



บริษัท ซีเอ็นพีซีเอชเค (ไทยแลนด์) จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 บึงหญ้า แปลงสำรวจบนบกหมายเลข L1/64 พื้นที่ผลิตบึงหญ้าตะวันตก-หนองสระ
และพื้นที่ผลิตบึงหญ้าตะวันตก-หนองสระส่วนขยาย แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร
ฉบับเดือนมกราคม - มิถุนายน พ.ศ.2567

ภาคผนวก ง.6

เอกสารขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์



ที่ อก ๐๓๑๐(๑)/๗๓๒๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๕ กรกฎาคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ 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 ๑๒ แผ่น

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

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด
ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๙ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย 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 ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๐๐๒ ๐ ๒๒๐๒ ๔๑๔๖

โทรสาร ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ๖-๐๙๙

ที่ อก ๐๓๑๐(๑)/๗๓๒๕

ลงวันที่ ๒๕ กรกฎาคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย



ทะเบียนเลขที่ ๖-๐๙๙-ค-๒๔๑๔
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

เอกสารแนบท้ายหนังสือรับต่ออาชญากรรมทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๙๙
ที่ ออก ๐๓๑๐(๑)/ ลงวันที่

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๙ ราย

ทะเบียนเลขที่ ๖-๐๙๙-จ-๕๔๐๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๒๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๒๙
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๓๗
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๔๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๔๔
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๔๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๕๐
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๕๔
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๕๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๓
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๐
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๓
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๗
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๘
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๙
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๓
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๔
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๗
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๘
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๒๙
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๐
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๓
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๔

๓๖) นายรอมชี...

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ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๖
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๗
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๘
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๓๙
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๐
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๔
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๕
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๗
ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๔๘
ทะเบียนเลขที่ ๖-๐๙๙-จ-๙๕๑๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๙๕๑๒

เอกสารแนบท้ายหนังสือรับต่ออาชญากรรมขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
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ที่ กก ๐๓๑๐(๑)/ ลงวันที่

ขอขยาสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘๗ รายการ

น้ำเสีย จำนวน 27 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
2	Barium	Digestion, Inductively Coupled Plasma Method ^[3]
3	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ^[3] 2) 5-Day BOD Test, Membrane Electrode Method ^[3]
4	Cadmium	Digestion, Inductively Coupled Plasma Method ^[3]
5	Chemical Oxygen Demand	Closed Reflux, Titrimetric Method ^[3]
6	Chromium	Digestion, Inductively Coupled Plasma Method ^[3]
7	Color	ADMI Weighted-Ordinate Spectrophotometric Method ^[3]
8	Copper	Digestion, Inductively Coupled Plasma Method ^[3]
9	Cyanide	Distillation, Colorimetric method ^[3]
10	Formaldehyde	Distillation, Colorimetric Method ^[2]
11	Free Chlorine	1) Iodometric Method ^[3] 2) DPD Colorimetric Method ^[3]
12	Hexavalent Chromium	Colorimetric Method ^[3]
13	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
14	Manganese	Digestion, Inductively Coupled Plasma Method ^[3]
15	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[3]
16	Nickel	Digestion, Inductively Coupled Plasma Method ^[3]
17	Oil & Grease	Liquid-Liquid, Partition-Gravimetric Method ^[3]
18	pH	Electrometric Method ^[3]
19	Phenols	Distillation, Direct Photometric Method ^[3]
20	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[3] 2) Digestion, Inductively Coupled Plasma Method ^[3]
21	Sulfide	Iodometric method ^[3]

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

น้ำใต้ดิน จำนวน 58 รายการ

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

ผู้ดำเนินการวิเคราะห์
สมชาย เจริญกิจกิจ

22 Temperature...

ผู้ดำเนินการวิเคราะห์
สมชาย เจริญกิจกิจ

14 Chloroform...

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



ผู้ชำนาญการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และทะเบียนข้อมูลปฏิบัติการ

32 Lead...

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



ผู้ชำนาญการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และทะเบียนข้อมูลปฏิบัติการ

50 Trichloroethylene...

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

อากาศเสีย (ปล่อยระบาย) จำนวน 26 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[4]
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[4] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[4]
3	Beryllium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[4]
4	Cadmium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[4]
5	Carbon Monoxide	Instrumental Analyzer Method ^[4]
6	Chlorine	1) Absorption Sampling, Ion Chromatographic Method ^[4] 2) Isokinetic Sampling, Ion Chromatographic Method ^[4]

ผู้ควบคุมการปฏิบัติงาน
และนายทะเบียนท้องถิ่น

7 Chromium...

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

ผู้ควบคุมการปฏิบัติงาน
และนายทะเบียนท้องถิ่น

21 Sulfur...

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

สิ่งบ่งชี้หรือวัสดุที่ไม่ใช้แล้ว จำนวน 20 รายการ

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

ใช้สำหรับการประเมินความเสี่ยงการวิเคราะห์ทางเคมี
และประเมินผลกระทบต่อสุขภาพ

15 pH...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	pH	Electrometric Method ^[14]
16	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5,12] 2) Digestion, Inductively Coupled Plasma Method ^[5,3]
17	Silver	Digestion, Inductively Coupled Plasma Method ^[5,8]
18	Thallium	Digestion, Inductively Coupled Plasma Method ^[5,8]
19	Vanadium	Digestion, Inductively Coupled Plasma Method ^[5,8]
20	Zinc	Digestion, Inductively Coupled Plasma Method ^[5,8]

ดิน จำนวน 56 รายการ

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

ใช้สำหรับการประเมินความเสี่ยงการวิเคราะห์ทางเคมี
และประเมินผลกระทบต่อสุขภาพ

14 Chloroform...

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

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

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

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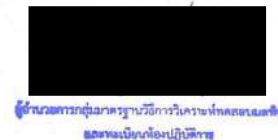
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ที่ อก ๐๓๑๐(๑)/ ๒๐๓ ๙



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

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 ท้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ว-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖ ซอยชินเขต ๑ ถนนงามวงศ์วาน
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงสารมลพิษที่วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้วให้ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี
จำกัด เพิ่มขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในดิน 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



ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๑๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ว-๐๙๙

ที่ อก ๐๓๑๐(๑)/ ๒๐๓ ๙

ลงวันที่ ๑๐ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓ รายการ

ดิน จำนวน 3 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	TPH (C ₅ – C ₈)	Purge and Trap, Gas Chromatographic Method ^[2,3]
2	TPH (C _{>8} – C ₁₆)	Ultrasonic Extraction, Gas Chromatographic Method ^[1,3]
3	TPH (C _{>16} – C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ^[1,3]

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ที่ อก ๐๓๓๐(๑)/ ๑๑๕๖๗



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

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 ๒๕/๑๓๔ หมู่ที่ ๖ ซอยชินเขต ๑
ถนนงามวงศ์วานแขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้อยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๙ ราย

๑	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๐๕๔
๒	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๗๖๗๑
๓	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๒
๔	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-จ-๘๘๑๙
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

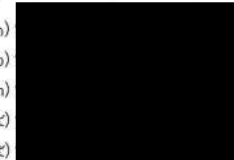
๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๕ ราย

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)
๑๒)
๑๓)
๑๔)
๑๕)



ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๑
ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๒
ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๓
ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๔
ทะเบียนเลขที่ ๖-๐๙๙-จ-๐๐๑๕

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๗๓๒๕๔ ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๔ คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามหนังสือกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๕๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



“อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”





ที่ อก ๐๓๓๐(๑)/ ๑๑๔๔๔

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๗ สิงหาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๔ มิถุนายน ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์
บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด จำนวน ๖ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ว-๐๙๔๔ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖ ซอยชินเขต ๑ ถนนงามวงศ์วาน
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ ความละเอียด
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย

[Redacted]

ทะเบียนเลขที่ ว-๐๙๔๔-ค-๘๘๐๖

๒. เพิกถอนเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

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๑๒.)

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๗/๐๕๖

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๑๐

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๑๓

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๑๗

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๒๕

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๓๔

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๘๘๓๒

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๙๕๕๒๒

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๐๐๐๑

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๐๐๐๖

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๐๐๑๑

ทะเบียนเลขที่ ว-๐๙๔๔-จ-๐๐๑๔

๓. ให้เพิ่มขอขยาย...

- ๒ -

๓. ให้เพิ่มขอขยายสารมลพิษที่วิเคราะห์ในสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

[Signature]

(นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๙๙

ที่ อภ ๐๓๑๐(๑)/ ๑ ๑ ๙ ๙ ๙ ลงวันที่ ๑ ๗ สิงหาคม ๒๕๖๖

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘ รายการ

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 18 รายการ

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

15 Silver...

- ๒ -

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

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คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

วันที่ 24 เดือน เมษายน พ.ศ. 2567

เรียน อธิบดีกรมโรงงานอุตสาหกรรม

ข้าพเจ้า ☐ ผู้รับใบอนุญาตประกอบกิจการโรงงาน☒ บริษัท/ห้างหุ้นส่วนจำกัด / บริษัทเอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

สถานที่ตั้งห้องปฏิบัติการ

เลขที่ 25/114 หมู่ที่ 6 ต.ครอก/ซอย ชินเขต 1 ถนน งามวงศ์วาน

ตำบล/แขวง ทุ่งสองห้อง อำเภอ/เขต หลักสี่ จังหวัด กรุงเทพมหานคร

รหัสไปรษณีย์ 10210 โทรศัพท์ 0-2954-7745-6 E-mail -

เลขทะเบียนห้องปฏิบัติการ ว-099



ได้รับทราบ ประกาศกรมโรงงานอุตสาหกรรม เรื่อง ห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ. 2566 โดยตลอดแล้ว และยินยอมปฏิบัติตามประกาศฯ ทุกประการ และได้แนบบเอกสารต่างๆ ตามรายการเอกสารประกอบการพิจารณา (แบบ ปอ.1-1) มาพร้อมนี้

รายการขอดำเนินการ

การดำเนินการ	จำนวนสารมลพิษ					
	น้ำเสีย/น้ำทิ้ง (รายการ)	น้ำใต้ดิน (รายการ)	อากาศ (รายการ)	สิ่งปฏิกูลหรือวัสดุ ที่ไม่ใช้แล้ว (รายการ)	ดิน (รายการ)	รวมทั้งสิ้น (รายการ)
<input type="checkbox"/> ขอขึ้นทะเบียน ห้องปฏิบัติการ วิเคราะห์เอกชน						
<input checked="" type="checkbox"/> ต่ออายุห้องปฏิบัติการ วิเคราะห์เอกชน	32 รายการ	64 รายการ	33 รายการ	40 รายการ	58 รายการ	227 รายการ
<input checked="" type="checkbox"/> เปลี่ยนแปลงสารมลพิษที่ วิเคราะห์						
<input checked="" type="checkbox"/> เพิ่มสารมลพิษ		4 รายการ		1 รายการ	1 รายการ	
<input type="checkbox"/> ยกเลิกสารมลพิษ						
<input checked="" type="checkbox"/> เปลี่ยนแปลงบุคลากร						
<input checked="" type="checkbox"/> เพิ่มบุคลากร	จำนวน.....ราย (รายละเอียดตาม แบบ ปอ.1)					
<input checked="" type="checkbox"/> ยกเลิกบุคลากร	จำนวน.....ราย (รายละเอียดตาม แบบ ปอ.1-1)					
<input type="checkbox"/> ยกเลิกห้องปฏิบัติการวิเคราะห์เอกชน						
<input type="checkbox"/> อื่นๆ โปรดระบุ.....						

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และ คณะกรรมการปฏิบัติการ
วันที่ ๒๔ เม.ย. ๖๗
วันที่ ๒๔ เม.ย. ๖๗
เวลา ๑๕.๒๖ น.

จึงเรียนมาเพื่อโปรดพิจารณา

ลงนาม

ท.ว.ท.

เพื่อโปรดพิจารณา

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน

ลง

ผู้มีอำนาจลงนามแทนอธิบดี

ประทับตรา (ชื่อ)





บริษัท ซีเอ็นพีซีเอชเค (ไทยแลนด์) จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 บึงหญ้า แปลงสำรวจบนบกหมายเลข L1/64 พื้นที่ผลิตบึงหญ้าตะวันตก-หนองสระ
และพื้นที่ผลิตบึงหญ้าตะวันตก-หนองสระส่วนขยาย แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร
ฉบับเดือนมกราคม - มิถุนายน พ.ศ.2567

ภาคผนวก ง.7

เอกสารสอบเทียบเครื่องมือตรวจวัด

ระยะก่อสร้างและติดตั้ง

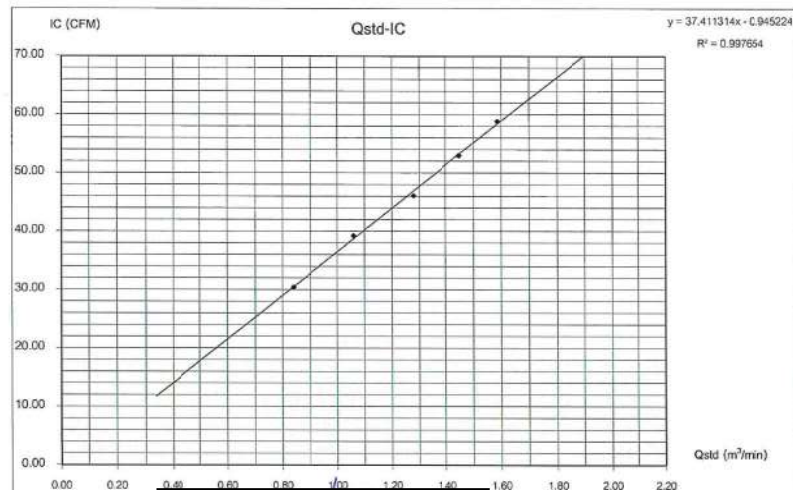
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	June 15, 2023
A6 : หมู่ที่ 6 บ้านโนนจานวัด (2023-00866)				Start Time	12:39 AM
Sampler Number	TSP No.A16	Transfer Standard Type	Orifice	Stop Time	12:49 AM
Instrument Model	HIVOL-BSCBE	Calibrator Model	TE-5025A	Calibrated By	<div></div>
Motor Serial Number	2214	Calibrator Serial Number	3362		
Recorder Serial Number	7363				

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$[\Delta H_0(Pa/P_{atm})(T_{atm}/T)]^{1/2}$	$Qstd = (1/m)[(A-b)]$	Simple Flow Rate Indicator	$IC = [(P/P_{atm})(T_{atm}/T)]^{1/2}$	(°K = °C+273)	Pressure	Meter	Meter
	Positive Negative ΔH_0		(m³/min)	(l/min)		(mmHg)			
5	1.5 1.5 3.0	1.66972	0.83927	31.0	30.42	307.0	754.0		
7	2.4 2.4 4.8	2.16000	1.06974	40.0	39.25	307.0	754.0		
10	3.5 3.5 7.0	2.99637	1.27830	47.0	45.12	307.0	754.0		
13	4.5 4.5 9.0	2.94401	1.4851	54.0	52.90	307.0	754.0		
18	5.4 5.4 10.8	3.22500	1.58610	60.0	58.88	307.0	754.0		
Linear Regression Y ON X: Y = mx + b						Average	307.0	754.0	
1	Slope (m)	2.04234	Linear Equation			r²	0.997654	Pstd(mmHg)	760.0
2	Intercept (b)	-0.01435	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9998203	Tapp	298.0	
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.963020744			
Result					C=(Pa/Pstd)(Tstd/Ta)^0.5	0.981336203			

COMMENT

Andersen Instruments, Inc.



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Technician

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ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Environmental Scientist

F-AB-029, Rev. 01, November 16, 2019

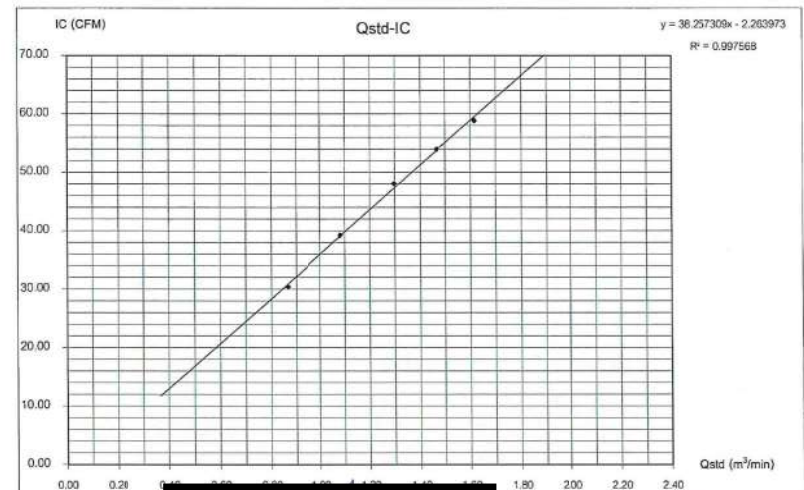
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	June 15, 2023
A6 : หมู่ที่ 6 บ้านโนนจานวัด(2023-00866)				Start Time	12:50 AM
Sampler Number	PM-10 No.28	Transfer Standard Type	Orifice	Stop Time	1:00 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By <div></div>	
Motor Serial Number	2205	Calibrator Serial Number	3362		
Recorder Serial Number	2613				

Plate No.	(Delta I)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$[\Delta H_0(Pa/P_{atm})(T_{atm}/T)]^{1/2}$	$Qstd = (1/m)[(A-b)]$	Simple Flow Rate Indicator	$IC = [(P/P_{atm})(T_{atm}/T)]^{1/2}$	(°K = °C+273)	Pressure	Meter	Meter
	Positive Negative ΔH_0		(m³/min)	(l/min)		(mmHg)			
5	1.6 1.6 3.2	1.75547	0.80696	31.0	30.42	307.0	754.0		
7	2.5 2.5 5.0	2.19433	1.08145	40.0	39.25	307.0	754.0		
10	3.6 3.6 7.2	2.63320	1.29633	49.0	48.09	307.0	754.0		
13	4.6 4.6 9.2	2.97654	1.46444	55.0	53.97	307.0	754.0		
18	5.6 5.6 11.2	3.26418	1.61507	60.0	58.88	307.0	754.0		
Linear Regression Y ON X: Y = mx + b						Average	307.0	754.0	
1	Slope (m)	2.04234	Linear Equation			r²	0.997568	Pstd(mmHg)	760.0
2	Intercept (b)	-0.01435	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9997833	Tapp	298.0	
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)	0	(Pa/Pstd)(Tstd/Ta)	0.963020744			
Result					C=(Pa/Pstd)(Tstd/Ta)^0.5	0.981336203			

COMMENT

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Environmental Scientist

F-AB-029, Rev. 02, June 3, 2019

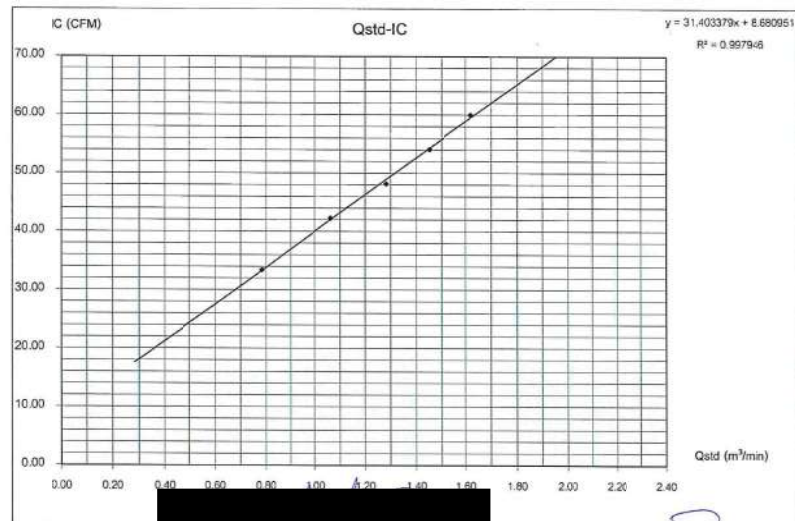
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location			Date	June 15, 2023
AG - กรุงเทพมหานคร (2023-00866)			Start Time	1:36 PM
Sampler Number	TSP No.A27	Transfer Standard Type	Orifice	Stop Time
Instrument Model	HV0L-BBCBE	Calibrator Model	TE-5025A	Calibrated By
Motor Serial Number	2215	Calibrator Serial Number	3362	
Recorder Serial Number	2133			

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$[\Delta H \cdot O(Pa/P_{atm})(T_{ref}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(P/P_{atm})(T_{ref}/T_a)]^{1/2}$	$^{\circ}K = ^{\circ}C + 273$	Pressure	Motor	Motor
	Positive Negative ΔH_2O		(m ³ /min)	(m ³ /min)		(mmHg)			
5	1.3 1.3 2.6	1.58599	0.78358	34.0	33.44	306.0	755.0		
7	2.4 2.4 4.8	2.15494	1.08216	43.0	42.29	306.0	755.0		
10	3.5 3.5 7.0	2.60233	1.28122	49.0	48.20	306.0	755.0		
13	4.5 4.5 9.0	2.95077	1.45182	55.0	54.10	306.0	755.0		
16	5.6 5.6 11.2	3.29172	1.61877	61.0	60.00	306.0	755.0		
Linear Regression Y ON X: Y = mX + b						Average	306.0	755.0	
1	Slope (m)	2.04234	Linear Equation			r^2	0.997946	$P_{std}/mmHg$	760.0
2	Intercept (b)	-0.01435	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9999729	T_{ref}		298.0
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)			$(Pa/P_{std})(T_{std}/T_a)$	0.96744926		
Result						$C = (Pa/P_{std})(T_{std}/T_a)^{0.5}$	0.98358996		

COMMENT

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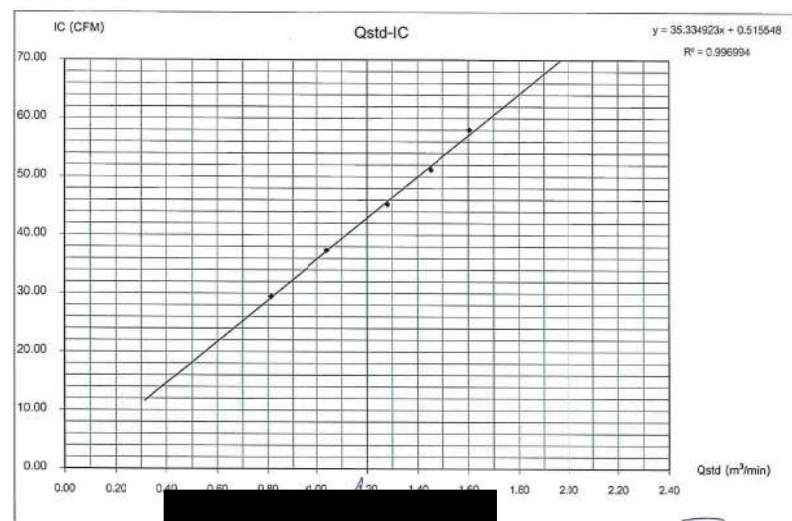
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	June 15, 2023
AQ : กรุงเทพมหานคร (2023-00866)				Start Time	1:47 PM
Sampler Number	PM-10 No.19	Transfer Standard Type	Orifice	Stop Time	1:57 PM
Instrument Model	HV0L-BMBSE	Calibrator Model	TE-5025A	Calibrated By	
Motor Serial Number	2133	Calibrator Serial Number	3362		
Recorder Serial Number	2396				

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$[\Delta H \cdot O(Pa/P_{atm})(T_{ref}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(P/P_{atm})(T_{ref}/T_a)]^{1/2}$	$^{\circ}K = ^{\circ}C + 273$	Pressure	Motor	Motor
	Positive Negative ΔH_2O		(m ³ /min)	(m ³ /min)		(mmHg)			
5	1.4 1.4 2.8	1.64586	0.81290	30.0	29.51	305.0	755.0		
7	2.3 2.3 4.6	2.10957	1.03094	38.0	37.38	305.0	755.0		
10	3.5 3.5 7.0	2.60233	1.28122	46.0	45.25	305.0	755.0		
13	4.5 4.5 9.0	2.95077	1.45182	52.0	51.15	305.0	755.0		
16	5.5 5.5 11.0	3.26220	1.60431	59.0	58.03	305.0	755.0		
Linear Regression Y ON X: Y = mX + b						Average	305.0	755.0	
1	Slope (m)	2.04234	Linear Equation			r^2	0.996994	$P_{std}/mmHg$	760.0
2	Intercept (b)	-0.01435	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9984959	T_{ref}		298.0
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)			$(Pa/P_{std})(T_{std}/T_a)$	0.96744926		
Result						$C = (Pa/P_{std})(T_{std}/T_a)^{0.5}$	0.98358996		

COMMENT

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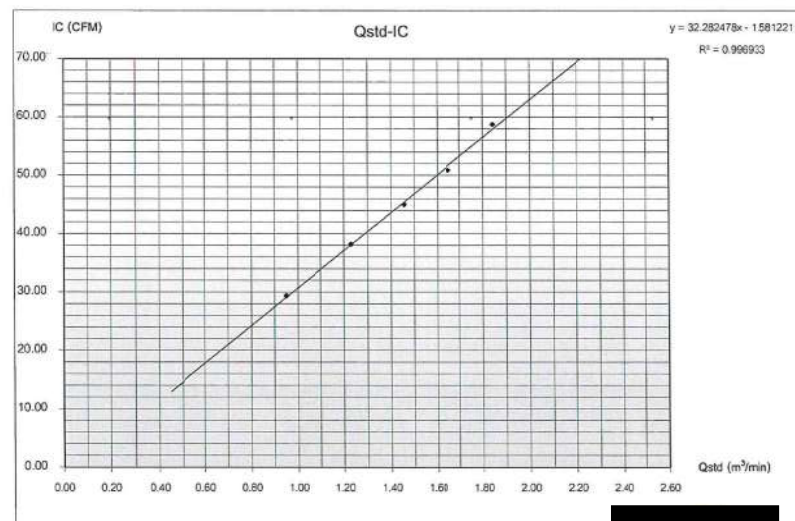
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	1024-00810	Date	April 24, 2024
Sampler Location	AB : หมู่ที่ 11 บ้านจันทน์ (1)	Start Time	3:30 PM
Sampler Number	PM-10 No.24	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	2151	Calibrator Serial Number	2915
Recorder Serial Number	2407	Calibrated By	

Plate	(Delta H)	(A)		(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmHg)	ΔH_{H_2O}	$(\Delta H_{H_2O} / (P_{atm} - P_{orifice} / Tail))^{1/2}$	$Q_{std} = (V_{std} / (A \cdot t)) \cdot (P_{atm} / P_{std}) \cdot (T_{std} / T_{amb})^{1.5}$	sample Flow Rate Indicator	$IC = ((P_{atm} / P_{std}) \cdot (T_{std} / T_{amb}))^{1/5}$	(°K = °C + 273)	Pressure (mmHg)	Meter	Meter
	Positive	Negative	ΔH_{H_2O}	(m^3/min)	(l/min)					
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.0	755.0	
7	2.5	2.5	5.0	2.18867	1.22869	39.0	38.17	309.0	755.0	
10	3.5	3.5	7.0	2.58967	1.45517	46.0	45.02	309.0	755.0	
13	4.5	4.5	9.0	2.93641	1.65100	52.0	50.90	309.0	755.0	
18	5.6	5.6	11.2	3.27570	1.84263	60.0	58.73	309.0	755.0	
Linear Regression Y = mX + b							Average	309.0	755.0	
1	Slope (m)		1.77059	Linear Equation		r^2	0.996933	Pressure (mmHg)	760.0	
2	Intercept (b)		0.01317	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.9984653	T_{std}	298.0	
3	Correlation Coefficient (r)		0.99974	Final Set Flow Rate = (I)		0	$(Pa/Pstd)(Tstd/Ta)$		0.95805549	
Result							$C = (Pa/Pstd)(Tstd/Ta)^{0.5}$		0.978803632	

COMMENT

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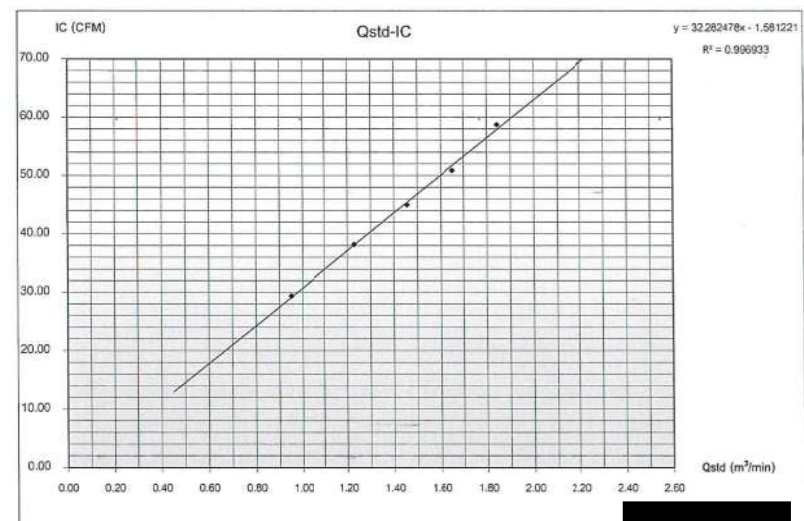
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	1024-00810	Date	April 24, 2024
Sampler Location	AB : หมู่ที่ 11 บ้านจันทน์ (1)	Start Time	3:30 PM
Sampler Number	PM-10 No.24	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	2151	Calibrator Serial Number	2915
Recorder Serial Number	2407	Calibrated By	

Plate No.	(Delta H)		(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mmHg)		$\Delta H_{H_2O} = (P_{atm} - P_{orifice}) / \rho_{H_2O} \cdot g$	$Q_{std} = (V_{std} / (A \cdot t)) \cdot (P_{atm} / P_{std}) \cdot (T_{std} / T_{amb})^{1.5}$	single Flow Rate Indicator	$IC = (P_{atm} / P_{std}) \cdot (T_{std} / T_{amb})^{1.5}$	(°K = °C + 273)	(mmHg)		
	Positive	Negative	ΔH_{H_2O}	(m³/min)	(m³/min)					
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.0	755.0	
7	2.5	2.5	5.0	2.18867	1.22869	39.0	38.17	309.0	755.0	
10	3.5	3.5	7.0	2.58967	1.45517	46.0	45.02	309.0	755.0	
13	4.5	4.5	9.0	2.93641	1.65100	52.0	50.90	309.0	755.0	
18	5.6	5.6	11.2	3.27570	1.84263	60.0	58.73	309.0	755.0	
Linear Regression Y = mX + b							Average	309.0	755.0	
1	Slope (m)		1.77059	Linear Equation			r²	0.996933	Pressure (mmHg)	760.0
2	Intercept (b)		0.01317	Set Point Flow Rate (X) (m³/min)		1.133	r	0.9984653	Tstd	298.0
3	Correlation Coefficient (r)		0.99974	Final Set Flow Rate = (I)				(Pa/Pstd)(Tstd/Ta)	0.95805549	
Result								C = (Pa/Pstd)(Tstd/Ta)⁰.⁵	0.978803632	

COMMENT

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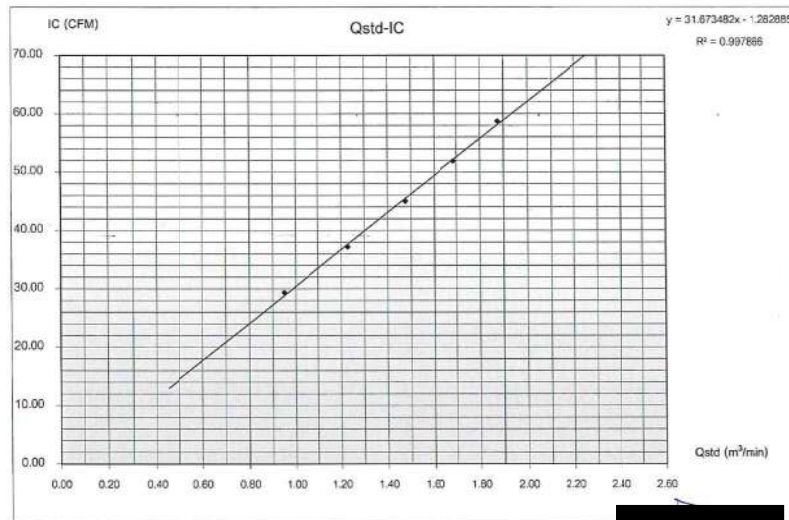
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	0024-00810	Date	April 24, 2024
Sampler Location	AT : หมู่ที่ 11 บ้านอัมพนา (2)	Start Time	4:05 PM
Sampler Number	TSP No A18	Stop Time	4:15 PM
Instrument Model	HIVOL-BSCBE	Transfer Standard Type	Orifice
Motor Serial Number	2014-03	Calibrator Model	TE-5025A
Recorder Serial Number	7373	Calibrator Serial Number	2915
Calibrated By			

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mH ₂ O)			$\Delta H_2O/(Pa_{atm}/\rho_{atm}/T_{atm})^{1/2}$	$Q_{set} = (I \ln[(A/b)])$	orifice Flow Rate Indicator	$IC = [(Pa_{atm}/T_{atm})^{1/2}]$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O		(m ³ /min)	(m ³ /min)					
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.3	755.0		
7	2.5	2.5	5.0	2.18867	1.22869	36.0	37.19	309.3	755.0		
10	3.5	3.5	7.0	2.62841	1.47591	46.0	45.02	309.3	755.0		
13	4.7	4.7	9.4	3.00096	1.68745	53.0	51.86	309.3	755.0		
18	5.8	5.8	11.6	3.33369	1.87537	60.0	58.73	309.3	755.0		
Linear Regression Y ON X: Y= mX + b								Average	309.3	755.0	
1	Slope (m)			1.77059	Linear Equation			r ²	0.997896	Pressure (mmHg)	760.0
2	Intercept (b)			0.01317	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9989324	T _{atm}	298.0
3	Correlation Coefficient (r)			0.99974	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.96805549	
Result								C	(Pa/Pstd)*(Tstd/Ta)*0.5	0.978803632	

COMMENT

Andersen Instruments, Inc.



