



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการในพื้นที่จังหวัดกำแพงเพชร
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

ภาคผนวกที่ 40
ผลการตรวจวัดคุณภาพน้ำใต้ดิน

ព្រះឥសាន

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตไบโอดีเซลจากไขมันสัตว์และของเหลือใช้จากโรงงานอาหาร (ฐานการผลิตไบโอดีเซล) (NPG-E)
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อกักเก็บน้ำใต้ดินที่ฐานการผลิตไบโอดีเซล (NPG-E)
GPS. Coordinate : UTM (WGS84) 47Q 0589398 E, 1833266 N
Sampling Date : January 9, 2024
Sampling Time : 13:58
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Turbid, Light Yellow, Sediment, Odorless

Quotation No. : 2023-01037
Analysis No. : 2024-AA066-001
Received Date : January 11, 2024
Analytical Date : January 11-25, 2024
Report No. : 2024-RAMAB43
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ¹⁾	MRL	Result	Standard ²⁾	Standard ³⁾	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	700	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,000	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	3.0	<3.0	10,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.016	1.0	≤1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	0.016	0.01	None	0.25
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	13	0.5	≤0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.04	5.0	≤5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0027	0.01	None	0.25
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold Vapor Atomic Absorption Spectrometry	0.0005	<0.0005	2.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	8.1	-	≤0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.44	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	31.0	-	-	-
pH	-	Electronic	-	7.0	-	7.0-8.5	6.5-8.2
Total Dissolved Solids	mg/L	Dried at 180°C	50	185	-	≤600	1,200
Conductivity	µs/cm	Electrical Conductivity Meter	0.1	262	-	-	-
Salinity	ppt	Electrical Conductivity Meter	0.1	0.2	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตไบโอดีเซลจากไขมันสัตว์และของเหลือใช้จากโรงงานอาหาร (ฐานการผลิตไบโอดีเซล) (NPG-E)
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อกักเก็บน้ำใต้ดินที่ฐานการผลิตไบโอดีเซล (NPG-E)
GPS. Coordinate : UTM (WGS84) 47Q 0589398 E, 1833266 N
Sampling Date : January 9, 2024
Sampling Time : 13:58
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Turbid, Light Yellow, Sediment, Odorless

Quotation No. : 2023-01037
Analysis No. : 2024-AA066-001
Received Date : January 11, 2024
Analytical Date : January 11-25, 2024
Report No. : 2024-RAMAB43
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ¹⁾	MRL	Result	Standard ²⁾	Standard ³⁾	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons: C4-C6)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.040	<0.040	-	-	-
TPH (Kerosene Range Hydrocarbons: C7-C10)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons: C11-C25)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Heavy Oil Range Hydrocarbons: C26-C40)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-

Remark: ¹⁾ Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.
²⁾ Notification of the National Environment Board, No.20, B.E.2550 (2000), issued under the Enforcement and Conservation of National Environmental Quality Act, B.E.2538 (1995), published in the Royal Government Gazette No.117 Part 940, dated September 15, B.E.2543 (2000).
³⁾ Notification of the National Resources and Environment B.E.2551 (2008), published in the Royal Government Gazette, Vol.325, Part 850, dated May 21, B.E.2551 (2008).



Laboratory Reviewer



Laboratory Supervisor

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Sol Maneeya Soi 3, Sai Ma, Muang Nonthaburi, Nonthaburi 11000
Project Name : โครงการติดตั้งโคมไฟถนนพลังงานแสงอาทิตย์ บริเวณ 1 จังหวัดกาญจนบุรี (ฐานขุดดิน (NPG-E))
Project Location : จังหวัดกาญจนบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณถนนปรางค์กู่/บ้าน ปรางค์กู่ละแวกเลข ๗/๕ 7 ส่วนในเขต อำเภอปรางค์กู่ จังหวัดกาญจนบุรี (นตส.๓)
GPS. Coordinate : UTM (WGS84) 47Q 0588284 E, 1832552 N
Sampling Date : January 13, 2024
Sampling Time : 11:22
Sampling Method : [REDACTED]
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, Sediment, Odorless

Quotation No. : 2023-01037
Analysis No. : 2024-AA101-001
Received Date : January 15, 2024
Analytical Date : January 15-25, 2024
Report No. : 2024-RAA8035
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ^{1,2}	MRL	Result	Standard ³	Standard ³	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	700	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,000	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	30,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.008	1.0	≤1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	<0.001	0.01	None	0.05
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.765	0.5	≤0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.02	5.0	≤5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0003	0.01	None	0.05
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold-Vapor Atomic Absorption Spectrometry	0.0005	<0.0005	0.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	0.4	-	≤0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.33	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	30.5	-	-	-
pH	-	Electronic	-	7.6	-	7.0-8.5	6.5-9.2
Total Dissolved Solids	mg/L	Dried at 180°C	50	133	-	≤500	1,200
Conductivity	µscm	Electrical Conductivity Meter	0.1	162	-	-	-
Salinity	gpt	Electrical Conductivity Meter	0.1	0.1	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Sol Maneeya Soi 3, Sai Ma, Muang Nonthaburi, Nonthaburi 11000
Project Name : โครงการติดตั้งโคมไฟถนนพลังงานแสงอาทิตย์ บริเวณ 1 จังหวัดกาญจนบุรี (ฐานขุดดิน (NPG-E))
Project Location : จังหวัดกาญจนบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณถนนปรางค์กู่/บ้าน ปรางค์กู่ละแวกเลข ๗/๕ 7 ส่วนในเขต อำเภอปรางค์กู่ จังหวัดกาญจนบุรี (นตส.๓)
GPS. Coordinate : UTM (WGS84) 47Q 0588284 E, 1832552 N
Sampling Date : January 13, 2024
Sampling Time : 11:22
Sampling Method : [REDACTED]
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, Sediment, Odorless

Quotation No. : 2023-01037
Analysis No. : 2024-AA101-001
Received Date : January 15, 2024
Analytical Date : January 15-25, 2024
Report No. : 2024-RAA8035
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ^{1,2}	MRL	Result	Standard ³	Standard ³	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons: C4-C9)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.040	<0.040	-	-	-
TPH (Kerosene Range Hydrocarbons: C10-C14)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.100	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons: C15-C25)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.100	<0.020	-	-	-
TPH (Heavy Oil Range Hydrocarbons: C26-C30)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.100	<0.020	-	-	-

Remark : 1. Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.
2. Notification of the National Enforcement Board, No.10, S.E.2443 (2000), issued under the Environment and Conservation of National Environmental Quality Act, B.E.2535 (1992), published in the Royal Government Gazette No.117 Part III, dated September 16, S.E.2549 (2006).
3. Notification of the Natural Resources and Environment, S.E.2551 (2008), published in the Royal Government Gazette, Vol.125 Part III, dated May 21, S.E.2551 (2008).



Laboratory Reviewer



Laboratory Supervisor

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang, Nonthaburi, Nonthaburi 11000
Project Name : โครงการพัฒนาระบบบำบัดน้ำเสียชุมชนตำบลบางตลาด 1 จังหวัดนนทบุรี (โครงการพัฒนาระบบบำบัดน้ำเสีย (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณหน้าบ่อบำบัดน้ำเสียบริเวณ 16 บริเวณหน้าบ่อบำบัดน้ำเสียชุมชนตำบลบางตลาด 1 จังหวัดนนทบุรี (พื้นที่)
GPS. Coordinate : UTM (YGS94) 47Q 0590266 E, 1833683 N
Sampling Date : January 13, 2024
Sampling Time : 08:47
Sampling Method : [REDACTED]
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless

Quotation No. : 2023-01037
Analysis No. : 2024-AA101-002
Received Date : January 15, 2024
Analytical Date : January 15-25, 2024
Report No. : 2024-RAAB036
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ^{1*}	MRL	Result	Standard ^{2*}	Standard ^{3*}	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	700	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,000	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	3.0	<3.0	30,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.011	1.0	≤1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	0.091	0.01	None	0.05
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.851	0.5	≤0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.02	5.0	≤5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0005	0.01	None	0.05
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold-Vapor Atomic Absorption Spectrometry	0.0003	<0.0003	0.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	0.2	-	≤0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.29	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	29.5	-	-	-
pH	-	Electronic	-	7.7	-	7.0-8.5	6.5-9.2
Total Dissolved Solids	mg/L	Dried at 180°C	50	151	-	≤600	1,200
Conductivity	µm/cm	Electrical Conductivity Meter	0.1	183	-	-	-
Salinity	ppt	Electrical Conductivity Meter	0.1	0.1	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang, Nonthaburi, Nonthaburi 11000
Project Name : โครงการพัฒนาระบบบำบัดน้ำเสียชุมชนตำบลบางตลาด 1 จังหวัดนนทบุรี (โครงการพัฒนาระบบบำบัดน้ำเสีย (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณหน้าบ่อบำบัดน้ำเสียบริเวณ 16 บริเวณหน้าบ่อบำบัดน้ำเสียชุมชนตำบลบางตลาด 1 จังหวัดนนทบุรี (พื้นที่)
GPS. Coordinate : UTM (YGS94) 47Q 0590266 E, 1833683 N
Sampling Date : January 13, 2024
Sampling Time : 08:47
Sampling Method : [REDACTED]
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless


Quotation No. : 2023-01037
Analysis No. : 2024-AA101-002
Received Date : January 15, 2024
Analytical Date : January 15-25, 2024
Report No. : 2024-RAAB036
Report Date : January 25, 2024

Parameter	Unit	Method of Analysis ^{1*}	MRL	Result	Standard ^{2*}	Standard ^{3*}	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons: C4-C6)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.010	<0.010	-	-	-
TPH (Kerosene Range Hydrocarbons: C7-C10)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons: C11-C25)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Heavy Oil Range Hydrocarbons: C26-C30)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-

Remark : ^{1*} Standard Method for Examination of Water and Wastewater, 25th Edition, APHA.
^{2*} Notification of the National Environmental Board, No.20, B.E.2543 (2000), issued under the Enforcement and Conservation of National Environmental Quality Act B.E.2545 (1982), published in the Royal Government Gazette No.119 Part 60, dated September 13, B.E.2543 (2000).
^{3*} Notification of the National Resources and Environment B.E.2551 (2008), published in the Royal Government Gazette, Vol.325, Part 65, dated May 21, B.E.2551 (2008).



Laboratory Reviewer



Laboratory Supervisor

ฤดูฝน

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeysa Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตปุ๋ยอินทรีย์และมูลสัตว์จากมูลสุกร แปลงเกษตร 1 จังหวัดนนทบุรี (กรุงเทพมหานคร-5 (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อกักเก็บน้ำในที่ดินแปลงเกษตรแปลงเกษตร-5 (NPG-E)
GPS. Coordinate : UTM (WGS84) 47Q 0589398 E, 1833266 N
Sampling Date : August 11, 2023
Sampling Time : 17:07
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Turbid, Light Yellow, Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD402-001
Received Date : August 15, 2023
Analytical Date : August 15-September 6, 2023
Report No. : 2023-RAAPCB8
Report Date : September 6, 2023

Parameter	Unit	Method of Analysis**	MRL	Result	Standard**	Standard**	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	750	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,000	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	3.0	<3.0	10,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.005	1.0	≤1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	0.042	0.01	None	0.05
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	1.5	0.5	≤0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.12	5.0	≤5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0025	0.01	None	0.05
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold-Vapor Atomic Absorption Spectrometry	0.0005	<0.0005	0.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	11	-	≤0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.45	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	29.0	-	-	-
pH	-	Electrometric	-	6.2	-	7.0-8.5	5.5-9.2
Total Dissolved Solids	mg/L	Dried at 180°C	50	176	-	≤600	1,200
Conductivity	µs/cm	Electrical Conductivity Meter	0.1	284	-	-	-
Salinity	ppt	Electrical Conductivity Meter	0.1	0.1	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeysa Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตปุ๋ยอินทรีย์และมูลสัตว์จากมูลสุกร แปลงเกษตร 1 จังหวัดนนทบุรี (กรุงเทพมหานคร-5 (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อกักเก็บน้ำในที่ดินแปลงเกษตรแปลงเกษตร-5 (NPG-E)
GPS. Coordinate : UTM (WGS84) 47Q 0589398 E, 1833266 N
Sampling Date : August 11, 2023
Sampling Time : 17:07
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Turbid, Light Yellow, Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD402-001
Received Date : August 15, 2023
Analytical Date : August 15-September 6, 2023
Report No. : 2023-RAAPCB8
Report Date : September 6, 2023

Parameter	Unit	Method of Analysis**	MRL	Result	Standard**	Standard**	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons, C ₆ -C ₁₀)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.040	<0.040	-	-	-
TPH (Kerosene Range Hydrocarbons, C ₁₀ -C ₁₄)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons, C ₁₄ -C ₂₈)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	0.043	-	-	-
TPH (Heavy Oil Range Hydrocarbons, C ₂₈ -C ₃₄)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	0.036	-	-	-

Remark : ** Standard Method for Examination of Water and Wastewaters, 23rd Edition, 2017.
*1 Notification of the National Environment Board, No.20, B.E.2543 (2000), issued under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.117 Part 9-9, dated September 13, B.E.2543 (2000).
*2 Notification of the Natural Resources and Environment B.E.2538 (2000), published in the Royal Government Gazette, Vol.126, Part 450, dated May 21, B.E.2538 (2000).



