empty if necessary.
- ☒ Replace the DI water supply with fresh DI water.
  - ☐ Make sure the DI water supply is sufficient for sample analysis (1 Liter minimum)
- ☒ Make sure the methanol supply is sufficient for sample analysis.

### Atomx Leak and Pressure Check

- ☐ Section NOT Applicable
- ☒ Scan through the sample log to verify that the purge pressures are staying consistent throughout the daily runs.
- ☒ Use the Teklink software to check the standard pressure.
- ☒ Run a leak check to ensure that the unit is leak tight.

### Inspect ATOMX Hardware

- ☐ Section NOT Applicable
- ☒ Check the tray vial holes for foreign particles. Clean if necessary.
- ☒ Inspect the needle for particles or sample build up. Clean if necessary.
- ☒ Inspect the sparger glassware for damage and/or discoloration that could restrict flow or cause contamination. Replace if necessary.
- ☒ Inspect the drain tubing for clogging. Replace the drain line if necessary.
- ☒ Lubricate the ATOMX Carousel Drive. Refer to the diagram on page 6-25 of the ATOMX User Manual for lubrication points. Teledyne Tekmar recommends using DuPont Krytox lubrication.
- ☒ Lubricate the ATOMX Elevator. Refer to the diagram on page 6-32 of the ATOMX User Manual for lubrication points. Teledyne Tekmar recommends using DuPont Krytox lubrication.

### Restore Instrument

#### 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 PM service activity in the customer's instrument records/logbook
- ☒ 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 below if there are additional comments
- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

### Product or Product Type Test Results Table

Test Description	Expected Test Result	Actual Test Result
Leak Test	Pass	Pass

### Product or Product Type Parts List Table

Part Description	Part Number	Product or Model# where used	Quantity Consumed
Sparger Glassware	Ask the customer what size sparger glassware they are using; refer to the ATOMX parts list for part numbers.	TMR-ATOMX	1
Lubricant, Dupont Krytox	15-0293-000	TMR-ATOMX	1
Tubing, Drain, Self Retracting	15-0087-002	TMR-ATOMX	1

**Teledyne Tekmar ATOMX Purge and Trap  
Preventive Maintenance Checklist - Standard**



**Service Engineer Comments (optional)**


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

**Other Important Customer Web Links**

- ☐ How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
- ☐ Need to know more? - [www.agilent.com/chem/education](http://www.agilent.com/chem/education)
- ☐ Need technical support, FAQs? - [www.agilent.com/chem/techsupp](http://www.agilent.com/chem/techsupp)
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

**Service Completion**

Service request number 600543170 Date service completed 25 Nov 2022

Agilent signature  Customer signature Pernade

Number of pages in this document \_\_\_\_\_

Issued: 30-09-2019, Revision:02

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Select pages for required products or Page 5 of 5

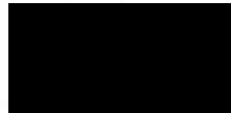
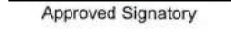


TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SCI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert No.: 23CHO3  
Page: 1 of 3

**Certificate of Calibration**

Equipment :	UV-VIS Spectrophotometer
Manufacturer :	PerkinElmer
Model :	Lambda 365+
Serial No. :	365PK22072603
ID No. :	ERTC-L-In.-180
Condition As-Received:	Used Item
Received Date :	04 January 2023
Calibration Date :	04 January 2023
Reference :	2301-0002ON-14
Submitted by :	Environment Research & Technology Company Limited. 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210
Calibration Place :	ห้องปฏิบัติการวิเคราะห์ Spectrophotometer
Ambient Temperature :	( 24.8 - 25.2 ) °C (On-Site)
Relative Humidity :	( 56 - 61 ) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-01
Calibrated by :	
Approved by :	 Approved Signatory
	(✓) Malee Butkruea ( ) Salthip Meangmai ( ) Warakorn Lemgagrakul
Issue Date :	17 January 2023

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

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

A 0045992





Cert. No. : 23CHO3

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
6. Stray Light Standard set	32629	9112980	03 Aug 2024

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

3. This certificate is traceable to the International System of Unit 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 nm  
Scan Speed : 30 nm/min

**Calibration Results : without adjustment****Wavelength Accuracy**

Certified Values of Reference Material ( nm )	UUC Reading ( nm )	Uncertainty of Measurement ( $\pm$ nm )	Coverage Factor k
360.89	360.96	0.12	2.00
459.99	459.98	0.12	2.00
536.52	536.38	0.12	2.00
638.00	637.88	0.12	2.00
879.41	879.43	0.12	2.00



Cert. No. : 23CHO3

Page : 3 of 3

**Calibration Results : without adjustment****Photometric Accuracy**

Wavelength (nm)	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( $\pm$ Abs )	Coverage Factor k
350.0	Zero	0.0000	0.0046	2.00
	0.4253	0.4239	0.0051	2.00
	Zero	0.0000	0.0050	2.00
	0.6389	0.6383	0.0056	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5281	0.5269	0.0028	2.00
	0.6962	0.6945	0.0028	2.00
	0.9984	0.9962	0.0028	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5699	0.5676	0.0028	2.00
	0.7606	0.7581	0.0028	2.00
	1.0927	1.0894	0.0028	2.00

**Stray Light**

* Straylight at 280.05 nm $\pm$ 0.11 nm	Reading at 280.05 nm $\pm$ 0.11 nm
Abs	2.0810
%T	0.8214

**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.
- Cut-off wavelength of stray light reference material (Potassium Iodide) at wavelength 280.05 nm  $\pm$  0.11 nm
- Result = Pass, if Absorbance > 2.00 Abs and Transmission < 1.0 %T at Wavelength 280.05 nm  $\pm$  0.11 nm
- \* : Not NSC-ONSC Accredited

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 %.

-o0o-

a 1142780

a 1142779



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม  
โครงการผลิตปิโตรเลียมแหล่งประดู่เตาและแหล่งเสาเดียวร่อนขยาย แปลงเอส 1 จังหวัดพิษณุโลก และสุโขทัย  
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

## ภาคผนวกที่ 40

ผลการตรวจสอบคุณภาพพนักงานประจำปี 2566

## รายงานผลการตรวจสอบสุขภาพ

(ข้อมูลส่วนบุคคล ได้รับการคุ้มครองไม่ต้องเปิดเผยตามกฎหมาย)

## รายงานผลการตรวจสอบสุขภาพ

(ข้อมูลส่วนบุคคล ได้รับการคุ้มครองไม่ต้องเปิดเผยตามกฎหมาย)