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Technician

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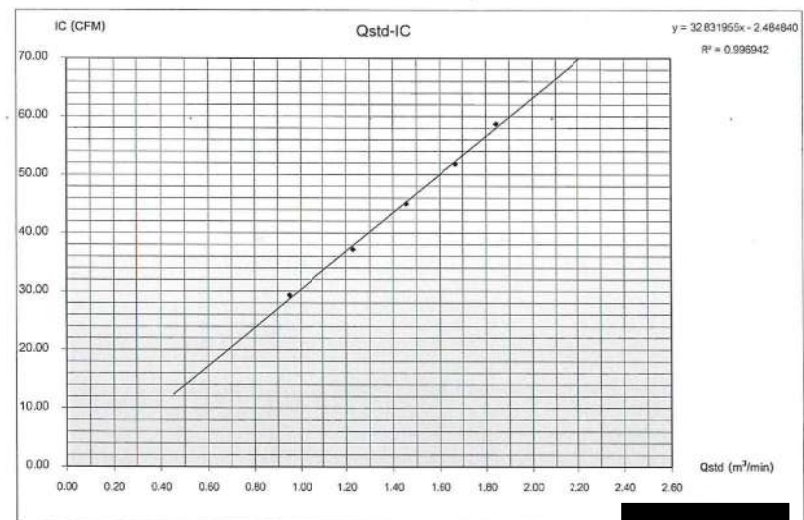
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	April 24, 2024
Sampler Location	AT : หมู่ที่ 11 บ้านอัมพนา (2)	Start Time	4:10 PM
Sampler Number	PM-10 No 15	Stop Time	4:26 PM
Instrument Model	HIVOL-8MBBE	Transfer Standard Type	Orifice
Motor Serial Number	B2012-10	Calibrator Model	TE-5025A
Recorder Serial Number	4849	Calibrator Serial Number	2915
Calibrated By			

Plate (Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mm H ₂ O)		$[\Delta H_2O(Pa/P_{std}(T_{std}/T_a)^{1.2})]$	$Q_{std} = (1/m)(\Delta H)$	Simple Flow Rate Indicator	$IC = [(Pa/P_{std})(T_{std}/T_a)^{1.2}]^{1/2}$		Pressure	Meter	Meter
	Positive	Negative	ΔH_{H_2O}	(m ³ /min)	(g/min)		(°K = °C + 273)	(mmHg)		
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.0	755.0	
7	2.5	2.5	5.0	2.18867	1.22869	36.0	37.19	309.0	755.0	
10	3.5	3.5	7.0	2.59967	1.45517	46.0	45.02	309.0	755.0	
13	4.6	4.6	9.2	2.96866	1.60932	53.0	51.86	309.0	755.0	
18	5.6	5.6	11.2	3.27570	1.84263	60.0	58.73	309.0	755.0	
Linear Regression Y ON X: Y= mx + b							Average	309.0	755.0	
1	Slope (m)		1.77059	Linear Equation			r^2	0.995942	760.0	750.0
2	Intercept (b)		0.01317	Set Point Flow Rate (X) (m ³ /min)			1.133	r	0.9984699	T _{avg} = 298.0
3	Correlation Coefficient (r)		0.99974	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.95805549	
Result							C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.978803632		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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



RECALIBRATION
DUE DATE:
January 17, 2024

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	January 17, 2023	Rootsometer S/N:	438320
Operator:	Jim Tisch	Ta:	295 °K
Calibration Model #:	TE-5025A	Pa:	740.2 mm Hg
Calibrator S/N:	3362		

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	0.9920	6.4	4.00
3	5	6	1	0.8930	8.0	5.00
4	7	8	1	0.8490	8.8	5.50
5	9	10	1	0.7000	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9795	0.6927	1.4027	0.9957	0.7042	0.8928
0.9753	0.9832	1.9837	0.9914	0.9993	1.2626
0.9732	1.0898	2.2179	0.9892	1.1077	1.4117
0.9721	1.1450	2.3261	0.9881	1.1639	1.4806
0.9668	1.3811	2.8054	0.9827	1.4039	1.7856
QSTD	m=	2.04234	QA	m=	1.27888
	b=	-0.01435		b=	-0.00913
	r=	0.99993		r=	0.99993

Calculations			
Vstd=	$\Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$	Va=	$\Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$
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

Environmental, Inc.
South Miami Avenue
ge of Cleves, OH 45002

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

Calibration Certificate ID
TH2036-001-011723-ACC-TH

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

METTLER TOLEDO



Accuracy Calibration Certificate

Customer

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



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: CPW002/20

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

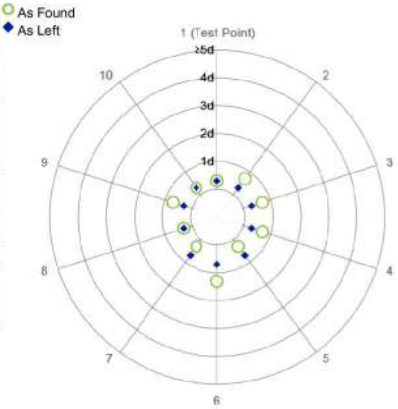
Measurement Results

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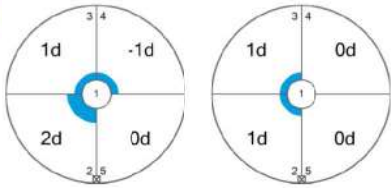
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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.

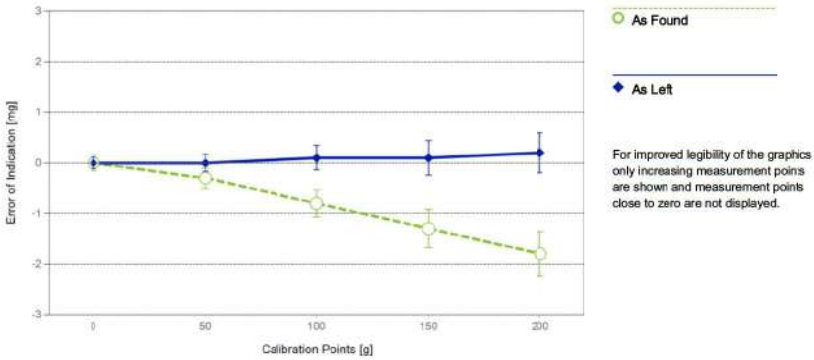
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0400 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	0.1400 g	0.0999 g	-0.0001 g	0.16 mg	2
4	0.5400 g	0.4999 g	-0.0001 g	0.16 mg	2
5	1.0400 g	1.0000 g	0.0000 g	0.16 mg	2
6	5.0400 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	100.4000 g	99.9992 g	-0.0008 g	0.27 mg	2
10	150.4000 g	149.9987 g	-0.0013 g	0.38 mg	2
11	200.4000 g	199.9982 g	-0.0018 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0400 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	0.1400 g	0.1000 g	0.0000 g	0.13 mg	2
4	0.5400 g	0.5000 g	0.0000 g	0.13 mg	2
5	1.0400 g	1.0000 g	0.0000 g	0.13 mg	2
6	5.0400 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	100.4000 g	100.0001 g	0.0001 g	0.24 mg	2
10	150.4000 g	150.0001 g	0.0001 g	0.34 mg	2
11	200.4000 g	200.0002 g	0.0002 g	0.39 mg	2



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

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: $\pm 0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $\pm K$

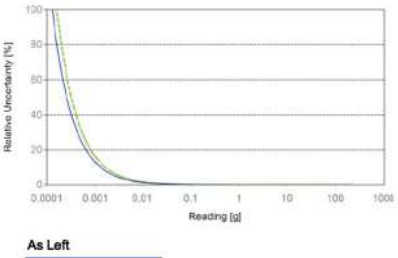
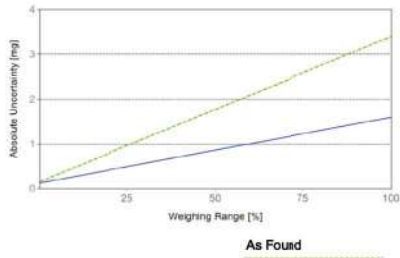
Linearization of Uncertainty Equation

	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%



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

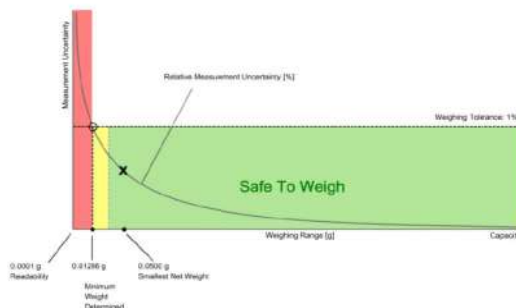
Process Requirements

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:

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	0.00007 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.

Error of Indication

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.



Request No.: 22-66/0326

MTC No.: PSL-T 0491/66

Certificate of Calibration

Equipment: Digital Thermometer with Sensor

Manufacturer: TRACEBLE

Model: 4421

Serial No.: 160143242

Customer: Environment Research & Technology Co., Ltd.

Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Date of Request: 13 February 2023

Date of Calibration: 10 March 2023

Place of Calibration: Photometry and Temperature Standards Laboratory,

Soi 1, Bangpoo Industrial Estate, Sukhumvit Road, Samut Prakan 10260

Range of Calibration: Calibrated from 25.0 °C to 40.0 °C

Conditions of Calibration: 1. Ambient temperature: $(23 \pm 3) ^\circ\text{C}$

2. Relative humidity: $(60 \pm 20) \%$

Reference Standard: Standards Platinum Resistance Thermometer, Manufacturer: KDACT, Model: WZPB-1, S/N.: 6729,

Which was calibrated on 15 July 2022, Calibration Certificate No.: 22-65/0706, PSL-T 0864/65

Traceability: This Certificate is traceable to SI Unit through Photometry and Temperature Standards Laboratory,

Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technological

Research (TISTR), NSC-ONSC Accreditation No.: Calibration 0015

Calibration Procedure: The measurement was done in accordance with WI.CP.05 (Comparison Technique)

The temperature scale in use of this laboratory is the International Temperature Scale of 1990 (ITS-90).

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing

a level of confidence of approximately 95 %

The results 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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Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



Request No.: 22-56/0326

MTC No.: PSL-T 0491/66

Calibration Results:

Standard Temperature (°C)	UUC* Reading (°C)	Correction (°C)	Uncertainty ($\pm ^\circ\text{C}$)
25.0024	25.2	-0.2	0.10
30.0033	30.9	-0.9	0.10
35.0024	35.2	-0.2	0.10
40.0031	40.3	-0.3	0.10

UUC* = Unit under Calibration

...End of Certificate...

Calibrated by:



Approved by:



Director

Photometry and Temperature Standards Laboratory

Ref.: 2012266021300627001

Issued Date: 13 March 2023

Page 2 of 2

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FM.BLMTC.002 Rev.4

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Fax. (66) 0 2323 9165
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



BSWA-IV-C021-03-0048A

CA 111

590335

OK

1.5V LR6 (AA battery) x2

93.97 / 113.98 dB

1000.9 / 1000.9 Hz

0.51 / 1.31 %

Copying and using select parts, or tampering with this document without the permission of BSWA is forbidden!

BSWA Technology Ltd.

www.bswa-tech.com

This equipment was calibrated at the following ambient conditions:

20 °C

40 %RH

1025 hPa

This equipment is qualified

Calibrated

2023-3-7

Date _____



envi research
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Environment Research & Technology Company Limited

25/114 Mu 6 Soi Chinnakhet 1, Ngam Wong Wan Road,

Thung Song Hong, Lak Si, Bangkok 10210

Tel 0-2954-7745-6 Fax 0-2954-7747

E-mail : cnv@cnvresearch.co.th

www.enviresearch.co.th

Head Office/Tax ID 0105 542 664 981

Sound Level Meter Calibration Report

Support Equipment Type : Sound Level Calibrator

Manufacture : BSWA Technology

Model : CA111

Serial No. : 590335

Range of Calibrator

- Sound Pressure Level : 94,0 dB.

- Frequency : 1,000 Hz

Calibrated By

Calibration Date : June 15, 2023

Customer Name : Vision E Consultants Co., Ltd. ; โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 ปิ๊งหญ้า แปลงสำรวจบนบก
หมายเลข L1/64 พื้นที่ผลิตปิ๊งหญ้าตะวันตก-หนองสระ และพื้นที่ผลิตปิ๊งหญ้าตะวันตก-หนองสระส่วนขยาย
แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร
(ระยะก่อสร้าง ณ ฐานหลุมผลิตปิ๊ง 3 (BM3))

[illegible]

Checked By

Technician

Environmental Scientist

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	Larson Davis
Model	:	CAL200
Serial No.	:	3605
Range of Calibrator		
- Support Equipment Type	:	93.8
- Frequency	:	1,000 Hz.
Calibrated By	:	
Calibration Date	:	May 16, 2024
Customer Name	:	Vision E. Consultants Co., Ltd

โครงการผลิตปีโตรเลียมพื้นที่ผลิต L1/64 ปิโตรภูฏา แปลงสำรวจบนบกหมายเลข L1/64
พื้นที่ผลิตปิโตรภูฏาตะวันตก-หนองสระ และพื้นที่ผลิตปิโตรภูฏาตะวันตก-หนองสระส่วนขยาย
แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร
(การก่อสร้างแนวท่อลำเลียงปีโตรเลียมงาน BM3, BM6)

[illegible]

Checked By

Approved By _____

Technician

Environmental Scientist

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	Larson Davis
Model	:	CAL200
Serial No.	:	3605
Range of Calibrator		
- Support Equipment Type	:	93.8
- Frequency	:	1,000 Hz.
Calibrated By	:	
Calibration Date	:	April 25, 2024
Customer Name	:	Vision E. Consultants Co., Ltd.

โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 ปิ๊งพญา แปลงสำรวจบนบกหมายเลข L1/64
พื้นที่ผลิตปิ๊งพญาตะวันตก-หนองสระ และพื้นที่ผลิตปิ๊งพญาตะวันตก-หนองสระส่วนขยาย
แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร
(การก่อสร้างแนวท่อลำเลียงปิโตรเลียมตาม BM3, BM6)

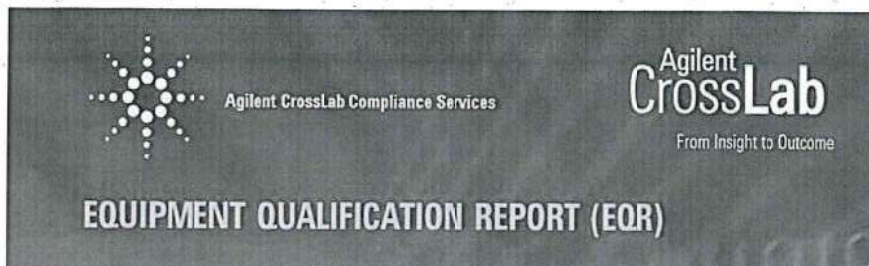
[illegible]

Checked By

Approved By _____

Technician

Environmental Scientist

**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

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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 VDV	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:	Agilent Recommended
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:	
Job Title:	Supervisor Scientist
Qualification Location	ICPCES Room

Operator Details

Name:	
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	G3475A
Serial Number	MY15330002

Test 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

Purposes

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

Configuration Details

Model/Serial No.:

Results

Criteria	Observed Result	Expected Result	Status
Does the plasma ignite successfully in the first three attempts?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Was the detector calibration performed and completed successfully?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Was the instrument calibration performed and completed successfully?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Test Results

Image Details: Was the detector calibration performed and completed successfully?
Date and Time: November 28, 2022 4:07:22 PM
Host Name: 5CGC202NQ4



Image Details:

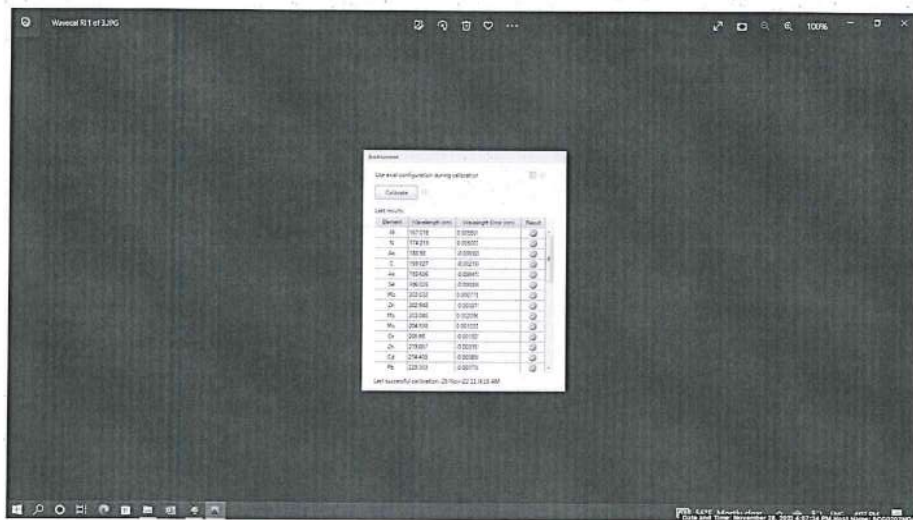
Was the instrument calibration performed and completed successfully?

Date and Time:

November 28, 2022 4:07:34 PM

Host Name:

5CG0202NQ4



Overall Test Status

Pass

Runs: 1

Instrument Tests

Purpose:

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details

Model/Serial No.:

G8011A

MY15330001

Results

Observed Result

Expected Result

Status

Are the Functional Tests results within acceptance criteria?

Subsystem Communications

Yes

Yes

Pass

Air Flow

Yes

Yes

Pass

Water Flow

Yes

Yes

Pass

Gas Flows

Yes

Yes

Pass

RF Generator

Yes

Yes

Pass

Camera

Yes

Yes

Pass

Optics

Yes

Yes

Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution

Yes

Yes

Pass

Sensitivity

Yes

Yes

Pass

Precision

Yes

Yes

Pass

Overall Test Status

Pass

Runs: 1

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
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EQR	Material	Certificate of Analysis Wavelength calibration solution	22

General

Document Name: Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

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

Drive Serial #: 90593EBA

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

Generation:

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.

Generation:

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 (188.980 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
Co (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 (338.071 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 (614.171 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)	≥ 3516.0	SRBR	12083.1	303064.1	625.5
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	111109.6	22733.2

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	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	1360.5	17846.2	168.8
Zn (213.857 nm)	≥ 1743.0	SRBR	9129.7	200493.0	486.0
Cd (214.439 nm)	≥ 4227.0	SRBR	8255.6	156439.2	357.4
Pb (220.353 nm)	≥ 320.0	SRBR	666.7	16502.1	571.0
Mn (257.610 nm)	≥ 10625.0	SRBR	39180.3	1593731.9	1661.2
Cr (267.716 nm)	≥ 1048.0	SRBR	4862.3	176423.2	1297.2
Cu (324.754 nm)	≥ 19.0	SBR	65.7	268073.8	4030.3
Al (396.152 nm)	≥ 6.0	SBR	24.3	271032.8	10722.4
Ba (493.408 nm)	≥ 60.0	SBR	275.4	8034589.3	29668.7
K (766.491 nm)	≥ 24.0	SBR	81.9	3677801.4	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

Page 3 of 3

General

Document Name: Software verification

Software Verification Report

Date: Monday, November 28, 2022 Time: 1:44:56 PM [UTC +07:00:00] Host Name: S100VDY-HP
Windows User Name: Admin Base Revision Number: 1.0.1 Product Name: ICP Expert
Install Type: N/A Additional Packages: RA

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

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: 6610030100
Lot No: 0012193521

Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7784-37-2	5.000 ± 0.025 mg/L	Mn	Mn	7439-96-6	5.001 ± 0.025 mg/L
As	As	2449-38-2	5.001 ± 0.025 mg/L	Mo	(NH ₄) ₂ MoO ₄	13106-75-8	5.000 ± 0.025 mg/L
Ba	Ba(NO ₃) ₂	10020-31-8	5.000 ± 0.025 mg/L	Ni	Ni	7440-02-0	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 ₃) ₃	13548-38-4	5.000 ± 0.025 mg/L	Sr	Sr(NO ₃) ₂	10042-78-9	5.000 ± 0.025 mg/L
Cu	Cu	7440-60-8	5.000 ± 0.025 mg/L	Zn	Zn	7440-66-6	4.999 ± 0.025 mg/L
K	KNO ₃	7757-79-1	50.80 ± 0.25 mg/L				

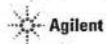
Matrix: 5% HNO₃

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 (HNO₃) 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, 3106, 3110, 3112a, 3114, 3141a, 3122, 3134, 3136, 3128, 3149, 3163a, 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.

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.

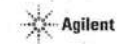
Date of release: 21 January 2022
Date of expiration: 31 July 2023

Sample lot approval:


Chuck Henderson, Certifying Officer

Page 2 of 3

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.

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 8-13 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 Certification: This CRM was prepared under a quality management system that is:

- Registered to ISO 9001 – Quality Management Systems – Requirements (TUV NORD Cert. Reg. No. 44 109 16980231)
- Accredited to ISO 17014 – 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. 2848.01)
- LSC (London, 124 Abby Road, Northwood, 901 82102)

Page 3 of 3

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.

Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

User Name: worawit.timakul
 Hostname: SCG0210150

System ID: MY15330001
 Print Date: November 28, 2022 4:16:10 PM

OQ HW ICP 5100 Envi researc 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 4:36:32 PM	End	Configuration	Session	None
November 28, 2022 4:36:35 PM	Start	Qualification	Session	OQ
November 28, 2022 4:46:36 PM	Start	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2022 4:47:38 PM	End	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:47:39 PM	Start	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2022 4:48:52 PM	End	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

User Name: worawit.timakul
 Username: JCQ0001VDC

 System ID: MY15330001
 Print Date: November 28, 2022 4:19:10 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_Certificat e_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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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.

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**, 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
 - **Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual**
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

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	7890B/5477B
Instrument System Site and Location	Environmental Research & Technologies, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3940B	CN1649976
2. G4513A	CN1600132
3. G4514A	CN18930130
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	11/11
Back detector output	5	5
AUX detector output	5	5
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	1E710-20119	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 600514376 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	7810 B / 5177 B
Instrument System Site and Location	Environmental Research & Technologies, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. 670477 B	U51701M011
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 type="checkbox"/>
Yes selected means that the task was done or the part was required.				
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No selected means that the task was not done or the part was not required.				
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interim selected means that this task is recommended to be done at 6-month intervals.				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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.				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input 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.

GCMS		Description
Yes/No	Interim/Major	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Instrument model no. <u>63707B</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Instrument serial no. <u>651203M011</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Rough Vacuum <u>N/A</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Manifold Vacuum <u>N/A</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Type of Column installed <u>DB-124 UI, PE 624 UI</u>

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

Wet Mechanical vacuum pumps		Description
Yes/No	Interim/Major	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input 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.

Dry Mechanical vacuum pumps - Diaphragm		Description
Yes/No	Interim/Major	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

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

Cleaning System and Filters		Description
Yes/No	Interim/Major	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Fans
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Source cleaning
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Re-install source and close analyzer.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Filters
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace RMSH-2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace RMSN-2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace RMSHY-2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8"; Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CP17973 – Gas Clean Filter, Replacement Filter – if applicable.
<input checked="" type="checkbox"/>	<input 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				Description
Yes/No	Interim	Major		
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system in manual tune
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Compare against previous tune file report(s)
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input 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"/>	Bg Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2
<input type="checkbox"/>	<input type="checkbox"/>	Gas Clean Carrier Gas Kit for 7890 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)	5040-0809 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)	DP3TS
<input type="checkbox"/>	<input type="checkbox"/>	Filter element for IDP-3	REPLSLRFILTER2
<input type="checkbox"/>	<input type="checkbox"/>	DS42 Oil Mist Eliminator 3/4G & 3/8	SR03706556
<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
--------------------------	--------------------------	--------------------------	-------------------------------------	-------------------------------------	--	---------

Consumable Parts Reference – Purchasable by customer, not included as part of PM

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

Common Recommended Consumables Parts				
Yes/No	Interim/Major/As needed	Description	Part number	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	El High Temperature Filaments	G7005-60061 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HES El Filaments	G7002-60001
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	LE-El Filaments	G3850-60021
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl High Temperature Filament – all MSDs	G7005-60072
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PFTBA GCMS Tuning Standard calibrant	05971-60571
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PFDTD calibrant, 1 mL	8500-8510
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PFET, IRM calibrant for GC QTOF 0.5 mL	5190-0531

MSD Maintenance Supplies 5973/5975/5977 Series

Yes/No				Supplies	
Yes/No	Interim/Major/As needed			Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal (tip and spring combo)	G1999-60412
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal (tip only)	G3870-20542
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal spring (spring only)	G1999-20023
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Repeller insulator	G1099-20133 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Lens insulator/holder (-HES)	G7002-20074
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ring heater/sensor assembly (HES)	G7002-60043
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ceramic insulator for Extractor (HES)	G7002-20064
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer-Line Tip Cap, Threaded	G3870-20547
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer-Line Tip Base, Threaded	G3870-20548

MS Maintenance Supplies for 7000/7010 Series

Yes/No <input type="checkbox"/> <input type="checkbox"/>				Supplies	
Yes/No	Interim	Major/As needed		Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal - 7000	G1999-60412
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal - 7010	G7002-60412
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal (tip only)	G3870-20542
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cl Interface tip seal spring (spring only)	G1999-20023
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Repeller insulator - 7000	G1099-20133 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Lens insulator/holder (HES)	G7002-20074
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ring heater/sensor assembly (HES)	G7002-60043
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Ceramic insulator for Extractor (HES)	G7002-20064
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer-Line Tip Cap, Threaded	G3870-20547
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer-Line Tip Base, Threaded	G3870-20548

MS Maintenance Supplies for 7200 Series

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

MS Maintenance Supplies for Intuvo 9000 MS Systems

Yes/No				Supplies
Yes/No	Interim/Major/As needed	Description		Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Swaged MS Tail - Packaged	G4590-60009
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Swaged MS Tail (HES) - Packaged	G4590-60109

Common MS Maintenance Supplies

Parts required				
Yes/No	Interim	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Abrasive paper, 30 um	5061-5896
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Alumina powder	393706201
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cloths, clean (pkg of 15)	05980-60051
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cloths, cleaning (pkg of 300)	9310-4828
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cotton swabs (pkg of 100)	5080-5400
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gbvcs, clean, large	8650-0030
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gbvcs, clean, small	8650-0029

Teledyne Tekmar ATOMX Purge and Trap Preventive Maintenance Checklist - Standard



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.

Teledyne Tekmar ATOMX Purge and Trap Preventive Maintenance Checklist - Standard



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.	TMR - 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.

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



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.

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



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	15-0299-000	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
- ☐ Need technical support, FAQs? - www.agilent.com/chem/techsupp
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6009143170 Date service completed 25 Nov 2022

Agilent signature _____

Number of pages in this document _____



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 ₃	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 TH-GA 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 TH-GA 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	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$
	$= \frac{0.1456}{0.1456+0.1293}$
	$= 0.52$

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.</i>	
This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)



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.: 22CH1753

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Eutech
Model :	pHTestr 30
Serial No. :	3015187
ID No. :	NO.27
Condition As-Received:	Used Item
Received Date :	27 December 2022
Calibration Date :	27 December 2022
Reference :	2212-0734WN-9
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-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by :	<div style="background-color: black; width: 100px; height: 40px;"></div>
Approved by :	<div style="background-color: black; width: 100px; height: 40px;"></div>
Issue Date :	28 December 2022

Approved Signatory

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 22CH1753
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 k
pH Electrode	4.008	4.02	N/A	0.0079	2.00
S/N.: 3015187	6.987	7.01	N/A	0.011	2.00
	10.008	10.02	N/A	0.011	2.05

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 %

-o0o-

a 1142232



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.: 22CH1758
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : HM DIGITAL
Model : COM-100
Serial No. : PONPE5860865
ID No. : NO.1
Condition As-Received: Used Item
Received Date : 27 December 2022
Calibration Date : 27 December 2022
Reference : 2212-0734WN-7
Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : (25 \pm 2.5) °C
Relative Humidity : (50 \pm 15) %
Calibration Procedure: In-house method ;
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

28 December 2022

The Uncertainties are for a confidence probability of approximately 95%

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

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ระยะเจาะหลุมปิโตรเลียม

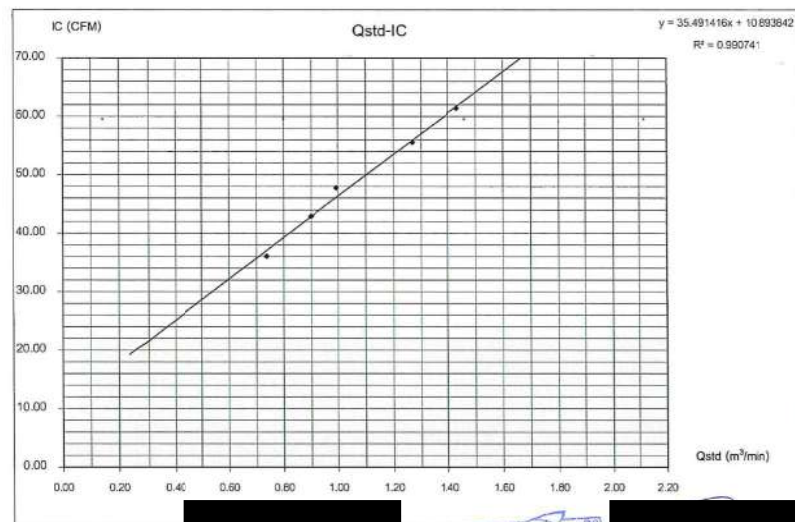
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	3024-00465	Date	April 18, 2024
Sampler Location	บ้านโนนสำราญ	Start Time	8:36 AM
Sampler Number	TSP No A25	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BECBE	Calibrator Model	TE-5025A
Motor Serial Number	2152	Calibrator Serial Number	2913
Recorder Serial Number	2411	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}]^{1/2}$	$T(K) = T(^{\circ}C) + 273.15$	Pressure	Meter	Meter
	Positive	Negative	ΔH_2O	(m^3/min)	(l/min)	$T(K) = T(^{\circ}C) + 273.15$	$(mmHg)$		
5	1.2	1.2	2.4	1.51005	0.73649	37.0	35.07	312.3	756.0
7	1.8	1.8	3.6	1.84942	0.89963	44.0	42.89	312.3	756.0
10	2.2	2.2	4.4	2.04481	0.99377	49.0	47.76	312.3	756.0
13	3.6	3.6	7.2	2.61548	1.26652	57.0	55.56	312.3	756.0
18	4.6	4.6	9.2	2.95651	1.43265	63.0	61.41	312.3	756.0
Linear Regression Y ON X: Y = mX + b						Average	312.3	756.0	
1	Slope (m)	2.07779	Linear Equation			r^2	0.990741	Std(m/mg)	760.0
2	Intercept (b)	-0.02023	Set Point Flow Rate (X) (m ³ /min)	1.133	F	0.9953597	T _{avg}	298.0	
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)		0	(Pa/P _{std})(T _{std} /T _{air})	0.950101215		
Result						C=(Pa/P _{std})(T _{std} /T _{air}) ^{0.5}	0.974731355		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-028, Rev. 01, November 16, 2018

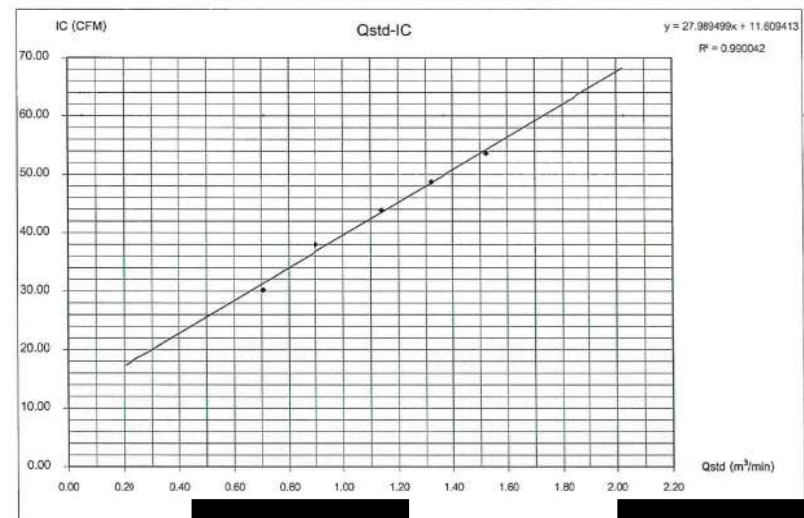
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	3024-00465	Date	April 18, 2024
Sampler Location	บ้านโนนสำราญ	Start Time	8:36 AM
Sampler Number	PM-10 No.20	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBEE	Calibrator Model	TE-5025A
Motor Serial Number	2140	Calibrator Serial Number	2913
Recorder Serial Number	2393	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}]^{1/2}$	$T(K) = T(^{\circ}C) + 273.15$	Pressure	Meter	Meter
	Positive	Negative	ΔH_2O	(m^3/min)	(l/min)	$T(K) = T(^{\circ}C) + 273.15$	$(mmHg)$		
5	1.1	1.1	2.2	1.44578	0.70559	31.0	30.22	312.0	756.0
7	1.8	1.8	3.6	1.84942	0.89966	39.0	38.01	312.0	756.0
10	2.9	2.9	5.8	2.34746	1.13956	45.0	43.85	312.0	756.0
13	3.9	3.9	7.8	2.72228	1.31995	50.0	48.74	312.0	756.0
16	5.2	5.2	10.4	3.14341	1.52203	55.0	53.61	312.0	756.0
Linear Regression Y ON X: Y = mX + b						Average	312.0	756.0	
1	Slope (m)	2.07779	Linear Equation			r^2	0.990042	Std(m/mg)	760.0
2	Intercept (b)	-0.02030	Set Point Flow Rate (X) (m ³ /min)	1.133	F	0.9950085	T _{avg}	298.0	
3	Correlation Coefficient (r)	0.99993	Final Set Flow Rate = (I)		0	(Pa/P _{std})(T _{std} /T _{air})	0.950101215		
Result						C=(Pa/P _{std})(T _{std} /T _{air}) ^{0.5}	0.974731355		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