Laboratory Reviewer



Laboratory Supervisor

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Soi Ma, Muang Nonthaburi, Nonthaburi 11000
Project Name : โครงการขุดลอกและปรับปรุงระบบบำบัดน้ำเสีย 1 จังหวัดนนทบุรี (ฐานข้อมูลข้อมูลน้ำเสีย-5 (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณจุดบ่อน้ำดิบในบ่อบำบัดน้ำเสียของระบบบำบัดน้ำเสีย 1 จังหวัดนนทบุรี (ฐานข้อมูลข้อมูลน้ำเสีย-5 (NPG-E))
GPS. Coordinate : UTM (WGS84) 47Q 0588284 E, 1832552 N
Sampling Date : August 8, 2023
Sampling Time : 16:25
Sampling Method : Grab
Sampling By : [REDACTED]
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD365-001
Received Date : August 11, 2023
Analytical Date : August 11-29, 2023
Report No. : 2023-RAAP568
Report Date : August 31, 2023

Parameter	Unit	Method of Analysis ^{1*}	MRL	Result	Standard ^{2*}	Standard ^{3*}	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	700	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,800	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	3.0	<3.0	12,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.008	1.0	≤1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	<0.001	0.01	None	0.05
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.010	0.5	≤0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	1.01	0.10	5.0	≤5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0016	0.01	None	0.05
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold Vapor Atomic Absorption Spectrometry	0.0005	<0.0005	0.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	0.2	-	≤0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.22	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	29.0	-	-	-
pH	-	Electrometric	-	8.4	-	7.0-8.5	6.5-9.2
Total Dissolved Solids	mg/L	Dried at 180°C	50	137	-	≤600	1,200
Conductivity	µs/cm	Electrical Conductivity Meter	0.1	186	-	-	-
Salinity	ppt	Electrical Conductivity Meter	0.1	<0.1	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Soi Ma, Muang Nonthaburi, Nonthaburi 11000
Project Name : โครงการขุดลอกและปรับปรุงระบบบำบัดน้ำเสีย 1 จังหวัดนนทบุรี (ฐานข้อมูลข้อมูลน้ำเสีย-5 (NPG-E))
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณจุดบ่อน้ำดิบในบ่อบำบัดน้ำเสียของระบบบำบัดน้ำเสีย 1 จังหวัดนนทบุรี (ฐานข้อมูลข้อมูลน้ำเสีย-5 (NPG-E))
GPS. Coordinate : UTM (WGS84) 47Q 0588284 E, 1832552 N
Sampling Date : August 8, 2023
Sampling Time : 16:25
Sampling Method : Grab
Sampling By : [REDACTED]
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD365-001
Received Date : August 11, 2023
Analytical Date : August 11-29, 2023
Report No. : 2023-RAAP568
Report Date : August 31, 2023

Parameter	Unit	Method of Analysis ^{1*}	MRL	Result	Standard ^{2*}	Standard ^{3*}	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons: C ₆ -C ₈)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.040	<0.040	-	-	-
TPH (Kerosene Range Hydrocarbons: C ₉ -C ₁₀)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons: C ₁₁ -C ₂₅)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Heavy Oil Range Hydrocarbons: C ₂₆ -C ₃₀)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-

Remarks ^{1*} Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.
^{2*} Notification of the National Environment Board, No.26, B.E.2543 (2000), issued under the Enhancement and Corporation of National Environmental Quality Act B.E.2515 (1999), published in the Royal Government Gazette No.137 Part 6-0, dated September 15, B.E.2543 (2000).
^{3*} Notification of the Natural Resource and Environment B.E.2559 (2006), published in the Royal Government Gazette, Vol.429, Part 650, dated May 21, B.E.2559 (2006).



Laboratory Reviewer



Laboratory Supervisor

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตไบโอดีเซลจากกากขี้เถ้าจากโรงไฟฟ้า (กากขี้เถ้าผลิตไบโอดีเซล-2) (NPG-E2)
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อบำบัดน้ำทิ้งบริเวณโรงไฟฟ้า 16 บ้านท่าหวี หมู่ที่ 1 ตำบลบ้านพลอ อำเภอลำลูกเกด จังหวัดกำแพงเพชร (บ้านท่าหวี)
GPS. Coordinate : UTM (49Q) 47Q 0590266 E, 1833683 N
Sampling Date : August 8, 2023
Sampling Time : 16:48
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD365-002
Received Date : August 11, 2023
Analytical Date : August 11-29, 2023
Report No. : 2023-RAAP569
Report Date : August 31, 2023

Parameter	Unit	Method of Analysis ¹⁾	MRL	Result	Standard ²⁾	Standard ³⁾	
						Suitable Allowance	Maximum Allowable
Benzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	5	-	-
Ethylbenzene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	700	-	-
Toluene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	1.0	<1.0	1,000	-	-
Total Xylene	µg/L	Purge and Trap, Gas Chromatographic Mass Spectrometric (GC-MS)	3.0	<3.0	10,000	-	-
Cadmium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.003	<0.003	0.003	None	0.01
Copper	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.008	1.0	<1.0	1.5
Lead	mg/L	Digestion, Electrothermal Atomic Absorption Spectrometry	0.001	<0.001	0.01	None	0.05
Manganese	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	0.025	0.5	<0.3	0.5
Nickel	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	0.02	-	-
Zinc	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.05	5.0	<5.0	15
Arsenic	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	0.0005	0.01	None	0.05
Selenium	mg/L	Digestion, Hydride Generation Atomic Absorption Spectrometry	0.0002	<0.0002	0.01	None	0.01
Mercury	mg/L	Digestion, Cold-Vapor Atomic Absorption Spectrometry	0.0005	<0.0005	0.001	None	0.001
Iron	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.1	<0.1	-	<0.5	1.0
Barium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.01	0.20	-	-	-
Total Chromium	mg/L	Digestion, Inductively Coupled Plasma (ICP-OES)	0.005	<0.005	-	-	-
Temperature	°C	Certified Thermometer	-	29.0	-	-	-
pH	-	Electrometric	-	6.4	-	7.0-8.5	6.5-9.3
Total Dissolved Solids	mg/L	Dried at 180°C	50	163	-	<500	1,200
Conductivity	µS/cm	Electrical Conductivity Meter	0.1	175	-	-	-
Salinity	ppt	Electrical Conductivity Meter	0.1	<0.1	-	-	-

ANALYSIS REPORT

Customer Name : Vision E. Consultants Co., Ltd.
Address : 101/22 Moo 2, Soi Maneeya Soi 3, Sai Ma, Mueang Nonthaburi, Nonthaburi 11000
Project Name : โครงการผลิตไบโอดีเซลจากกากขี้เถ้าจากโรงไฟฟ้า (กากขี้เถ้าผลิตไบโอดีเซล-2) (NPG-E2)
Project Location : จังหวัดนนทบุรี
Sampling Source : Ground Water Sampling
Sampling Point : บริเวณบ่อบำบัดน้ำทิ้งบริเวณโรงไฟฟ้า 16 บ้านท่าหวี หมู่ที่ 1 ตำบลบ้านพลอ อำเภอลำลูกเกด จังหวัดกำแพงเพชร (บ้านท่าหวี)
GPS. Coordinate : UTM (49Q) 47Q 0590266 E, 1833683 N
Sampling Date : August 8, 2023
Sampling Time : 16:48
Sampling Method : Grab
Sampling By : Grab
Analyzed By : Environment Research & Technology Co., Ltd.
Physical Properties : Clear, Colorless, No Sediment, Odorless

Quotation No. : 2023-01005
Analysis No. : 2023-AD365-002
Received Date : August 11, 2023
Analytical Date : August 11-29, 2023
Report No. : 2023-RAAP569
Report Date : August 31, 2023

Parameter	Unit	Method of Analysis ¹⁾	MRL	Result	Standard ²⁾	Standard ³⁾	
						Suitable Allowance	Maximum Allowable
TPH (Gasoline Range Hydrocarbons, C6-C9)	mg/L	Purge and Trap, Gas Chromatographic (GC-FID)	0.040	<0.040	-	-	-
TPH (Kerosene Range Hydrocarbons, C10-C14)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Diesel Range Hydrocarbons, C15-C28)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-
TPH (Heavy Oil Range Hydrocarbons, C29-C36)	mg/L	Liquid-Liquid Extraction, Gas Chromatographic (GC-FID)	0.020	<0.020	-	-	-

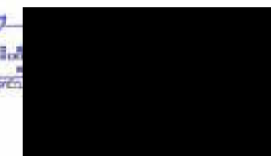
Remark : ¹⁾ Standard Methods for Examination of Water and Wastewater, 21st Edition, 2017.

²⁾ Notification of the National Environment Board, No.20, B.E.2545 (2002), issued under the Enforcement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.117 Part 141, dated September 14, B.E.2545 (2002).

³⁾ Notification of the National Environment Board, B.E.2551 (2008), published in the Royal Government Gazette, Vol.125, Part 850, dated May 21, B.E.2551 (2008).



Laboratory Reviewer



Laboratory Supervisor



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการในพื้นที่จังหวัดกำแพงเพชร
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

ภาคผนวกที่ 41
เอกสารการขึ้นทะเบียนห้องปฏิบัติการ

ที่ อก ๐๓๑๐(๑) ๗๓๖๕



กรมโรงงานอุตสาหกรรม
ถนนพหลโยธินที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๕ กรกฎาคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มีนาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ แผ่น
๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙๔ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๒
ซอยหินเขต ๑ ถนนงามวงศ์วาน แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ความเห็น เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด
ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๔ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๒๗ รายการ น้ำได้ดิน
จำนวน ๕๘ รายการ อากาศเสีย จำนวน ๒๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๒๐ รายการ และ
ดิน จำนวน ๔๖ รายการ รวมทั้งสิ้นจำนวน ๑๔๙ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤษภาคม ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการกองวิเคราะห์และประเมินความเสี่ยง
ปฏิบัติการทางเคมีและชีวเคมีกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๖๐๒ ๔๐๐๒-๐ ๒๖๐๒ ๔๔๔๖

โทรสาร ๐ ๒๖๕๔ ๓๔๔๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ๖-๐๙๙๔

ที่ อก ๐๓๑๐(๑) ๗๓๖๕

ลงวันที่ ๒๕ กรกฎาคม ๒๕๖๕

๖. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย

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พะเยียนเลขาฯ	7-๐๙๙-๖-๔๘๕๑

เอกสารแนบท้ายหนังสือรับข้ออาชญาขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์อาชญา
บริษัท เอ็มวอร์นเมิร์ท ซีรีส์ แอนด์ เทคโนโลยี จำกัด เลขทะเบียน 7-๐๙๙
ที่ กก ๐๓๑๐(๑)/ ลงวันที่

ขอขยายสามลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘๗ รายการ

นี้เสีย 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 ^[2]
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]

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 Kjeldahl 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]

ผู้รับอนุญาต
ผู้ดำเนินการวิเคราะห์
เอกสารแนบท้ายหนังสือรับข้ออาชญาขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์อาชญา

22 Temperature...

ผู้รับอนุญาต
ผู้ดำเนินการวิเคราะห์
เอกสารแนบท้ายหนังสือรับข้ออาชญาขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์อาชญา

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⁾



ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

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⁾



ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

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 (ต่อเนื่อง) 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 ⁽⁶⁾ 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⁾

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⁾

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 ⁽²⁾
25	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
26	Xylene	Adsorption Sampling, Gas Chromatographic Method ⁽⁴⁾

สิ่งกีดขวางหรือวัสดุที่ไม่ขึ้นตัว 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 ^(5,6,10)
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)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	pH	Electrometric Method ^(7,4)
16	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(5,12) 2) Digestion, Inductively Coupled Plasma Method ^(5,8)
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)

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 ⁽¹⁴⁾

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	สารพิษ	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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ที่ อก ๐๓๓๐(๑)/ ๒๐๓๕



กรมโรงงานอุตสาหกรรม
ถนนพรหมมาที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๐ กุมภาพันธ์ ๒๕๖๕

เรื่อง เปลี่ยนแปลงสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอรับทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๕ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด จำนวน ๒ แผ่น

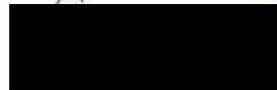
ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๒๑๕ หมู่ที่ ๖ ซอยชินเขต ๑ ถนนรามวงศาวัน
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงสารมลพิษที่วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้วให้ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี
จำกัด เพิ่มขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในดิน ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้ขอสงวนสิทธิ์มอบหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๒๐๓๕ ลงวันที่ ๒๕ กรกฎาคม ๒๕๖๕ คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่น
คำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ทำหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้ว่าราชการจังหวัดและอธิบดีกรมโรงงาน
อุตสาหกรรม



เป็นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๖ ๖๓๐๒ ต่อ ๒๓๐๓-๕ โทรสาร ๐ ๒๕๓๖ ๖๓๓๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.mail.go.th

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

เลขทะเบียน ๖-๐๙๙

ที่ อก ๐๓๓๐(๑)/ ๒๐๓๕

ลงวันที่ ๑๐ กุมภาพันธ์ ๒๕๖๕

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม 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 ₁₈ - C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ^(1,3)

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ที่ อก ๐๓๐๐(๑)/ ๑๕๕๖๗



กรมโรงงานอุตสาหกรรม
ถนนพหลโยธินที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๕ สิงหาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง ๑. ทำขออนุญาต/ขอย้าย/เปลี่ยนแปลงบุคลากร และขณิคารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๑ สิงหาคม ๒๕๖๕

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

ตามหนังสือที่อ้างถึง ๑ และ ๒ บริษัท เอ็นไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๓๓๕ หมู่ที่ ๒ ซอยจินเขตร ๑
ถนนงามวงศ์วาน แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้อยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๙
๒)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๐
๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๑
๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๒
๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๓
๖)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๔
๗)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๕
๘)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๖
๙)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๕๗

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๑
๒)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๒
๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๓
๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๔
๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๕
๖)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๖
๗)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๗
๘)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๘
๙)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๙

๑๑) นายพงศ์ปวีร์...