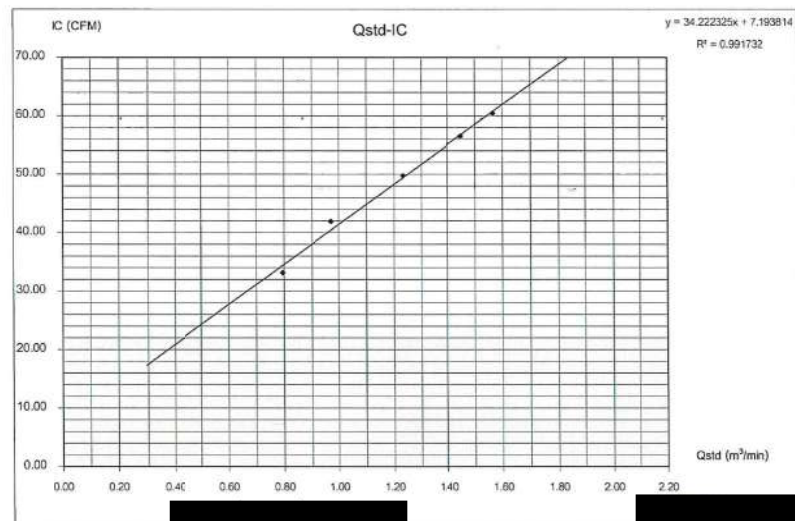
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00485	Date	April 17, 2024
Sampler Location	โรงเรียนบ้านดอนสามัคคี	Start Time	4:50 PM
Sampler Number	TSP No. A26	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	2217	Calibrator Serial Number	2913
Recorder Serial Number	2134	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH ₂ O)	$\Delta H_2O(Pa/P_{atm})(T_{std}/T_a)^{1.9}$	$Q_{std} = (1.13m^3)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{std}/T_a)^{1.9}]$	$^{\circ}K = ^{\circ}C + 273$	Pressure	Motor	Motor
	Positive Negative ΔH_2O		(m ³ /min)	(ft ³ /min)		(mmHg)			
5	1.4 1.4 2.8	1.03104	0.79472	34.0	33.14	312.3	756.0		
7	2.1 2.1 4.2	1.99760	0.97114	43.0	41.91	312.3	756.0		
10	3.4 3.4 6.8	2.54179	1.23305	51.0	49.71	312.3	756.0		
13	4.7 4.7 9.4	2.98847	1.44803	56.0	55.53	312.3	756.0		
18	5.5 5.5 11.0	3.23282	1.55563	62.0	60.43	312.3	756.0		
Linear Regression Y ON X: Y = mX + b						Average	312.3	756.0	
1	Slope (m)	2.07779	Linear Equation			r ²	0.991732	Pa/(mmHg)	760.0
2	Intercept (b)	-0.02023	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9958574	T _{std}	298.0	
3	Correlation Coefficient (r)	0.99983	Final Set Flow Rate = (I)	0	(Pa/P _{std})(T _{std} /T _a)	0.950101215			
Result					C = (Pa/P _{std})(T _{std} /T _a) ^{0.5}	0.974731355			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-025, Rev. 01, November 16, 2018

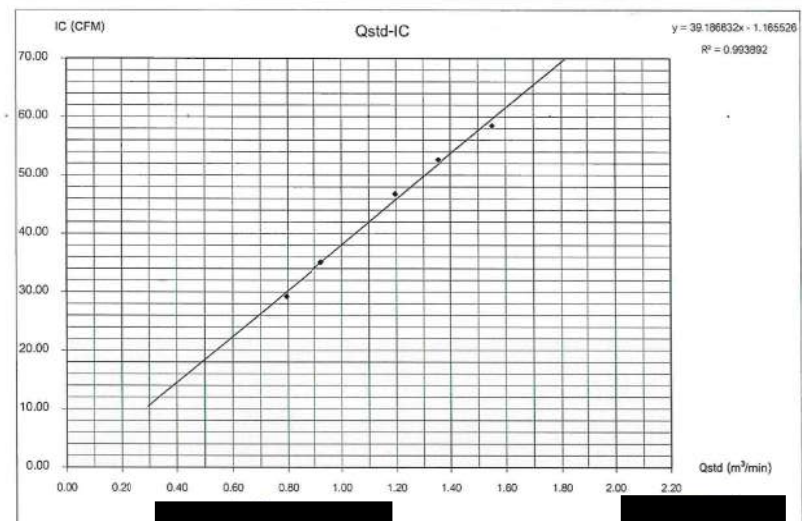
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00485	Date	April 17, 2024
Sampler Location	โรงเรียนบ้านดอนสามัคคี	Start Time	5:00 PM
Sampler Number	PM-10 No.21	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BM30E	Calibrator Model	TE-5025A
Motor Serial Number	2132	Calibrator Serial Number	2913
Recorder Serial Number	2392	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH ₂ O)	$\Delta H_2O(Pa/P_{atm})(T_{std}/T_a)^{1.9}$	$Q_{std} = (1.13m^3)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{std}/T_a)^{1.9}]$	$^{\circ}K = ^{\circ}C + 273$	Pressure	Motor	Motor
	Positive Negative ΔH_2O		(m ³ /min)	(ft ³ /min)		(mmHg)			
5	1.4 1.4 2.8	1.03104	0.79472	30.0	29.24	312.0	756.0		
7	1.9 1.9 3.8	1.90010	0.92422	36.0	35.09	312.0	756.0		
10	3.2 3.2 6.4	2.46590	1.19652	48.0	46.79	312.0	756.0		
13	4.1 4.1 8.2	2.79121	1.35309	54.0	52.64	312.0	756.0		
18	5.4 5.4 10.8	3.20329	1.55142	60.0	58.48	312.0	756.0		
Linear Regression Y ON X: Y = mX + b						Average	312.0	756.0	
1	Slope (m)	2.07779	Linear Equation			r ²	0.993892	Pa/(mmHg)	760.0
2	Intercept (b)	-0.02023	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9969413	T _{std}	298.0	
3	Correlation Coefficient (r)	0.99983	Final Set Flow Rate = (I)	0	(Pa/P _{std})(T _{std} /T _a)	0.950101215			
Result					C = (Pa/P _{std})(T _{std} /T _a) ^{0.5}	0.974731355			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-025, Rev. 02, June 1, 2019

CERTIFICATE OF CALIBRATION

Certificate No. : COF-013-66

Page 1 of 2 Pages

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

: Top Load Orifice
: TISCH
: TE-5025A
: 2913
: -
: Used item
: Environment Research & Technology Co., Ltd.
25/114 Moo 6 Soi Chinakiet 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210

RECEIVED DATE : 08 Sep 2023
MEASUREMENT DATE : 11 Sep 2023
ISSUE DATE : 13 Sep 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 24.5 °C and 47.7 %RH.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp, The WI-CL-004 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"

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

TABULATION OF RESULTS:

The table on next page give the measured values.

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 ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.707	753.911	24.39	23.31	54.094	1.809	1.341	0.655
2	1.005	753.864	24.49	24.02	58.538	3.610	1.894	0.923
3	1.117	753.809	24.30	24.05	40.197	4.715	2.165	1.052
4	1.174	753.829	24.25	23.95	30.361	5.366	2.310	1.121
5	1.417	753.823	24.35	24.06	30.498	7.837	2.791	1.353

Slope (m): 2.07779
Intercept (b): -0.02023
Correlation coefficient (r): 0.99983
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.707	753.911	24.39	23.31	54.094	1.809	0.845	0.659
2	1.005	753.864	24.49	24.02	58.538	3.610	1.154	0.928
3	1.117	753.809	24.30	24.05	40.197	4.715	1.364	1.058
4	1.174	753.829	24.25	23.95	30.361	5.366	1.455	1.128
5	1.417	753.823	24.35	24.06	30.498	7.837	1.759	1.361

Slope (m): 1.30141
Intercept (b): -0.01275
Correlation coefficient (r): 0.99983
Uncertainty (k = 2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:



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: 25114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong
City: Lakso Contact: [REDACTED]
Zip / Postal: 10210
State / Province: Bangkok
Order Number:  0 5 3 2 9 6 3 6 1 1

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: AE204-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: CPW00220

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: [REDACTED]
As Left Calibration Date: 15-Jan-2024
Issue Date: 15-Jan-2024
Approved Signature: [REDACTED]
Technical Manager / Head of Calibration Center

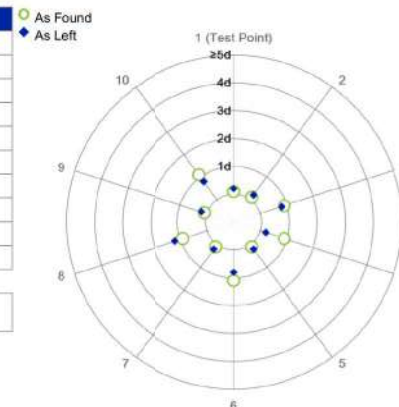
Measurement Results

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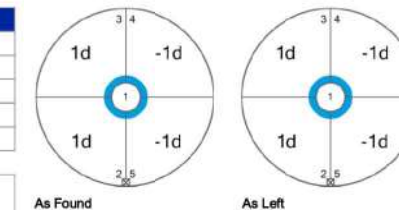
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9993 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
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

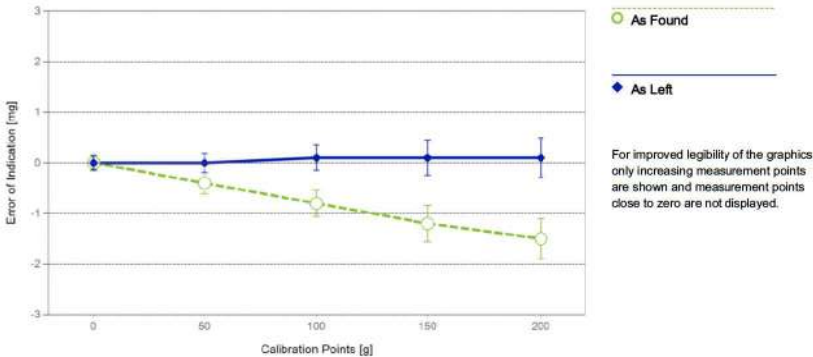
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 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 Hygromeier

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: $3.0 \cdot 10^{-6} / K$

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

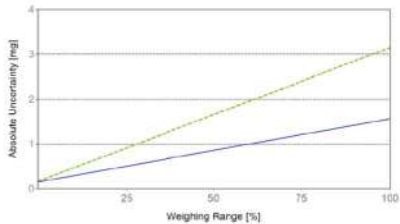
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.17 \text{ mg} + 0.0136 \text{ mg/g} \cdot R$	$U_1 = 0.15 \text{ mg} + 0.00644 \text{ mg/g} \cdot R$

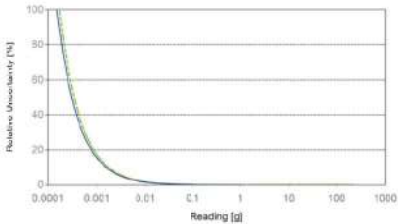
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.075%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.15 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%



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

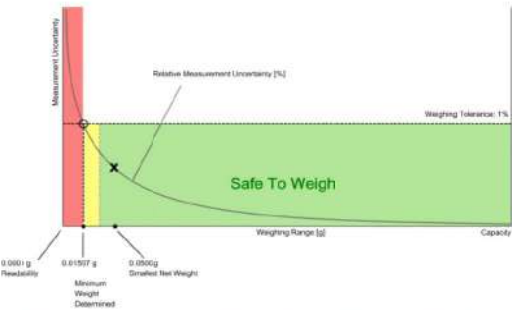
Process Requirements

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%	0.17097 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	0.05783 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	0.30304 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	0.30304 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

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	0.00006 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° 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

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	-0.0004 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

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
100.0001 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.

Calibration Data of NOx Analyzer

Analyzer Performance Test

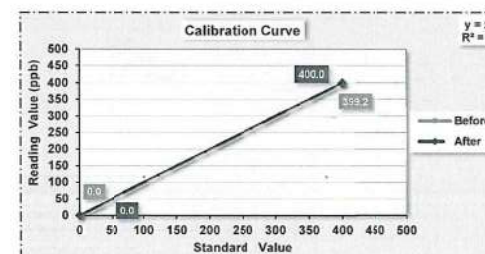
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00465
Serial No.	U9LS50WU	Calibration Date	March 12, 2024
Analyzer Unit	ppb	Time	1:40 PM

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 ₂ = 64.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO _x (ppb)		NO (ppb)		NO ₂ (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	0.7	0.0	0.0	0.0	0.7	0.0	-	-	-
Span	400	399.9	400.0	399.2	400.0	0.7	0.0	-	-	0.2



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	1.3	1.0	Voltage of the measured NO value
Signal NOx	mV	15.4	10.5	Voltage of the measured NOx value
Detecto	°C	42.6	42.1	43 °C ± 5 °C
Ambient	kPa	101.5	101.1	Current atmospheric pressure
DC 24V	V	23.6	23.7	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.26930	1.13670	0.50000 - 2.0000
NOx Slope	-	1.89530	1.14930	0.50000 - 2.0000

Calibrate By :

March 12, 2024

Checked By :

March 12, 2024

Calibration Data of NOx Analyzer

Analyzer Performance Test

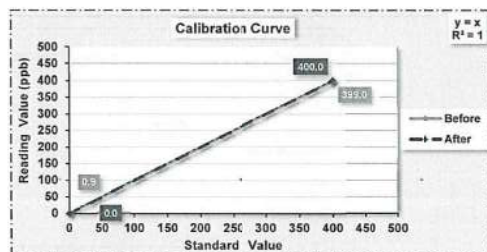
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00465
Serial No.	VLR55LT4	Calibration Date	March 12, 2024
Analyzer Unit	ppb	Time	6:57 PM

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 ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value						% Abs Error
		NO _x (ppb)		NO (ppb)		NO ₂ (ppb)		
		Before	After	Before	After	Before	After	
Zero	0	0.8	0.0	0.9	0.0	-0.1	0.0	-
Span	400	399.2	400.0	399.0	400.0	0.2	0.0	0.3



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	0.2	Voltage of the measured NO value
Signal NOx	mV	5.6	5.2	Voltage of the measured NOx value
Detector	°C	40.9	39.7	43 °C ± 5 °C
Ambient	kPa	101.0	101.1	Current atmospheric pressure
DC 24V	V	23.7	23.5	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.06243	1.20110	0.50000 - 2.00000
NOx Slope	-	1.59453	1.85600	0.50000 - 2.00000

Calibrate By :

March 12, 2024

Checked By :

March 12, 2024

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

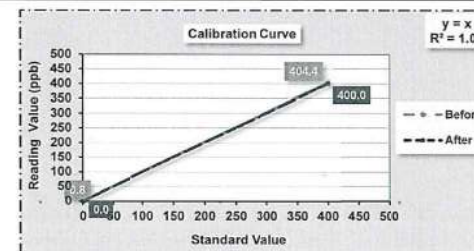
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2024-00465
Serial No.	73370-373	Calibration Date	March 21, 2024
Analyzer Unit	ppb	Time	2:45 PM

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 ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.8	0.0	-	-	-
Span	400	404.4	400.0	-	-	1.1



STATUS TEST AND VALIDATION OF SO₂ 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	33.0	33.0	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	44.4	45.5	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	711.1	660.6	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.367	0.581	0.350 to 1,000
Lamp Intensity	INTENSITY	Hz	28132	30899	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	969	1029	750 to 1,200
SO2 Concentration	SO2 CONCENTRATION	ppb	2.6	1.4	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :

March 21, 2024

Checked By :

March 21, 2024

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

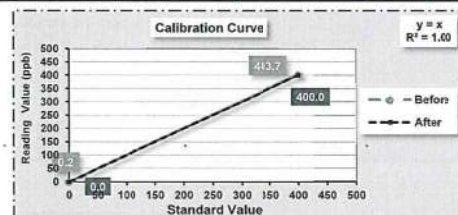
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2024-00465
Serial No.	X7L602W6	Calibration Date	March 21, 2024
Analyzer Unit	ppb	Time	11:07 AM

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 = 4.516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.2	0.0	-	-	-
Span	400	403.7	400.0	-	-	0.9



STATUS TEST AND VALIDATION OF SO₂ ANALYZER MODEL APSA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal (SO ₂)	mV	7	6.3	Voltage of the measured SO ₂ value
LAMP	mV	270.9	243.9	200 mV - 1200 mV
CELL	°C	28.9	29.2	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	64.6	42.9	65 kPa or less
AMBIENT	kPa	101.3	101.8	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 :

March 21, 2024

Checked By :

March 21, 2024

Calibration Data of CO Analyzer

Analyzer Performance Test

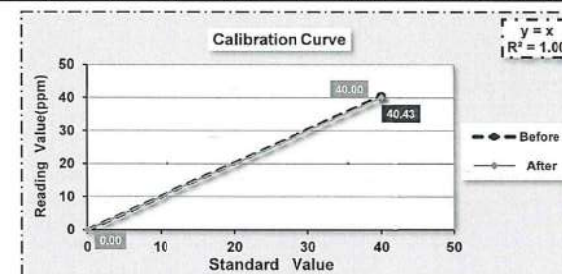
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2024-00465
Serial No.	RBBRW0L3	Calibration Date	April 8, 2024
Analyzer Unit	ppm	Time	1:35 PM

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 = 45.1 ppm		
Expire Date : Oct 22, 2027	SO ₂ = 45.0 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-0.02	0.00	-	-	-
Span	40	40.43	40.00	-	-	1.08



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	5.8	7.1	Voltage of the measured CO Value
SIGNAL (COMP)	mV	0.4	0.6	Voltage of the interference component Value
CELL	°C	36.2	35.3	Ambient + (5 to 10 C)
PUMP	kpa	37.9	37.9	less than 65
AMBIENT	kpa	101.1	101.0	Atmospheric pressure
DC 24V	mV	23.8	23.8	24 +/- 0.5 V
DC 5V	mV	4.9	4.9	5 +/- 0.5 V

Calibrate By :

April 8, 2024

Checked By :

April 8, 2024

Calibration Data of CO Analyzer

Analyzer Performance Test

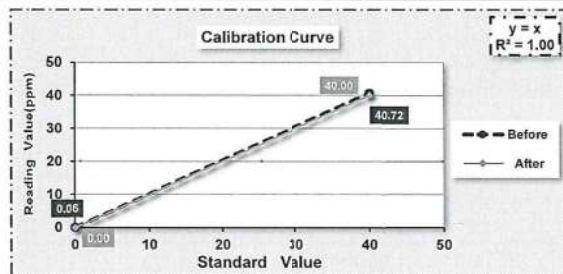
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2024-00465
Serial No.	SFB4TS99	Calibration Date	April 17, 2024
Analyzer Unit	ppm	Time	1:38 PM

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 ₂ = 54.9 ppm		
Cylinder No : EB0123013			
Expire Date : Oct22, 2027			

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.06	0.00	-	-	-
Span	40	40.72	40.00	-	-	1.80



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	6.6	6.5	Voltage of the measured CO Value
SIGNAL (COMP)	mV	1.3	1.2	Voltage of the interference component Value
CELL	°C	38.1	38.0	Ambient + (5 to 10 °C)
PUMP	kpa	39.2	39.0	less than 65
AMBIENT	kpa	101.6	101.6	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 :

April 17, 2024

Checked By :

April 17, 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A0292 Reference Number: 160-401604495-1
Cylinder Number: EB0123013 Cylinder Volume: 144.4 Cubic Feet
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO₂,BALN 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	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010429	KAL004123	57.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010429	KAL004123	57.6 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010235	KAL004419	57.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
NTRM	08012318	KAL004620	4657 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 ₂ - 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 11 August, 2023

Certification No. 283/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WE91016A07 ID No. : No.9

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 1008.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: 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 0 - 20 m/sec



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 283/23

11 August, 2023

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HCOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.0	0.02
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



Mechanical Engineer





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 11 August, 2023

Certification No. 285/23

Page : 1 of 3

Object : Weather Station

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC50824A13 ID No. : No.32

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 1008.7 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: 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 0 - 20 m/sec

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

: Thermoscheider No.918802



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 285/23

11 August, 2023

Page : 2 of 3

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.0	0.02
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



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 0-2396-0156, 0-2399-0469

The Result of Calibration

Certification No. 285/23

11 August, 2023

Page : 3 of 3

Standard Temp. 'C	Temperature Sensor Reading	
	Reading 'C	Correction 'C
50.4	50.5	-0.1
30.2	30.2	0.0
15.4	15.5	-0.1

Mechanical Engineer



Environment Research & Technology Company Limited

25/114 Mu 6 Soi Chinnakhet 1, Ngam Wong War Road,

Thung Song Hong, Lak Si, Bangkok 10210

Tel 0-2954-7745-6 Fax 0-2954-7747

E-mail : envi@enviresearch.co.th

www.envirosearch.co.th

Head Office/Tax ID 0105 542 064 981

Sound Level Meter Calibration Report

Support Equipment Type : Sound Level Calibrator

Manufacture : Larson Davis

Model : CAL200

Serial No. : 3605

Range of Calibrator

- Support Equipment Type : 93.8

- Frequency : 1,000 Hz.

Calibrated By _____

Calibration Date : April 17, 2024

Customer Name :

Vision E. Consultants Co., Ltd. : โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 ปังญา

แปลงสำรวจบนบกหมายเลข L1/64 พื้นที่ผลิตปิงหญ้าตะวันตก-หนองสระ และพื้นที่

ผลิตเบี่ยงเบนตะวันตก-หนองสรวงส่วนขยาย แปลงสำรวจฉบับสุดท้ายเลข L21/43

จังหวัดสโขทัย และจังหวัดกำแพงเพชร (ระยะเจาะหลุม)

[illegible]

Checked By

Technician



Approved B

Environmental Scientist



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co.,Ltd.

Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Precision Acoustic Calibrator

Manufacturer : Larson Davis

Model : CAL200

Serial No. : 3605

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

7. Condenser Microphone B&K 4180 S/N 2889871

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

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

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

Date of Receipt : 8 Jan. 2024

Date of Calibration : 10 Jan. 2024

1 / 3

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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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

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196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

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 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, 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 1
1/2 inch Bruel&Kjaer4180	93.85	-0.15	± 0.10	$\pm 0.40 \text{ dB}$

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	0.32	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Date of Calibration : 10 Jan. 2024

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

Nominal Output of Unit Under Test = 114 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, 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 1
1/2 inch Bruel&Kjaer 4180	113.80	-0.20	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.8	-0.2	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.38	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Calibrated by :

Approved by :

Date of Calibration : 10 Jan. 2024

Date of Issue : 11 Jan. 2024

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011267010800067006

End of Certificate

3 / 3

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

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FM.BLMTC.002 Rev.4

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH16

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Water Proof
Model : pHTestr 30
Serial No. : 3066354
ID No. : -
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 09 January 2024
Reference : 2401-0077DN-2
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-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment, Calibration and Testing Services.

A 0062384



Cert.No.: 24CH16
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	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 k
pH Electrode	4.008	4.01	N/A	0.0079	2.00
S/N.: 3066354	6.986	6.99	N/A	0.0099	2.00
	9.997	10.01	N/A	0.0085	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 %

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a 1196386



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Cert.No.: 24TW1
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro20
Serial No. : 14L101229
ID No. : -
Received Date : 05 January 2024
Test Date : 08 January 2024
Reference : 2401-0077DN-5
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 : [Redacted]
Approved by : [Redacted]
Approved Signatory
[Redacted]
Issue Date : 10 January 2024

B 0331698



Cert.No.: 24TW1
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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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.: 15K100212

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

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

-o0o-

a 1196378



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



Certificate of Calibration

Certificate No. : MT23-7846
Page : 1 of 2

Customer : Environment Research & Technogy Co., Ltd.
Address : 25/114 Moo 6 Soi Chinaket1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Description	: Incubator	Order No.	: 3936/23
Manufacturer	: Accuplus	Received date	: Dec 12, 2023
Model	: Smart i250	Calibration date	: Dec 12, 2023
Serial No.	: 2059-0218-0002	Environment Condition :	
Identification No.	: ERTC-L-IN-143	Temperature	: (25+/-10) °C
Calibration Place	: Customer Laboratory	Humidity	: (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 Euramei 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	MT23-5938	Oct 05, 2024

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 : [Redacted]
Issue date : Jan 09, 2024

Approved by : [Redacted]

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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 No. : MT23-7846

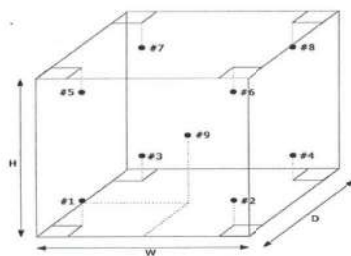
Page : 2 of 2

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	20.542	20.166	20.504	20.211	20.551	20.501	20.477	20.723	19.867	0.46

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20 to 20.3	0.25	1.0	1.3



- #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

Front view

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



Cert. No.: 24TM96

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 : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ

Received Order : 03 January 2024

Calibration Date : 04 January 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2401-0001ON-6

Cert. No.: 24TM96
 Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

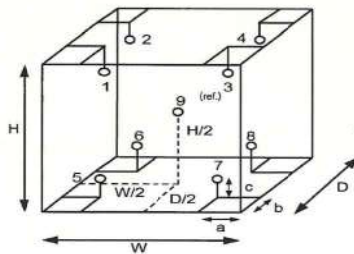
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	45	50
AC Supply (Volt)	225	226

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2401-0001ON-6

Cert. No.: 24TM96
 Page : 3 of 3

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
44.5	44.5	45.0	0.20	0.77	1.6	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
44.5	45.038	45.142	45.077	45.127	43.812	44.180	44.402	44.990	44.497	0.85

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 %.

-o0o-

a 1197873

a 1197872



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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM95
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IF 160
Serial No. : C522.0070
ID No. : ERTC-L-In.-181
Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6 Soi Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
Bangkok 10210
Location : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ
Received Order : 03 January 2024
Calibration Date : 04 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Procedure Used :-

Cert. No.: 24TM95

Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

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

Result of Calibration :- (*) Without Adjustment

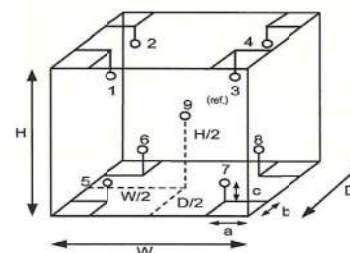
Function of UUC* : Temperature Source

Fresh air setting : Close

Fan setting : 50%

Environment during calibration

	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	47	50
AC Supply (Volt)	225	226



Probe Installation Details :

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

Dimension of Chamber :

D = 0.40 m
W = 0.56 m
H = 0.73 m
Capacity = 0.16 m³

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

A 0062474

a 1197875



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM95
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.020	0.15	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.043	34.933	35.015	34.992	35.019	34.980	34.843	34.961	34.985	0.32

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 %.

-o0o-

EQUIPMENT QUALIFICATION REPORT (EQR)

Agilent CrossLab Compliance Services



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, 2023 1:10:31 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

Section	Page
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Test Summary

Purpose

This section includes the Overall Qualification Status and details for each test that meets at least one of the following criteria: (1) was not scheduled; (2) was scheduled but not run; (3) was processed more than once; (4) passed recommended limits only when dual limits were selected; (5) required deviation(s) or comment(s); (6) required integration event change(s). Tests that pass and do not meet any criteria above are not included.

For a complete list of scheduled tests, see the table of contents. For supporting documentation, refer to the Attachments section.

NOTE: A Pass for the Overall Qualification Status indicates that all scheduled tests were run and passed; R, I, D, and C are blank if not applicable for that specific test.

R: runs

I: integration event changes

D: number of deviations submitted

C: number of comments submitted

Status: NS (not scheduled); NR (scheduled but not run); NC (unlocked but not completed)

Details

Test

Status

R I D C

There were no repeated or re-integrated tests. All test resulted in a pass status.

Overall Qualification Status

Pass

Service Details

Purpose

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

General Details

Service Order No./Request: 6006377416
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: K 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

Protocol 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
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Results

Criteria	Observed Result	Expected Result	Status
Does the plasma ignite successfully in the first three attempts?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Was the detector calibration performed and completed successfully?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Was the instrument calibration performed and completed successfully?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Test Evidence

Image Details:	Was the detector calibration performed and completed successfully?
Date and Time:	November 28, 2023 12:56:03 PM
Host Name:	5CGC202NQ4

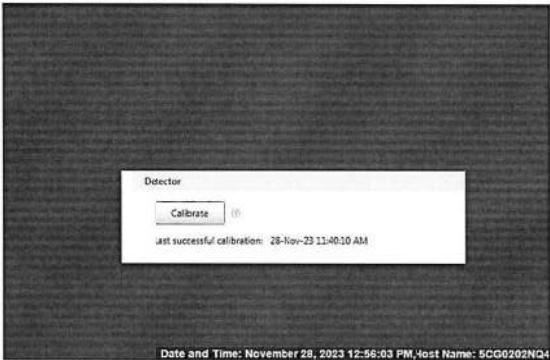


Image Details: Was the instrument calibration performed and completed successfully?
Date and Time: November 28, 2023 12:56:20 PM
Host Name: 5CG0202NQ4



Overall Test Status

Pass

Runs: 1

Instrument Tests

Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details

Model/Serial No.: G8011A MY15330001

Results

	Observed Result	Expected Result	Status
Are the Functional Tests results within acceptance criteria?			
Subsystem Communications	Yes	Yes	Pass
Air Flow	Yes	Yes	Pass
Water Flow	Yes	Yes	Pass
Gas Flows	Yes	Yes	Pass
RF Generator	Yes	Yes	Pass
Camera	Yes	Yes	Pass
Optics	Yes	Yes	Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	Yes	Yes	Pass
Sensitivity	Yes	Yes	Pass
Precision	Yes	Yes	Pass

Overall Test Status

Pass

Runs: 1

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	13
EQR	General	Operator's training certificate and qualifications	14
EQR	General	Operator's training certificate and qualifications	15
EQR	General	Certificate of System Qualification	16
EQR	General	Instrument's Test Report	17
EQR	General	Software Verification	20
EQR	Material	Certificate of Analysis Wavelength calibration solution	21

General

Document Name:

Certificate of Qualification for ACE

Agilent Technologies

Agilent Compliance Engine Self Qualification

Date:October 18, 2023 10:19:46 AM

Drive Serial #:90593EBAPlatform Revision:ACE 1.12.112

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
ICPMS	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

General

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.

General

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: Worswit 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.

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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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: 27-Nov-23 2:23:13 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	7.28
As (188.960 nm)	≤ 8.20	6.66
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.71
Cr (206.158 nm)	≤ 13.40	10.27
Zn (213.857 nm)	≤ 8.70	7.56
Pb (220.353 nm)	≤ 9.50	7.70
Co (228.615 nm)	≤ 17.20	10.70
Ba (230.424 nm)	≤ 9.40	8.14
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	15.91
Cr (267.716 nm)	≤ 11.00	9.30
Cu (324.754 nm)	≤ 25.00	17.80
Cu (327.395 nm)	≤ 14.20	12.73
Sr (338.071 nm)	≤ 33.50	27.28
Ba (455.403 nm)	≤ 44.00	31.08
Sr (460.733 nm)	≤ 36.00	21.11
Ba (493.408 nm)	≤ 36.00	29.33
Ba (614.171 nm)	≤ 42.00	32.02
Ar (675.283 nm)	≤ 74.00	64.85
K (766.491 nm)	≤ 80.00	62.51

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Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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Document Name:

Instrument's Test Report

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	111.1	1111.0	85.2
Se (196.026 nm)	≥ 41.0	SRBR	68.5	856.2	116.6
Zn (213.857 nm)	≥ 1421.0	SRBR	3583.1	52766.1	215.1
Pb (220.353 nm)	≥ 46.0	SRBR	183.7	2811.8	201.3
Mn (257.610 nm)	≥ 3518.0	SRBR	10296.2	279763.9	735.3
Al (396.152 nm)	≥ 3.4	SBR	8.2	37571.9	4071.0
Ba (493.408 nm)	≥ 34.0	SBR	100.5	1198903.7	11867.1
K (766.491 nm)	≥ 1.8	SBR	3.8	100874.8	20871.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	248.6	3738.6	202.3
Se (196.026 nm)	≥ 159.0	SRBR	163.8	3040.9	283.3
Zn (206.200 nm)	≥ 234.0	SRBR	1402.0	19648.6	192.3
Zn (213.857 nm)	≥ 1743.0	SRBR	8340.9	200514.1	574.3
Cd (214.439 nm)	≥ 4227.0	SRBR	7606.2	156421.5	420.7
Pb (220.353 nm)	≥ 320.0	SRBR	631.4	16069.9	600.3
Mn (257.610 nm)	≥ 10625.0	SRBR	32328.3	1472044.4	2067.5
Cr (267.716 nm)	≥ 1048.0	SRBR	4308.3	155802.6	1286.3
Cu (324.754 nm)	≥ 19.0	SBR	57.8	242584.8	4123.5
Al (396.152 nm)	≥ 6.0	SBR	21.9	239924.8	10474.6
Ba (493.408 nm)	≥ 60.0	SBR	236.0	7235267.3	30527.2
K (766.491 nm)	≥ 24.0	SBR	68.8	3110677.8	44585.8

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	0.74
Se (196.026 nm)	≤ 2.60	0.65
Zn (213.857 nm)	≤ 1.50	0.21
Pb (220.353 nm)	≤ 2.60	0.51
Mn (257.610 nm)	≤ 1.50	0.25
Al (396.152 nm)	≤ 1.50	0.30
Ba (493.408 nm)	≤ 1.50	0.60
K (766.491 nm)	≤ 1.50	0.20
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.37
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.26
Cd (214.439 nm)	≤ 1.50	0.21
Pb (220.353 nm)	≤ 1.50	0.30
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.17
Cu (324.754 nm)	≤ 1.50	0.32
Al (396.152 nm)	≤ 1.50	0.30
Ba (493.408 nm)	≤ 1.50	0.48
K (766.491 nm)	≤ 1.50	0.53

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General

Document Name: Software Verification

Software Verification Report			
Date:	Monday, November 27, 2023	Time:	1:58:23 PM [UTC -07:00:00]
Windows User Name:	Admin	Base Revision Number:	1.0.1
Install Type:	N/A	Additional Packages:	RA
Host Name: 500NDV-HP			
Product Name: ICP Expert			
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, 2023 1:10:31 PM
System ID: MY15330001

Materials

Document Name: Certificate of Analysis Wavelength calibration solution

Agilent							
CERTIFICATE OF ANALYSIS							
Agilent Product Name: Wavelength Calibration Solution for ICP-OES & MP-AES, 5 mg/L, 500mL							
Agilent Part No: 661030100							
Lot No: 0012990411							
Product Specifications							
Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7704-27-2	5.000 ± 0.025 mg/L	Mn	Mn	7439-96-5	5.000 ± 0.025 mg/L
As	As	7440-38-2	5.000 ± 0.025 mg/L	Mo	(NH ₄) ₂ MoO ₄	13166-76-6	5.000 ± 0.025 mg/L
Ba	Ba(NO ₃) ₂	10022-31-9	5.000 ± 0.025 mg/L	Ni	Ni	7440-02-0	5.000 ± 0.025 mg/L
Cd	Cd	7440-43-8	5.000 ± 0.025 mg/L	Pb	Pb	7439-92-1	5.000 ± 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 ₃) ₃	13448-38-4	5.000 ± 0.025 mg/L	Sr	Sr(NO ₃) ₂	10043-71-9	5.000 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.000 ± 0.025 mg/L	Zn	Zn	7440-66-6	5.000 ± 0.025 mg/L
K	KNO ₃	7757-79-1	50.00 ± 0.25 mg/L				
Matrix: 5% HNO ₃							
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 17030 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 ₃) 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, 3112, 3112a, 1114, 3141a, 3132, 3134, 3136, 3128, 3148, 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 500µL, (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.							
Page 1 of 2							

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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.

Sample lot approval:

Date of release: 18 October 2022
Date of expiration: 30 April 2024

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Date: November 28, 2023 1:10:31 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.

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 OSP 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, or 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. 44 100 18580231)
- Accredited to ISO 17034 – General Requirements for the Competence of Reference Material Producers (AZLA Cert. No. 264832)
 - 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. 2548.01)
- LGC Standards, 219 Midway Road, Manchester, M11 2DQ

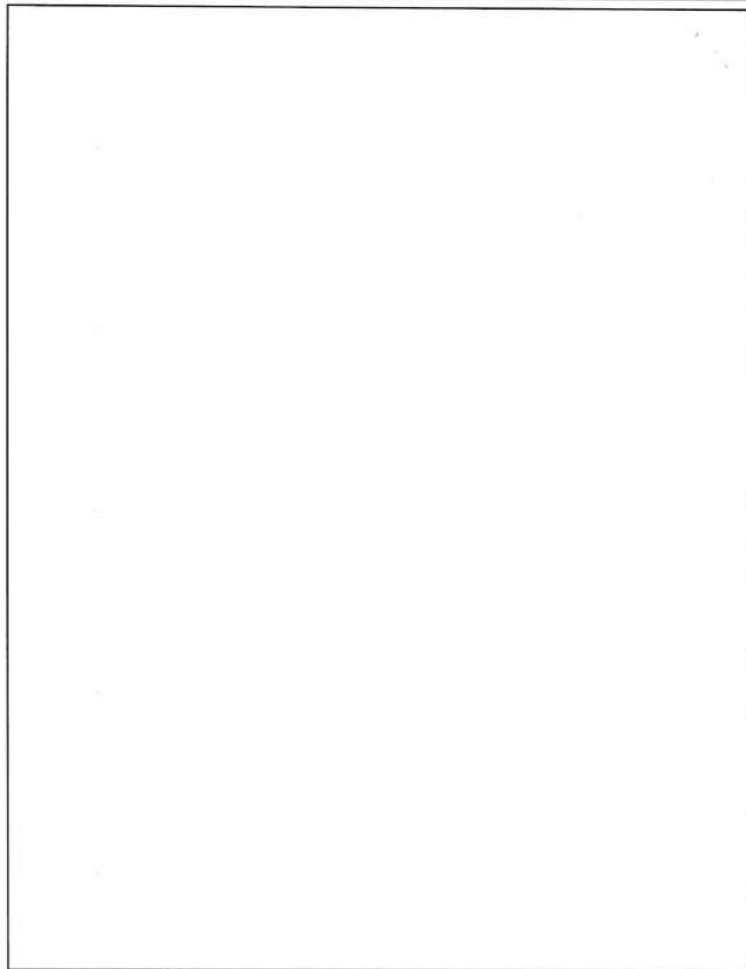
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Document Name:

Certificate of Analysis Wavelength calibration solution



Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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

Logged On User Name:

Signature Creation Date:

November 28, 2023

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.

Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

User Name: worawit.timakul
Report Generated by Hostname: SCG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

OQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:54:06 PM	Audit	SessionCreated	Session	None
November 28, 2023 12:54:06 PM	Start	Configuration	Session	None
November 28, 2023 12:54:06 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 28, 2023 12:54:32 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], Protocol Revision: [Es.02.50]
November 28, 2023 12:54:38 PM	End	Configuration	Session	None
November 28, 2023 12:54:41 PM	Start	Qualification	Session	OQ
November 28, 2023 12:54:41 PM	Start	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:26 PM	End	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2023 12:56:27 PM	Start	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:57 PM	End	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

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User Name: worawit.timakul
Report Generated by Hostname: SCG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

OQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:57:03 PM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	None
November 28, 2023 12:57:08 PM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2023 12:57:09 PM	End	Qualification	Session	OQ
November 28, 2023 12:57:09 PM	Start	Reporting	Session	None
November 28, 2023 1:04:49 PM	Audit	AceRestarted	Session	None
November 28, 2023 1:04:50 PM	Audit	SessionReloaded	Session	None
November 28, 2023 1:04:58 PM	Start	Qualification	Session	OQ
November 28, 2023 1:08:10 PM	Audit	Reporting	Session	Report Generated : Certificate
November 28, 2023 1:09:28 PM	Audit	Reporting	Session	Report Generated : Report

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Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Page 26 / 28

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Page 27 / 28

User Name: worawit.timakul
Report Generated by Hostname: SCG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

QQHW ICP 5100 ENVI Research Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 1:10:31 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: QQHW ICP 5100 ENVI Research_20231128_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

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Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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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. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH10
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : HM DIGITAL
Model : COM-100
Serial No. : PONPE5863548
ID No. : NO.4
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 08 January 2024
Reference : 2401-0077DN-6
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In -house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062387



Cert.No.: 24CH10

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	231435	10 Apr 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
*100 $\mu\text{S/cm}$	Thermo Scientific	193/01	11 May 2024
1413.0 $\mu\text{S/cm}$	CPA Chem	931955	30 Sep 2024

- 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.: PONPE5863548

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
*100 $\mu\text{S/cm}$	101 $\mu\text{S/cm}$	99.9 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1445 $\mu\text{S/cm}$	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 %.

-oOo-

a 1196383

Calibration Certificate ID
TH3067-066-011524-ACC-TH**METTLER TOLEDO**

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

NSC-TISI-TIS 17025
CALIBRATION 0062**Accuracy Calibration Certificate****Customer**

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

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS204TS/00	Asset Number:	ERTC-L-IN-114
Serial No.:	B547728937	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: CPW002/20

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: 26.9 $^{\circ}\text{C}$	End: 27.0 $^{\circ}\text{C}$	Start: 44.5 %	End: 44.5 %

As Found Calibration Date:	15-Jan-2024	Calibrator:	
As Left Calibration Date:	N/A		
Issue Date:	15-Jan-2024	Approved Signator	

Technical Manager / Head of Calibration Center

Software Version: 1.23.2.187
Report Version: 2.17.18
Form Number: F103C© METTLER TOLEDO
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written permission of the issuing calibration laboratory.

Page 1 of 5

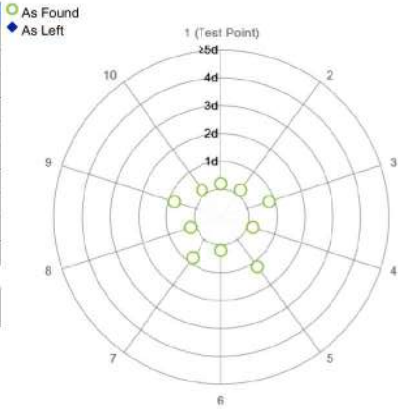
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0001 g	N/A
8	100.0000 g	N/A
9	100.0001 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00006 g	N/A
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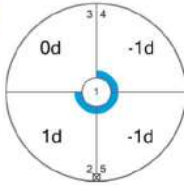
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	99.9999 g	N/A

Maximum Deviation	0.0001 g	N/A
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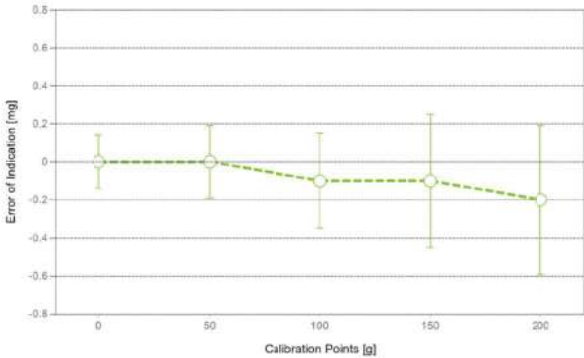
As Found

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	0.14 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	0.5001 g	0.0001 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0001 g	0.0001 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	100.0000 g	-0.0001 g	0.25 mg	2
10	150.0001 g	150.0000 g	-0.0001 g	0.35 mg	2
11	200.0000 g	199.9998 g	-0.0002 g	0.39 mg	2



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. 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 Hygromeier

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

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: $\pm 0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $\pm K$

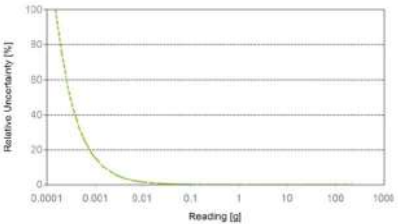
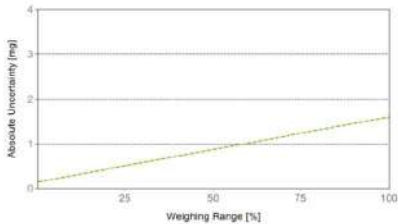
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00663 \text{ mg/g} \cdot R$	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	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.16 mg	0.0075%	N/A	N/A
22.0000 g	0.30 mg	0.0013%	N/A	N/A
220.0000 g	1.6 mg	0.00073%	N/A	N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

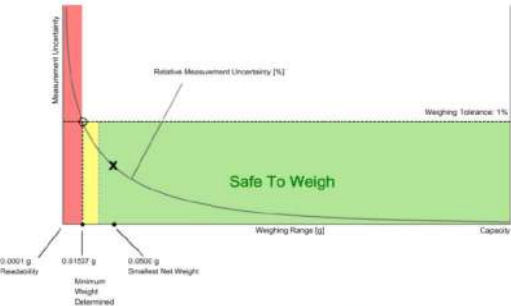
The weighing device meets the given
process requirements.

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%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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:

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	0.00006 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

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.

Error of Indication

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
100.0001 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	-0.0002 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	-0.0002 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.



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

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

TEL. 0-2717-3000-29 FAX. 0-2719-9484

Cert.No.: 24CH13

Page.: 1 of 2

Certificate of Calibration

Equipment : Salinity Meter
Manufacturer : AZ
Model : AZ8372
Serial No. : 2103264
ID No. : -
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 08 January 2024
Reference : 2401-0077DN-9
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 : (65 ± 15) %
Calibration Procedure: In - house method : based on direct measurement by
using Sodium Chloride Solution

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 10 January 2024

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

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



Cert.No.: 24CH13

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) Thermometer	9549224	130RC003	231435	10 Apr 2024
2) Thermo-Hygrograph	1103328	130EC010	23H1361	13 June 2024

2. Reference Standard Material :

- Conductivity calibrated solution, Eutech Instruments Pte Ltd., The measurement results are traceable to SI through ThermoFisher Scientific Water and Lab Products.
- Calibrated Total Dissolved Solids solution temperature controlled by Water bath at (25 ± 0.1) °C
- The Total Dissolved Solids has been prepared dilution from

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

Material	Manufacturer	Lot No.	Exp. Date
25 ppt	Eutech	292/01	22 July 2025

Calibration results (*) Without Adjustment

Probe Serial No. : 2103264

Standard NaCl Solution	UUC* Reading	Uncertainty of Measurement (±)
2.50 ppt	2.55 ppt	0.027 ppt
2.84 ppt	2.98 ppt	0.030 ppt

Remark:

- UUC* = Unit Under Calibration
- ppt = ppt of NaCl
- ppt = Parts per Thousand

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

-o0o-

A 0012712

a 1196379

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: 25114 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/W00220
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: 27.5 °C	End: 26.9 °C	Start: 44.1 %	End: 44.5 %

As Found Calibration Date: 15-Jan-2024 Calibrator: [Redacted]
As Left Calibration Date: N/A
Issue Date: 15-Jan-2024
Approved Signatory: [Redacted]
Technical Manager / Head of Calibration Center

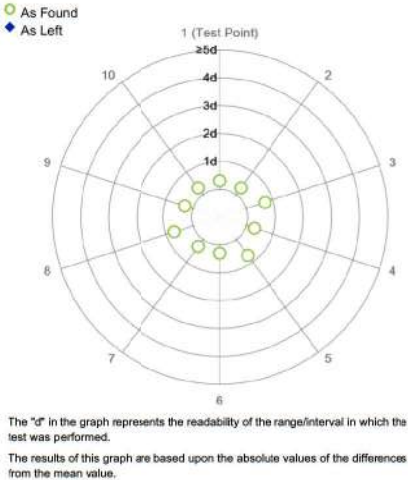
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A

Standard Deviation: 0.00005 g N/A

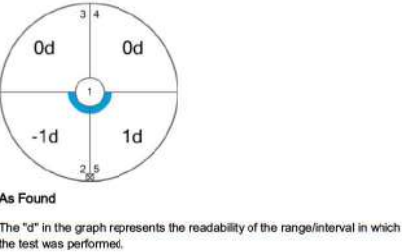


Eccentricity

Test Load: 100 g

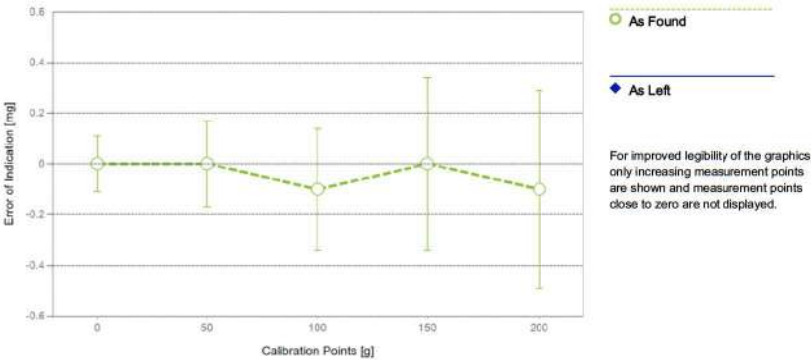
Position	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	100.0000 g	N/A
5	100.0001 g	N/A

Maximum Deviation: 0.0001 g N/A



Error of Indication

As Found					
	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 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	5.0000 g	0.0000 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	100.0001 g	100.0000 g	-0.0001 g	0.24 mg	2
10	150.0001 g	150.0001 g	0.0000 g	0.34 mg	2
11	200.0000 g	199.9999 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

- 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: $1.5 \cdot 10^{-6} / K$

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

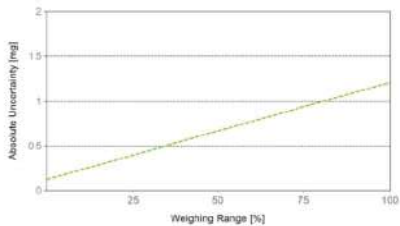
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00494 \text{ mg/g} \cdot R$	N/A

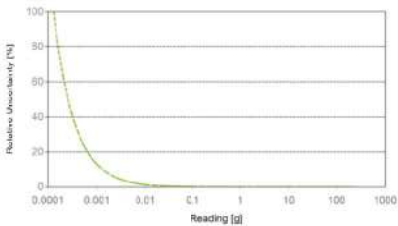
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.14 mg	0.0064%	N/A	N/A
22.0000 g	0.24 mg	0.0011%	N/A	N/A
220.0000 g	1.2 mg	0.00055%	N/A	N/A



As Found



As Left

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

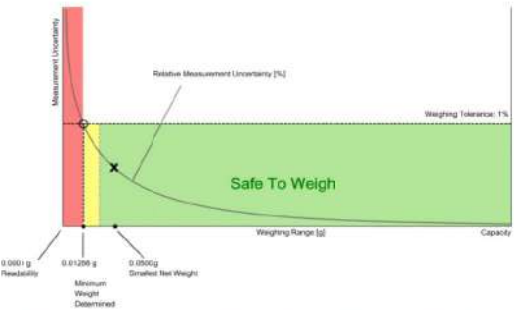
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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	0.00005 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 $0.41 \cdot d$ 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.

Attachment to Calibration Certificate:

TH3067-065-011524-ACC-TH

GWP® Certificate

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
100.0001 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	0.0000 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
100.0001 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	0.0000 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.

METTLER TOLEDO Service



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



Cert. No.: 24TM92

Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Binder

Model : FED 115 E2

Serial No. : 11-22823

ID No. : ERTC-L-In.-076

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

Location : Laboratory (ERTC)

Received Order : 03 January 2024

Calibration Date : 03 January 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : 

Approved by : 

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0062471



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-0001ON-2

Cert. No.: 24TM92
 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

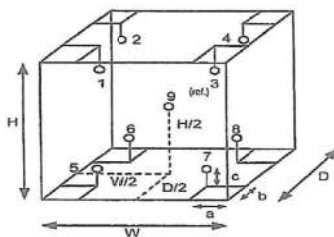
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function 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 = 0.60 m
c = 5.0 cm	H = 0.48 m
	Capacity = 0.12 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	33
REL.Humid. (%)	53	41
AC Supply (Volt)	226	225

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-0001ON-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 24TM92
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104	104	104	0.10	1.8	2.1	2
180	180	180	0.27	4.4	5.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104	104.379	103.463	103.443	103.893	104.213	103.223	105.222	104.297	103.494	0.77
180	179.045	177.562	181.296	179.300	180.773	177.931	182.136	178.131	178.019	1.6

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 %.

-o0o-

a 1197881

a 1197880



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



Cert. No.: 24TM93
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 110
Serial No. : E414.0652
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 : 03 January 2024
Calibration Date : 03 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-0001ON-3

Cert. No.: 24TM93
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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

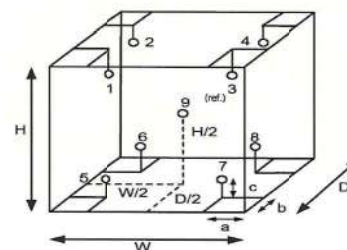
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function 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 = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	30
REL.Humid. (%)	53	53
AC Supply (Volt)	226	225

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09

A 0062472

a 1197879



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-0001ON-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM93

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
104.0	104.0	104.0	0.075	1.2	2.4	2
180.0	180.0	180.0	0.41	3.4	3.9	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	105.068	102.783	103.239	103.695	104.855	103.867	102.799	103.295	103.959	0.42
180.0	179.954	177.587	177.414	178.118	181.087	179.869	179.584	178.045	180.704	1.3

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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ระยะผลิตปิโตรเลียม
(การก่อสร้างแนวท่อลำเลียงปิโตรเลียม)

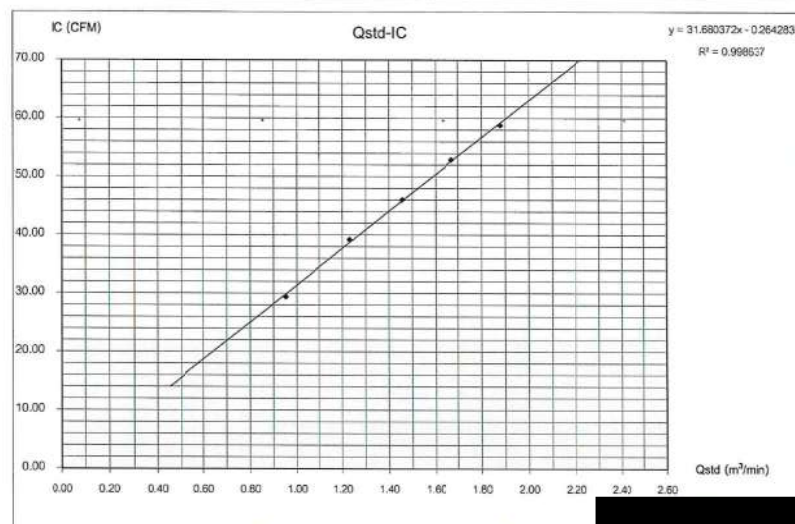
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	May 15, 2024
Sampler Location	AB : โรงไฟฟ้าปูนซีเมนต์	Start Time	2:47 PM
Sampler Number	PM-10 No.25	Stop Time	2:57 PM
Instrument Model	HIVOL-BMSBE	Transfer Standard Type	Orifice
Motor Serial Number	2150	Calibrator Model	TE-5025A
Recorder Serial Number	2409	Calibrator Serial Number	2915
		Calibrated By	

Rate (Delta H)		(A)		(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (inH ₂ O)	$\Delta H_2O(Pa/P_{atm}[T_{std}/T_a])^{1.2}$		$Q_{std} = (1/m)[(A-b)]$	sample Flow Rate Indicator	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{0.5}$	(°K = °C+273)	Pressure	Meter	Meter	
	Positive	Negative	ΔH_2O	(m ³ /min)	(m ³ /min)						
5	1.5	1.5	3.0	1.69809	0.95161	30.0	29.41	308.0	755.0		
7	2.5	2.5	5.0	2.18222	1.23009	40.0	39.22	308.0	755.0		
10	3.5	3.5	7.0	2.59387	1.45754	47.0	46.08	308.0	755.0		
13	4.5	4.5	9.2	2.97367	1.67204	54.0	52.94	308.0	755.0		
16	5.5	5.5	11.5	3.33909	1.87843	60.0	58.82	308.0	755.0		
Linear Regression Y ON X : Y = mX + b							Average	308.0	755.0		
1	Slope (m)			1.77059	Linear Equation		r ²	0.998637	Pstd(mmHg)	760.0	
2	Intercept (b)			0.01317	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9993183	T _{std}	296.0
3	Correlation Coefficient (r)			0.99974	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)	0.991167122		
Result							C=(Pa/Pstd)*(Tstd/Ta)*0.5				0.980391311

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-021, Rev. 02, June 3, 2019

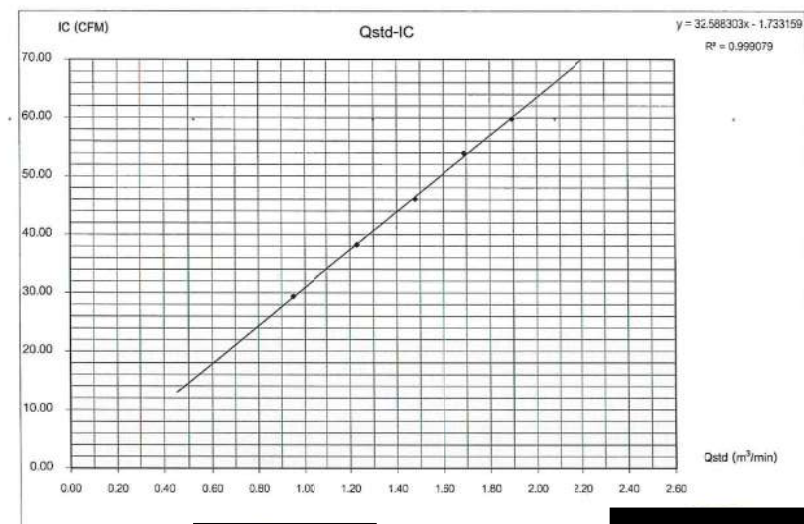
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	May 15, 2024
Sampler Location	AB : โรงไฟฟ้าปูนซีเมนต์	Start Time	2:38 PM
Sampler Number	TSP No.A31	Stop Time	2:46 PM
Instrument Model	HIVOL-BBCBE	Transfer Standard Type	Orifice
Motor Serial Number	57-507	Calibrator Model	TE-5025A
Recorder Serial Number	507-012	Calibrator Serial Number	2915
		Calibrated By	

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_2O(Pa/P_{atm}[T_{std}/T_a])^{1.2}]$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{0.5}$	(°K = °C+273)	Pressure	Meter	Meter	
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(m ³ /min)						
5	1.5	1.5	3.0	1.69809	0.95161	30.0	29.41	308.0	755.0			
7	2.5	2.5	5.0	2.19222	1.23009	39.0	38.24	308.0	755.0			
10	3.5	3.5	7.2	2.63067	1.47832	47.0	46.08	308.0	755.0			
13	4.7	4.7	9.4	3.00582	1.69020	55.0	53.92	308.0	755.0			
16	5.9	5.9	11.8	3.36775	1.89401	61.0	58.80	308.0	755.0			
Linear Regression Y ON X : Y = mX + b								Average	308.0	755.0		
1	Slope (m)			1.77059	Linear Equation		r ²	0.999079	Pstd(mmHg)	760.0		
2	Intercept (b)			0.01317	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9995394	T _{std}	296.0	
3	Correlation Coefficient (r)			0.99974	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)	0.991167122			
Result							C=(Pa/Pstd)*(Tstd/Ta)*0.5					0.980391311

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-021, Rev. 02, June 3, 2019

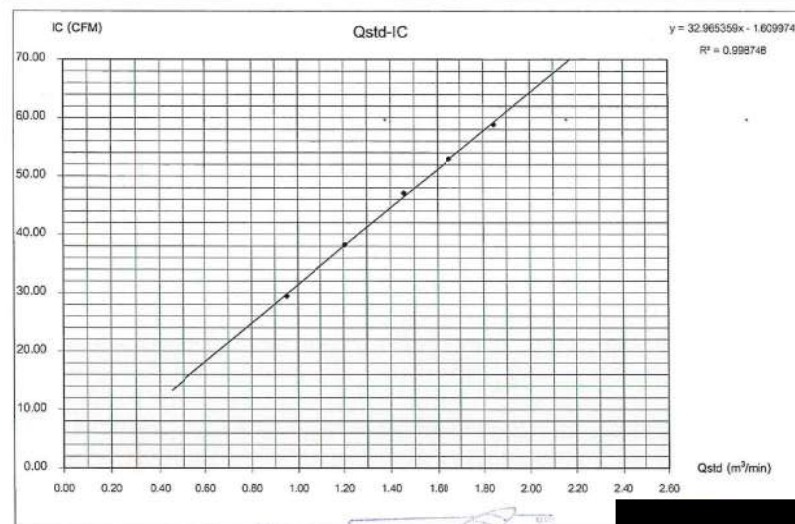
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	1024-00810	Date	May 15, 2024
Sampler Location	M8 : หมู่ที่ 8 บ้านโนนสำราญ	Start Time	2:10 PM
Sampler Number	PM-10 No.26	Stop Time	2:20 PM
Instrument Model	HIVOL-BMBBE	Transfer Standard Type	Orifice
Motor Serial Number	2211	Calibrator Model	TE-5025A
Recorder Serial Number	2610	Calibrator Serial Number	2915
		Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(Y)	Temperature	Barometric Pressure	Start Motor	Stop Motor
	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm} \cdot T_{atm}/T_{ref})^{1.2}$	$Q_{std} = (1/m) \cdot [(A \cdot b)]$	$IC = [(Pa \cdot P_{std}) / (T_{std} \cdot T_{ref})]^{1.2}$	(°C = °C + 273)	(mmHg)		
	Positive Negative ΔH_2O		(m³/min)	(m³/min)				
5	1.5 1.5 3.0	1.09809	0.95161	30.0	29.41	308.0	755.0	
7	2.4 2.4 4.8	2.14793	1.20568	39.0	38.24	308.0	755.0	
10	3.5 3.5 7.0	2.59387	1.45754	48.0	47.06	308.0	755.0	
13	4.5 4.5 9.0	2.94117	1.65360	54.0	52.94	308.0	755.0	
18	5.6 5.6 11.2	3.28102	1.84563	60.0	59.82	308.0	755.0	
Linear Regression Y ON X: Y = mX + b					Average	308.0	755.0	
1	Slope (m)	1.77059	Linear Equation		r^2	0.998748	P_{std}/m	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9993738	T_{ref}	298.0
3	Correlation Coefficient (r)	0.99974	Final Set Flow Rate = (1)	0		(Pa/Pstd) * (Tstd/Tref)	0.961167122	
Result					C = (Pa/Pstd) * (Tstd/Tref) * 0.5			
					0.980391311			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

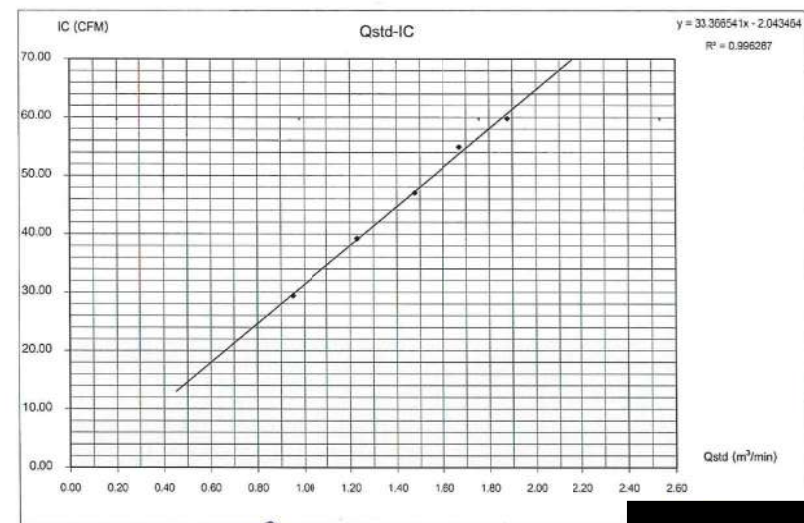
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	May 15, 2024
Sampler Location	A8 : หมู่ที่ 8 บ้านโนนสำราญ	Start Time	1:59 PM
Sampler Number	TSP No.A20	Stop Time	2:09 PM
Instrument Model	HIVOL-BMBBE	Transfer Standard Type	Orifice
Motor Serial Number	2142	Calibrator Model	TE-5025A
Recorder Serial Number	2397	Calibrator Serial Number	2915
		Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(Y)	Temperature	Barometric Pressure	Start Motor	Stop Motor
	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm} \cdot T_{atm}/T_{ref})^{1.2}$	$Q_{std} = (1/m) \cdot [(A \cdot b)]$	$IC = [(Pa \cdot P_{std}) / (T_{std} \cdot T_{ref})]^{1.2}$	(°C = °C + 273)	(mmHg)		
	Positive Negative ΔH_2O		(m³/min)	(m³/min)				
5	1.5 1.5 3.0	1.09809	0.95161	30.0	29.41	308.0	755.0	
7	2.5 2.5 5.0	2.19222	1.23066	40.0	39.22	308.0	755.0	
10	3.6 3.6 7.2	2.63957	1.47832	48.0	47.06	308.0	755.0	
13	4.6 4.6 9.2	2.97367	1.67204	56.0	54.99	308.0	755.0	
18	5.8 5.8 11.6	3.33909	1.87843	61.0	59.86	308.0	755.0	
Linear Regression Y ON X: Y = mX + b					Average	308.0	755.0	
1	Slope (m)	1.77059	Linear Equation		r^2	0.999287	P_{std}/m	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9981418	T_{ref}	298.0
3	Correlation Coefficient (r)	0.99974	Final Set Flow Rate = (1)	0		(Pa/Pstd) * (Tstd/Tref)	0.961167122	
Result					C = (Pa/Pstd) * (Tstd/Tref) * 0.5			
					0.980391311			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

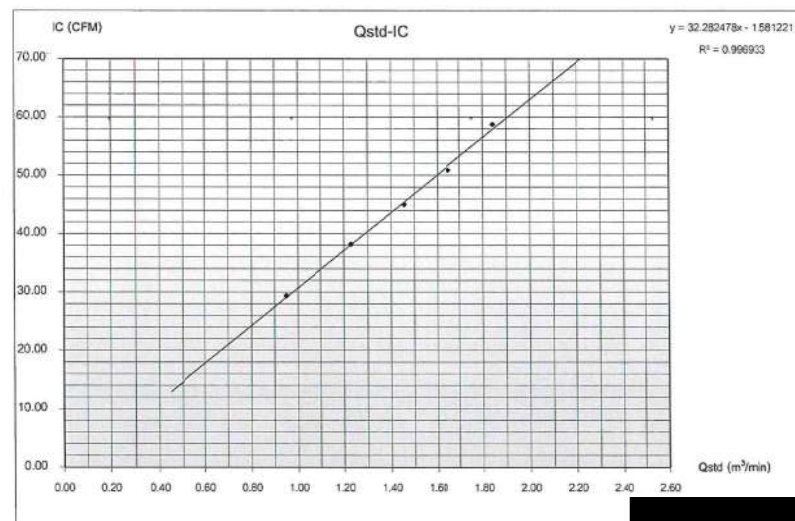
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	1024-00810	Date	April 24, 2024
Sampler Location	AB : หมู่ที่ 11 บ้านจันทน์ (1)	Start Time	3:30 PM
Sampler Number	PM-10 No.24	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	2151	Calibrator Serial Number	2915
Recorder Serial Number	2407	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm} \cdot T_{ref}/T_{air})^{1.25}$	$Q_{std} = (1/min)[(A \cdot b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})]^{1.25}$	(°K = °C + 273)	Pressure	Meter	Meter
	Positive Negative ΔH_2O		(m³/min)	(L/min)		(mmHg)			
5	1.5 1.5 3.0	1.69534	0.95006	30.0	29.36	309.0	755.0		
7	2.5 2.5 5.0	2.18867	1.22869	39.0	38.17	309.0	755.0		
10	3.5 3.5 7.0	2.58967	1.45517	46.0	45.02	309.0	755.0		
13	4.5 4.5 9.0	2.93641	1.65100	52.0	50.90	309.0	755.0		
18	5.6 5.6 11.2	3.27570	1.84263	60.0	58.73	309.0	755.0		
Linear Regression Y QN X: Y = mX + b						Average	309.0	755.0	
1	Slope (m)	1.77059	Linear Equation			r²	0.996933	Pstd(mmHg)	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9984653	T _{air}	298.0	
3	Correlation Coefficient (r)	0.99974	Final Set Flow Rate = (I)		0	(Pa/Pstd)(Tstd/Tair)	0.958056549		
Result						C = (Pa/Pstd)(Tstd/Tair)*0.5	0.978803632		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