๑๓)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๑
๑๔)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๒
๑๕)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๓
๑๖)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๔
๑๗)	[Redacted]	ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๕

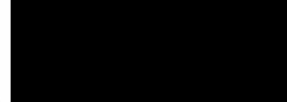
๓. ให้เปลี่ยนชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาววราภรณ์ ชื่นเงิน ทะเบียน
เลขที่ ๖-๐๙๙-๖-๐๐๖๐ เป็น นางสาวอิทธิฤทธิ์ ชื่นเงิน

๔. ให้เปลี่ยนชื่อ-สกุลเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาวเปรมวดี ปุริโธ
ทะเบียนเลขที่ ๖-๐๙๙-๖-๐๐๖๑ เป็น นางเคธิณี สืบเศรษฐ

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๐๐(๑)/๒๕๖๕ ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๕ คือในวันที่ ๓๑ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน/นายก อบจ.ราชบุรี
ผู้ตรวจราชการกรม/อธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนามลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๕๖๐ ๖๓๓๐ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๕๖๐ ๖๓๓๐ ต่อ ๒๑๐๔๔
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเพณีไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"





ท. ยก ๐๓๑๐(๑)/ ๑๑ ๑๙ ๕๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๗ สิงหาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเม้นท์ วิสริช แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๕ มิถุนายน ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์
บริษัท เอ็นไวรอนเม้นท์ วิสริช แอนด์ เทคโนโลยี จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอ็นไวรอนเม้นท์ วิสริช แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ๖-๐๔๙ สถานที่ตั้งเลขที่ ๒๕/๓๓๕ หมู่ที่ ๖ ซอยจินเขต ๓ ถนนงามวงศ์วาน
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์ ความละเอียด
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกสัญญาคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๓ ราย
ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๐๖
๒. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย

๑) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๗๐๕๖
๒) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๑๐
๓) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๑๓
๔) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๑๗
๕) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๒๕
๖) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๓๔
๗) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๔๐
๘) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๘๘๕๒
๙) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๐๐๐๓
๑๐) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๐๐๐๖
๑๑) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๐๐๑๑
๑๒) [REDACTED]	ทะเบียนเลขที่ ๖-๐๔๙-๙-๐๐๑๔

๓. ให้เพิ่มขอบข่าย...

- ๒ -

๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว ตามสิ่งที่ส่งมาด้วย

หนังสือแนบมาซึ่งจะหมดอายุหรือเกินวันออกอายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



ผู้อำนวยการจังหวัดและอธิบดีกรมโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๗-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๗

ไปรษณีย์อิเล็กทรอนิกส์ sarabangk@dlw.mail.go.th



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

บริษัท เอ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๙๙

ที่ อก ๐๓๑๔(๑)/ ๓๑ ๕ ๕ ๕ ลงวันที่ ๑๗ สิงหาคม ๒๕๖๖

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘ รายการ

ซึ่งถูกต้องหรือวัสดุที่ไม่ใช่แล้ว 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 ^(1,2,3,4)
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 ^(1,2,3)
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)

- 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)

เอกสารอ้างอิง

1. กรมโรงงานอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 25๔8. เรื่อง การจัดทำสิ่งปฏิกูลหรือวัสดุที่ไม่ใช่แ้วราชกิจจานุเบกษา 25 มกราคม 2549. เล่มที่ 123 ตอนพิเศษ 11๓.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. SW-846, 1997.
3. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma-Optical Emission Spectrometry. SW-846 Method 6010D, 2018.
4. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Chromium, Hexavalent (Colorimetric). SW-846 Method 7196A, 1992.
5. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Liquid Waste (Manual Cold-vapor Technique). SW-846 Method 7470A, 1994.

15 Silver...



บริษัท ปตท.สผ. สยาม จำกัด

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการในพื้นที่จังหวัดกำแพงเพชร
ฉบับเดือนมกราคม - ธันวาคม พ.ศ. 2566

ภาคผนวกที่ 42
เอกสารสอบเทียบเครื่องมือตรวจวัด

ព្រះរាជាណាចក្រកម្ពុជា

ព្រះបរមរាជវាំង

ភ្នំពេញ

ថ្ងៃទី ០១ ខែ ០១ ឆ្នាំ ២០២០

លេខ ០១/២០២០

ស្តីពី

ការងារ

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ការងារ

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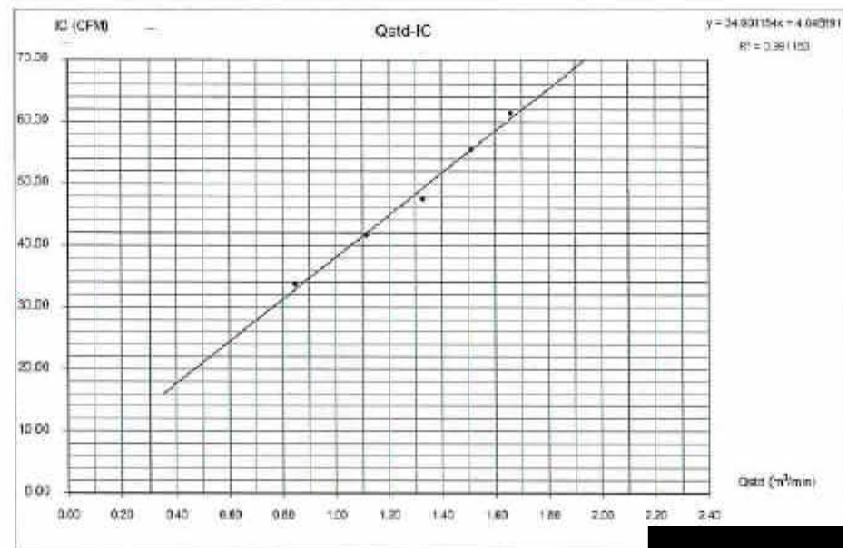
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Customer	2025-31037	Date	January 11, 2024
Sampler Location	Shuangkiet 1 (Thailand)	Start Time	0:00 AM
Sampler Model	TSP HVA-24	Transfer Standard Type	0.000
Instrument Model	HVCL-500BE	Calibrator Model	TS-500SA
Motor Serial Number	2514-01	Calibrator Serial Number	3302
Recorder Serial Number	2154	Calibrated By	

Point	(Delta H)			(A)	(C)	(I)	(Y)	Temperature	Barometric	Bar	Sup	
No.	Pressure Drop Across Orifice (mmHg)			$\Delta H \cdot C \cdot P_{std} \cdot T_{std} / T_{amb}$	$Q_{std} = (1/16) \cdot K \cdot C \cdot \Delta H$	orifice flow rate indicator	$IC = (1/16) \cdot K \cdot C \cdot \Delta H \cdot T_{std}^2$	(°C)	Pressure (mmHg)	Water	User	
	Positive	Negative	$\Delta H \cdot C$		(m³/min)	(m³/min)						
5	1.5	1.5	3.0	17.091	0.54724	34.0	33.69	302.0	750.0			
7	2.5	2.5	5.0	22.693	1.11222	62.0	41.61	302.0	750.0			
10	3.7	3.7	7.5	26.943	1.50644	98.0	47.56	302.0	750.0			
13	4.8	4.8	9.6	3.0954	1.53086	50.0	45.48	302.0	750.0			
16	5.8	5.8	11.6	3.37453	1.55822	62.0	41.43	302.0	750.0			
Linear Regression Y OR X: Y = ax + b								Average	302.0	750.0		
1	Slope (m)			3.0004	Linear Equation			P	0.361153	Intercept	750.0	
2	Intercept (b)			0.01455	Slope Flow Rate (K) (m³/min)		1.325	F	0.360507	T _{std}	293.0	
3	Correlation Coefficient (r)			0.99999	Final Slope Flow Rate = (1)			0	0.361051	IC		
Result:								C = (P/F) * (Qstd/IC) * 100				4.60675002

COMMENT

Anderson Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

P-01425, Rev. 8, November 6, 2019



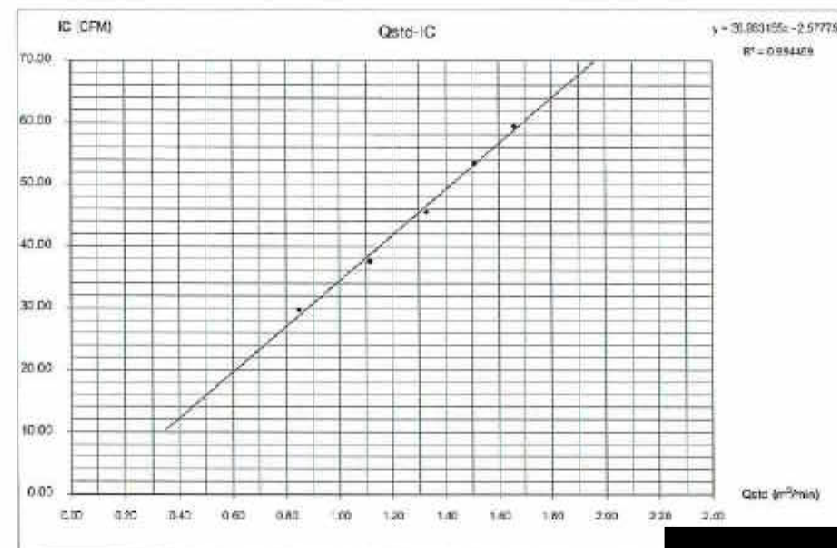
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Customer	2025-31037	Date	January 11, 2024
Sampler Location	Shuangkiet 1 (Thailand)	Start Time	0:00 AM
Sampler Model	PM-10 HVA-21	Transfer Standard Type	0.000
Instrument Model	HVCL-500BE	Calibrator Model	TS-500SA
Motor Serial Number	404-002	Calibrator Serial Number	3302
Recorder Serial Number	504-002	Calibrated By	

Point No.	(Delta H)		(A)	(C)	(I)	(Y)	Temperature	Barometric	Bar	Bar
	Positive	Negative	$\Delta H \cdot C$	$Q_{std} = (1/16) \cdot K \cdot C \cdot \Delta H$	orifice flow rate indicator	$IC = (1/16) \cdot K \cdot C \cdot \Delta H \cdot T_{std}^2$	(°C)	(mmHg)	(mmHg)	(mmHg)
5	1.5	1.5	3.0	1.71601	0.61734	30.0	30.02	302.0	750.0	
7	2.5	2.5	5.0	2.25903	1.11572	30.0	30.05	302.0	750.0	
10	3.7	3.7	7.5	2.66500	1.20644	30.0	30.07	302.0	750.0	
13	4.8	4.8	9.6	3.06002	1.51045	30.0	30.09	302.0	750.0	
16	5.8	5.8	11.6	3.57422	1.65072	30.0	30.11	302.0	750.0	
Linear Regression Y OR X: Y = ax + b							Average	30.02	750.0	
1	Slope (m)		2.64234		Linear Equation			r ²	0.924403	Intercept
2	Intercept (b)		0.01435		Slope Flow Rate (K) (m³/min)	1.333		r	0.967250	T _{std}
3	Correlation Coefficient (r)		0.99999		Final Slope Flow Rate = (1)	0		0.361507	IC	0.2815612
Result										

COMMENT

Anderson Instruments, Inc.



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Technician

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Environmental Scientist

P-01425, Rev. 8, Nov 6, 2019



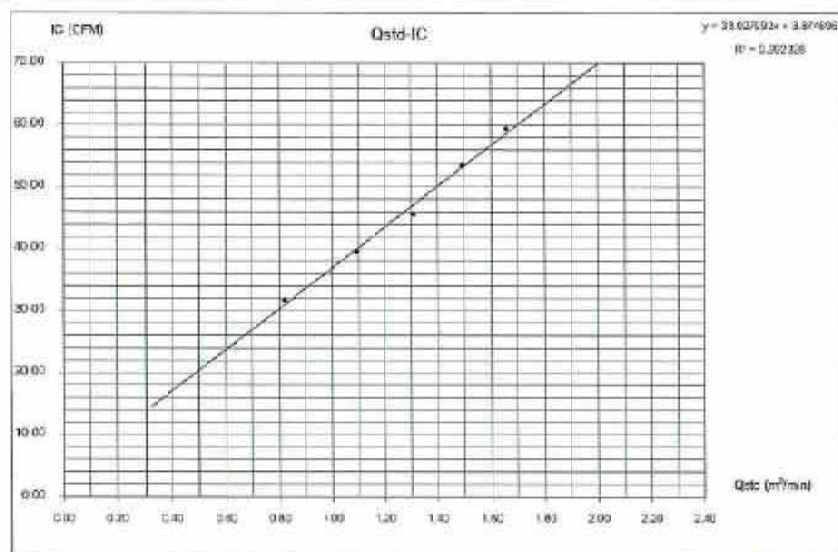
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	0320-01037	Date	January 11, 2024
Sampler Location	Chungkrasong Industrial	Start Time	8:30 AM
Sampler Number	TS-10-A22	Transfer Standard Type	On-site
Instrument Model	HVOL-85085	Calibrator Model	TS-SC05A
Master Serial Number	3051	Calibrator Serial Number	3002
Reference Serial Number	2187	Calibrated By	

Rate	beta H0		(A)	(C)	(E)	(Y)	Temperature	Barometric	Scr	Sop
No.	Pressure Drop Across Orifice (H ₂ O)		$(\Delta H_0)(\rho_{H_2O}/(\rho_{gas}(T_{gas}))^{0.5})$	Qstd = (Y)(C)(A)(E)	Slope Rate Ratio (K)		$(C = (Y)(\rho_{gas}(T_{gas})/(\rho_{H_2O}))^{0.5})$	Pressure	Motor	Motor
	Positive	Negative	ΔH ₀	(m³/min)	(l/min)		(l/min)	(Pa × 10 ²)	(mmHg)	
5	1.5	1.5	0.6	0.05752	0.08175	52.0	1013.0	750.0		
7	2.5	2.5	3.0	0.23100	1.09174	40.0	1013.0	750.0		
10	3.5	3.5	7.0	0.50340	1.00849	40.0	1013.0	750.0		
13	4.5	4.2	9.4	0.01764	1.49431	54.0	1013.0	750.0		
16	5.5	5.8	11.8	0.57693	1.61052	50.0	1013.0	750.0		
Linear Regression: Y = C(A)(X) + B							Average	1013.0	750.0	
1	Slope (m)		2.5-0.00000		Linear Equation			0.00000	750.0	750.0
2	Intercept (b)		-0.00000		Slope Rate Ratio (K) (m³/min)		1.033	0.00000	750.0	750.0
3	Correlation Coefficient (r)		0.99999		Final Set Point Rate = (1)		0	0.00000	750.0	750.0
Result		C = (Pa/Pstd) * (Qstd/Q) * 0.5								

COMMENT

Andersen Instruments, Inc.



Checked By

Approved By

Technician

Environmental Scientist



FAB 05, Rev. E, November 15, 2019

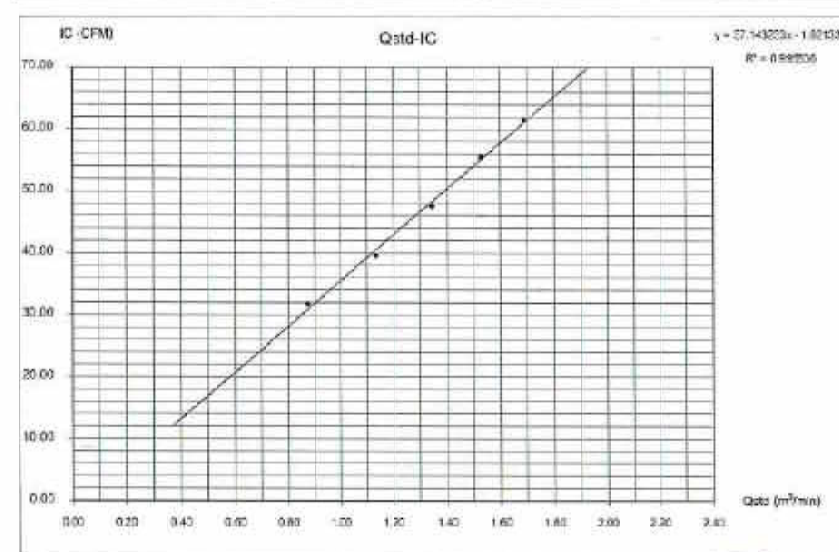
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	0320-01037	Date	January 11, 2024
Sampler Location	Chungkrasong Industrial	Start Time	8:30 AM
Sampler Number	PM-10-P020	Transfer Standard Type	On-site
Instrument Model	HVOL-8498C	Calibrator Model	TS-SC05A
Master Serial Number	3135	Calibrator Serial Number	3002
Reference Serial Number	3001	Calibrated By	

Rate	(Delta H)		(A)	(C)	(E)	(Y)	Temperature	Barometric	Scr	Sop
No.	Pressure Drop Across Cell (mm Hg)		$(\Delta H) (Pa/P_{std}) (Q_{std}/Q) \cdot 1.5$	Gold = $(1/P_{std}) (P - P_{std})$	Simple Flow Rate (ml/min)	$Q_C = (P/P_{std}) (Q_{std}/T_{std}/T)^{1.5}$	$(^{\circ}K = (^{\circ}C + 273))$	Pressure	Motor	Motor
	Positive	Negative	ΔH_{10}	(m^3/min)	(l^3/min)					
5	1.5	1.5	0.2	0.00000	0.00000	0.00000	300.0	750.0		
7	2.5	2.5	0.4	0.00007	0.00008	0.00000	300.0	750.0		
10	3.5	3.5	0.6	0.00012	0.00013	0.00000	300.0	750.0		
13	4.5	4.5	0.8	0.00019	0.00020	0.00000	300.0	750.0		
16	5.5	5.5	1.0	0.00026	0.00027	0.00000	300.0	750.0		
19	6.5	6.5	1.2	0.00032	0.00033	0.00000	300.0	750.0		
Linear Regression: $Y = AX + B$						Average	300.0	750.0		
1	Slope (m)		2.5-0.00000		Linear Equation			0.00000	750.0	750.0
2	Intercept (b)		-0.00000		Set Point Flow Rate = $(1) \cdot (P/P_{std})$	1.033	0	0.00000	750.0	750.0
3	Correlation Coefficient (r)		0.99999		Final Set Point Rate = (1)	0	$(P/P_{std}) (T_{std}/T)$	0.00000	750.0	750.0
Result										

COMMENT

Andersen Instruments, Inc.



Checked By

Approved By

Technician

Environmental Scientist



FAB 05, Rev. E, November 15, 2019



RECALIBRATION
DUE DATE:
January 17, 2024

Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 17, 2023	Rootsometer S/N: 438320	Ta: 295 °K	
Operator: Jim Tisch		Pa: 740.2 mm Hg	
Calibration Model #: TE-5025A	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	0.9857	0.7042	0.8928
0.9753	0.9832	1.9637	0.9814	0.9993	1.2676
0.9732	1.0893	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:	rootsometer 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
gale of Cleves, OH 45002

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

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

Contact: Ramita Taengthai

Weighing Device

Manufacturer: Mettler Toledo
Model: AB204-S
Serial No.: 1123103723
Building: N/A
Floor: 4
Room: 406

Instrument Type: Weighing Instrument
Asset Number: ERTC-L-IN-0048
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

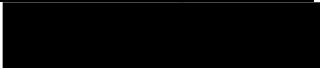

Procedure

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

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

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

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

Calibrator: 
Chawalit Martsuloke
Approved Signatory: 
Technical Manager / Head of Calibration Center

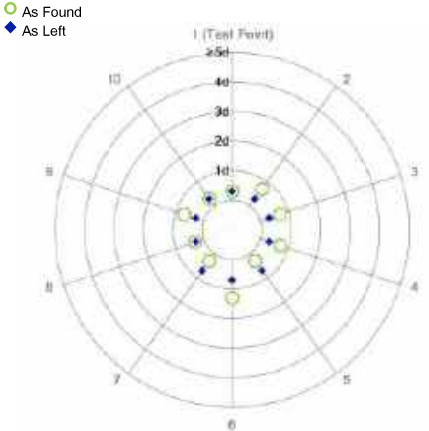
Measurement Results

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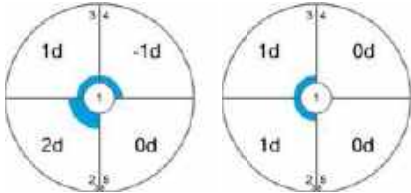
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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.

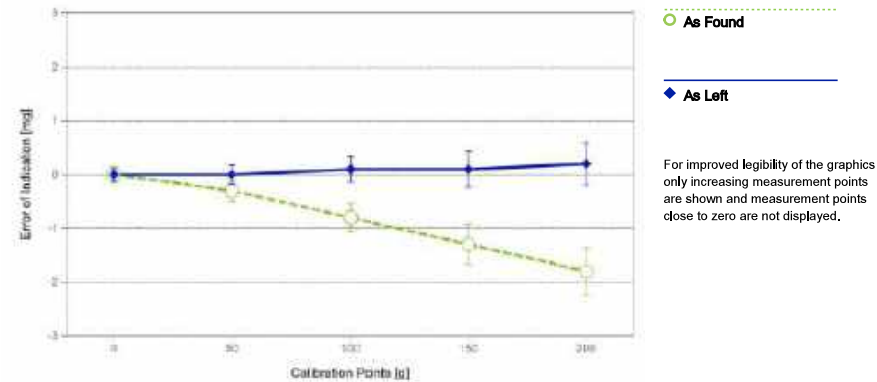
Error of Indication

As Found

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

As Left

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



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

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

Test Equipment

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

Weight Set 1: OIML E2

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

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

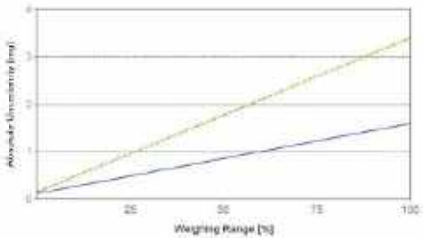
Linearization of Uncertainty Equation

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

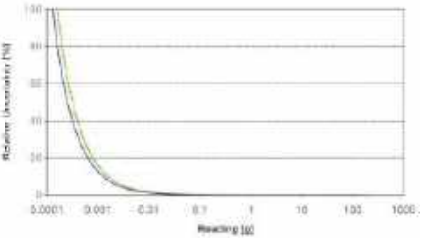
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

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



As Found



As Left

GWP® Certificate



As
Found



As
Left



The weighing device meets the given process requirements.

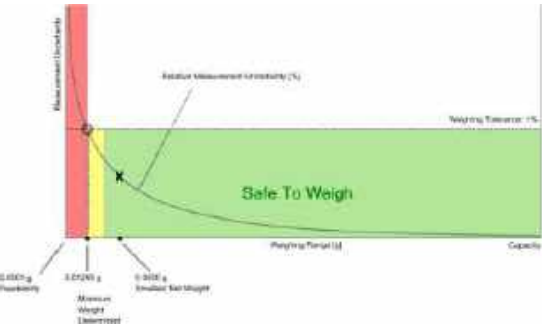
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☒ As Left

Process Requirements

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

Safe Weighing Range



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

Minimum Weight

As Found Minimum Weight Table

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



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

As Left Minimum Weight Table

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



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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 100 g

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

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

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

Eccentricity

Test Load: 100 g

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

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

As Found

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

As Left

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

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

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

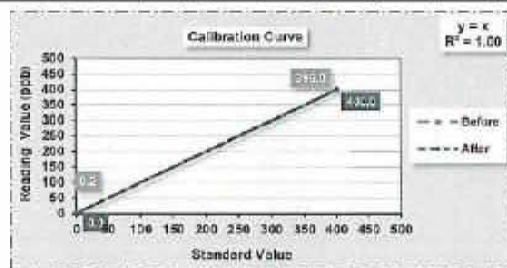
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacturer	Thermo	Location	Envir Research
Model	43C	Quotation	2023-01037
Serial No.	0611116460	Calibration Date	December 24, 2023
Analyzer Unit	ppb	Time	2:05 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700413629
Dynamic Dilution Calibrator	Tanabate	300	0165
Standard Gas Components	CO = 4.516 ppm		
Cylinder No : E80123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO ₂ = 54.3 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	399.0	400.0	-	-	0.3



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	30.3	30.4	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	44.8	44.8	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	725.3	725.1	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.406	0.407	0.350 to 1.000
Lamp Intensity	INTENSITY	Hz	23,946	24,016	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	929	930	750 to 1,200
SO ₂ Concentration	SO ₂ CONCENTRATION	ppb	1.8	1.3	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By:

December 24, 2023

Checked By:

December 24, 2023



Calibration Data of SO₂ Analyzer

Analyzer Performance Test

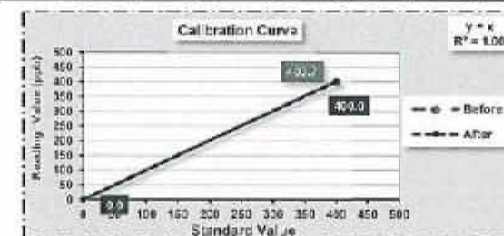
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacturer	Horiba	Location	Envir Research
Model	APSA-370	Quotation	2023-01037
Serial No.	E8KBWB08	Calibration Date	December 21, 2023
Analyzer Unit	ppb	Time	11:13 AM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env	111	0700413629
Dynamic Dilution Calibrator	Tanabate	300	0165
Standard Gas Components	CO = 4.516 ppm		
Cylinder No : E80123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO ₂ = 54.3 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-0.4	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	5	5	Voltage of the measured SO ₂ value
LAMP	mV	236.4	236.5	200 mV - 1200 mV
CELL	°C	33.5	33.7	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	44.1	44.2	65 kPa or less
AMBIENT	kPa	100.5	100.6	Current atmospheric pressure
DC 24V	V	23.9	23.9	24 V ±0.5 V
DC 5V	V	5.0	5.0	5 V ±0.5 V

Calibrate By:

December 21, 2023

Checked By:

December 21, 2023



Calibration Data of NOx Analyzer

Analyzer Performance Test

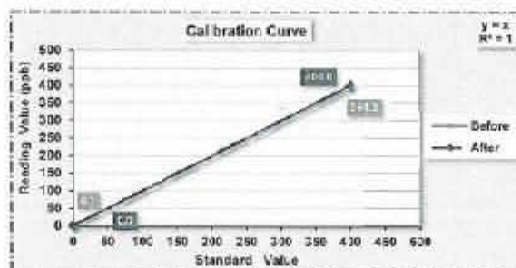
Equipment	Gas Analyzer (NOx)	Customer Name	Vison E.
Manufacturer	HORIBA	Location	Env. Research
Model	APNA-370	Quotation	2023-01037
Serial No.	M4285P21	Calibration Date	December 24, 2023
Analyzer Unit	ppb	Time	1:40 PM

Instruments for Calibration

Instruments	Manufacturer	Model	Serial Number
Zero Air Supply	Thermo Env.	111	070410429
Dynamic Dilution Calibrator	Tanabys	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 35.3 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	-0.5	0.0	0.1	0.0	-0.5	0.0	-	-	-
Span	400	396.3	400.0	396.2	400.0	2.1	0.0	-	-	1.5



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	1.9	2.0	Voltage of the measured NO value
Signal NOx	mV	14.7	14.8	Voltage of the measured NOx value
Detector	°C	42.1	42.9	43 °C ± 5 °C
Ambient	kPa	101.2	101.0	Current atmospheric pressure
DC 24V	V	23.8	23.8	24V ± 0.5
DC 5V	V	5.0	5.0	5V ± 0.5
NO Slope	-	0.91997	0.92145	0.50000 - 2.0000
NOx Slope	-	0.02275	0.02366	0.50000 - 2.0000

Calibrate By:

(Signature)
December 24, 2023

Checked By:

(Signature)
December 24, 2023

Calibration Data of NOx Analyzer

Analyzer Performance Test

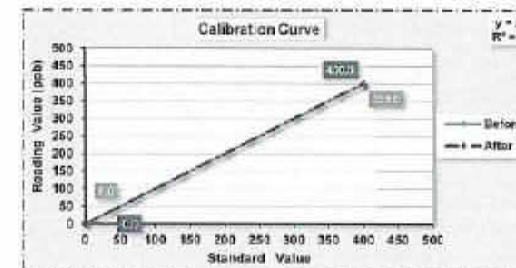
Equipment	Gas Analyzer (NOx)	Customer Name	Vison E.
Manufacturer	HORIBA	Location	Env. Research
Model	APNA-370	Quotation	2023-01037
Serial No.	YCP44HTM	Calibration Date	December 27, 2023
Analyzer Unit	ppb	Time	3:00 PM

Instruments for Calibration

Instruments	Manufacturer	Model	Serial Number
Zero Air Supply	Thermo Env.	111	070410429
Dynamic Dilution Calibrator	Tanabys	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 35.3 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	0.1	0.0	0.0	0.0	0.1	0.0	-	-	-
Span	400	401.6	400.0	399.0	400.0	2.6	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	2.2	2.1	Voltage of the measured NO value
Signal NOx	mV	12.3	11.0	Voltage of the measured NOx value
Detector	°C	41.9	41.9	43 °C ± 5 °C
Ambient	kPa	101.4	101.4	Current atmospheric pressure
DC 24V	V	23.7	23.7	24V ± 0.5
DC 5V	V	5.0	5.0	5V ± 0.5
NO Slope	-	1.02258	1.00900	0.50000 - 2.0000
NOx Slope	-	1.04500	1.05120	0.50000 - 2.0000

Calibrate By:

(Signature)
December 27, 2023

Checked By:

(Signature)
December 27, 2023

Calibration Data of CO Analyzer

Analyzer Performance Test

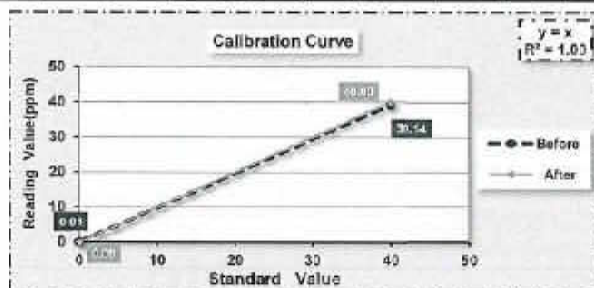
Equipment	Gas Analyzer (CO)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01037
Serial No.	EFE4TS99	Calibration Date	December 22, 2023
Analyzer Unit:	ppm	Time	12:41 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419629
Dynamic Dilution Calibrator	Tanabate	300	0165
Standard Gas Components	CO = 4.516 ppm		
Cylinder No. : EB0123013	NO = 55.3 ppm		
Expires Date : Oct 22, 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	0.08	0.00	-	-	-
Span	40	39.14	40.00	-	-	2.15



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	2.7	Voltage of the measured CO Value
SIGNAL (COMP)	mV	0.0	0.1	Voltage of the interference component Value
CELL	°C	35.2	35.4	Ambient + (5 to 10 °C)
PUMP	kpa	40.4	40.3	less than 65
AMBIENT	kpa	101.2	101.2	Atmospheric pressure
DC 24V	mV	23.9	23.9	24±0.5 V
DC 5V	mV	4.9	4.8	5±0.5 V

Calibrate By:

December 22, 2023

Checked By:

December 22, 2023

Calibration Data of CO Analyzer

Analyzer Performance Test

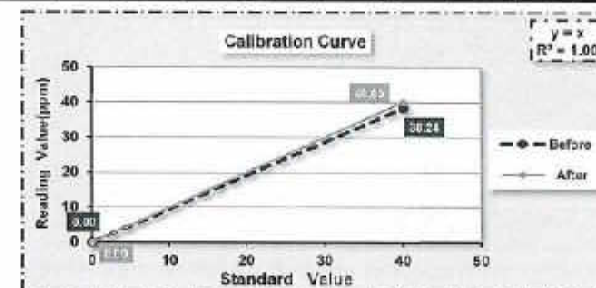
Equipment	Gas Analyzer (CO)	Customer Name	TLT Consultants
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-00214
Serial No.	4NC2XP27	Calibration Date	December 22, 2023
Analyzer Unit:	ppm	Time	1:35 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419629
Dynamic Dilution Calibrator	Tanabate	300	0165
Standard Gas Components	CO = 4.497 ppm		
Cylinder No. : EB0123013	NO = 46.1 ppm		
Expires 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	0.00	0.00	-	-	-
Span	40	38.24	40.00	-	-	4.40



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	3.1	4.3	Voltage of the measured CO Value
SIGNAL (COMP)	mV	0.3	0.1	Voltage of the interference component Value
CELL	°C	32.1	31.4	Ambient + (5 to 10 °C)
PUMP	kpa	42.1	42.1	less than 65
AMBIENT	kpa	101.0	100.9	Atmospheric pressure
DC 24V	mV	23.9	23.3	24±0.5 V
DC 5V	mV	4.9	4.8	5±0.5 V

Calibrate By:

December 22, 2023

Checked By:

December 22, 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI89E15A0292 Reference Number: 16C-401604495-1
Cylinder Number: EB0123013 Cylinder Volume: 144.4 Cubic Feet
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 66C
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-12/011, 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 the 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	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15010429	KAL004123	97.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Jul 23, 2025
NTRM	15010429	KAL004123	97.6 PPM NOX/NITROGEN	+/- 0.5%	Jul 23, 2025
NTRM	16010235	KAL004419	97.66 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Dec 23, 2021
NTRM	06012318	KAL004620	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Jun 07, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000926781	FTIR	Sep 25, 2019
MKS FTIR - NO - 000926781	FTIR	Oct 16, 2019
MKS FTIR - NOx - 000926781	FTIR	Oct 16, 2019
MKS FTIR - SO2 - 000926781	FTIR	Oct 23, 2019

Triad Data Available Upon Request

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



Approved for Release

Page 1 of 166-401604495-1



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2359-0469

Calibration Certificate

Issued by: Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue: 12 April, 2023

Certification No. 15823

Page : 1 of 3

Object : เครื่องมือตรวจวัดอุณหภูมิอากาศ

Manufacturer : Davis Instruments

Type : Vantage Pro2 ID No. : No.30

Serial No. : Display BE181108006 Transmitter: AS160105011

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO.1425 Pilot Tube Theodor Friedrichs Type 0800,0000 serial 9C23

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

: Ultrasonic Anemometer Model DA-850-3TV (sensor TR-ECAH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity 31.0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.839094 Wet No. 8389/94

: testo, testo 645 Serial No. Thermoschne der No.818802

Calibrated by :

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 158/23

12 April, 2023

Page : 2 of 3

Standard Ultrasonic Anemometer m/sec	HOCK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	hPa (120)	hPa (120)	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
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	-	-	-	19.7	0.32

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

Calibration

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 158/23

12 April, 2023

Page : 3 of 3

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
50.1	50.2	-0.1
30.2	30.2	0.0
16.8	16.0	-0.2

Check

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 : 12 September, 2023 Certification No. : 350/23

Page : 1 of 4

Object : Weather Station

Manufacturer : Davis Instruments Inc.

Type : Vantage Pro 2 ID No. : No.29

Serial No. : Display AZ170227015 Transmitter ED181211070

Customer : Environment Research & Technology Company Limited,
25/113-114 Moo 5 Soi Chinakiet 1, Ngamwongwan Road,
Toongsonghong, Lakki, Bangkok 10210.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL :

Micromanometer : Theodor Friedrich PC014 Serial No. 9310110

HOOK GAGE NO 1425 : Pitot Tube Theodor Friedrich 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

Thermoschneider No. 916602

Signed :

Mr. Pibod Promrat

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 350/23

12 September, 2023

Page : 2 of 4

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	hPa (100)	hPa (100)	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	-	-	-	15.0	0.01
17.02	-	-	-	16.9	0.12
20.02	-	-	-	20.0	0.02

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

Calibration & Test Section

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 0-2396-0156, 0-2399-0459

The Result of Calibration

Certification No. 350/23

12 September, 2023

Page : 3 of 4

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
50.2	50.3	-0.1
30.4	30.4	0.0
15.6	15.6	0.0

Checked

Mechanical Engineer



Date of Issue 12 September, 2023

Certification No. 350/23

Page: 4 of 4

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING
BUCKET Product No. 6322C Mfg. Code. BD181211070 ที่ทำการสอบเทียบกับแก้ววัดฝนแบบ
แก้วทอง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082
และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.01 มม./TIP)



ลงชื่อ วิมล วัฒน

(นายวิมล วัฒน)

วิศวกรชำนาญการ

Sound Level Meter Calibration Report

Support Equipment Type	:	Sound Level Calibrator
Manufacture	:	BSWA, Technology
Model	:	CA111
Serial No.	:	590331
Range of Calibrator		
- Support Equipment Type	:	94.0
- Frequency	:	1,000 Hz.
Calibrated By	:	Mr.Romosa Kaleb
Calibration Date	:	January 10, 2024
Customer Name	:	Vision E. Consultants Co., Ltd

โครงการผลิตปิโตรเลียมแหล่งโนนพลวงวพขบ. แปลงเลข 1
จังหวัดกำแพงเพชร (ฐานข้อมูลผลิตโนนพลวง-อี (NPG-E))

[illegible]

Checked Ey

Technician

Approved By _____

Environmental Scientist

Calibration Chart

BSWA-IV-C021-03-0048A

Sound Calibrator model

Serial Number

Appearance

Power Supply

Sound Pressure Level

Frequency

THD (@1000Hz)

Copying and using select parts, or tampering with this document without the permission of 3SWA is forbidden!