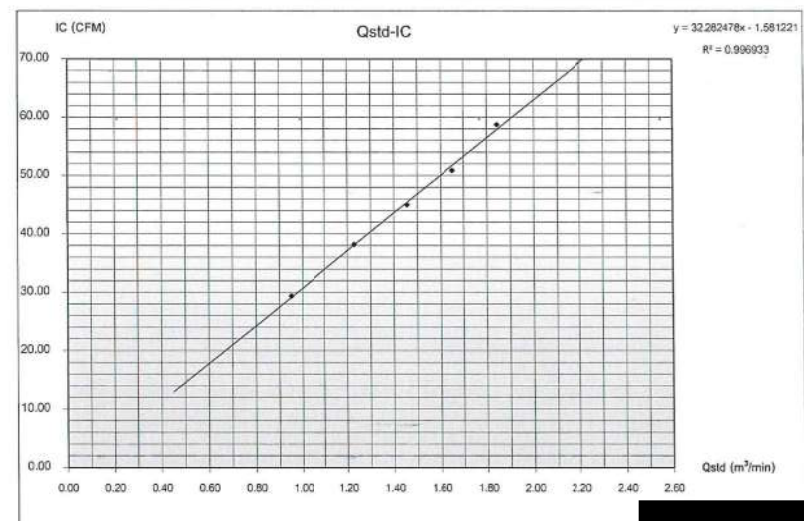
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	April 24, 2024
Sampler Location	AB : หมู่ที่ 11 บ้านจันทน์ (1)	Start Time	3:30 PM
Sampler Number	PM-10 No.24	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	2151	Calibrator Serial Number	2915
Recorder Serial Number	2407	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)	$\Delta H_2O(Pa/P_{atm} \cdot T_{ref}/T_{air})^{1.25}$	$Q_{std} = (1/min)[(A \cdot b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})]^{1.25}$	(°K = °C + 273)	Pressure	Meter	Meter
	Positive Negative ΔH_2O		(m³/min)	(L/min)		(mmHg)			
5	1.5 1.5 3.0	1.69534	0.95006	30.0	29.36	309.0	755.0		
7	2.5 2.5 5.0	2.18867	1.22869	39.0	38.17	309.0	755.0		
10	3.5 3.5 7.0	2.58967	1.45517	46.0	45.02	309.0	755.0		
13	4.5 4.5 9.0	2.93641	1.65100	52.0	50.90	309.0	755.0		
18	5.6 5.6 11.2	3.27570	1.84263	60.0	58.73	309.0	755.0		
Linear Regression Y QN X: Y = mX + b						Average	309.0	755.0	
1	Slope (m)	1.77059	Linear Equation			r²	0.996933	Pstd(mmHg)	760.0
2	Intercept (b)	0.01317	Set Point Flow Rate (X) (m³/min)	1.133	r	0.9984653	T _{air}	298.0	
3	Correlation Coefficient (r)	0.99974	Final Set Flow Rate = (I)		0	(Pa/Pstd)(Tstd/Tair)	0.958056549		
Result						C = (Pa/Pstd)(Tstd/Tair)*0.5	0.978803632		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

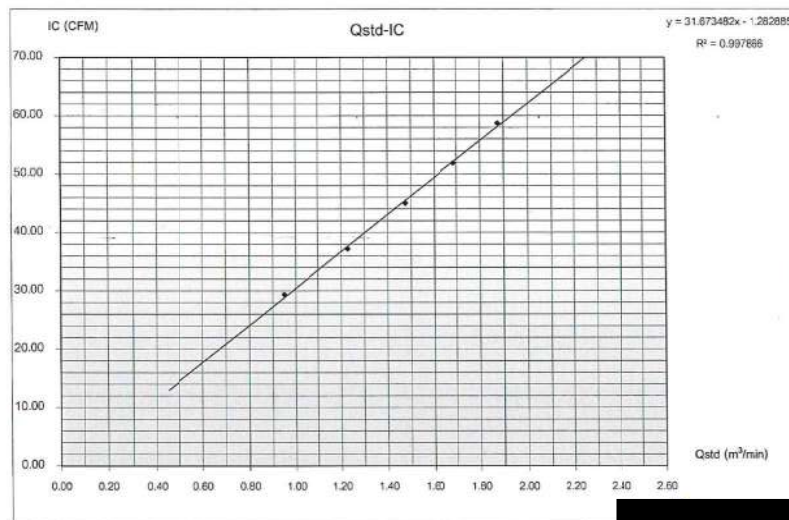
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	1024-00810	Date	April 24, 2024
Sampler Location	AT : หมู่ที่ 11 บ้านดงน้ำเย็น (2)	Start Time	4:05 PM
Sampler Number	TSP No A18	Stop Time	4:15 PM
Instrument Model	HIVOL-BSCBE	Transfer Standard Type	Orifice
Motor Serial Number	2014-03	Calibrator Model	TE-5025A
Recorder Serial Number	7373	Calibrator Serial Number	2915
Calibrated By			

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (mH ₂ O)			$\Delta H_2O/(Pa_{atm}/\rho_{atm}/T_{atm})^{1/2}$	$Q_{set} = (I \ln[(A/b)])$	orifice Flow Rate Indicator	$IC = [(Pa_{atm}/T_{atm})^{1/2}]$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_2O		(m ³ /min)	(l ³ /min)					
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.3	755.0		
7	2.5	2.5	5.0	2.18867	1.22868	38.0	37.19	309.3	755.0		
10	3.5	3.5	7.2	2.62841	1.47591	48.0	45.02	309.3	755.0		
13	4.7	4.7	9.4	3.00096	1.68745	53.0	51.86	309.3	755.0		
18	5.8	5.8	11.6	3.33369	1.87537	60.0	58.73	309.3	755.0		
Linear Regression Y ON X: Y= mx + b								Average	309.3	755.0	
1	Slope (m)			1.77059	Linear Equation			r ²	0.997896	Pressure (mmHg)	760.0
2	Intercept (b)			0.01317	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9989324	T _{atm}	298.0
3	Correlation Coefficient (r)			0.99974	Final Set Flow Rate = (I)			C=(Pa/Pstd)*(Tstd/Ta)	0.95805549		
Result:								C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.978803632		

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

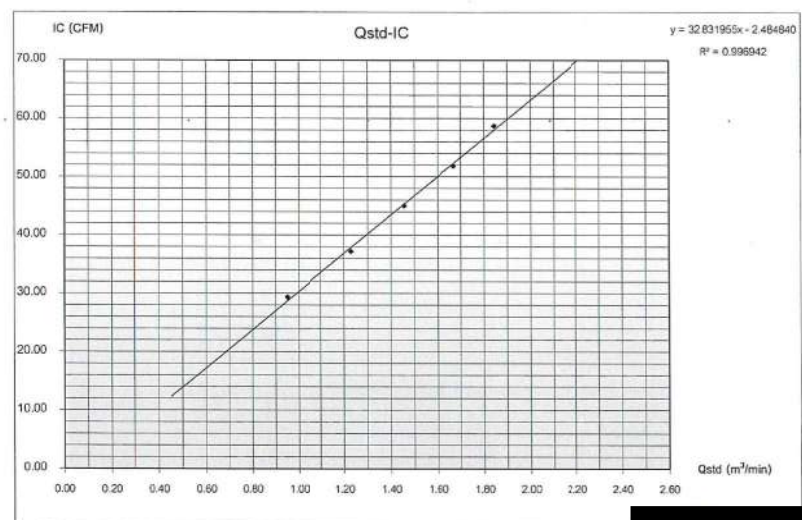
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00810	Date	April 24, 2024
Sampler Location	AT : หมู่ที่ 11 บ้านดงน้ำเย็น (2)	Start Time	4:16 PM
Sampler Number	PM-10 No 15	Stop Time	4:26 PM
Instrument Model	HIVOL-8MBBE	Transfer Standard Type	Orifice
Motor Serial Number	B2012-10	Calibrator Model	TE-5025A
Recorder Serial Number	4849	Calibrator Serial Number	2915
Calibrated By			

Plate (Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mH ₂ O)		$[\Delta H_2O(Pa/P_{std}T_{std}/T_a)]^{1/2}$	$Q_{std} = (l/min)(A/b)$	Sample Flow Rate Indicator	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	'K' = °C + 273	Pressure	Motor	Motor
	Positive	Negative	ΔH_2O	(m ³ /min)	(l/min)			(mmHg)		
5	1.5	1.5	3.0	1.69534	0.95006	30.0	29.36	309.0	755.0	
7	2.5	2.5	5.0	2.18867	1.22868	38.0	37.19	309.0	755.0	
10	3.5	3.5	7.0	2.59867	1.45517	46.0	45.02	309.0	755.0	
13	4.6	4.6	9.2	2.96866	1.60932	53.0	51.86	309.0	755.0	
18	5.6	5.6	11.2	3.27570	1.84263	60.0	58.73	309.0	755.0	
Linear Regression Y ON X: Y = mx + b							Average	309.0	755.0	
1	Slope (m)		1.77059	Linear Equation			r ²	0.998542	760.0	
2	Intercept (b)		0.01317	Set Point Flow Rate (X) (m ³ /min)			1.133	r	0.9984699	T _{std} = 298.0
3	Correlation Coefficient (r)		0.99974	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.95805549	
Result:								C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.978803632	

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

CERTIFICATE OF CALIBRATION

Certificate No. : COF-001-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 2915
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Environment Research & Technology Co., Ltd.
25/114 Moo 6 Soi Chinakiet 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 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 NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

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".

RECEIVED DATE : 04 Jan 2024
MEASUREMENT DATE : 29 Jan 2024
ISSUE DATE : 30 Jan 2024

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 23.9 °C and 63.8 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☐ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol



Approved signatory: _____

Calibration Department Manager

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^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.696	761.303	23.97	23.42	53.502	1.358	1.169	0.652
2	1.001	761.260	23.59	23.04	58.300	2.755	1.665	0.932
3	1.111	761.216	23.70	23.27	39.578	3.557	1.892	1.062
4	1.165	761.175	23.82	23.34	28.812	4.010	2.008	1.129
5	1.416	761.184	23.58	23.16	27.005	5.983	2.454	1.377

Slope (m): 1.77059
Intercept (b): 0.01317
Correlation coefficient (r): 0.99974
Uncertainty ($k=2$): 0.015 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.696	761.303	23.97	23.42	53.502	1.358	0.728	0.649
2	1.001	761.260	23.59	23.04	58.300	2.755	1.036	0.926
3	1.111	761.216	23.70	23.27	39.578	3.557	1.178	1.055
4	1.165	761.175	23.82	23.34	28.812	4.010	1.251	1.123
5	1.416	761.184	23.58	23.16	27.005	5.983	1.527	1.368

Slope (m): 1.10898
Intercept (b): 0.00822
Correlation coefficient (r): 0.99973
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



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: AE204-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: CPW00220

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 Signature:
Technical Manager / Head of Calibration Center

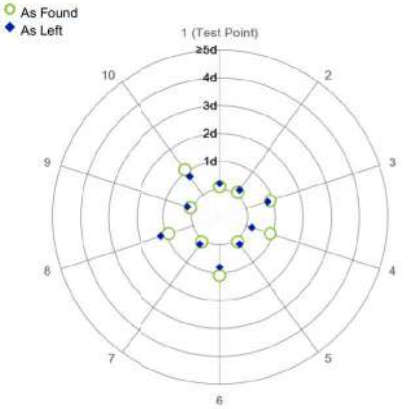
Measurement Results

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



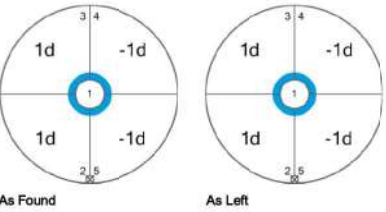
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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

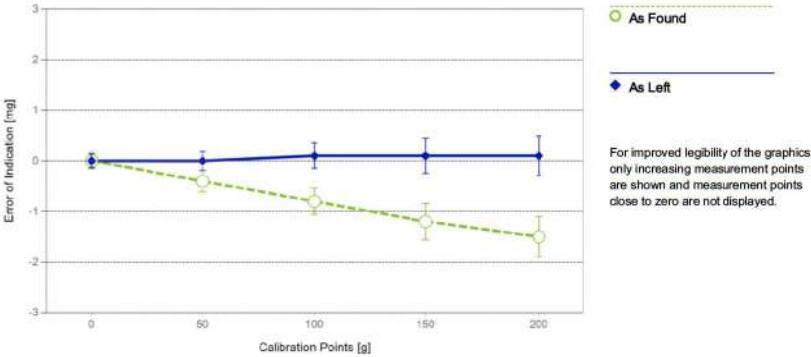


The "d" in the graph represents the readability of the range/interval in which the test was performed.

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 Hygromeier

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: $3.0 \cdot 10^{-6} / K$

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

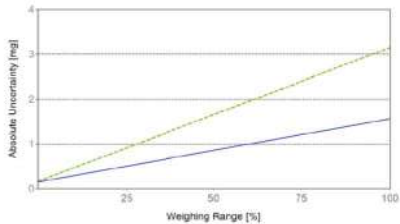
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.17 \text{ mg} + 0.0136 \text{ mg/g} \cdot R$	$U_1 = 0.15 \text{ mg} + 0.00644 \text{ mg/g} \cdot R$

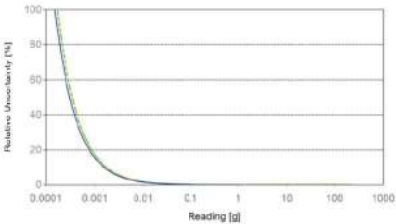
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.075%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.15 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%



As Found



As Left

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

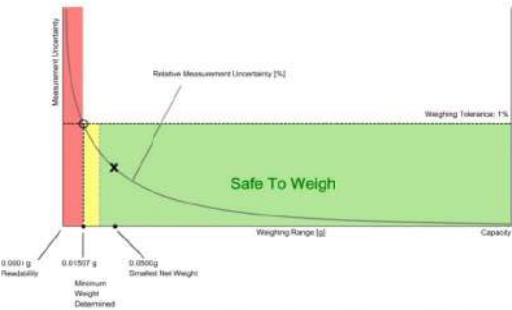
The weighing device meets the given process requirements.

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%	0.17097 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	0.05783 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	0.30304 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	0.30304 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

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	0.00006 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

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.

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	-0.0004 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

		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
100.0001 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.

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 : 17 April, 2024

Certification No. 183/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC21023B64 ID No. : No.6

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 1008.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NC 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 110730C29 (sensor 120629586)

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

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 183/24

17 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.7	0.31
17.02	-	-	-	16.5	0.52
20.02	-	-	-	20.0	0.02

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

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



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 17 April, 2024

Certification No. 182/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC20318B07 ID No. : No.2

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 1008.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: 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 0 - 20 m/sec

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 182/24

17 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
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

Mechanical Engineer



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 17 April, 2024

Certification No. 184/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC60110A03 ID No. : No.11

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 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NC 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 0 - 20 m/sec





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 184/24

17 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	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.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Mechanical Engineer



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 17 April, 2024

Certification No. 183/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC21023B64 ID No. : No.6

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 1008.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NC 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 110730C29 (sensor 120629586)

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

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 183/24

17 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H ₂ O	inches H ₂ O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.7	0.31
17.02	-	-	-	16.5	0.52
20.02	-	-	-	20.0	0.02

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

Mechanical Engineer



Environment Research & Technology Company Limited
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Tel 0-2954-7745-6 Fax 0-2956-7747
E-mail : env@enviresearch.co.th
www.enviresearch.co.th
Head Office/Tax ID 0105 542 064 981

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	Larson Davis
Model	:	CAL200
Serial No.	:	3605
Range of Calibrator		
- Support Equipment Type	:	93.8
- Frequency	:	1,000 Hz.
Calibrated By	:	
Calibration Date	:	May 16, 2024
Customer Name	:	Vision E. Consultants Co., Ltd.

โครงการผลิตโพลิเอสเตอร์พื้นผิผลิต L1/64 ปีงบฯ ๒๕๖๑
 พื้นผิผลิตปีงบฯ ๒๕๖๑ วันตก-ทองสงระ และพื้นผิผลิตปีงบฯ ๒๕๖๑ วันตก-ทองสงระส่วนยาย
 แปล่อสำรวจวนเบกหมยเลข L21/43 จังหัดสุโขทัย และจังหัดกันงเพร
 (การก่อสร้งแนวท่อสำเลียงปีโตรีเลมจวน BM3, BM6)

[illegible]

Checked By

Technician

Approved By _____

Environmental Scientist

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	Larson Davis
Model	:	CAL200
Serial No.	:	3605
Range of Calibrator		
- Support Equipment Type	:	93.8
- Frequency	:	1,000 Hz.
Calibrated By	:	
Calibration Date	:	April 25, 2024
Customer Name	:	Vision E. Consultants Co., Ltd.

โครงการผลิตไบโอดีเซลพื้นที่ลัด L1/64 บีทัก้า แปลงสำรวจบนกฎหมายเลข L1/64
พื้นที่ผลิตบีทัก้าตะวันตก-ทองสระ และพื้นที่ผลิตบีทัก้าตะวันตก-ทองสระส่วนขยาย
แปลงสำรวจบนกฎหมายเลข L21/43 จังหัดไชโย และจังหัดกำแพงเพชร
(การก่อสร้างแนวท่อลำเลียงไบโอดีเซลจาก BM3, BM6)

[illegible]

Checked By

Technician

Approved By

Environmental Scientist



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co.,Ltd.
Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Sarutprakan 10280.

Instrument Calibrated :		Ambient Environment	
Description	: Precision Acoustic Calibrator	Temperature	: (23 ± 3) °C
Manufacturer	: Larson Davis	Relative Humidity	: (50 ± 15) %
Model	: CAL200	Ambient Pressure	: (101.325 ± 1.500) kPa
Serial No.	: 3605		

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871

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

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

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

Date of Receipt : 8 Jan, 2024

Date of Calibration : 10 Jan. 2024

1/3

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.BLM.MTC002 Rev.4

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

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 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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 1
1/2 inch Bruel&Kjaer4180	93.85	-0.15	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	0.32	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Date of Calibration : 10 Jan. 2024

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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 1
1/2 inch Bruel&Kjaer 4180	113.80	-0.20	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.8	-0.2	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.38	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Calibrated by :

Approved by :

Date of Calibration : 10 Jan. 2024

Date of Issue : 11 Jan. 2024

Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011267010800067006

End of Certificate

3 / 3

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FM.BLMTC.002 Rev.4

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Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
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196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
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E-mail : sumalee@tistr.or.th



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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH17
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Water Proof
Model : pHTestr 30
Serial No. : 3066320
ID No. : -
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 09 January 2024
Reference : 2401-0077DN-3
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinakei 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by :

Approved by :

Issue Date :

Approved Signatory

10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0062385



Cert.No.: 24CH17
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	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 (±)	Coverage factor k
pH Electrode	4.008	4.01	N/A	0.0071	2.00
S/N.: 3066320	6.986	7.00	N/A	0.0093	2.00
	9.997	10.00	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 %

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a 1196385



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW254

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 : 29 November 2023
Test Date : 30 November 2023
Reference : 2311-0939DN-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-CH3
by Comparison Technique with Azide Modification Method
Tested by : 
Approved by : 
Issue Date : 4 December 2023

B 0328870



Cert.No.: 23TW254

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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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.: 17J100003

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

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

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a 1192571



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

Cert.No.: 24TW2
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro2330
Serial No. : 21H104437
ID No. : -
Received Date : 05 January 2024
Test Date : 08 January 2024
Reference : 2401-0077DN-10
Submitted by : Environment Research & Technology Company Limited.
25/14 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 : 
Issue Date : 10 January 2024

B 0331699



Cert.No.: 24TW2
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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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.: 21G100097

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

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

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a 1196377



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



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. : MT23-7846
Page : 1 of 2

Customer : Environment Research & Technogy Co., Ltd.
Address : 25/114 Moo 6 Soi Chinaket1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Description : Incubator
Manufacturer : Accuplus
Model : Smart i250
Serial No. : 2059-0218-0002
Identification No. : ERTC-L-IN-143
Calibration Place : Customer Laboratory

Order No. : 3936/23
Received date : Dec 12, 2023
Calibration date : Dec 12, 2023
Environment Condition :
Temperature : (25+/-10) °C
Humidity : (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	MT23-5938	Oct 05, 2024

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 : Jan 09, 2024

Approved by :

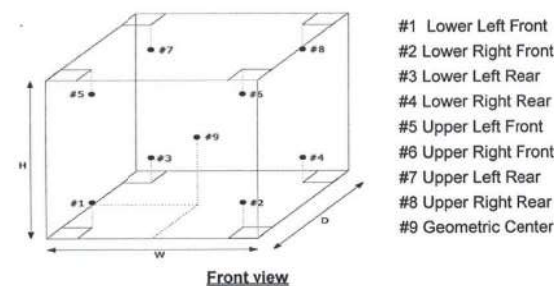
This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

Function : Temperature measurement
Calibration point : 20 °C

Certificate No. : MT23-7846
Page : 2 of 2
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	20.542	20.166	20.504	20.211	20.551	20.501	20.477	20.728	19.867	0.46

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20 to 20.3	0.25	1.0	1.3



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 value 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. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM95
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IF 160
Serial No. : C522.0070
ID No. : ERTC-L-In.-181
Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6 Soi Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
Bangkok 10210
Location : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ
Received Order : 03 January 2024
Calibration Date : 04 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Procedure Used :-

Cert. No.: 24TM95
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

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

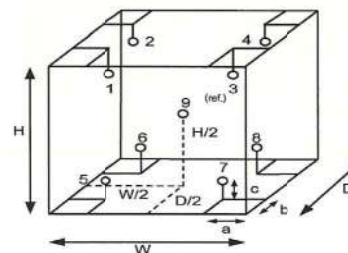
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Fan setting : 50%

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	47	50
AC Supply (Volt)	225	226



Probe Installation Details :

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

Dimension of Chamber :

D = 0.40 m
W = 0.56 m
H = 0.73 m
Capacity = 0.16 m³

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

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a 1197875



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM95

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.020	0.15	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.043	34.933	35.015	34.992	35.019	34.980	34.843	34.961	34.985	0.32

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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a 1197874



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



Cert. No.: 24TM96

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 : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ
Received Order : 03 January 2024
Calibration Date : 04 January 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0062475



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2401-0001ON-6

Cert. No.: 24TM96
 Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

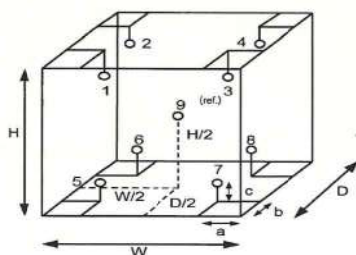
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	45	50
AC Supply (Volt)	225	226

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2401-0001ON-6
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 24TM96
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
44.5	44.5	45.0	0.20	0.77	1.6	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
44.5	45.038	45.142	45.077	45.127	43.812	44.180	44.402	44.990	44.497	0.85

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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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, 2023 1:10:31 PM

Report Type: Report

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

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

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Test Summary

Purpose

This section includes the Overall Qualification Status and details for each test that meets at least one of the following criteria: (1) was not scheduled; (2) was scheduled but not run; (3) was processed more than once; (4) passed recommended limits only when dual limits were selected; (5) required deviation(s) or comment(s); (6) required integration event change(s). Tests that pass and do not meet any criteria above are not included.

For a complete list of scheduled tests, see the table of contents. For supporting documentation, refer to the Attachments section.

NOTE: A Pass for the Overall Qualification Status indicates that all scheduled tests were run and passed; R, I, D, and C are blank if not applicable for that specific test.

R: runs
I: integration event changes
D: number of deviations submitted
C: number of comments submitted
Status: NS (not scheduled); NR (scheduled but not run); NC (unlocked but not completed)

Details

Test	Status			
	R	I	D	C
There were no repeated or re-integrated tests. All test resulted in a pass status.				
Overall Qualification Status				
Pass				

Service Details

Purpose

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

General Details

Service Order No./Request: 6006377416
EQP Name: AgilentRecommended
EQP Revision: ES.C2.50
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: K Relwin Posit
Job Title: Supervisor Scientist
Qualification Location: ICP0ES 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

Protocol 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?

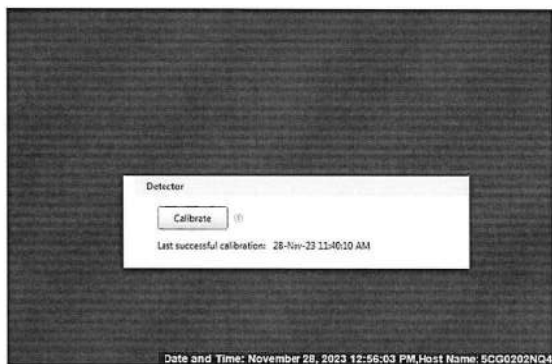
Yes	Yes	Pass
-----	-----	------

Test Evidence

Image Details: Was the detector calibration performed and completed successfully?

Date and Time: November 28, 2023 12:56:03 PM

Host Name: 5CG0202NQ4



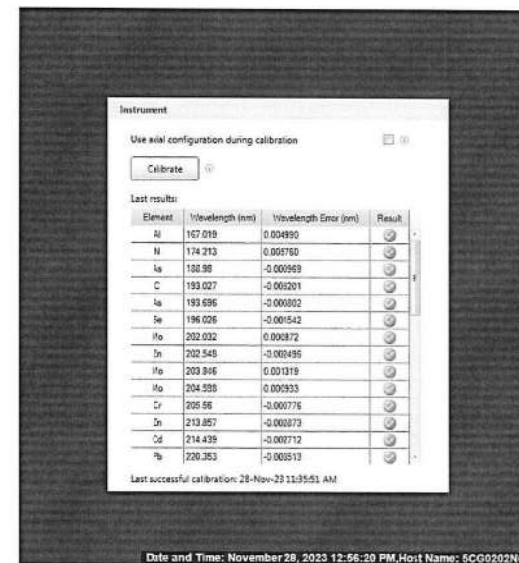
Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Image Details:

Was the instrument calibration performed and completed successfully?

Date and Time: November 28, 2023 12:56:20 PM

Host Name: 5CG0202NQ4



Overall Test Status

Pass

Runs: 1

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Instrument Tests

Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details

Model/Serial No.:	G8011A	MY15330001
-------------------	--------	------------

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

Are the Functional Tests results within acceptance criteria?

Subsystem Communications	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Air Flow	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Water Flow	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Gas Flows	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
RF Generator	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Camera	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Optics	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Sensitivity	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Precision	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Overall Test Status

Pass	Runs: 1
------	---------

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)?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="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	13
EQR	General	Operator's training certificate and qualifications	14
EQR	General	Operator's training certificate and qualifications	15
EQR	General	Certificate of System Qualification	16
EQR	General	Instrument's Test Report	17
EQR	General	Software Verification	20
EQR	Material	Certificate of Analysis Wavelength calibration solution	21

General

Document Name: Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

Date: October 18, 2023 10:13:46 AM

Drive Serial #: 90593EBA

Platform Revision: ACE 3.12.112

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

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:

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.

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:

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:

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	2984
Tested By	
Test Completed On	27-Nov-23 2:23:13 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	7.28
As (188.980 nm)	≤ 8.20	6.66
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.71
Cr (206.158 nm)	≤ 13.40	10.27
Zn (213.857 nm)	≤ 8.70	7.56
Pb (220.353 nm)	≤ 9.50	7.70
Co (228.615 nm)	≤ 17.20	10.70
Ba (230.424 nm)	≤ 9.40	8.14
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	15.91
Cr (267.716 nm)	≤ 11.00	9.30
Cu (324.754 nm)	≤ 25.00	17.80
Cu (327.395 nm)	≤ 14.20	12.73
Sr (338.071 nm)	≤ 33.50	27.28
Ba (455.403 nm)	≤ 44.00	31.08
Sr (460.733 nm)	≤ 36.00	21.11
Ba (493.408 nm)	≤ 36.00	29.33
Ba (614.171 nm)	≤ 42.00	32.02
Ar (675.283 nm)	≤ 74.00	64.85
K (766.491 nm)	≤ 80.00	62.51

Document Name: Instrument's Test Report

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	111.1	1111.0	85.2
Se (196.026 nm)	≥ 41.0	SRBR	68.5	856.2	116.6
Zn (213.857 nm)	≥ 1421.0	SRBR	3583.1	52766.1	215.1
Pb (220.353 nm)	≥ 46.0	SRBR	183.7	2611.8	201.8
Mn (257.610 nm)	≥ 3518.0	SRBR	10286.2	279763.9	735.8
Al (396.152 nm)	≥ 3.4	SBR	8.2	37571.9	4071.0
Ba (493.408 nm)	≥ 34.0	SBR	100.5	1198903.7	11807.1
K (766.491 nm)	≥ 1.8	SBR	3.8	100874.8	20871.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 206.0	SRBR	248.6	3738.6	202.3
Se (196.026 nm)	≥ 159.0	SRBR	163.8	3040.9	283.3
Zn (206.200 nm)	≥ 234.0	SRBR	1402.0	19648.6	192.6
Zn (213.857 nm)	≥ 1743.0	SRBR	8340.9	200514.1	574.6
Cd (214.439 nm)	≥ 4227.0	SRBR	7606.2	156421.5	420.7
Pb (220.353 nm)	≥ 320.0	SRBR	631.4	16069.9	600.3
Mn (257.610 nm)	≥ 10625.0	SRBR	32328.3	1472044.4	2057.5
Cr (267.716 nm)	≥ 1048.0	SRBR	4308.3	155802.6	1286.3
Cu (324.754 nm)	≥ 19.0	SBR	57.8	242584.8	4123.5
Al (396.152 nm)	≥ 6.0	SBR	21.9	239924.8	10474.6
Ba (493.408 nm)	≥ 60.0	SBR	236.0	7235267.3	30527.2
K (766.491 nm)	≥ 24.0	SBR	68.8	3110677.8	44585.8

Document Name: Instrument's Test Report

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.74	
Se (196.026 nm)	≤ 2.60	0.65	
Zn (213.857 nm)	≤ 1.50	0.21	
Pb (220.353 nm)	≤ 2.60	0.51	
Mn (257.610 nm)	≤ 1.50	0.25	
Al (396.152 nm)	≤ 1.50	0.30	
Ba (493.408 nm)	≤ 1.50	0.60	
K (766.491 nm)	≤ 1.50	0.20	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.51	
Se (196.026 nm)	≤ 1.50	0.37	
Zn (206.200 nm)	≤ 1.50	0.30	
Zn (213.857 nm)	≤ 1.50	0.26	
Cd (214.439 nm)	≤ 1.50	0.21	
Pb (220.353 nm)	≤ 1.50	0.30	
Mn (257.610 nm)	≤ 1.50	0.63	
Cr (267.716 nm)	≤ 1.50	0.17	
Cu (324.754 nm)	≤ 1.50	0.32	
Al (396.152 nm)	≤ 1.50	0.30	
Ba (493.408 nm)	≤ 1.50	0.48	
K (766.491 nm)	≤ 1.50	0.53	


General

Document Name: Software Verification

Software Verification Report			
Date:	Monday, November 27, 2023	Time:	2:58:23 PM [UTC: +07:00:00]
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			

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: 66100100
Lot No: 0012990411

Product Specifications			
Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7794-27-2	5.000 ± 0.025 mg/L
As	As	7440-38-2	5.000 ± 0.025 mg/L
Ba	Ba(NO ₃) ₂	10023-31-5	5.000 ± 0.025 mg/L
Cd	Cd	7440-43-9	5.000 ± 0.025 mg/L
Co	Co	7440-48-4	5.000 ± 0.025 mg/L
Cr	Cr(NO ₃) ₃	13549-38-4	5.000 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.000 ± 0.025 mg/L
K	KNO ₃	7757-79-1	50.00 ± 0.25 mg/L

Metric: 5% HNO₃

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 (HNO₃) 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, 3152, 3134, 3136, 3108, 3149, 3153a, and 3108a. 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 air-cleaned containers and transferware, (2) avoid pipetting directly from the CRM's original container, (3) use a minimum sub-sample size of 500µL, (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.

Page 1 of 3

Document Name: Certificate of Analysis Wavelength calibration solution



Period of Validity: Agilent insures 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.

Sample lot approval:

Date of release: 18 October 2022
Date of expiration: 30 April 2024

Page 2 of 3

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.

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 USP <1>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. 44 100 18082231)
- 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. 2848.01)
- LSC Standards, 200 Almy Road, Winchester, NY 12792

Document Name:

Certificate of Analysis Wavelength calibration solution

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: [REDACTED]

Logged On User Name:

Signature Creation Date: November 28, 2023

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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User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System ID: MY15330001
Print Date: November 28, 2023 1:10:41 PM

OQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:54:08 PM	Audit	SessionCreated	Session	None
November 28, 2023 12:54:08 PM	Start	Configuration	Session	None
November 28, 2023 12:54:08 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 28, 2023 12:54:32 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], Protocol Revision: [Es_02_50]
November 28, 2023 12:54:38 PM	End	Configuration	Session	None
November 28, 2023 12:54:41 PM	Start	Qualification	Session	OQ
November 28, 2023 12:54:41 PM	Start	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:26 PM	End	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2023 12:56:27 PM	Start	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:57 PM	End	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

Page 1 / 3

User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

QQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:57:03 PM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	None
November 28, 2023 12:57:08 PM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	Rur Count : 1
November 28, 2023 12:57:09 PM	End	Qualification	Session	OQ
November 28, 2023 12:57:09 PM	Start	Reporting	Session	None
November 28, 2023 1:04:49 PM	Audit	AccRestarted	Session	None
November 28, 2023 1:04:50 PM	Audit	SessionReloaded	Session	None
November 28, 2023 1:04:58 PM	Start	Qualification	Session	OQ
November 28, 2023 1:08:10 PM	Audit	Reporting	Session	Report Generated : Certificate
November 28, 2023 1:09:28 PM	Audit	Reporting	Session	Report Generated : Report

Page 2 / 3

User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

QQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 1:10:31 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: QQHW ICP 5100 ENVI Research_20231128_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

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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 ₃	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	≤ 16.5 pg/0.0044 A-s	15.4	Passed
Zeeman Ratio	0.52 ± 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	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1456}{0.1456 + 0.1293}$ $= 0.52$

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.	
This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)



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



Cert.No.: 24CH10
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : HM DIGITAL
Model : COM-100
Serial No. : PONPE5863548
ID No. : NO.4
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 08 January 2024
Reference : 2401-0077DN-6
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In -house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)
Calibrated by : 
Approved by : 
Issue Date : 10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062387



Cert.No.: 24CH10

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	231435	10 Apr 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
*100 $\mu\text{S/cm}$	Thermo Scientific	193/01	11 May 2024
1413.0 $\mu\text{S/cm}$	CPA Chem	931955	30 Sep 2024

- 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.: PONPE5863548

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
*100 $\mu\text{S/cm}$	101 $\mu\text{S/cm}$	99.9 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1445 $\mu\text{S/cm}$	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 %.

-oOo-

a 1196383

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: 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/W00220

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.

As Found	Temperature		Humidity	
	Start: 27.5 °C	End: 26.9 °C	Start: 44.1 %	End: 44.5 %

As Found Calibration Date: 15-Jan-2024 Calibrator:
As Left Calibration Date: N/A
Issue Date: 15-Jan-2024

Approved Signatory

Technical Manager / Head of Calibration Center

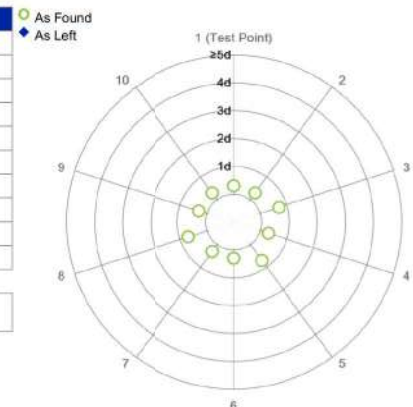
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00005 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.

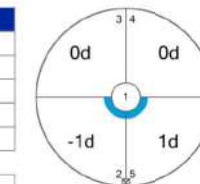
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	100.0000 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0001 g	N/A
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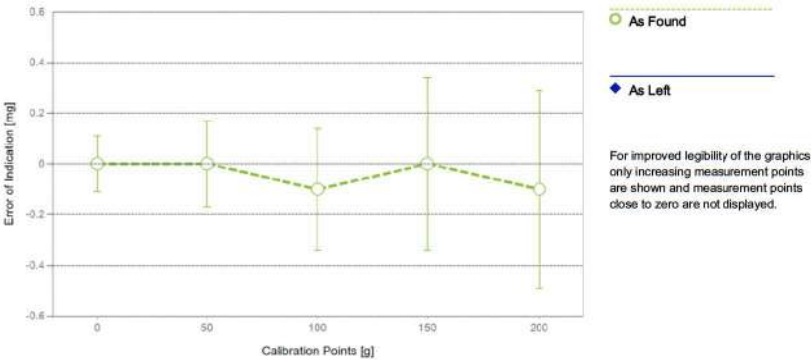


As Found

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	0.11 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	5.0000 g	0.0000 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	100.0001 g	100.0000 g	-0.0001 g	0.24 mg	2
10	150.0001 g	150.0001 g	0.0000 g	0.34 mg	2
11	200.0000 g	199.9999 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

- FACT adjustment functionality activated
- Equipment condition: Good
- Next calibration according to customer's procedure
- Calibration data not decided 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: $1.5 \cdot 10^{-6} / K$

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

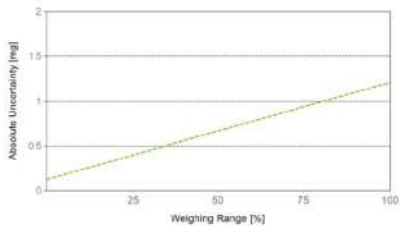
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00494 \text{ mg/g} \cdot R$	N/A

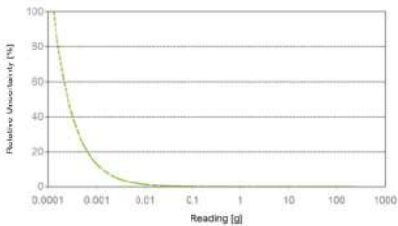
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.14 mg	0.0064%	N/A	N/A
22.0000 g	0.24 mg	0.0011%	N/A	N/A
220.0000 g	1.2 mg	0.00055%	N/A	N/A



As Found



As Left

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

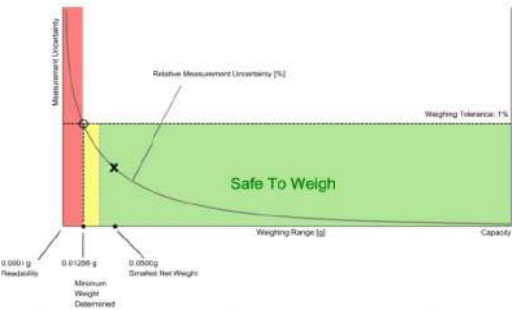
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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	0.00005 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 $0.41 \cdot d$ 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.

Attachment to Calibration Certificate:

TH3067-065-011524-ACC-TH

GWP® Certificate

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
100.0001 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	0.0000 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
100.0001 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	0.0000 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.

METTLER TOLEDO Service

Calibration Certificate ID

TH3067-065-011524-ACC-TH

METTLER TOLEDO

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

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

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

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS204TS/00	Asset Number:	ERTC-L-IN-114
Serial No.:	B547728937	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:	CPW002/20

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: 26.9 °C	End: 27.0 °C	Start: 44.5 %	End: 44.5 %

As Found Calibration Date:	15-Jan-2024	Calibrator:	
As Left Calibration Date:	N/A		
Issue Date:	15-Jan-2024	Approved Signator	

Technical Manager / Head of Calibration Center

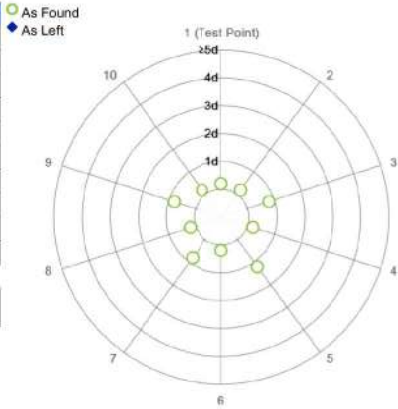
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0001 g	N/A
8	100.0000 g	N/A
9	100.0001 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00006 g	N/A
--------------------	-----------	-----



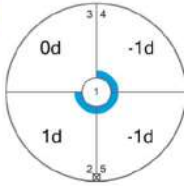
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	99.9999 g	N/A

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



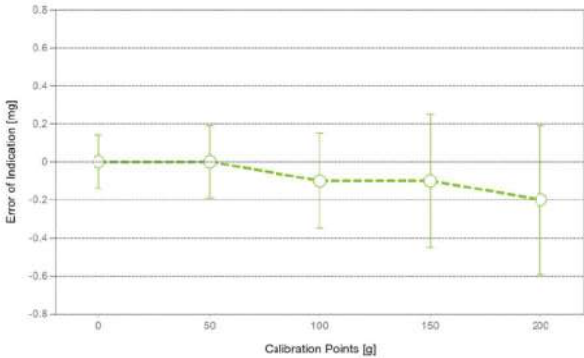
As Found

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	0.14 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	0.5001 g	0.0001 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0001 g	0.0001 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	100.0000 g	-0.0001 g	0.25 mg	2
10	150.0001 g	150.0000 g	-0.0001 g	0.35 mg	2
11	200.0000 g	199.9998 g	-0.0002 g	0.39 mg	2



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. 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 Hygromeier

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

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: $\pm 0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $\pm K$

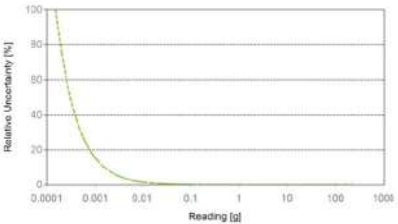
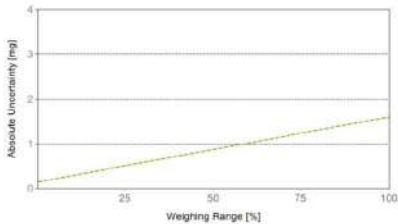
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00663 \text{ mg/g} \cdot R$	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	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.16 mg	0.0075%	N/A	N/A
22.0000 g	0.30 mg	0.0013%	N/A	N/A
220.0000 g	1.6 mg	0.00073%	N/A	N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

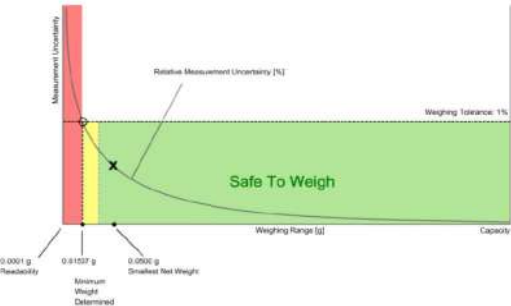
The weighing device meets the given
process requirements.

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%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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:

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	0.00006 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

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.

Error of Indication

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
100.0001 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	-0.0002 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	-0.0002 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.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10230
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM92
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Binder
Model : FED 115 E2
Serial No. : 11-22823
ID No. : ERTC-L-In.-076
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 8, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi,
Bangkok 10210
Location : Laboratory (ERTC)
Received Order : 03 January 2024
Calibration Date : 03 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0062471



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-00010N-2

Cert. No.: 24TM92
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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

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

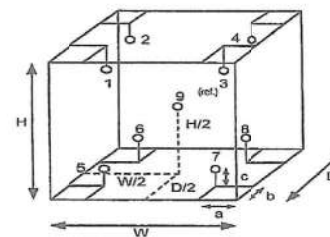
Remark : TPA : Technology Promoton Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	33
REL.Humid. (%)	53	41
AC Supply (Volt)	226	225



Probe Installation Details :	Dimension of Chamber :
a = 5.0 cm	D = 0.40 m
b = 5.0 cm	W = 0.60 m
c = 5.0 cm	H = 0.48 m
	Capacity = 0.12 m ³

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09

a 1197861



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-0001ON-2
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM92
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104	104	104	0.10	1.8	2.1	2
180	180	180	0.27	4.4	5.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104	104.379	103.463	103.443	103.893	104.213	103.223	105.222	104.297	103.494	0.77
180	179.045	177.562	181.299	179.300	180.773	177.931	182.136	178.131	178.019	1.6

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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a 1197880



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-1717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM93
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 : 03 January 2024
Calibration Date : 03 January 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062472



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-00010N-3

Cert. No.: 24TM93
 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

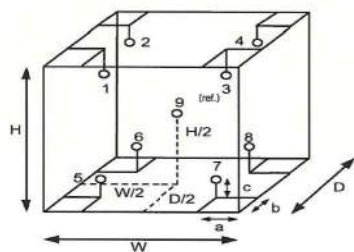
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function 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 ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	30
REL.Humid. (%)	53	53
AC Supply (Volt)	226	225

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-00010N-3
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 24TM93
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.075	1.2	2.4	2
180.0	180.0	180.0	0.41	3.4	3.9	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	105.068	102.783	103.239	103.695	104.855	103.867	102.799	103.295	103.959	0.42
180.0	179.954	177.587	177.414	178.118	181.087	179.869	179.584	178.045	180.704	1.3

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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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.

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**, 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
 - **Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual**
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

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 tickmark "✓".
- 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	GCMS
Instrument System Site and Location	Environmental Research & Technology Co., Ltd.

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440B	CN16993176
2. G4513A	CN16600132
3. G4514A	CN170 CN1830130
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 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.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	OK
Back detector output		N/A
AUX detector output		N/A
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	N/A
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	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
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 6001915875 Date service completed 24 Nov 2023
Agilent signature [redacted] Customer signature _____
Total number of pages in this document _____

Agilent Preventive Maintenance Services

Agilent GCMS Preventive Maintenance

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Introduction

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.

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.

Important Customer Web Links

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

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.

- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in order by sections: Review, System Checks, Pump maintenance, Cleaning System and Filters, then System Post Check.
 - The tasks in each section may be completed in the most logical order relevant to the system. Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section
- Complete Signature Page and attach Signature Page to Service Order.

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.**

Definition of the Task/Recommended items within the document

Task		Recommended			
Yes	No	Interim	Major	As Needed	
✓					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.

Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☒ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

System Information

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

Instrument System Name and ID	GCMS
Instrument System Site and Location	Environment Research & Technology Co., Ltd.

List System Component Product Numbers	List the Serial Numbers of each Component
1. G7077B	U170314011
2.	
3.	
4.	
5.	
6.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check firmware version(s). Updating to the most current versions is strongly recommended. Verify with the customer before updating.

Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Vent the instrument
<input checked="" type="checkbox"/> <input type="checkbox"/> <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 type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Visually inspect calibrant levels – PFTBA PFDTD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Look for any obvious external damage or problems.
<input checked="" type="checkbox"/> <input type="checkbox"/> <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 type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		For HydroInert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/>

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of oil leakage. Check pump gasket for leakage.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>		GC/MS SQ with diffusion pump; drain and replace diffusion pump oil.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Drain and replace mechanical pump oil.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace Oil Mist Filter if applicable.

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss with customer the need for more frequent oil changes if the oil is dirty
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Don't use mist filters with Chemical Ionization.
<input type="checkbox"/> <input checked="" type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Clear air flow paths of dust.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		If vacuum is poor, then replace the diaphragm pump.
<input type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace the lips seal on the IDP pump.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of poor vacuum – Rough vac pressure, turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace the Exhaust Filter if required.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss with customer the need for more frequent changes, if needed.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Inform customer that pump gas ballast should be installed all the time.
<input type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

Cleaning System and Filters			
Yes/No	Interim/Major	Description	
Fans			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Remove dust from fans and vent covers.	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Verify fans are functional and that there is enough space around the instrument for proper cooling.	
Source cleaning (all sources except HydroInert)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Open analyzer and remove the source.	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Disassemble, Clean, Re-assemble source. (7200, also, remove and clean entrance lens)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Re-install source and close analyzer.	
HydroInert Source			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and extractor), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier.	
Filters			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSH-2 Helium gas filter (collision cell gas) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSN-2 Nitrogen gas filter (collision cell gas) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSHY-2 Hydrogen gas filter (HydroInert and JetClean) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		CP17973 – Gas Clean GS/MS Filter (for He, N2 or H2 carrier) – if required	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		5190-9071 – Methane Gas Filter (CI systems) – if applicable	

Guidance: Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

System post-check			
Yes/No	Interim/Major	Description	
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system vacuum reading(s) via the gauge controller.			
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Leak Check			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system in manual tune			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Compare against previous tune file report(s)			
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check manually that you have calibration peaks.			
<input checked="" type="checkbox"/>	<input 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 Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete Signature Page and attach Signature Page to Service Order.

Test Results

Test Description	Expected Test Result	Actual Test Result
------------------	----------------------	--------------------

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6006365875

Date of Service Completion:

24 Nov 2023

Service Engineer Name:

Customer Name:

Total number of pages in this document:

Parts for consumption during PM

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

Part Description	Part Number	Interim	Major	As Needed
Agilent AVF Platinum, 1 quart	5191-5651	✓	✓	✓
Helium gas filter* (collision cell gas) – if required	RMSH-2		✓	✓
Nitrogen gas filter* (collision cell gas) – if required	RMSN-2		✓	✓
Hydrogen gas filter* ^ (HydroInert and JetClean) – if required	RMSHY-2		✓	✓
Chemical Ionization Gas Purifier (CI systems) (Methane) – if required	5190-9071		✓	✓
Gas Clean GS/MS Filter (for He, N2 or H2) – if required	CP17973		✓	✓
# Gas Clean Filter Kit GC/MS 1/8 in (complete replacement kit - bench mounted) – if required	CP17974			✓
# Gas Clean Carrier Gas Kit for 7890 for He, N2 or H2; Bracket, Mount and Filter – if required	CP17988			✓
# Gas Clean Carrier Gas Kit for 8890 & 8860 for He, N2 or H2; Bracket, Mount and Filter – if required	CP179880			✓

Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

* Big Universal Trap (BUT), 1/8" fittings

^ HydroInert and JetClean Systems

Alternate Gas Clean kit part numbers. A Gas Clean filter is included in the kits. They are only necessary if replacing carrier gas Big Universal Traps with indicating traps

MS Maintenance Supplies for 5973/5975/5977 Series

Part Description	Part Number	Interim	Major	As Needed
Diffusion pump fluid (Diffusion Pump Models)	6040-0809		✓	✓
Qty 2				
Exhaust oil mist trap (threaded) Edwards/Pfeiffer	G1099-80039	✓	✓	✓
DS42 Oil Mist Eliminator 3/4G & 3/8	SR03706556	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Scroll Pump Models – Includes tip seal, 60mm filter element, tools, mask and cleaning supplies)	G7077-67018	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (no tools – CSD P/N)	5190-9561	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (no tools – VPD P/N)	IDP3TS	✓	✓	✓
Filter element for IDP-3 (diameter: 60mm)	REPLSLRFILTER2	✓	✓	✓

MS Maintenance Supplies for 7000/7010 Series

Part Description	Part Number	Interim	Major	As Needed
Oil Mist Filter R/V5	36600-80043	✓	✓	✓
IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models - Includes tip seal, 102mm filter element, tools, mask and cleaning supplies)	37004-67023	✓	✓	✓
IDP-10 Tip Seal Replacement Kit (no tools etc. - VPD P/N)	X3807-67000	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 102mm)	REPLSLRFILTER	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 79mm)	REPLSLRFILTER1	✓	✓	✓

MS Maintenance Supplies for 7200/7250 Series

Part Description	Part Number	Interim	Major	As Needed
RIS Probe Maintenance Kit (7200 Series only)	G7005-60170		✓	✓
DS202 Oil Mist Eliminator	SR03706800	✓	✓	✓
DS202 3/8" Magnetic Plug and Gasket	SR03701824	✓	✓	✓
IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Scroll Pump Models - Includes tip seal, 102mm filter element, tools, mask and cleaning supplies)	5190-9613	✓	✓	✓
IDP-15 Tip Seal Replacement Kit (no tools etc. - VPD P/N)	X3815-67000	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 102mm)	REPLSLRFILTER	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 79mm)	REPLSLRFILTER1	✓	✓	✓

HydroInert Source Supplies

To determine if replacement of HydroInert parts is required, please review tune history and sample signal intensity performance. If performance is decreasing, the below parts may be used to restore performance as part of the PM.

One way to determine if the source performance on SQ is being affected is to review the gain factor history in autotune reports or tune history csv file. If the gain factor is increasing the source performance may be degrading.

Since TQ tunes to a fixed gain factor, review PFTBA abundance. If PFTBA abundance is decreasing over time, the source performance may be degrading.

Real sample/standard area counts are another way to determine the performance, there could also be other factors that affect compounds abundance such as inlet and column status.

Part Description	Part Number	Interim	Major	As Needed
Repeller Insulator (qty 2)	G1099-20133			✓
Lens insulator for Extractor (ring insulator)	G3870-20445			✓
HydroInert Extractor lens (9mm)	G7078-20909			✓
HydroInert Repeller	G7078-20902			✓

Common Parts Reference

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

Filaments and Calibrant Supplies 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
El High Temperature Filaments	G7005-60061 Qty 2	597X	7000x	N/A
HES E Filaments	G7002-60001	5977B/C	7010x	N/A
LE-El Filaments (7250 QTOF)	G3850-60021	N/A	N/A	7250
CI High Temperature Filament - SQ TQ, 7200 QTOF	G7005-60072	N/A	N/A	7200A/B
Axial CI Filament, W/Re Straight (7250 QTOF)	G7250-60095	N/A	N/A	7250
PFTBA GCMS Tuning Standard calibrant	05971-60571	597X	70X0	72X0
PFDTD calibrant, 1 mL	8500-8510	597X	70X0	72X0
PFET, IRM calibrant for GC QTOF 0.5 mL (7200)	5190-0531	N/A	N/A	7200A/B

Transfer line seals and springs 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
CI Interface tip seal (ceramic tip and spring combo) (non-captured CI tip seal interface) (5973, 5975, 7000B)	G1999-60412	5973, 5975	7000B	N/A
CI Interface tip seal (ceramic tip and spring low/non-magnetic spring combo) (non-captured CI tip seal interface) (7010A)	G7002-60412	N/A	7010A	N/A
CI Interface tip seal spring (spring only)	G1999-20023	597X	70X0	72X0
CI Interface tip seal (tip only) (captured style)	G3870-20542	5977x	70X0	72X0
Transfer-Line Tip Base, Threaded (captured style)	G3870-20548	5977x	70X0	72X0
Transfer-Line Tip Cap, Threaded (captured style)	G3870-20547	5977x	70X0	72X0
RIS Xfer Tip (7200)	G7005-20542	N/A	N/A	7200A/B
RIS Xfer Tip Spring (7200)	G7005-20024	N/A	N/A	7200A/B

MS Maintenance Supplies for Intuvo 9000 MS Series

Part Description	Part Number	SQ	TQ	QTOF
Swaged MS Tail - Packaged	G4590-60009	5977x	7000	N/A
Swaged MS Tail (HES) - Packaged	G4590-60109	5977x	7010x	N/A

Ion source insulators for 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Repeller Insulator (SQ, TQ)	G1C99-20133 Qty 2	597X	7000x	N/A
Lens insulator for extractor lens (ceramic ring insulator) (Extractor source)	G3870-20445	5977x	7000C/D/E	N/A
Lens insulator for Extractor lens (Vespel ring insulator) (7000B extractor ion source)	G7000-20445	N/A	7000B only	N/A
Lens stack insulator for SS, Inert, Extractor sources (captures ion focus and entrance lens) (Vespel)	G3170-20530	597X	7000x	N/A
Lens insulator for Extractor lens for HES/LEEI (ceramic ring insulator)	G7002-20064	5977B/C	7010x	7250
Lens stack insulator/holder for HES/LEEI (Vespel)	G7002-20074	5977B/C	7010x	7250
CI Repeller Lens Insulator (SQ, TQ)	G1999-20433	597X	70X0x	N/A
CI Lens stack insulator (SQ, TQ) (Vespel)	G3170-20540	597X	70X0x	N/A
Repeller insulator (7200 RIS) (Ceramic)	G7005-20447	N/A	N/A	7200A/B
Extractor Lens Insulator (7200 RIS) (Vespel)	G7005-20133	N/A	N/A	7200A/B
Ion Focus Insulator (7200 RIS) (Vespel)	G7005-20442	N/A	N/A	7200A/B
CI Repeller Insulator/bushing (7200 RIS) (Ceramic)	G7005-20030	N/A	N/A	7200A/B

HydroInert coated lenses for 5977/7000 Series

Part Description	Part Number	SQ	TQ	QTOF
HydroInert Repeler	G7078-20902	5977x	7000C/D/E	N/A
Ext Source Body - HydroInert	G7078-20903	5977x	7000C/D/E	N/A
HydroInert Extractor lens (9mm)	G7078-20909	5977x	7000C/D/E	N/A
Ion Focus Lens - HydroInert	G7078-20905	5977x	7000C/D/E	N/A
Entrance Lens - HydroInert	G7078-20904	5977x	7000C/D/E	N/A

Heater/Sensor assemblies for 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Stainless Steel Heater/Sensor assembly (SST EI 350)	G3870-67180	597X	N/A	N/A
Inert Heater/Sensor assembly (Inert EI 350)	G3870-67179	597X	7000A/B	N/A
Extractor Heater/Sensor assembly (Xtr EI 350)	G3870-67177	5977x	7000C/D/E	N/A
H2 EI Heater/Sensor Assembly - HydroInert (H2 EI 350)	G7078-67910	5977x	7000C/D/E	N/A
CI 350 Heater/Sensor Assembly (CI 350)	G3870-67415	597X	70X0x	N/A
Ring heater/sensor assembly (HES, RIS and LEEI) (ceramic ring)	G7002-60058	5977B/C	7010x	72X0

Rough pump hoses 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Foreline Hose - imbedded spring	G7077-60119	597X	70X0x	72X0

Common MS Maintenance Supplies

Part Description	Part Number	SQ	TQ	QTOF
Abrasive paper, 30 µm	5061-5896	597X	70X0	72X0
Alumina powder	393706201	597X	70X0	72X0
Cloths, dean (pkg of 15)	05980-60051	597X	70X0	72X0
Cloths, deaning (pkg of 300)	9310-4828	597X	70X0	72X0
Cotton swabs (pkg of 100)	5080-5400	597X	70X0	72X0
Gloves, dean, large	8650-0030	597X	70X0	72X0
Gloves, dean, small	8650-0029	597X	70X0	72X0

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



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.
 - o 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.

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



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**



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.

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



System Information

Guidance

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

Instrument system name and ID	ATOMX Purge & Trap
Instrument system site and location	Environment Research & Technology Co., Ltd.
List system component product numbers	List the serial numbers of each component
1. TMR-ATOMX	1. VS17013007
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.

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
- ☐ Need technical support, FAQs? - www.agilent.com/chem/techsupp
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6006965875 Date service completed 24 Nov 2023

Agilent signature  Customer signature _____

Number of pages in this document _____

Issued: 30-09-2019, Revision: 02

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Agilent Technologies

Select pages for required products or Page 5 of 5



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*, 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>.

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	US2125A011
2. 64514 A	CN2109505
3. 64515 A	CN2107024
4.	US2125A011
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	282.6
Back detector output	N/A	249.2
AUX 1 detector output	N/A	282.6
AUX 2 detector output CFPD	N/A	249.2 126
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 2023
 Agilent signature  Customer signature _____
 Total number of pages in this document 9 pages

ระยะผลิตปิโตรเลียม
(การผลิตปิโตรเลียม)

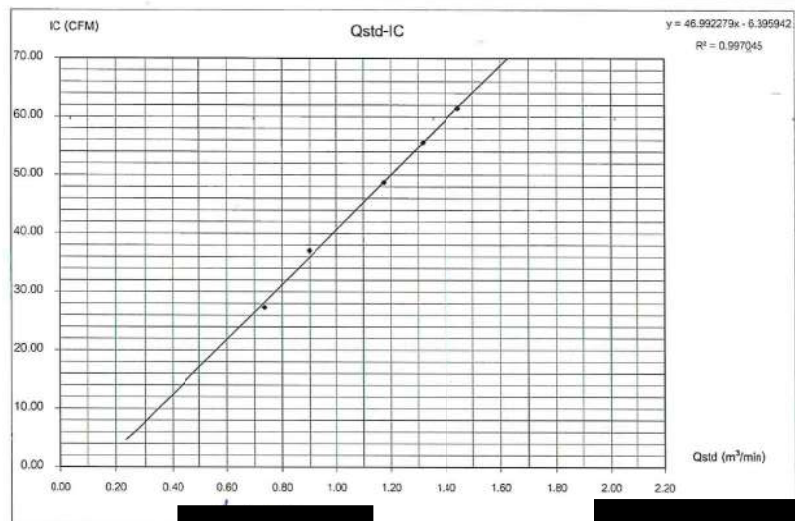
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00482	Date	April 17, 2024
Sampler Location	Frangium/บ้านจั่น	Start Time	3:47 PM
Sampler Number	TSP No. A21	Transfer Standard Type	Orifice
Instrument Model	HIVOL-8BCBE	Calibrator Model	TE-5025A
Motor Serial Number	2016	Calibrator Serial Number	2914
Recorder Serial Number	2398	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH ₂ O)	$\Delta H_2O(Pa/P_{atm})(T_{atm}/T)^{1.2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{atm}/T)^{1.2}]^{10}$	Temperature	Barometric	Start	Stop
	Positive Negative ΔH_2O		(m ³ /min)	(l/min)	(m ³ /min)	(°K = °C+273)	Pressure	Motor	Motor
5	1.2 1.2 2.4	1.51005	0.73539	28.0	27.29	312.8	756.0		
7	1.8 1.8 3.6	1.84942	0.89865	38.0	37.04	312.8	756.0		
10	3.1 3.1 6.2	2.42706	1.17953	50.0	48.74	312.8	756.0		
13	3.9 3.9 7.8	2.72228	1.31855	57.0	55.50	312.8	756.0		
18	4.7 4.7 9.4	2.98847	1.44561	63.0	61.41	312.8	756.0		
Linear Regression Y ON X: Y = mX + b						Average	312.8	756.0	
1	Slope (m)	2.07871	Linear Equation			r ²	0.997045	Pass/mHg	760.0
2	Intercept (b)	-0.01861	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9985214	T _{atm}	298.0
3	Correlation Coefficient (r)	0.99984	Final Set Flow Rate = (I)		0	(Pa/P _{std})(T _{std} /T)	0.950101215		
Result						C = (Pa/P _{std})(T _{std} /T) ^{0.5}			
						0.87471355			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

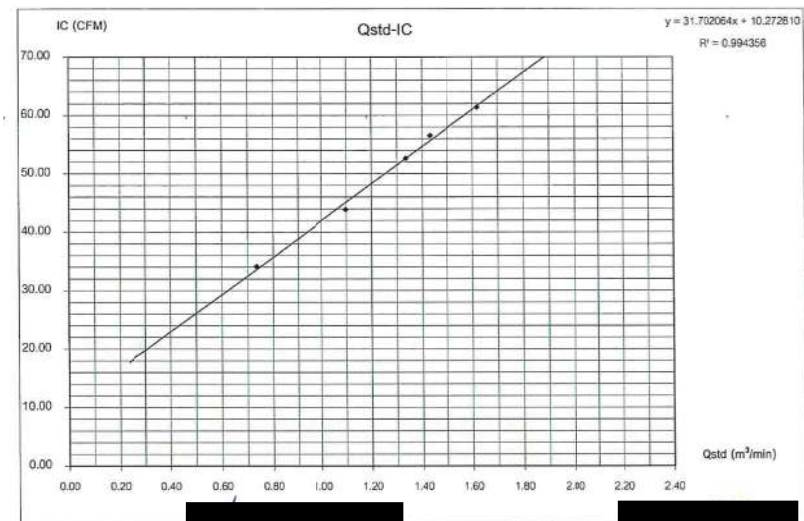
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00482	Date	April 17, 2024
Sampler Location	Frangium/บ้านจั่น	Start Time	3:57 PM
Sampler Number	TSP No. 28	Transfer Standard Type	Orifice
Instrument Model	HIVOL-8BCBE	Calibrator Model	TE-5025A
Motor Serial Number	2206	Calibrator Serial Number	2914
Recorder Serial Number	2613	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH ₂ O)	$\Delta H_2O(Pa/P_{atm})(T_{atm}/T)^{1.2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{atm}/T)^{1.2}]^{10}$	Temperature	Barometric	Start	Stop
	Positive Negative ΔH_2O		(m ³ /min)	(l/min)	(m ³ /min)	(°K = °C+273)	Pressure	Motor	Motor
5	1.2 1.2 2.4	1.51005	0.73539	35.0	34.12	312.0	756.0		
7	2.7 2.7 5.4	2.26507	1.09600	45.0	43.85	312.0	756.0		
10	4.0 4.0 8.0	2.75098	1.33524	54.0	52.64	312.0	756.0		
13	4.6 4.6 9.2	2.95551	1.43123	59.0	56.53	312.0	756.0		
18	5.9 5.9 11.8	3.34831	1.61972	63.0	61.41	312.0	756.0		
Linear Regression Y ON X: Y = mX + b						Average	312.0	756.0	
1	Slope (m)	2.07871	Linear Equation			r ²	0.994355	Pass/mHg	760.0
2	Intercept (b)	-0.01861	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.997171	T _{atm}	298.0
3	Correlation Coefficient (r)	0.99984	Final Set Flow Rate = (I)		0	(Pa/P _{std})(T _{std} /T)	0.950101215		
Result						C = (Pa/P _{std})(T _{std} /T) ^{0.5}			
						0.87471355			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

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

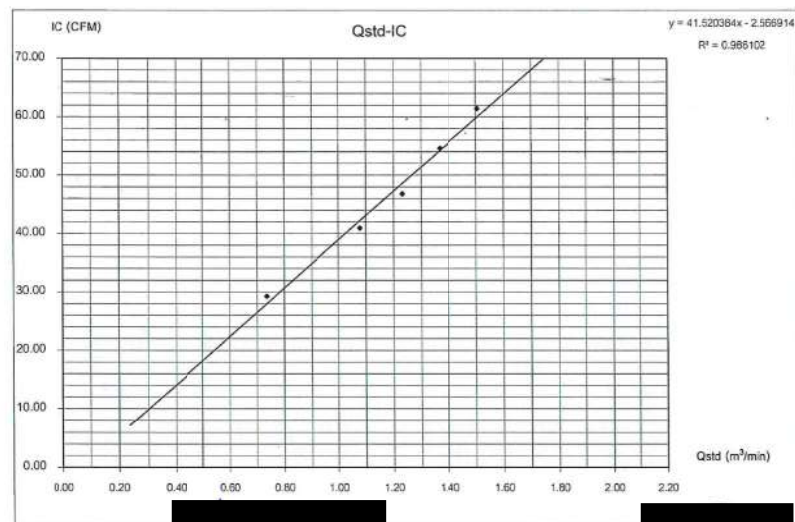
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00485	Date	April 18, 2024
Sampler Location	บ้านสวนโมกข์(1)	Start Time	8:30 AM
Sampler Number	TSP No.A25	Transfer Standard Type	Orifice
Instrument Model	HVOL-8BC9E	Calibrator Model	TE-5025A
Motor Serial Number	No.A26	Calibrator Serial Number	2914
Recorder Serial Number	102950701	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)	$\Delta H_0(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}$	$Q_{std} = (1 \text{ min})[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}]$	(°K = °C+273)	(mmHg)		
	Positive Negative ΔH_0		(m ³ /min)	(l/min)					
5	1.2 1.2	2.4	1.51005	0.73539	30.0	29.24	312.8	756.0	
7	2.6 2.6	5.2	2.22773	1.07924	42.0	40.94	312.8	756.0	
10	3.4 3.4	6.8	2.54179	1.23172	48.0	46.79	312.8	756.0	
13	4.2 4.2	8.4	2.82504	1.36798	56.0	54.58	312.8	756.0	
18	5.6 5.6	10.2	3.11304	1.50654	63.0	61.41	312.8	756.0	
Linear Regression Y ON X: Y=mx + b						Average	312.8	756.0	
1	Slope (m)	2.07871	Linear Equation			r ²	0.995102	Pstd(mmHg)	760.0
2	Intercept (b)	-0.01861	Set Point Flow Rate (X) (m ³ /min)			r	0.9933267	T _{ref}	298.0
3	Correlation Coefficient (r)	0.99964	Final Set Flow Rate = (I)			0	(Pa/Pstd)(Tstd/Ta)	0.95010215	
Result						C=(Pa/Pstd)(Tstd/Ta)*0.5			
						0.074731355			

COMMENT

Andersen Instruments Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-038, Rev. 02, June 3, 2019

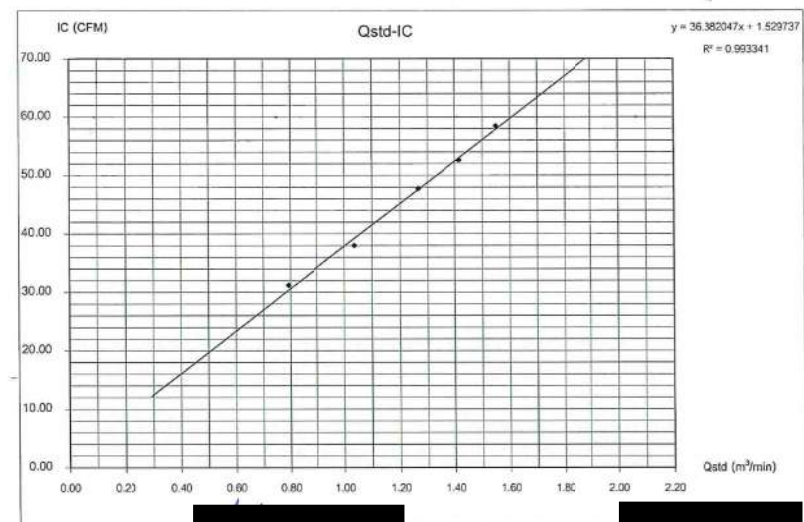
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00485	Date	April 18, 2024
Sampler Location	บ้านสวนโมกข์(1)	Start Time	6:12 PM
Sampler Number	PM-10 No.20	Transfer Standard Type	Orifice
Instrument Model	HVOL-8M/BBE	Calibrator Model	TE-5025A
Motor Serial Number	20	Calibrator Serial Number	2914
Recorder Serial Number	2614	Calibrated By	

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)	$\Delta H_0(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}$	$Q_{std} = (1 \text{ min})[(A-b)]$	Sample Flow Rate Indicator	$IC = [(Pa/P_{atm})(T_{ref}/T_{air})^{1.2}]$	(°K = °C+273)	(mmHg)		
	Positive Negative ΔH_0		(m ³ /min)	(l/min)					
5	1.4 1.4	2.8	1.63104	0.79359	32.0	31.19	312.0	756.0	
7	2.4 2.4	4.8	2.13553	1.03829	39.0	38.01	312.0	756.0	
10	3.6 3.6	7.2	2.61548	1.26717	49.0	47.76	312.0	756.0	
13	4.5 4.5	9.0	2.92419	1.41569	54.0	52.64	312.0	756.0	
16	5.4 5.4	10.8	3.20329	1.54995	60.0	58.48	312.0	756.0	
Linear Regression Y ON X: Y=mx + b						Average	312.0	756.0	
1	Slope (m)	2.07871	Linear Equation			r ²	0.993341	Pstd(mmHg)	760.0
2	Intercept (b)	-0.01851	Set Point Flow Rate (X) (m ³ /min)			r	0.9959649	T _{ref}	298.0
3	Correlation Coefficient (r)	0.99994	Final Set Flow Rate = (I)			0	(Pa/Pstd)(Tstd/Ta)	0.95010215	
Result						C=(Pa/Pstd)(Tstd/Ta)*0.5			
						0.074731355			

COMMENT

Andersen Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

F-AB-038, Rev. 02, June 3, 2019

CERTIFICATE OF CALIBRATION

Certificate No. : COF-006-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-S025A
SERIAL NUMBER : 2914
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Environment Research & Technology Co., Ltd.
25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210

RECEIVED DATE : 27 Jul 2023
MEASUREMENT DATE : 31 Jul 2023
ISSUE DATE : 31 Jul 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 24.3 °C and 50.5 %RH.