BSWA Technology Ltd.

www.feswa-tech.com

This equipment was calibrated at the following ambient conditions:

Temperature: 20 °C

Humidity: 40 %RH

Pressure: 1025 hPa

This equipment is qualified

Calibrated

2023-3-

Date _____



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534M PATTANAKARN ROAD SOI 11, 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. : 3015167
ID No. : NC.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, Lakki, 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 : 
() Malee Butkruea
() Sathip Meangmai
(x) Ponpan Palom
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 & 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 4.006	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826500	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 (±)	Coverage factor k
pH Electrode	4.008	4.02	N/A	0.0079	2.00
S/N: 3015167	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 %

-000-



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 FAX. 0-2719-9684

Cert.No.: 22TW/287
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro20i
Serial No. : 19D1C1641
ID No. : NO.6
Received Date : 27 December 2022
Test Date : 27 December 2022
Reference : 2212-0734/WN-12
Submitted by : Environment Research & Technology Company Limited,
25/114 Moo 5, Soi Chinakot 1, Ngamwongwan Road,
Toongsonghong, Lakki, Bangkok 10210
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : QP-CH9
by Comparison Technique with Azide Modification Method
Tested by : 
Approved by : 
Approved Signatory
() Malee Butkruea
() Sathip Meangmai
(x) Wasakorn Leringtrakul
Issue Date : 28 December 2022

B 0303341



Cert.No.: 22TW/287
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	112E143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 19D100260

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

-000-

a 1142238



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



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



Certificate of Calibration

Certificate No. : MT22-6773

Page : 1 of 2

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

Description : Incubator
Manufacturer : Sanyo
Model : MIR-254
Serial No. : 1103017
Identification No. : ERTC-L-IN-066
Calibration Place : Customer Laboratory

Order No. : 3555/22
Received date : Dec 06, 2022
Calibration date : Dec 12, 2022
Environment Condition :
Temperature : (25 \pm 10) °C
Humidity : (50 \pm 30) %RH

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

Reference Standard Instruments :

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

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

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

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



Calibrated by : [Redacted]
Issue date : Dec 19, 2022

Approved by : [Redacted]

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

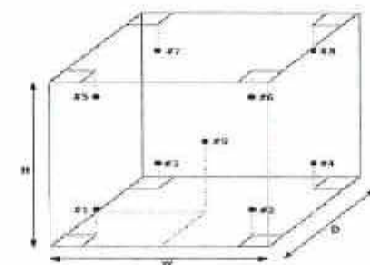
Certificate No. : MT22-6773
Page : 2 of 2

Function : Temperature measurement
Calibration point : 20 °C

Result : Without adjustment
Resolution : 0.1 °C

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

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



- #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.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/48 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10259
TEL. 0-2717-3009-17 FAX. 0-2789-9884



Cert. No.: 23TM1
Page: 1 of 3

Certificate of Calibration

Equipment: Incubator
Manufacturer: Ehret
Model: BK 4106
Serial No.: 22162
ID No.: ERTC-L-In-022
Submitted by: Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chinakot 1, Ngamwongwan Road,
Toongsonghong, Lakki,
Bangkok 10210
Location: ห้องปฏิบัติการมาตรฐานสิ่งแวดล้อม (408/2)
Received Order: 4 January 2023
Calibration Date: 4 January 2023
Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$
Relative Humidity: $(50 \pm 30) \%$
Calibrated by: 
Approved by: 
() Pornthipha Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date: 17 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0045995



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

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44073381	22LM7B71	12 May 2023

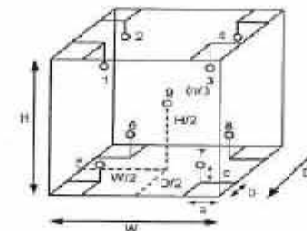
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration:- () Without Adjustment

Function of UUC*: Temperature Source

Fresh air setting: Close



Probe Installation Details:

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

Dimension of Chamber:

D = 0.50 m
W = 0.60 m
H = 0.60 m
Capacity = 0.15 m³

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

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

a 1142797



Equipment: Incubator
Condition As-Received: Used Item
Reference: 2301-00020N-6
Result of Calibration: (*) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

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

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

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
44.5	44.527	45.501	45.139	45.606	43.893	44.165	44.411	44.551	45.204

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

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

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

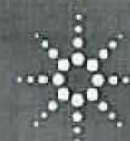
Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.

UUC*: Unit Under Calibration

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

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

-000-



Agilent CrossLab Compliance Services

Agilent
CrossLab
From Insight to Outcome

EQUIPMENT QUALIFICATION REPORT (EQR)

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 4:15:06 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: 6305573434
EQP Name: Agilent Recommended
EQP Revision: ES.02.60
Report Type: Report

Organization Details

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

Local Contact Details

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

Operator Details

Name: Worawit Timakul
Job Title: Field Service Engineer

Data Acquisition Details

Acquisition Software Name: ICP Expert
Acquisition Software Revision: 7.1.0.6621

Customer Data System (CDS): Ex: ICP Expert

Instrument Data

Purpose

This section describes the as found system configuration.

Details

Spectrometer 1

Manufacturer: Agilent Technologies
Name: 5100 VDV
Model Number: GE011A
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: 1A1560367

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

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

Purpose

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

Configuration Details

Model/Serial No.:	G3011A	MY15330001
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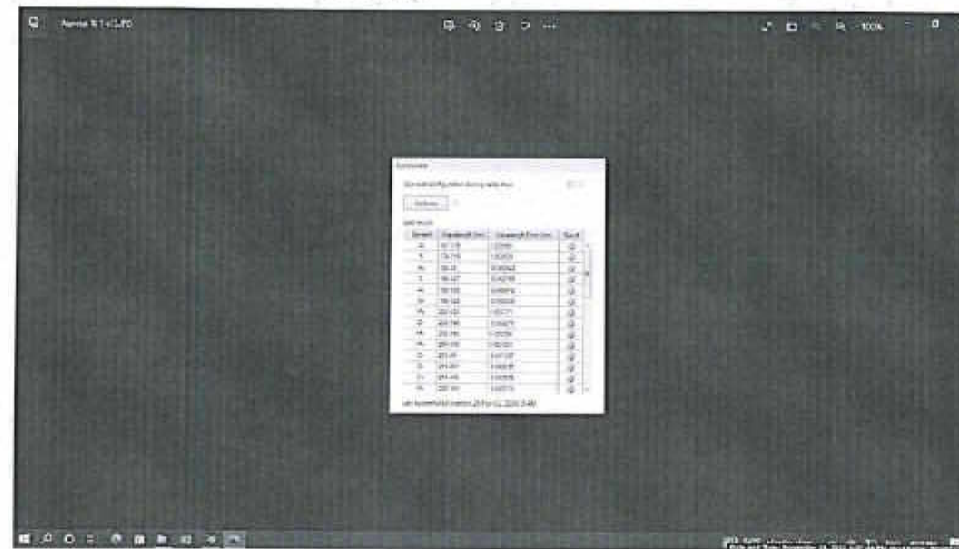
Results

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

Image Details: Was the detector calibration performed and completed successfully?
 Date and Time: November 28, 2022 4:07:22 PM
 Host Name: 5CG0202NQ4



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.

Documents

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

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

Document Name:

Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

Date: April 17, 2022 11:11:43 PM

Drive Serial #: 605936104

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 console summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ programs listed 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 Spectrometry	5	Conforms
Gas Chromatography - GC/MS	17	Conforms
Gas Chromatography	29	Conforms
Gel Permeation Chromatography	5	Conforms
ICP-MS	8	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LC/MS	8	Conforms
Microwellplate	18	Conforms
Sample Preparation - Gas Chromatography	8	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	15	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	12	Conforms

Overall Qualification Status:

Conforms

Document Name:

Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Wenzel, Timoth

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 course, 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: Worewit Timalul

Title Of Course: ANY-CB-ICPQSS-2-007-C: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-CBS 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: Worewit Timalul

Title Of Course: AN-CB-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.

Document Name:

Instrument's Test Report

Report Summary

Instrument Model	Agilent 5100 MDV ICP-OES
Instrument ID	64011A
Instrument Serial Number	MY1530001
Software Version	7.1.0.0021
Firmware Version	2094
Tested By	Workali T.
Test Completed On	20-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 (174.210 nm)	≤ 8.40	7.40
As (188.980 nm)	≤ 8.20	6.49
C (193.023 nm)	≤ 11.60	8.05
Mo (202.032 nm)	≤ 8.20	6.86
Cr (204.153 nm)	≤ 13.40	10.29
Zn (213.857 nm)	≤ 8.70	7.43
Pb (220.353 nm)	≤ 9.50	8.06
Co (228.416 nm)	≤ 17.20	10.55
Be (230.474 nm)	≤ 9.40	7.87
Mn (257.610 nm)	≤ 13.30	9.47
Mn (259.858 nm)	≤ 23.20	15.61
Cr (267.716 nm)	≤ 11.20	8.93
Cu (324.754 nm)	≤ 23.00	15.31
Cu (327.305 nm)	≤ 14.20	12.72
Sr (358.071 nm)	≤ 33.50	23.39
Ba (455.403 nm)	≤ 44.30	33.39
Sr (460.783 nm)	≤ 36.00	23.22
Ba (485.403 nm)	≤ 36.00	33.33
Ba (514.171 nm)	≤ 42.00	28.54
Ar (676.283 nm)	≤ 74.20	63.29
K (766.491 nm)	≤ 60.00	61.24

Page 1 of 3

Document Name:

Instrument's Test Report

Sensitivity Test

Pass

Residual

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 40.0	SRBR	124.4	1263.4	89.1
Se (196.026 nm)	≥ 41.0	SRBR	74.4	203.6	112.9
Zn (213.857 nm)	≥ 1421.0	SRBR	4159.5	50079.5	139.6
Pb (220.353 nm)	≥ 45.0	SRBR	197.9	3032.4	223.5
Mn (257.610 nm)	≥ 3518.0	SRBR	12083.1	503064.1	676.5
Al (308.152 nm)	≥ 3.4	SRB	8.6	41307.1	4500.0
Ba (485.403 nm)	≥ 34.0	SRB	100.1	1276757.6	13253.0
K (766.491 nm)	≥ 1.8	SRB	3.9	111105.5	27733.2

Azial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 200.0	SRBR	250.8	3667.4	132.0
Se (196.025 nm)	≥ 199.0	SRBR	172.2	2602.2	235.1
Zn (213.857 nm)	≥ 234.0	SRBR	1330.5	17846.2	166.6
Zn (213.857 nm)	≥ 1743.0	SRBR	9129.7	300193.0	430.0
Co (214.493 nm)	≥ 4227.0	SRBR	8235.6	156403.2	357.4
Pb (220.353 nm)	≥ 320.0	SRBR	665.7	16532.1	571.0
Mn (257.610 nm)	≥ 10025.0	SRBR	39160.3	1593731.8	1621.2
Cr (267.716 nm)	≥ 1648.0	SRBR	4832.3	176423.2	1257.2
Cu (324.754 nm)	≥ 19.0	SRB	65.7	268373.8	4020.3
Al (308.152 nm)	≥ 5.0	SRB	24.3	271352.8	16722.4
Se (455.403 nm)	≥ 50.0	SRB	275.4	8034589.2	29068.7
K (766.491 nm)	≥ 24.0	SRB	81.9	3677604.4	44370.4

Page 2 of 3

Document Name: Instrument's Test Report

Precision Test **Pass**

Radcl

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.50	0.59
Se (193.026 nm)	≤ 2.50	1.01
Zn (213.857 nm)	≤ 1.50	0.21
Pb (220.353 nm)	≤ 2.50	0.41
Mn (257.610 nm)	≤ 1.50	0.43
Al (306.162 nm)	≤ 1.50	0.30
Ba (455.408 nm)	≤ 1.50	0.60
K (766.491 nm)	≤ 1.50	0.20

Add

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.87
Se (193.026 nm)	≤ 1.50	0.70
Zn (200.200 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	0.49
Al (306.162 nm)	≤ 1.50	0.48
Mo (493.908 nm)	≤ 1.50	0.71
K (766.491 nm)	≤ 1.50	0.50

Page 0 of 0

General

Document Name: Software verification

Software Verification Report

Date:	Monday, November 28, 2022	Time:	5:44:26 PM UTC 401:00:00	Host Name:	SDCVDM-08
Windows User Name:	Admin	Item Revision Number:	2.6.1	Project Name:	ICP Export
Install Type:	MA	Additional Packages:	NA		

Item Reference File Name: ICPRefDataFile.xml

Summary:

Overall Execution of Installation Check: PASS

File Report Summary

No missing files or invalid files found.

No system file differences found.

File Registration Report Summary

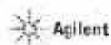
File Registration check was required for this product.

Registry Report Summary

Registry entries check was 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, 8 mg/L, 500mL
 Agilent Part No: 661000000
 Lot No: 011705321

Product Specifications

Analyte	Starting Material	CPS #	Certified Conc.	Analyte	Starting Material	CPS #	Certified Conc.
Al	Al(NO ₃) ₃	7004-07-1	5.001 ± 0.028 mg/L	As	As	2403-91-0	4.001 ± 0.028 mg/L
As	As	2403-91-0	5.001 ± 0.028 mg/L	As	(NH ₄) ₂ MoO ₄	1304-76-8	4.000 ± 0.028 mg/L
Ba	Ba(NO ₃) ₂	10101-12-4	5.000 ± 0.028 mg/L	Bi	Bi	7440-37-0	4.000 ± 0.028 mg/L
Ca	Ca	2045-14-7	5.000 ± 0.028 mg/L	Bi	Bi	7440-37-0	4.001 ± 0.028 mg/L
Co	Co	7440-48-4	5.000 ± 0.028 mg/L	Br	Br	7723-34-2	4.000 ± 0.028 mg/L
Cr	Cr(NO ₃) ₃	13141-30-4	5.000 ± 0.028 mg/L	Br	Br	7723-34-2	4.000 ± 0.028 mg/L
Cu	Cu	7440-50-8	4.000 ± 0.028 mg/L	Br	Br	7440-37-0	4.000 ± 0.028 mg/L
K	KNO ₃	7723-14-1	50.002 ± 0.29 mg/L				

Matrix: 5% HNO₃

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

Certificate of Traceability: This CRM was manufactured under a quality management system that is registered to ISO 9001:2015 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-MS" process developed by NIST and are directly traceable to the NIST SRMs used below. This solution was stabilized using high purity nitric acid (HNO₃) and diluted with filtered (0.22 µm), 18 M-ohm deionized water. The balance used in the preparation of this CRM was 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: 3010a, 3100a, 3101a, 3102a, 3103a, 3104a, 3105a, 3106a, 3107a, 3108a, 3109a, 3110a, 3111a, 3112a, 3113a, 3114a, 3115a, 3116a, 3117a, 3118a, 3119a, 3120a, 3121a, 3122a, 3123a, 3124a, 3125a, 3126a, 3127a, 3128a, 3129a, 3130a, 3131a, 3132a, 3133a, 3134a, 3135a, 3136a, 3137a, 3138a, 3139a, 3140a, 3141a, 3142a, 3143a, 3144a, 3145a, 3146a, 3147a, 3148a, 3149a, 3150a, 3151a, 3152a, 3153a, 3154a, 3155a, 3156a, 3157a, 3158a, 3159a, 3160a, 3161a, 3162a, 3163a, 3164a, 3165a, 3166a, 3167a, 3168a, 3169a, 3170a, 3171a, 3172a, 3173a, 3174a, 3175a, 3176a, 3177a, 3178a, 3179a, 3180a, 3181a, 3182a, 3183a, 3184a, 3185a, 3186a, 3187a, 3188a, 3189a, 3190a, 3191a, 3192a, 3193a, 3194a, 3195a, 3196a, 3197a, 3198a, 3199a, 3200a, 3201a, 3202a, 3203a, 3204a, 3205a, 3206a, 3207a, 3208a, 3209a, 3210a, 3211a, 3212a, 3213a, 3214a, 3215a, 3216a, 3217a, 3218a, 3219a, 3220a, 3221a, 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Document Name: Certificate of Analysis Wavelength calibration solution



Revised Information: Refer to the Safety Data Sheet (SDS), which can be obtained at www.agilent.com/chem/SDS.

Integrity: This solution was determined to be homogeneous by procedures consistent with the requirements of ISO 17025 and ISO 9001:2015. The entire sample of the finished solution was analyzed to confirm its homogeneity. In accordance with ISO 9001:2015, Assessment of Homogeneity and Stability. To ensure homogeneity, tests should not take a smaller sub-sample than specified in the procedure. In this, as doing so will invalidate the certified values and uncertainties.

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

Quality Certification: This CMA was prepared under a quality management system that is:

- Registered to ISO 9001 – Quality Management Systems – Requirements (IRF 1620 Cert. No. 44 ISO 100020)
- Accredited to ISO 17025 – General Requirements for the Competence of Reference Material Producers (UKAS Cert. No. 064602)
 - o ISO 17025 reference 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 (UKAS Cert. No. 064887)
- UKAS Version 20 Approved Number 06 0200

Page 1 of 3

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

Electronic Signature

7/16/2022

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System ID: MY15330001

User Name: wnsawit@agilent.com
Hardware: 600001120

System ID: MY16330001
Print Date: November 28, 2022 4:08:00 PM

QQ HW ICP 6100 Envi release Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2022 4:02:16 PM	Audit	Session Created	Session	None
November 28, 2022 4:02:16 PM	Start	Configuration	Session	None
November 28, 2022 4:02:16 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
November 28, 2022 4:06:30 PM	Audit	ExpLoaded	Session	ECP details for primary technique [G4] - File path: [ProtocolPacks\G4\Configurations\02_SQES 02.50.egg] ECP File Name: [E6.00.50.egg], ECP Name: [AgilentRecommended]
November 28, 2022 4:08:52 PM	End	Configuration	Session	None
November 28, 2022 4:09:36 PM	Start	Qualification	Session	QQ
November 28, 2022 4:09:36 PM	Start	Execution	Preparation - 5100 VDV; Qualitative Test - No setpoints associated	None
November 28, 2022 4:07:38 PM	End	Execution	Preparation - 5100 VDV; Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:07:39 PM	Start	Execution	Instrument Tests - 5100 VDV; Qualitative Test - No setpoints associated	None
November 28, 2022 4:08:52 PM	End	Execution	Instrument Tests - 5100 VDV; Qualitative Test - No setpoints associated	Run Count : 1

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User Name: wnsawit@agilent.com
Hardware: 600001120

System ID: MY16330001
Print Date: November 28, 2022 4:16:06 PM

QQ HW ICP 6100 Envi release 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 - SP54; Qualitative Test - No setpoints associated	None
November 28, 2022 4:09:05 PM	End	Execution	Autosampler Operation : Autosampler 1 - SP54; Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:09:09 PM	End	Configuration	Session	QQ
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: QQ HW ICP 6100 Envi release_20221128_Certificate_1.pdf User Name: wnsawit@agilent.com Full Name of Signer: Wnsawit Tinsakul Reason for signature: Executed process and published this original version of document
November 28, 2022 4:15:43 PM	Audit	Reporting	Session	Report Generated : Report

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TEL: 0-2717-3000-21 FAX: 0-2719-3484



Cert.No.: 22CH1759

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: 27 December 2022
Calibration Date: 27 December 2022
Reference: 2212-G734VVN-8
Submitted by: Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chinnakel 1, Ngamwongwan Road,
Toongsonghong, Lakai, 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: 
() Malee Butkruea
() Sathip Meangmai
(✓) Warakorn Lemgagtrakul
Issue Date: 28 December 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A C048995



Cert.No.: 22CH1759

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

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

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

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

2. Certified Reference Materials :-

- Conductivity calibration solution, Thermo Scientific (traceable to NIST)
- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to BI
through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1935

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

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

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

Calibration results

Function: Conductivity Measurement

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

Conductivity Electrode Serial No.: PONPE5863548

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

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

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

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a 1142233



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5346 PATTANAKARN ROAD SOI 15, RUAMLUANG, SUANLHANG BANGKOK 10250
TEL: 0-2717-5000-27 FAX: 0-2719-9884



Cert. No.: 23TM31
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Binder
Model : FED 115 E2
Serial No. : 11-22923
ID No. : ERTC-Lin.-078
Submitted by : Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chiraket 1, Ngamwongwan Road,
Toongsoenghong, Laks,
Bangkok 10210
Location : Laboratory (ERTC)
Received Order : 4 January 2023
Calibration Date : 4 January 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Preecha Hsieh

Approved by :

Approved Signatory

() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 16 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0049316



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2301-0002ON-2
Procedure Used :-

Cert. No.: 23TM31
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

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

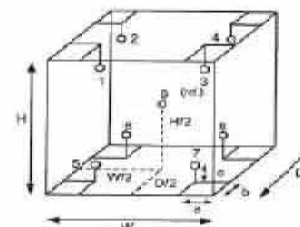
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	32
REL. Humid. (%)	60	55
AC Supply (Volt)	220	221

Probe Installation Details :
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :
D = 0.40 m
W = 0.60 m
H = 0.48 m
Capacity = 0.12 m³

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

a 1142806



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2301-COC2ON-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 23TM31
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104	104	104	0.16	2.4	2.6	0.86	2
180	180	180	0.34	6.1	3.8	1.8	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104	104.819	105.334	104.674	104.185	103.981	103.001	105.408	103.368	103.014
180	176.454	179.253	182.386	180.810	181.999	178.253	184.628	179.227	178.888

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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
 TEL: 0-27-7-3030-07 FAX: 0-2718-9484



Cert. No.: 23TM32
 Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
 Manufacturer : Memmert
 Model : UF 110
 Serial No. : B414.0652
 ID No. : ERTC-Lin.-098
 Submitted by : Environment Research & Technology Company Limited.
 25/114 Moo 6, Soi Chinakiet 1, Ngamwongwan Road,
 Toongseenghong, Lakel,
 Bangkok 10210
 Location : Laboratory (ERTC)
 Received Order : 4 January 2023
 Calibration Date : 4 January 2023
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Preecha Hlahib

Approved by : 
 Approved Signatory

() Ponthippa Tamayakul
 () Malee Butkruea
 () Suwit Imjai

Issue Date : 16 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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



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

Cert. No.: 23TM32
 Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT32 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

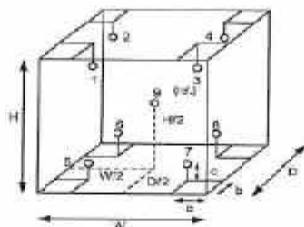
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :

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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	32
REL. Humid. (%)	60	55
AC Supply (Volt)	220	221

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



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

Cert. No.: 23TM32
 Page : 3 of 3

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.10	0.95	1.6	0.42	2
180.0	180.0	180.0	0.29	1.8	3.5	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.630	103.574	103.239	103.951	104.422	104.052	103.192	104.041	104.089
180.0	179.591	179.815	178.321	178.612	181.116	179.997	178.605	179.735	179.508

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

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

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

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

UUC* : Unit Under Calibration.

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

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

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Mettler-Toledo (Thailand) Ltd.

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

Bangna District, Bangkok 10260

+66 2723 0382

MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company:	Environment Research & Technology Co., Ltd.		
Address:	25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong		
City:	Laksi	Contact:	Ramita Taengthai
Zip / Postal:	10210		
State / Province:	Bangkok		
Order Number:	 * 0 3 3 2 6 1 7 8 5 6 *		

Weighing Device

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

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

Procedure



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

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

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

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

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

As Found Calibration Date:	17-Jan-2023	Calibrator:	
As Left Calibration Date:	N/A		
Issue Date:	19-Jan-2023		Chawalit Martsuloke
		Approved Signatory:	
			Technical Manager / Head of Calibration Center

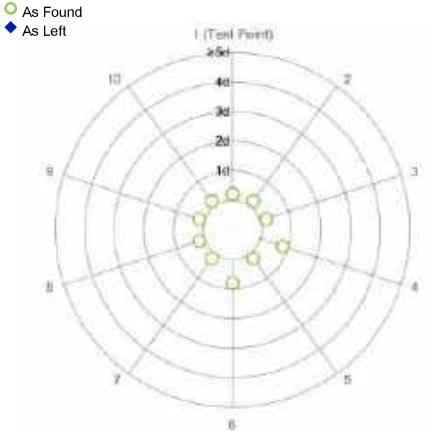
Measurement Results

Repeatability

Test Load: 100 g

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

Standard Deviation	0.00004 g	N/A
--------------------	-----------	-----



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

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

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0001 g	N/A
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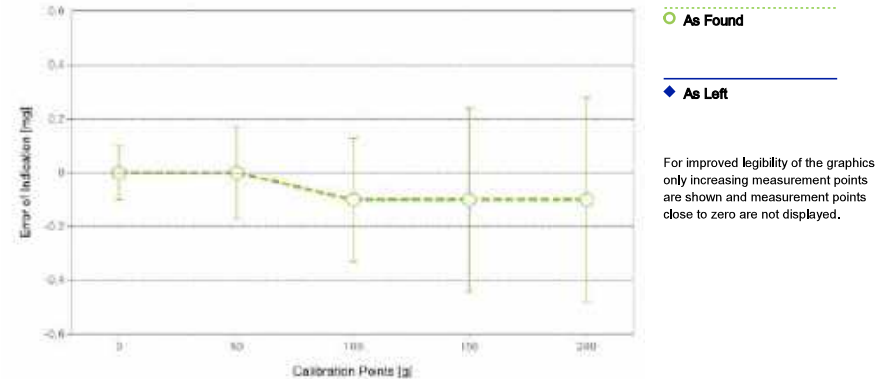
As Found

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

Error of Indication

As Found

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



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

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

Test Equipment

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

Weight Set 1: OIML E2

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

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: 1,5 · 10⁻⁶ / K

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

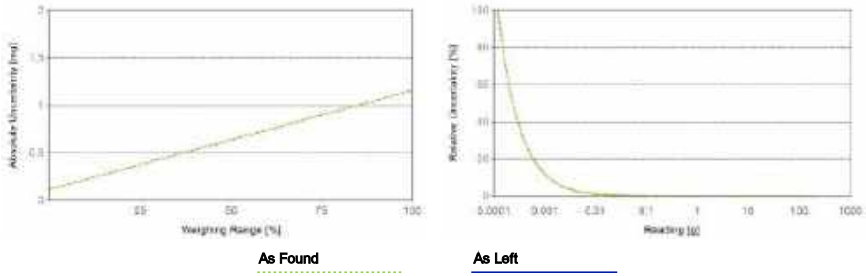
Linearization of Uncertainty Equation

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

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

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

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



GWP® Certificate



As Found



As Left



The weighing device meets the given process requirements.