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

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

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 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'

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 ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.699	755.476	24.24	23.40	53.510	1.786	1.334	0.649
2	1.000	755.470	24.17	23.68	58.170	3.598	1.894	0.921
3	1.111	755.481	24.19	23.60	40.793	4.682	2.160	1.050
4	1.167	755.465	23.87	23.48	31.004	5.323	2.305	1.118
5	1.411	755.522	24.29	23.78	30.145	7.846	2.796	1.352

Slope (m): 2.07871
Intercept (b): -0.01861
Correlation coefficient (r): 0.99984
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.699	755.476	24.24	23.40	53.510	1.786	0.839	0.651
2	1.000	755.470	24.17	23.68	58.170	3.598	1.190	0.924
3	1.111	755.481	24.19	23.60	40.793	4.682	1.357	1.053
4	1.167	755.465	23.87	23.48	31.004	5.323	1.447	1.121
5	1.411	755.522	24.29	23.78	30.145	7.846	1.758	1.357

Slope (m): 1.30200
Intercept (b): -0.01171
Correlation coefficient (r): 0.99984
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn 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: 25114 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: AE204-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: CPW00220

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
As Left Calibration Date: 15-Jan-2024
Issue Date: 15-Jan-2024

Approved Signature

Technical Manager / Head of Calibration Center

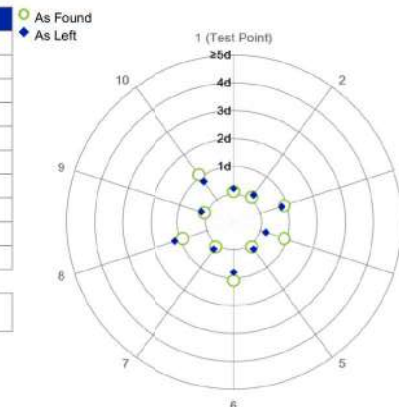
Measurement Results

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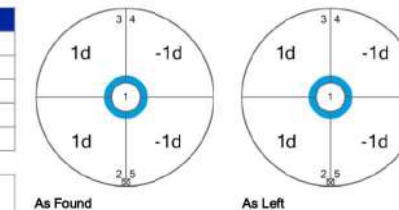
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9993 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
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

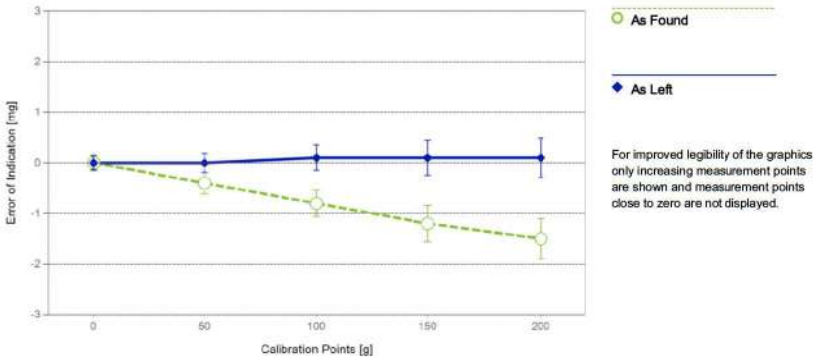
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 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 Hygromeier

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: $3.0 \cdot 10^{-6} / K$

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

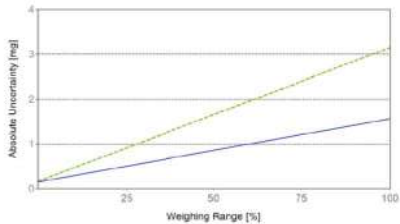
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.17 \text{ mg} + 0.0136 \text{ mg/g} \cdot R$	$U_1 = 0.15 \text{ mg} + 0.00644 \text{ mg/g} \cdot R$

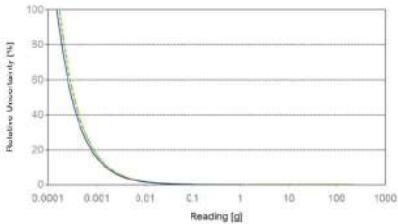
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.075%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.15 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%



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

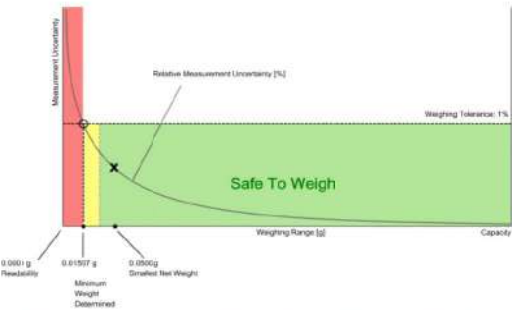
Process Requirements

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%	0.17097 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	0.05783 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	0.30304 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	0.30304 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

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	0.00006 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° 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

		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	-0.0004 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

		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
100.0001 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.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

534/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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



CALIBRATION 008

Cert.No.: 23MM1

Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : AND

Model : BM-5

Serial No. : T1004302

ID No. : ERTC-L-In.-176

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


Location : ห้องปฏิบัติการวิเคราะห์ (411)

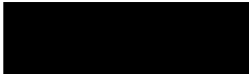
Received order : 4 January 2023

Calibration Date : 4 January 2023

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : 

Approved by :  Approved Signatory

Issue Date : 16 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.



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2301-0002ON-10
Procedure used :-

Cert.No.: 23MM1
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	-	70RC138	MM-0009-21	03 Feb 2023

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 5.2 g Resolution 0.000001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(\pm mg)	(k)
2.5	2.500008	-0.000008	0.026	2.00
5	5.000007	-0.000007	0.027	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight	Standard Deviation of Reading (g)
(g)	
2.5	0.000007
5	0.000007

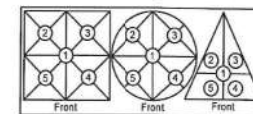


Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2301-0002CN-10
Result of calibration

Cert.No.: 23MM1
Page: 3 of 3

2. Effect of off center loading

A mass of 2 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between off-center and central loading (g)
0.000003

Position 1	Position 2	Position 3	Position 4	Position 5
(g)	(g)	(g)	(g)	(g)
+0.000002	+0.000005	+0.000004	+0.000002	+0.000003

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(\pm mg)	(k)
Unload	0.000000	0.000000	0.0060	2.11
0.014	0.014002	-0.000002	0.0060	2.00
0.015	0.015001	-0.000001	0.0060	2.00
0.5	0.499995	+0.000005	0.013	2.00
1	1.000001	-0.000001	0.016	2.00
1.5	1.500001	-0.000001	0.020	2.00
2	1.999996	+0.000004	0.020	2.00
2.5	2.500001	-0.000001	0.026	2.00
3	3.000004	-0.000004	0.026	2.00
4	3.999997	+0.000003	0.027	2.00
5	5.000002	-0.000002	0.027	2.00

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

-o0o-



Request No.: 22-66/0326

MTC No.: PSL-T 0491/66

Certificate of Calibration

Equipment: Digital Thermometer with Sensor

Manufacturer: TRACEBLE

Model: 4421

Serial No.: 160143242

Customer: Environment Research & Technology Co., Ltd.

Address: 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Date of Request: 13 February 2023

Date of Calibration: 10 March 2023

Place of Calibration: Photometry and Temperature Standards Laboratory,

Soi 1, Bangpoo Industrial Estate, Sukhumvit Road, Samut Prakan 10260

Range of Calibration: Calibrated from 25.0 °C to 40.0 °C

Conditions of Calibration: 1. Ambient temperature: $(23 \pm 3) ^\circ\text{C}$

2. Relative humidity: $(60 \pm 20) \%$

Reference Standard: Standards Platinum Resistance Thermometer, Manufacturer: KDACT, Model: WZPB-1, S/N.: 6729,

Which was calibrated on 15 July 2022, Calibration Certificate No.: 22-65/0706, PSL-T 0864/65

Traceability: This Certificate is traceable to SI Unit through Photometry and Temperature Standards Laboratory,

Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technological

Research (TISTR), NSC-ONSC Accreditation No.: Calibration 0015

Calibration Procedure: The measurement was done in accordance with WI.CP.05 (Comparison Technique)

The temperature scale in use of this laboratory is the International Temperature Scale of 1990 (ITS-90).

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing

a level of confidence of approximately 95 %

Page 1 of 2
P.1

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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E-mail : rumpaigtistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



Request No.: 22-66/0326

MTC No.: PSL-T 0491/66

Calibration Results:

Standard Temperature (°C)	UUC* Reading (°C)	Correction (°C)	Uncertainty ($\pm ^\circ\text{C}$)
25.0024	25.2	-0.2	0.10
30.0033	30.9	-0.9	0.10
35.0024	35.2	-0.2	0.10
40.0031	40.3	-0.3	0.10

UUC* = Unit under Calibration

...End of Certificate...

Calibrated by:

Approved by:

Director

Photometry and Temperature Standards Laboratory

Ref.: 2012266021300627001

Issued Date: 13 March 2023

Page 2 of 2

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FM.BLMTC.002 Rev.4

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Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
 MANUFACTURER : ROBERT E. WHITE INSTRUMENTS, INC.
 MODEL / TYPE : N/A
 SERIAL NO. : 52M004201
 CLID. NO. : 211600506
 JOB CONTROL NO. : 211118112784

CUSTOMER : ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.
 25/114 MOO 6 SOI CHINAKET 1, NGAMWONGWAN ROAD,
 TOONGSONGHONG, LAKSI, BANGKOK 10210

DATE OF RECEIVED : 18 November 2021

DATE OF ISSUED : 22 November 2021

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

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

22 November 2021



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

Certificate No. Q21112784

F3-011-04/01-12

page 1 of 3



#clccalibrator



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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
 MANUFACTURER : ROBERT E. WHITE INSTRUMENTS, INC.
 MODEL / TYPE : N/A
 SERIAL NO. : 52M004201
 DATE OF CALIBRATION : 19 November 2021

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-07 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Reference Pressure Monitor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Reference Pressure Monitor, Fluke Model R2M3 S/N. 829.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0172-21, Due Date 15 October 2022.

UNCERTAINTY :

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

Certificate No. Q21112784

F3-011-04/01-12

page 2 of 3



#clccalibrator



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Environment Research & Technology Company Limited
25/114 Mu 6 Soi Chinnakhet 1, Ngam Wong Wan Road,
Thung Song Hong, Lak Si, Bangkok 10210
Tel 0-2954-7745-6 Fax 0-2951-7747
E-mail : envi@enviresearch.co.th
www.enviresearch.co.th
Head Office/Tax ID 0105 542 04 951

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (inHg)		Correction (inHg)	
	Up	Down	Up	Down
28.00	28.552	28.567	+0.552	+0.567
29.00	29.113	29.131	+0.113	+0.131
29.50	29.534	29.545	+0.034	+0.045
30.00	29.922	29.938	-0.078	-0.062
31.00	30.836	30.836	-0.164	-0.164

Uncertainty of measurement ± 0.003 inHg

Transmitting fluid : Air,

Technical Note. k factor 1 kPa = 0.2952998 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q21112784

F3-011-04/01-12

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Calibration Data of NOx Analyzer

Analyzer Performance Test

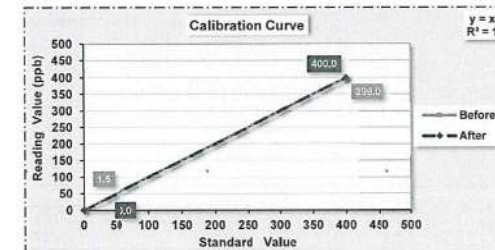
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00462
Serial No.	4VWFESUK	Calibration Date	March 8, 2024
Analyzer Unit	ppb	Time	2:39 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	1:1	0700419829
Dynamic Dilution Calibrator	Tanabyte	390	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO _x (ppb)		NO (ppb)		NO ₂ (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	2.7	0.0	1.5	0.0	1.2	0.0	-	-	-
Span	400	399.2	400.0	399.0	400.0	0.2	0.0	-	-	0.3



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	0.4	0.2	Voltage of the measured NO value
Signal NOx	mV	8.3	5.2	Voltage of the measured NOx value
Detector	°C	41.4	39.7	43 °C \pm 5 °C
Ambient	kPa	100.4	101.1	Current atmospheric pressure
DC 24V	V	23.5	23.5	24V \pm 0.5
DC 5V	V	5.0	5.0	5V \pm 0.5
NO Slope	-	1.32500	1.20110	0.50000 - 2.00000
NOx Slope	-	1.48130	1.85600	0.50000 - 2.00000

Calibrate By:

March 8, 2024

Checked By:

March 8, 2024

Calibration Data of NOx Analyzer

Analyzer Performance Test

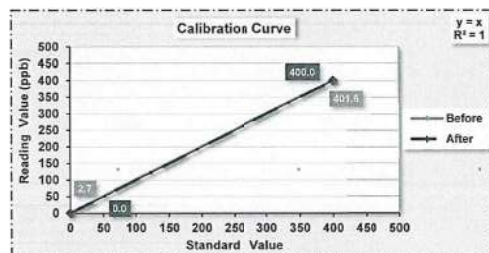
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00462
Serial No.	AX7HSMEO	Calibration Date	March 26, 2024
Analyzer Unit	ppb	Time	1:41 PM

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 ₂ = 54.9 ppm		
Cylinder No : E80123013			
Expire Date : Oct 22, 2027			

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO _x (ppb)		NO (ppb)		NO ₂ (ppb)		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	1.2	0.0	2.7	0.0	-1.5	0.0	-	-	-
Span	400	405.3	400.0	401.6	400.0	3.7	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	0.5	0.8	Voltage of the measured NO value
Signal NOx	mV	7.3	73.0	Voltage of the measured NOx value
Detector	°C	40.4	40.4	43 °C ± 5 °C
Ambient	kPa	101.2	101.2	Current atmospheric pressure
DC 24V	V	23.5	23.5	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.95520	1.95860	0.50000 - 2.0000
NOx Slope	-	1.54896	1.53860	0.50000 - 2.0000

Calibrate By :

March 26, 2024

Checked By :

March 26, 2024

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

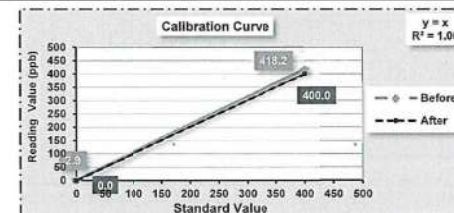
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2024-00462
Serial No.	J000EMWB	Calibration Date	April 10, 2024
Analyzer Unit	ppb	Time	3:13 PM

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 ₂ = 54.9 ppm		
Cylinder No : E80123013			
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	2.9	0.0	-	-	-
Span	400	418.2	400.0	-	-	4.6



STATUS TEST AND VALIDATION OF SO₂ ANALYZER MODEL APSA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal (SO ₂)	mV	12.6	12.7	Voltage of the measured SO ₂ value
LAMP	mV	205.5	201.0	200 mV - 1200 mV
CELL	°C	36.3	36.3	Ambient temperature + 5 °C - 15 °C
PUMP	kPa	45.5	45.5	65 kPa or less
AMBIENT	kPa	101.4	101.4	Current atmospheric pressure
DC 24V	V	24.0	24.0	24 V ±0.5 V
DC 5V	V	4.9	4.9	5 V ±0.5 V

Calibrate By :

April 10, 2024

Checked By :

April 10, 2024

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

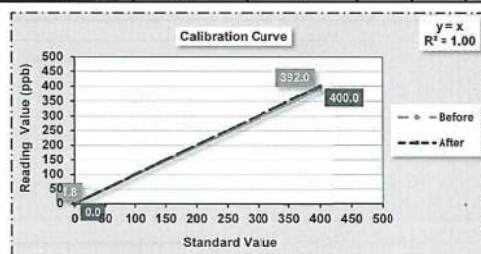
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2024-00462
Serial No.	0611116460	Calibration Date	April 10, 2024
Analyzer Unit	ppb	Time	1:58 PM

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 ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	1.8	0.0	-	-	-
Span	400	392.0	400.0	-	-	2.0



STATUS TEST AND VALIDATION OF SO₂ 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	33.2	33.3	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	40.6	40.6	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	725.3	725.3	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.658	0.658	0.350 to 1,000
Lamp Intensity	INTENSITY	Hz	21855	22012	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	866	866	750 to 1,200
SO2 Concentration	SO2 CONCENTRATION	ppb	3.2	1.8	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :

April 10, 2024

Checked By :

April 10, 2024

Calibration Data of CO Analyzer

Analyzer Performance Test

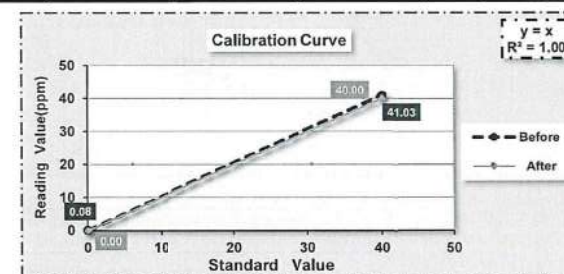
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2024-00462
Serial No.	WNTLD9N8	Calibration Date	April 10, 2024
Analyzer Unit	ppm	Time	1:45 PM

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 ₂ = 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	41.03	40.00	-	-	2.58



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	2.5	2.1	Voltage of the measured CO Value
SIGNAL (COMP)	mV	1.0	0.7	Voltage of the interference component Value
CELL	°C	32.2	32.3	Ambient + (5 to 10 °C)
PUMP	kpa	40.8	40.8	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	5.0	5.0	5 +/- 0.5 V

Calibrate By :

April 10, 2024

Checked By :

April 10, 2024

Calibration Data of CO Analyzer

Analyzer Performance Test

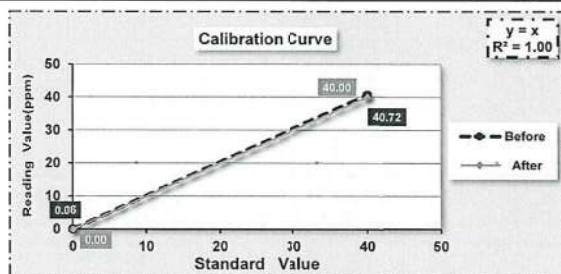
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2024-00462
Serial No.	GFB0BLNC	Calibration Date	April 10, 2024
Analyzer Unit	ppm	Time	1:38 PM

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 : Oct22, 2027	SO ₂ = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.06	0.00	-	-	-
Span	40	40.72	40.00	-	-	1.80



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL(MAIN)	mV	6.6	6.3	Voltage of the measured CO Value
SIGNAL (COMP)	mV	1.3	1.2	Voltage of the interference component Value
CELL	°C	38.1	38.0	Ambient + (5 to 10 C)
PUMP	kpa	39.2	39.0	less than 65
AMBIENT	kpa	101.6	101.6	Atmospheric pressure
DC 24V	mV	23.9	23.9	24±0.5 V
DC 5V	mV	4.9	4.5	5±0.5 V

Calibrate By :

April 10, 2024

Checked By :

April 10, 2024

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,SO₂,BALN

Reference Number: 160-401604495-1
Cylinder Volume: 144.4 Cubic Feet
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
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.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.27 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010429	KAL004123	57.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010429	KAL004123	57.6 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010235	KAL004419	57.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
NTRM	08012318	KAL004620	4657 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

ANALYTICAL EQUIPMENT		
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 - 006928781	FTIR	Oct 18, 2019
MKS FTIR - SO ₂ - 006928781	FTIR	Oct 03, 2019

Triad Data Available Upon Request

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



Approved for Release

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	Larson Davis
Model	:	CAL200
Serial No.	:	3605
Range of Calibrator		
- Support Equipment: Type	:	93.8
- Frequency	:	1,000 Hz.
Calibrated By	:	[REDACTED]
Calibration Date	:	April 18, 2024
Customer Name	:	Vision E. Consultants Co., Ltd. : โครงการผลิตปิโตรเลียมพื้นที่ผลิต L1/64 บึงหญ้า แปลงสำรวจบนบกหมายเลข L1/64 พื้นที่ผลิตบึงหญ้าตะวันตก-หนองสระ และ พื้นที่ผลิตบึงหญ้าตะวันออก-หนองสระส่วนขยาย แปลงสำรวจบนบกหมายเลข L21/43 จังหวัดสุโขทัย และจังหวัดกำแพงเพชร (ระยะผลิตผ่านฐานและผ่านท่อลำเลียง)

[illegible]

Checked By

Technician

Approved By

Environmental Scientist

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co.,Ltd.
Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok, 10210.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :		Ambient Environment	
Description	: Precision Acoustic Calibrator	Temperature	: (23 ± 3) °C
Manufacturer	: Larson Davis	Relative Humidity	: (50 ± 15) %
Model	: CAL200	Ambient Pressure	: (101.325 ± 1.500) kPa
Serial No.	: 3605		

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871

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

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

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

Date of Receipt : 8 Jan, 2024

Date of Calibration : 10 Jan. 2024

1/3

The results relate only to the items tested/calibrated or value assigned.
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FM.BLM.MTC002 Rev.4

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Fax. (66) 0 2323 9165
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Office
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Thailand
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E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

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 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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 1
1/2 inch Bruel&Kjaer4180	93.85	-0.15	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	0.32	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Date of Calibration : 10 Jan. 2024

2 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0190

MTC No. EEL. BP. 95/0167

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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 1
1/2 inch Bruel&Kjaer 4180	113.80	-0.20	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.8	-0.2	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.38	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.26 dB from manual.

Calibrated by :

Approved by :

Date of Calibration : 10 Jan. 2024

Date of Issue : 11 Jan. 2024

End of Certificate

Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011267010800067006

3 / 3

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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH17
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Water Proof
Model : pHTestr 30
Serial No. : 3066320
ID No. : -
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 09 January 2024
Reference : 2401-0077DN-3
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinakei 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0062385



Cert.No.: 24CH17
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	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 (±)	Coverage factor k
pH Electrode	4.008	4.01	N/A	0.0071	2.00
S/N.: 3066320	6.986	7.00	N/A	0.0093	2.00
	9.997	10.00	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 %

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a 1196385



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW254

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 : 29 November 2023
Test Date : 30 November 2023
Reference : 2311-0939DN-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-CH3
by Comparison Technique with Azide Modification Method
Tested by : 
Approved by : 
Issue Date : 4 December 2023

B 0328870



Cert.No.: 23TW254

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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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.: 17J100003

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

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

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a 1192571



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

Cert.No.: 24TW2
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro2330
Serial No. : 21H104437
ID No. : -
Received Date : 05 January 2024
Test Date : 08 January 2024
Reference : 2401-0077DN-10
Submitted by : Environment Research & Technology Company Limited.
25/14 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 : 
Issue Date : 10 January 2024

B 0331699



Cert.No.: 24TW2
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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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.: 21G100097

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

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

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a 1196377



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



Inctech Metrological Center Co.Ltd.
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Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Certificate of Calibration

Certificate No. : MT23-7846
Page : 1 of 2

Customer : Environment Research & Technogy Co., Ltd.
Address : 25/114 Moo 6 Soi Chinaket1, Ngamwongwan Road, Toongsonghong, Laksi, Bangkok 10210

Description : Incubator
Manufacturer : Accuplus
Model : Smart I250
Serial No. : 2059-0218-0002
Identification No. : ERTC-L-IN-143
Calibration Place : Customer Laboratory

Order No. : 3936/23
Received date : Dec 12, 2023
Calibration date : Dec 12, 2023
Environment Condition :
Temperature : (25+/-10) °C
Humidity : (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	MT23-5938	Oct 05, 2024

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 : Jan 09, 2024

Approved by :

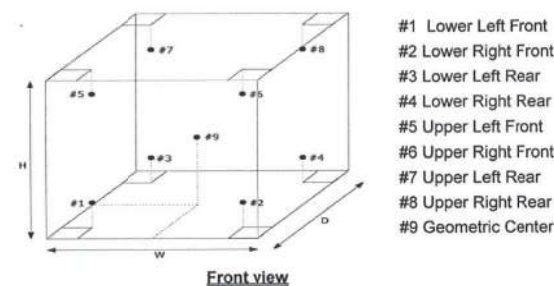
This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

Function : Temperature measurement
Calibration point : 20 °C

Certificate No. : MT23-7846
Page : 2 of 2
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	20.542	20.166	20.504	20.211	20.551	20.501	20.477	20.728	19.867	0.46

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
20.0	20 to 20.3	0.25	1.0	1.3



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 value 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. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM95
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IF 160
Serial No. : C522.0070
ID No. : ERTC-L-In.-181
Submitted by : Environment Research & Technology Company Limited
25/114 Moo 6 Soi Chinaket 1,
Ngamwongwan Road, Toongsonghong, Laksi,
Bangkok 10210
Location : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ
Received Order : 03 January 2024
Calibration Date : 04 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Procedure Used :-

Cert. No.: 24TM95

Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

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

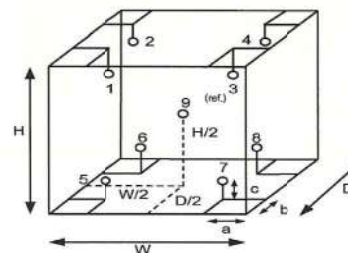
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Fan setting : 50%

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	47	50
AC Supply (Volt)	225	226



Probe Installation Details :

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

Dimension of Chamber :

D = 0.40 m
W = 0.56 m
H = 0.73 m
Capacity = 0.16 m³

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

A 0062474

a 1197875



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM95
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.020	0.15	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.043	34.933	35.015	34.992	35.019	34.980	34.843	34.961	34.985	0.32

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 %.

-o0o-

a 1197874



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 24TM96
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 : 408/2 ห้องปฏิบัติการป้อนอาหารเลี้ยงเชื้อ
Received Order : 03 January 2024
Calibration Date : 04 January 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062475



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-6

Cert. No.: 24TM96

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

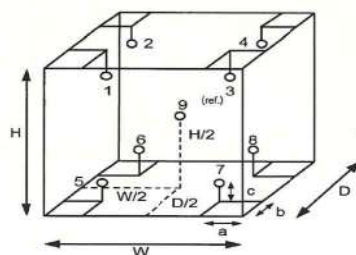
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	29
REL.Humid. (%)	45	50
AC Supply (Volt)	225	226

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2401-0001ON-6

Cert. No.: 24TM96

Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
44.5	44.5	45.0	0.20	0.77	1.6	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
44.5	45.038	45.142	45.077	45.127	43.812	44.180	44.402	44.990	44.497	0.85

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 %.

-o0o-

a 1197873

a 1197872



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, 2023 1:10:31 PM

Report Type: Report

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

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

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Test Summary

Purpose

This section includes the Overall Qualification Status and details for each test that meets at least one of the following criteria: (1) was not scheduled; (2) was scheduled but not run; (3) was processed more than once; (4) passed recommended limits only when dual limits were selected; (5) required deviation(s) or comment(s); (6) required integration event change(s). Tests that pass and do not meet any criteria above are not included.

For a complete list of scheduled tests, see the table of contents. For supporting documentation, refer to the Attachments section.

NOTE: A Pass for the Overall Qualification Status indicates that all scheduled tests were run and passed; R, I, D, and C are blank if not applicable for that specific test.

R: runs
I: integration event changes
D: number of deviations submitted
C: number of comments submitted
Status: NS (not scheduled); NR (scheduled but not run); NC (unlocked but not completed)

Details

Test	Status			
	R	I	D	C
There were no repeated or re-integrated tests. All test resulted in a pass status.				
Overall Qualification Status				
Pass				

Service Details

Purpose

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

General Details

Service Order No./Request: 6006377416
EQP Name: AgilentRecommended
EQP Revision: ES.C2.50
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: K Relwin Posit
Job Title: Supervisor Scientist
Qualification Location: ICP0ES 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

Protocol 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?

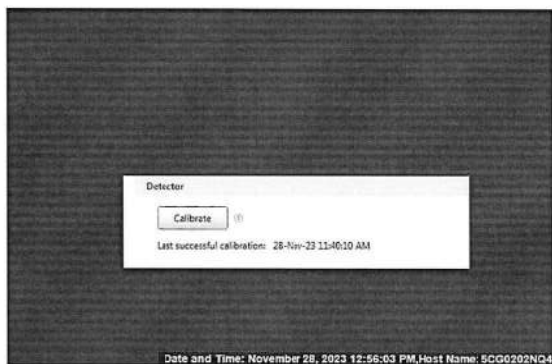
Yes	Yes	Pass
-----	-----	------

Test Evidence

Image Details: Was the detector calibration performed and completed successfully?

Date and Time: November 28, 2023 12:56:03 PM

Host Name: 5CG0202NQ4



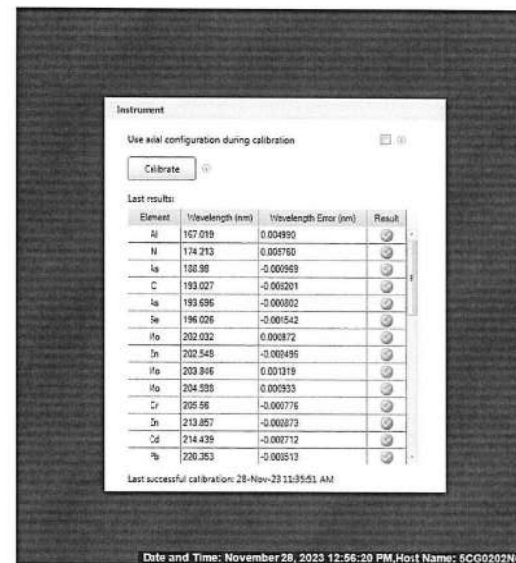
Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Image Details:

Was the instrument calibration performed and completed successfully?

Date and Time: November 28, 2023 12:56:20 PM

Host Name: 5CG0202NQ4



Overall Test Status

Pass

Runs: 1

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

Instrument Tests

Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details

Model/Serial No.:	G8011A	MY15330001
-------------------	--------	------------

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

Are the Functional Tests results within acceptance criteria?

Subsystem Communications	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Air Flow	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Water Flow	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Gas Flows	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
RF Generator	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Camera	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Optics	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Sensitivity	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>
Precision	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="Pass"/>

Overall Test Status

Pass	Runs: 1
------	---------

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)?	<input type="text" value="Yes"/>	<input type="text" value="Yes"/>	<input type="text" value="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	13
EQR	General	Operator's training certificate and qualifications	14
EQR	General	Operator's training certificate and qualifications	15
EQR	General	Certificate of System Qualification	16
EQR	General	Instrument's Test Report	17
EQR	General	Software Verification	20
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General

Document Name: Certificate of Qualification for ACE



Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: October 18, 2023 10:13:46 AM

Drive Serial #: 90593EBA

Platform Revision: ACE 3.12.112

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

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

General

Document Name: Operator's training certificate and qualifications



Agilent Technologies

Certificate of Completion

Learner Name:

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.

Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:

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:

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	27-Nov-23 2:23:13 PM

Result Summary

Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.28
As (188.980 nm)	≤ 8.20	6.66
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.71
Cr (206.158 nm)	≤ 13.40	10.27
Zn (213.857 nm)	≤ 8.70	7.56
Pb (220.353 nm)	≤ 9.50	7.70
Co (228.615 nm)	≤ 17.20	10.70
Ba (230.424 nm)	≤ 9.40	8.14
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	15.91
Cr (267.716 nm)	≤ 11.00	9.30
Cu (324.754 nm)	≤ 25.00	17.80
Cu (327.395 nm)	≤ 14.20	12.73
Sr (338.071 nm)	≤ 33.50	27.28
Ba (455.403 nm)	≤ 44.00	31.08
Sr (460.733 nm)	≤ 36.00	21.11
Ba (493.408 nm)	≤ 36.00	29.33
Ba (614.171 nm)	≤ 42.00	32.02
Ar (675.283 nm)	≤ 74.00	64.85
K (766.491 nm)	≤ 80.00	62.51

Document Name: Instrument's Test Report

Sensitivity Test

Pass

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	111.1	1111.0	85.2
Se (196.026 nm)	≥ 41.0	SRBR	68.5	856.2	116.6
Zn (213.857 nm)	≥ 1421.0	SRBR	3583.1	52766.1	215.1
Pb (220.353 nm)	≥ 46.0	SRBR	183.7	2611.8	201.8
Mn (257.610 nm)	≥ 3518.0	SRBR	10286.2	279763.9	735.8
Al (396.152 nm)	≥ 3.4	SBR	8.2	37571.9	4071.0
Ba (493.408 nm)	≥ 34.0	SBR	100.5	1198903.7	11807.1
K (766.491 nm)	≥ 1.8	SBR	3.8	100874.8	20871.5

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 206.0	SRBR	248.6	3738.6	202.3
Se (196.026 nm)	≥ 159.0	SRBR	163.8	3040.9	283.3
Zn (206.200 nm)	≥ 234.0	SRBR	1402.0	19648.6	192.6
Zn (213.857 nm)	≥ 1743.0	SRBR	8340.9	200514.1	574.6
Cd (214.439 nm)	≥ 4227.0	SRBR	7606.2	156421.5	420.7
Pb (220.353 nm)	≥ 320.0	SRBR	631.4	16069.9	600.3
Mn (257.610 nm)	≥ 10625.0	SRBR	32328.3	1472044.4	2057.5
Cr (267.716 nm)	≥ 1048.0	SRBR	4308.3	155802.6	1286.3
Cu (324.754 nm)	≥ 19.0	SBR	57.8	242584.8	4123.5
Al (396.152 nm)	≥ 6.0	SBR	21.9	239924.8	10474.6
Ba (493.408 nm)	≥ 60.0	SBR	236.0	7235267.3	30527.2
K (766.491 nm)	≥ 24.0	SBR	68.8	3110677.8	44585.8

Document Name:

Instrument's Test Report

Precision Test Pass

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.74
Se (196.026 nm)	≤ 2.60	0.65
Zn (213.857 nm)	≤ 1.50	0.21
Pb (220.353 nm)	≤ 2.60	0.51
Mn (257.610 nm)	≤ 1.50	0.25
Al (396.152 nm)	≤ 1.50	0.30
Ba (493.408 nm)	≤ 1.50	0.60
K (766.491 nm)	≤ 1.50	0.20

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.37
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.26
Cd (214.439 nm)	≤ 1.50	0.21
Pb (220.353 nm)	≤ 1.50	0.30
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.17
Cu (324.754 nm)	≤ 1.50	0.32
Al (396.152 nm)	≤ 1.50	0.30
Ba (493.408 nm)	≤ 1.50	0.48
K (766.491 nm)	≤ 1.50	0.53

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Date: November 28, 2023 1:10:31 PM
System ID: MY15330001

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General

Document Name:

Software Verification

Software Verification Report

Date:	Monday, November 27, 2023	Time:	2:58:23 PM [UTC: +07:00:00]	Host Name:	5100VDV-4HP
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, 2023 1:10:31 PM
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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: 6610010100

Lot No: 0012990411

Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7784-27-2	5.000 ± 0.025 mg/L	Mn	Mn	7439-95-5	5.000 ± 0.025 mg/L
As	As	7440-38-2	5.000 ± 0.025 mg/L	Mo	(NH ₄) ₂ MoO ₄	13106-76-8	5.000 ± 0.025 mg/L
Ba	Ba(NO ₃) ₂	10023-31-5	5.000 ± 0.025 mg/L	Ni	Ni	7440-02-0	5.000 ± 0.025 mg/L
Cd	Cd	7440-43-9	5.000 ± 0.025 mg/L	Pb	Pb	7439-92-1	5.000 ± 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 ₃) ₃	13549-38-4	5.000 ± 0.025 mg/L	Sr	Sr(NO ₃) ₂	10043-75-9	5.000 ± 0.025 mg/L
Cu	Cu	7440-50-8	5.000 ± 0.025 mg/L	Zn	Zn	7440-66-4	5.000 ± 0.025 mg/L
K	KNO ₃	7757-79-1	50.00 ± 0.25 mg/L				

Metric: 5% HNO₃

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 (HNO₃) 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, 3152, 3134, 3136, 3108, 3149, 3153a, and 3108a. 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 air-cleaned containers and transferware, (2) avoid pipetting directly from the CRM's original container, (3) use a minimum sub-sample size of 500µL, (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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
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Agilent CrossLab Compliance Services

Document Name: Certificate of Analysis Wavelength calibration solution



Period of Validity: Agilent insures 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.

Sample lot approval:

Date of release: 18 October 2022

Date of expiration: 30 April 2024

Chuck Gouffreau, Certifying Officer

Page 2 of 3

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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.

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 USP <1>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. 44 100 18082231)
- 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. 2848.01)
- LSC Standards, 200 Almy Road, Winchester, NY 13250

Document Name:

Certificate of Analysis Wavelength calibration solution

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: [REDACTED]

Logged On User Name:

Signature Creation Date: November 28, 2023

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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User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System ID: MY15330001
Print Date: November 28, 2023 1:10:41 PM

OQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:54:08 PM	Audit	SessionCreated	Session	None
November 28, 2023 12:54:08 PM	Start	Configuration	Session	None
November 28, 2023 12:54:08 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 28, 2023 12:54:32 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], Protocol Revision: [Es_02_50]
November 28, 2023 12:54:38 PM	End	Configuration	Session	None
November 28, 2023 12:54:41 PM	Start	Qualification	Session	OQ
November 28, 2023 12:54:41 PM	Start	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:26 PM	End	Execution	Preparation : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2023 12:56:27 PM	Start	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	None
November 28, 2023 12:56:57 PM	End	Execution	Instrument Tests : 5100 VDV: Qualitative Test - No setpoints associated	Run Count : 1

Page 1 / 3

User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

QQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 12:57:03 PM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	None
November 28, 2023 12:57:08 PM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4: Qualitative Test - No setpoints associated	Rur Count : 1
November 28, 2023 12:57:09 PM	End	Qualification	Session	OQ
November 28, 2023 12:57:09 PM	Start	Reporting	Session	None
November 28, 2023 1:04:49 PM	Audit	AccRestarted	Session	None
November 28, 2023 1:04:50 PM	Audit	SessionReloaded	Session	None
November 28, 2023 1:04:58 PM	Start	Qualification	Session	OQ
November 28, 2023 1:08:10 PM	Audit	Reporting	Session	Report Generated : Certificate
November 28, 2023 1:09:28 PM	Audit	Reporting	Session	Report Generated : Report

Page 2 / 3

User Name: worawit.timakul
Report Generated by Hostname: 5CG0202NQ4

System Id: MY15330001
Print Date: November 28, 2023 1:10:41 PM

QQHW ICP 5100 ENVI Research Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2023 1:10:31 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: QQHW ICP 5100 ENVI Research_20231128_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

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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 ₃	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	≤ 16.5 pg/0.0044 A-s	15.4	Passed
Zeeman Ratio	0.52 ± 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	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1456}{0.1456 + 0.1293}$ $= 0.52$

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.	
This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	<div style="background-color: black; width: 100px; height: 40px;"></div> Date: 30-Jun-2023 (DD-MMM-YYYY)



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



Cert.No.: 24CH10
Page: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : HM DIGITAL
Model : COM-100
Serial No. : PONPE5863548
ID No. : NO.4
Condition As-Received: Used Item
Received Date : 05 January 2024
Calibration Date : 08 January 2024
Reference : 2401-0077DN-6
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In-house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

10 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 24CH10

Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	231435	10 Apr 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
*100 $\mu\text{S/cm}$	Thermo Scientific	193/01	11 May 2024
1413.0 $\mu\text{S/cm}$	CPA Chem	931955	30 Sep 2024

- 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.: PONPE5863548

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
*100 $\mu\text{S/cm}$	101 $\mu\text{S/cm}$	99.9 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1445 $\mu\text{S/cm}$	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 %.

-o0o-

A 0062387

a 1196383

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: 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/W00220

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.

As Found	Temperature		Humidity	
	Start: 27.5 °C	End: 26.9 °C	Start: 44.1 %	End: 44.5 %

As Found Calibration Date: 15-Jan-2024

Calibrator:

As Left Calibration Date: N/A

Issue Date: 15-Jan-2024

Approved Signator

Technical Manager / Head of Calibration Center

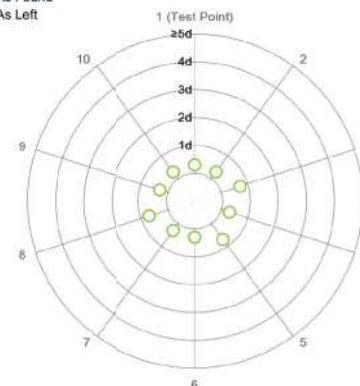
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A

As Found
As Left



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

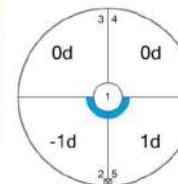
The results of this graph are based upon the absolute values of the differences from the mean value.

Standard Deviation	0.00005 g	N/A
--------------------	-----------	-----

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9999 g	N/A
3	100.0000 g	N/A
4	100.0000 g	N/A
5	100.0001 g	N/A



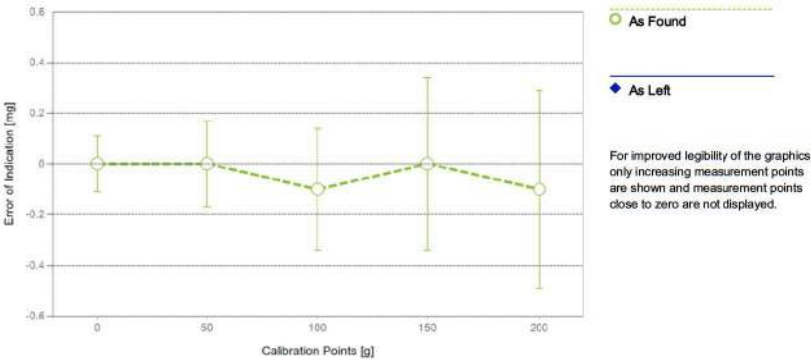
As Found

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

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----

Error of Indication

As Found					
	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 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	5.0000 g	0.0000 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	100.0001 g	100.0000 g	-0.0001 g	0.24 mg	2
10	150.0001 g	150.0001 g	0.0000 g	0.34 mg	2
11	200.0000 g	199.9999 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

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: $1.5 \cdot 10^{-6} / K$

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

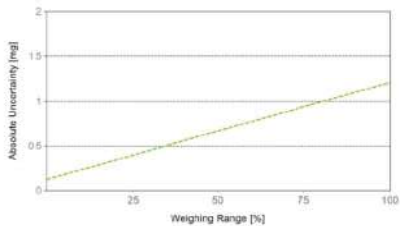
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00494 \text{ mg/g} \cdot R$	N/A

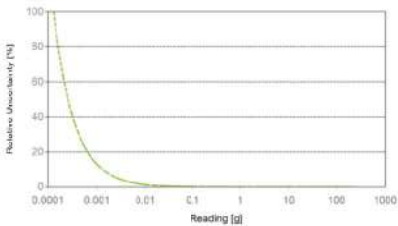
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.14 mg	0.0064%	N/A	N/A
22.0000 g	0.24 mg	0.0011%	N/A	N/A
220.0000 g	1.2 mg	0.00055%	N/A	N/A



As Found



As Left

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

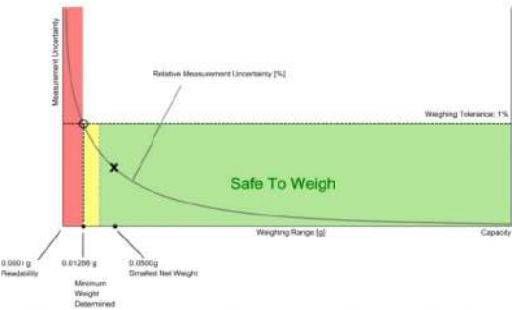
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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%	0.12712 g	0.25551 g	0.38518 g	0.64847 g	1.33062 g
0.2%	0.06340 g	0.12712 g	0.19115 g	0.32018 g	0.64847 g
0.5%	0.02532 g	0.05070 g	0.07612 g	0.12712 g	0.25551 g
1%	0.01266 g	0.02532 g	0.03800 g	0.06340 g	0.12712 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03166 g	0.06340 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02532 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	0.00005 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 $0.41 \cdot d$ 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.

Attachment to Calibration Certificate:

TH3067-065-011524-ACC-TH

GWP® Certificate

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
100.0001 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	0.0000 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
100.0001 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	0.0000 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.

METTLER TOLEDO Service

Calibration Certificate ID

TH3067-065-011524-ACC-TH

METTLER TOLEDO

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

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

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

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS204TS/00	Asset Number:	ERTC-L-IN-114
Serial No.:	B547728937	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

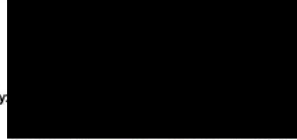
Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CPW002/20

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: 26.9 °C	End: 27.0 °C	Start: 44.5 %	End: 44.5 %

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

Technical Manager / Head of Calibration Center

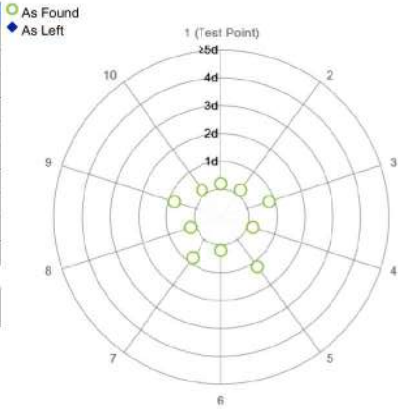
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0001 g	N/A
8	100.0000 g	N/A
9	100.0001 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00006 g	N/A
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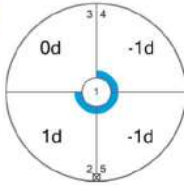
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	99.9999 g	N/A

Maximum Deviation	0.0001 g	N/A
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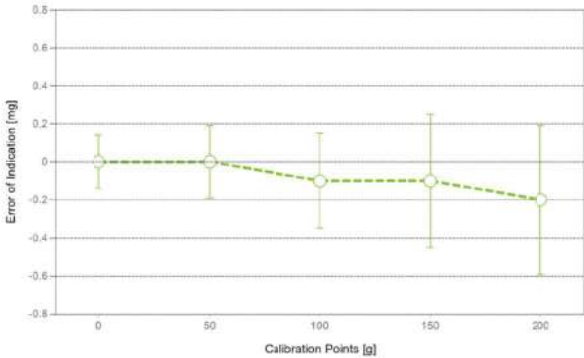
As Found

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	0.14 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	0.5001 g	0.0001 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0001 g	0.0001 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	100.0000 g	-0.0001 g	0.25 mg	2
10	150.0001 g	150.0000 g	-0.0001 g	0.35 mg	2
11	200.0000 g	199.9998 g	-0.0002 g	0.39 mg	2



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. 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 Hygromeier

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

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: $\pm 0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $\pm K$

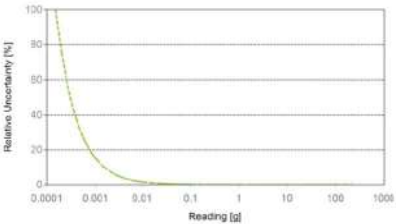
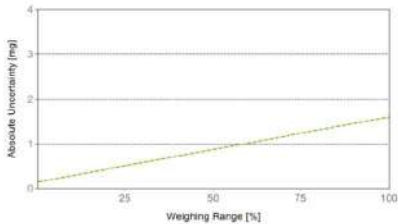
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.15 \text{ mg} + 0.00663 \text{ mg/g} \cdot R$	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	0.15 mg	0.68%	N/A	N/A
0.2200 g	0.15 mg	0.069%	N/A	N/A
2.2000 g	0.16 mg	0.0075%	N/A	N/A
22.0000 g	0.30 mg	0.0013%	N/A	N/A
220.0000 g	1.6 mg	0.00073%	N/A	N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

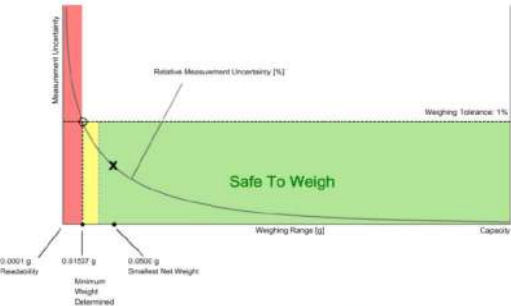
The weighing device meets the given
process requirements.

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%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.15156 g	0.30515 g	0.46083 g	0.77857 g	1.61241 g
0.2%	0.07553 g	0.15156 g	0.22810 g	0.38273 g	0.77857 g
0.5%	0.03015 g	0.06038 g	0.09069 g	0.15156 g	0.30515 g
1%	0.01507 g	0.03015 g	0.04526 g	0.07553 g	0.15156 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07553 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:

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	0.00006 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

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.

Error of Indication

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
100.0001 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	-0.0002 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	-0.0002 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.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM92
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Binder
Model : FED 115 E2
Serial No. : 11-22823
ID No. : ERTC-L-In.-076
Submitted by : Environment Research & Technology Company Limited.
25/114 Moo 8, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Laksi,
Bangkok 10210
Location : Laboratory (ERTC)
Received Order : 03 January 2024
Calibration Date : 03 January 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by :

Approved by :

Approved Signatory

Issue Date : 16 January 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0062471



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-00010N-2

Cert. No.: 24TM92
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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

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

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

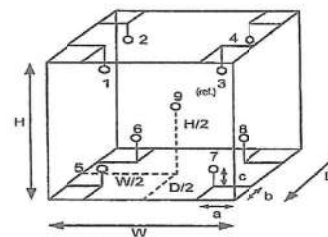
Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	33
REL.Humid. (%)	53	41
AC Supply (Volt)	226	225



Probe Installation Details :		Dimension of Chamber :	
a =	5.0 cm	D =	0.40 m
b =	5.0 cm	W =	0.60 m
c =	5.0 cm	H =	0.48 m
		Capacity =	0.12 m ³

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09

a 1197861



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2401-0001ON-2
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM92
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104	104	104	0.10	1.8	2.1	2
180	180	180	0.27	4.4	5.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104	104.379	103.463	103.443	103.893	104.213	103.223	105.222	104.297	103.494	0.77
180	179.045	177.562	181.299	179.300	180.773	177.931	182.136	178.131	178.019	1.6

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 %.

-o0o-

a 1197880



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-1717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM93
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 : 03 January 2024
Calibration Date : 03 January 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

16 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062472



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-00010N-3

Cert. No.: 24TM93
 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

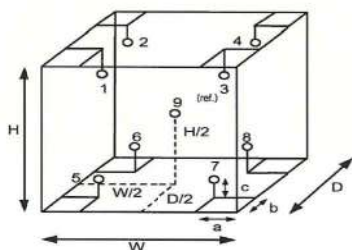
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function 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 ³	

Environment during calibration		
	Beginning	Finished
Temp. (°C)	30	30
REL.Humid. (%)	53	53
AC Supply (Volt)	226	225

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	23-17TC-02
3	17RTD-03	19-17TC-03
4	23-17RTD-10	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	23-17RTD-08	19-17TC-08
9 (ref.)	23-17RTD-09	19-17TC-09



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2401-00010N-3
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 24TM93
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.075	1.2	2.4	2
180.0	180.0	180.0	0.41	3.4	3.9	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	105.068	102.783	103.239	103.695	104.855	103.867	102.799	103.295	103.959	0.42
180.0	179.954	177.587	177.414	178.118	181.087	179.869	179.584	178.045	180.704	1.3

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 %.

-o0o-

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.

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**, 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
 - **Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual**
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

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 tickmark "✓".
- 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	GCMS
Instrument System Site and Location	Environmental Research & Technology Co., Ltd.

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440B	CN16993176
2. G4513A	CN16600132
3. G4514A	CN170 CN1830130
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 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.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	OK
Back detector output		N/A
AUX detector output		N/A
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	N/A
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	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
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 6001915875 Date service completed 24 Nov 2023
Agilent signature [redacted] Customer signature _____
Total number of pages in this document _____

Agilent Preventive Maintenance Services

Agilent GCMS Preventive Maintenance

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Introduction

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.

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.

Important Customer Web Links

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

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.

- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in order by sections: Review, System Checks, Pump maintenance, Cleaning System and Filters, then System Post Check.
 - The tasks in each section may be completed in the most logical order relevant to the system. Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section
- Complete Signature Page and attach Signature Page to Service Order.

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.**

Definition of the Task/Recommended items within the document

Task		Recommended			
Yes	No	Interim	Major	As Needed	
✓					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.

Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☒ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

System Information

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

Instrument System Name and ID	GCMS
Instrument System Site and Location	Environment Research & Technology Co., Ltd.

List System Component Product Numbers	List the Serial Numbers of each Component
1. G7077B	U170314011
2.	
3.	
4.	
5.	
6.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check firmware version(s). Updating to the most current versions is strongly recommended. Verify with the customer before updating.

Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Vent the instrument
<input checked="" type="checkbox"/> <input type="checkbox"/> <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 type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Visually inspect calibrant levels – PFTBA PFDTD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Look for any obvious external damage or problems.
<input checked="" type="checkbox"/> <input type="checkbox"/> <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 type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		For HydroInert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/>

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of oil leakage. Check pump gasket for leakage.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>		GC/MS SQ with diffusion pump; drain and replace diffusion pump oil.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Drain and replace mechanical pump oil.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace Oil Mist Filter if applicable.

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss with customer the need for more frequent oil changes if the oil is dirty
<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Don't use mist filters with Chemical Ionization.
<input type="checkbox"/> <input checked="" type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Clear air flow paths of dust.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		If vacuum is poor, then replace the diaphragm pump.
<input type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace the lips seal on the IDP pump.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Check for evidence of poor vacuum – Rough vac pressure, turbo power demand, poor manifold vacuum, etc.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Replace the Exhaust Filter if required.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Discuss with customer the need for more frequent changes, if needed.
<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		Inform customer that pump gas ballast should be installed all the time.
<input type="checkbox"/> <input type="checkbox"/> <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.

Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

Cleaning System and Filters			
Yes/No	Interim/Major	Description	
Fans			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Remove dust from fans and vent covers.	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Verify fans are functional and that there is enough space around the instrument for proper cooling.	
Source cleaning (all sources except HydroInert)			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Open analyzer and remove the source.	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Disassemble, Clean, Re-assemble source. (7200, also, remove and clean entrance lens)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Re-install source and close analyzer.	
HydroInert Source			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and extractor), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier.	
Filters			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSH-2 Helium gas filter (collision cell gas) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSN-2 Nitrogen gas filter (collision cell gas) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Replace RMSHY-2 Hydrogen gas filter (HydroInert and JetClean) – if applicable.	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		CP17973 – Gas Clean GS/MS Filter (for He, N2 or H2 carrier) – if required	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		5190-9071 – Methane Gas Filter (CI systems) – if applicable	

Guidance: Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

System post-check			
Yes/No	Interim/Major	Description	
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system vacuum reading(s) via the gauge controller.			
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Leak Check			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system in manual tune			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Compare against previous tune file report(s)			
<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check manually that you have calibration peaks.			
<input checked="" type="checkbox"/>	<input 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 Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete Signature Page and attach Signature Page to Service Order.

Test Results

Test Description	Expected Test Result	Actual Test Result
------------------	----------------------	--------------------

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6006365875

Date of Service Completion:

24 Nov 2023

Service Engineer Name:

Service Engineer Signature:

Customer Name:

Total number of pages in this document:

Parts for consumption during PM

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

Part Description	Part Number	Interim	Major	As Needed
Agilent AVF Platinum, 1 quart	5191-5651	✓	✓	✓
Helium gas filter* (collision cell gas) – if required	RMSH-2		✓	✓
Nitrogen gas filter* (collision cell gas) – if required	RMSN-2		✓	✓
Hydrogen gas filter* ^ (HydroInert and JetClean) – if required	RMSHY-2		✓	✓
Chemical Ionization Gas Purifier (CI systems) (Methane) – if required	5190-9071		✓	✓
Gas Clean GS/MS Filter (for He, N2 or H2) – if required	CP17973		✓	✓
# Gas Clean Filter Kit GC/MS 1/8 in (complete replacement kit - bench mounted) – if required	CP17974			✓
# Gas Clean Carrier Gas Kit for 7890 for He, N2 or H2; Bracket, Mount and Filter – if required	CP17988			✓
# Gas Clean Carrier Gas Kit for 8890 & 8860 for He, N2 or H2; Bracket, Mount and Filter – if required	CP179880			✓

Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

* Big Universal Trap (BUT), 1/8" fittings

^ HydroInert and JetClean Systems

Alternate Gas Clean kit part numbers. A Gas Clean filter is included in the kits. They are only necessary if replacing carrier gas Big Universal Traps with indicating traps

MS Maintenance Supplies for 5973/5975/5977 Series

Part Description	Part Number	Interim	Major	As Needed
Diffusion pump fluid (Diffusion Pump Models)	6040-0809		✓	✓
Qty 2				
Exhaust oil mist trap (threaded) Edwards/Pfeiffer	G1099-80039	✓	✓	✓
DS42 Oil Mist Eliminator 3/4G & 3/8	SR03706556	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Scroll Pump Models – Includes tip seal, 60mm filter element, tools, mask and cleaning supplies)	G7077-67018	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (no tools – CSD P/N)	5190-9561	✓	✓	✓
IDP-3 Tip Seal Replacement Kit (no tools – VPD P/N)	IDP3TS	✓	✓	✓
Filter element for IDP-3 (diameter: 60mm)	REPLSLRFILTER2	✓	✓	✓

MS Maintenance Supplies for 7000/7010 Series

Part Description	Part Number	Interim	Major	As Needed
Oil Mist Filter R/V5	36600-80043	✓	✓	✓
IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models - Includes tip seal, 102mm filter element, tools, mask and cleaning supplies)	37004-67023	✓	✓	✓
IDP-10 Tip Seal Replacement Kit (no tools etc. - VPD P/N)	X3807-67000	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 102mm)	REPLSLRFILTER	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 79mm)	REPLSLRFILTER1	✓	✓	✓

MS Maintenance Supplies for 7200/7250 Series

Part Description	Part Number	Interim	Major	As Needed
RIS Probe Maintenance Kit (7200 Series only)	G7005-60170		✓	✓
DS202 Oil Mist Eliminator	SR03706800	✓	✓	✓
DS202 3/8" Magnetic Plug and Gasket	SR03701824	✓	✓	✓
IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Scroll Pump Models - Includes tip seal, 102mm filter element, tools, mask and cleaning supplies)	5190-9613	✓	✓	✓
IDP-15 Tip Seal Replacement Kit (no tools etc. - VPD P/N)	X3815-67000	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 102mm)	REPLSLRFILTER	✓	✓	✓
Filter element for IDP-10/IDP15 (diameter: 79mm)	REPLSLRFILTER1	✓	✓	✓

HydroInert Source Supplies

To determine if replacement of HydroInert parts is required, please review tune history and sample signal intensity performance. If performance is decreasing, the below parts may be used to restore performance as part of the PM.

One way to determine if the source performance on SQ is being affected is to review the gain factor history in autotune reports or tune history csv file. If the gain factor is increasing the source performance may be degrading.

Since TQ tunes to a fixed gain factor, review PFTBA abundance. If PFTBA abundance is decreasing over time, the source performance may be degrading.

Real sample/standard area counts are another way to determine the performance, there could also be other factors that affect compounds abundance such as inlet and column status.

Part Description	Part Number	Interim	Major	As Needed
Repeller Insulator (qty 2)	G1099-20133			✓
Lens insulator for Extractor (ring insulator)	G3870-20445			✓
HydroInert Extractor lens (9mm)	G7078-20909			✓
HydroInert Repeller	G7078-20902			✓

Common Parts Reference

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

Filaments and Calibrant Supplies 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
El High Temperature Filaments	G7005-60061 Qty 2	597X	7000x	N/A
HES E Filaments	G7002-60001	5977B/C	7010x	N/A
LE-El Filaments (7250 QTOF)	G3850-60021	N/A	N/A	7250
CI High Temperature Filament - SQ TQ, 7200 QTOF	G7005-60072	N/A	N/A	7200A/B
Axial CI Filament, W/Re Straight (7250 QTOF)	G7250-60095	N/A	N/A	7250
PFTBA GCMS Tuning Standard calibrant	05971-60571	597X	70X0	72X0
PFDTD calibrant, 1 mL	8500-8510	597X	70X0	72X0
PFET, IRM calibrant for GC QTOF 0.5 mL (7200)	5190-0531	N/A	N/A	7200A/B

Transfer line seals and springs 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
CI Interface tip seal (ceramic tip and spring combo) (non-captured CI tip seal interface) (5973, 5975, 7000B)	G1999-60412	5973, 5975	7000B	N/A
CI Interface tip seal (ceramic tip and spring low/non-magnetic spring combo) (non-captured CI tip seal interface) (7010A)	G7002-60412	N/A	7010A	N/A
CI Interface tip seal spring (spring only)	G1999-20023	597X	70X0	72X0
CI Interface tip seal (tip only) (captured style)	G3870-20542	5977x	70X0	72X0
Transfer-Line Tip Base, Threaded (captured style)	G3870-20548	5977x	70X0	72X0
Transfer-Line Tip Cap, Threaded (captured style)	G3870-20547	5977x	70X0	72X0
RIS Xfer Tip (7200)	G7005-20542	N/A	N/A	7200A/B
RIS Xfer Tip Spring (7200)	G7005-20024	N/A	N/A	7200A/B

MS Maintenance Supplies for Intuvo 9000 MS Series

Part Description	Part Number	SQ	TQ	QTOF
Swaged MS Tail - Packaged	G4590-60009	5977x	7000	N/A
Swaged MS Tail (HES) - Packaged	G4590-60109	5977x	7010x	N/A

Ion source insulators for 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Repeller Insulator (SQ, TQ)	G1C99-20133 Qty 2	597X	7000x	N/A
Lens insulator for extractor lens (ceramic ring insulator) (Extractor source)	G3870-20445	5977x	7000C/D/E	N/A
Lens insulator for Extractor lens (Vespel ring insulator) (7000B extractor ion source)	G7000-20445	N/A	7000B only	N/A
Lens stack insulator for SS, Inert, Extractor sources (captures ion focus and entrance lens) (Vespel)	G3170-20530	597X	7000x	N/A
Lens insulator for Extractor lens for HES/LEEI (ceramic ring insulator)	G7002-20064	5977B/C	7010x	7250
Lens stack insulator/holder for HES/LEEI (Vespel)	G7002-20074	5977B/C	7010x	7250
CI Repeller Lens Insulator (SQ, TQ)	G1999-20433	597X	70X0x	N/A
CI Lens stack insulator (SQ, TQ) (Vespel)	G3170-20540	597X	70X0x	N/A
Repeller insulator (7200 RIS) (Ceramic)	G7005-20447	N/A	N/A	7200A/B
Extractor Lens Insulator (7200 RIS) (Vespel)	G7005-20133	N/A	N/A	7200A/B
Ion Focus Insulator (7200 RIS) (Vespel)	G7005-20442	N/A	N/A	7200A/B
CI Repeller Insulator/bushing (7200 RIS) (Ceramic)	G7005-20030	N/A	N/A	7200A/B

HydroInert coated lenses for 5977/7000 Series

Part Description	Part Number	SQ	TQ	QTOF
HydroInert Repeler	G7078-20902	5977x	7000C/D/E	N/A
Ext Source Body - HydroInert	G7078-20903	5977x	7000C/D/E	N/A
HydroInert Extractor lens (9mm)	G7078-20909	5977x	7000C/D/E	N/A
Ion Focus Lens - HydroInert	G7078-20905	5977x	7000C/D/E	N/A
Entrance Lens - HydroInert	G7078-20904	5977x	7000C/D/E	N/A

Heater/Sensor assemblies for 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Stainless Steel Heater/Sensor assembly (SST EI 350)	G3870-67180	597X	N/A	N/A
Inert Heater/Sensor assembly (Inert EI 350)	G3870-67179	597X	7000A/B	N/A
Extractor Heater/Sensor assembly (Xtr EI 350)	G3870-67177	5977x	7000C/D/E	N/A
H2 EI Heater/Sensor Assembly - HydroInert (H2 EI 350)	G7078-67910	5977x	7000C/D/E	N/A
CI 350 Heater/Sensor Assembly (CI 350)	G3870-67415	597X	70X0x	N/A
Ring heater/sensor assembly (HES, RIS and LEEI) (ceramic ring)	G7002-60058	5977B/C	7010x	72X0

Rough pump hoses 5973/5975/5977/7000/7010/7200/7250 Series

Part Description	Part Number	SQ	TQ	QTOF
Foreline Hose - imbedded spring	G7077-60119	597X	70X0x	72X0

Common MS Maintenance Supplies

Part Description	Part Number	SQ	TQ	QTOF
Abrasive paper, 30 µm	5061-5896	597X	70X0	72X0
Alumina powder	393706201	597X	70X0	72X0
Cloths, dean (pkg of 15)	05980-60051	597X	70X0	72X0
Cloths, deaning (pkg of 300)	9310-4828	597X	70X0	72X0
Cotton swabs (pkg of 100)	5080-5400	597X	70X0	72X0
Gloves, dean, large	8650-0030	597X	70X0	72X0
Gloves, dean, small	8650-0029	597X	70X0	72X0

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



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.

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



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



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.

Teledyne Tekmar ATOMX Purge and Trap Preventive Maintenance Checklist - Standard



System Information

Guidance

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

Instrument system name and ID	ATOMX Purge & Trap
Instrument system site and location	Environment Research & Technology Co., Ltd.
List system component product numbers	List the serial numbers of each component
1. TMR-ATOMX	1. VS17013007
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.

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
- ☐ Need technical support, FAQs? - www.agilent.com/chem/techsupp
- ☐ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6006965875 Date service completed 24 Nov 2023

Agilent signature  Customer signature _____

Number of pages in this document _____

Issued: 30-09-2019, Revision: 02

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Agilent Technologies

Select pages for required products or Page 5 of 5



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*, 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>.

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	US2125A011
2. 64514 A	CN2109505
3. 64515 A	CN2107024
4.	US2125A011
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	282.6
Back detector output	N/A	249.2
AUX 1 detector output	N/A	282.6
AUX 2 detector output CFPD	N/A	249.2 12.6
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 2023

Agilent signature  Customer signature _____

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