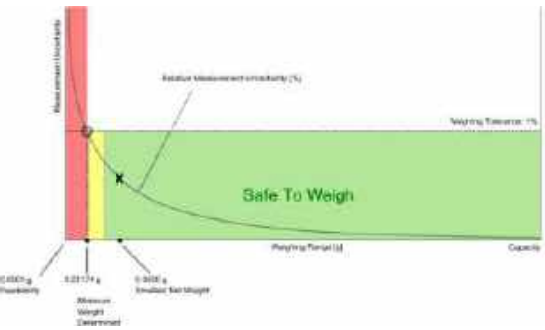
The weighing device meets the given process requirements.

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

Process Requirements

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

Safe Weighing Range




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

Minimum Weight


As Found Minimum Weight Table

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

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

As Left Minimum Weight Table

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

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

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







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




Notes on minimum weight values in above table:

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

Measurement Results











Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found			
As Left			

 = Passed
 = Failed
 = Safety Factor not met

Repeatability

Test Load: 100 g













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

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

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

Eccentricity

Test Load: 100 g

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

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

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
100.0000 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0000 g	-0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

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



Agilent CrossLab Start Up Services
Agilent 8890 Gas Chromatograph
Preventive Maintenance Checklist



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

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



Introduction

Customer Information

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

Important Customer Web Links

- For more information about *Agilent Technologies services*, 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-3a-175	US2125A011
Instrument System Site and Location	Environment Research	Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. 64513 A	US2125 CN2195025
2. 64514 A	CN21207024
3. 64515 A	US2125A011
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

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

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these inlets: Split/Spitless 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	243.2
AUX 1 detector output	N/A	282.6
AUX 2 detector output: CFP+ FID 2	N/A	282.6
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 605920479 Date service completed 12-13 June 2023

 Agilent signature  Customer signature _____

 Total number of pages in this document 9 pages



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

334/1 PATTANAKARN ROAD SOI 18, SUKHLUANG, SUKHUWANG BANGKOK 10250

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

Cert.No.: 22CH1757

Page.: 1 of 2

Certificate of Calibration

Equipment : Salinity Meter
Manufacturer : AZ
Model : AZ8371
Serial No. : 298475
IC No. : NO.1
Condition As-Received: Used Item
Received Date : 27 December 2022
Calibration Date : 27 December 2022
Reference : 2212-0734WN-6
Submitted by : Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chirakel 1, Ngamwongwan Road,
Toongsoenghong, Laks, Bangkok 10210
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(65 \pm 15) \%$
Calibration Procedure: In-house method : based on direct measurement by
using Sodium Chloride Solution
Calibrated by : 
Approved by : 
() Malee Butkruea
() Sathip Meangmai
(*) Warakorn Lengagtrakul

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 Calibration and Testing Equipment Services.



Cert.No.: 22CH1757

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	1963884	130RC114	2211141	12 Sep 2023
2) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023

2. Reference Standard Material :

- Conductivity calibrated solution, Eutech (traceable to NIST)
- Calibrated Total Dissolved Solids solution temperature controlled by Water bath at $(25 \pm 0.1) ^\circ\text{C}$
- 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

(*) Adjustment at 2.84 ppt

Probe Serial No. : 298475

Standard NaCl Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
2.50 ppt	2.52 ppt	2.45 ppt	0.027 ppt	2.00
2.84 ppt	2.91 ppt	2.84 ppt	0.030 ppt	2.00

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, providing a level of confidence of approximately 95%.

-000-

Warakorn

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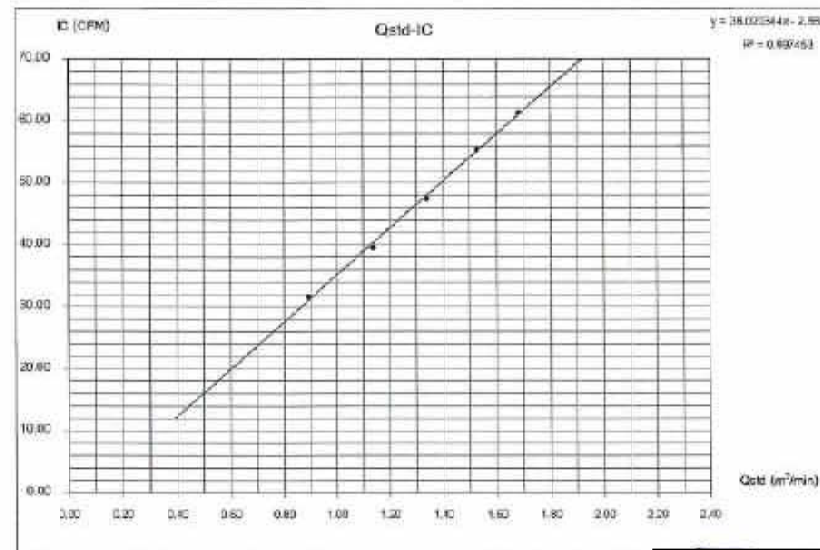
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Question	2023-01-03	Date	August 6, 2023
Sampler Location	On-Road	Start Time	7:45 AM
Sampler Number	1st No. 76	Sampler Standard Type	CH104
Instrument Model	PM10-BMERS	Calibrator Model	TS-3025A
Motor Serial Number	3983	Calibrator Serial Number	3663
Recorder Serial Number	0787	Calibrated By	

No.	Delta H ₂			(A)	(X)	(Y)	(Z)	(V)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH ₂	(m/min)	(m/min)	(m/min)	(m/min)	(m/min)	(°C)	(mmHg)	(min)	(min)
5	1.7	1.7	3.4	1.4220	0.0004	30.0	31.47	30.0	752.0			
7	3.8	3.8	7.6	2.5418	1.1627	40.0	35.49	39.0	752.0			
10	3.9	3.9	7.8	2.1800	1.3929	30.0	37.43	30.0	752.0			
13	5.1	5.1	10.2	3.1602	1.5229	30.0	38.43	30.0	752.0			
16	6.2	6.2	12.4	3.6836	1.6672	30.0	41.40	30.0	752.0			
Linear Regression Y = QX + Y-intercept									Average	30.0	752.0	
1	Range (m)			2.00961	Linear Equation				r ²	0.99743	Flowing	752.0
2	Intercept (m)			-0.04535	Set Point Flow Rate (X) (m/min)			1.105		0.3096725	T _{set}	25.0
3	Correlation Coefficient (r)			0.99970	Final Set Flow Rate (r)			0	(m/min)	0.57061182		
Result									COPROB (m/min) 0.56975414			

COMMENT

Anderson Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

FAB 01, Rev. 02 Jan 2, 2019

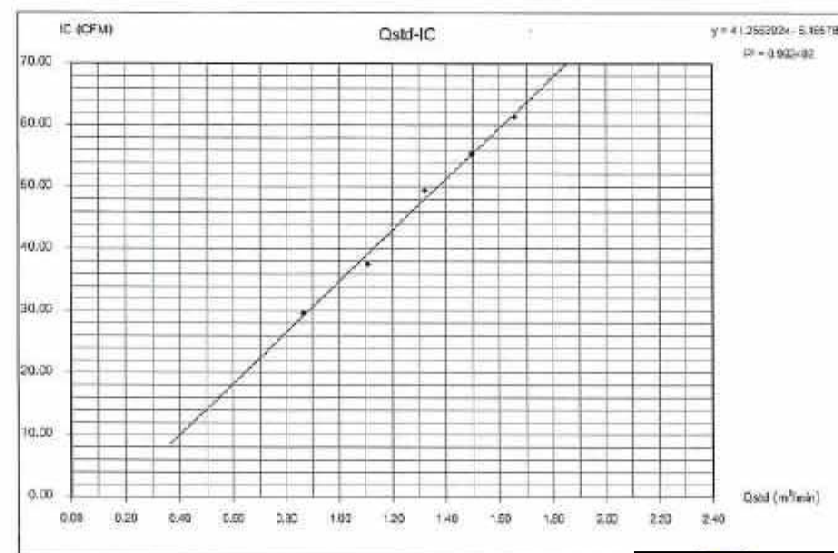
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Question	2023-01-03	Date	August 6, 2023
Sampler Location	On-Road	Start Time	7:45 AM
Sampler Number	PM10 No. 73	Sampler Standard Type	CH104
Instrument Model	PM10-BMERS	Calibrator Model	TS-3025A
Motor Serial Number	3983	Calibrator Serial Number	3663
Recorder Serial Number	0787	Calibrated By	

No.	Delta H ₂			(A)	(X)	(Y)	(Z)	(V)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH ₂	(m/min)	(m/min)	(m/min)	(m/min)	(m/min)	(°C)	(mmHg)	(min)	(min)
5	1.8	1.8	3.6	1.77012	0.39400	30.0	39.69	30.0	752.0			
7	3.8	3.8	7.6	2.57608	1.10588	30.0	37.61	30.0	752.0			
10	3.8	3.8	7.6	2.72655	1.32130	30.0	38.49	30.0	752.0			
15	5.9	5.9	11.8	3.08647	1.58707	30.0	38.43	30.0	752.0			
16	5.8	5.8	11.6	3.42841	1.55474	30.0	41.36	30.0	752.0			
Linear Regression Y = QX + Y-intercept									Average	30.0	752.0	
1	Range (m)			2.04851	Linear Equation				r ²	0.99980	Flowing	752.0
2	Intercept (m)			0.04603	Set Point Flow Rate (X) (m/min)			1.103		0.3096226	T _{set}	25.0
3	Correlation Coefficient (r)			0.99993	Final Set Flow Rate (r)			0	(m/min)	0.57061182		
Result									COPROB (m/min) 0.56975414			

COMMENT

Anderson Instruments, Inc.



Checked By

Technician

Approved By

Environmental Scientist

FAB 01, Rev. 02 Jan 2, 2019

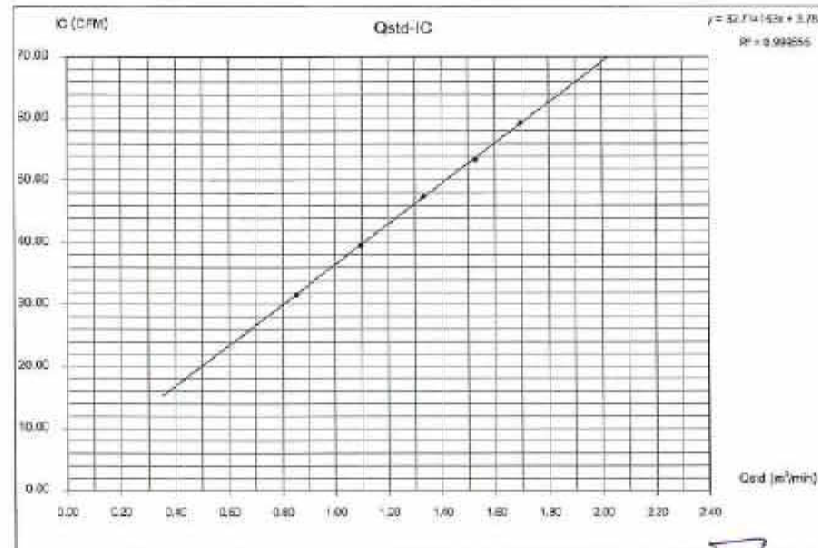
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Question	2020-01-01	Date	August 6, 2020
Sampler Location	Thunamun	Start Time	7:30 AM
Sampler Number	TSP HVA-20	Transfer Standard Type	Orisk
Instrument Model	HVA-2000R	Calibrator Model	TS-020A
Major Serial Number	851-02	Collector Serial Number	3883
Recorder Serial Number	2114	Collected By	

Rate	Delta H			(A)	(K)	(T)	(Y)	Temperature	Barometric	Stat.	Gap
No.	Percent Flow-Area Ratio (m³/min)			$(\Delta H)(Q_{air})/(T_{air}/T_{ref})^{1.4}$	Flow = $Q_{air}(K)(T_{ref})^{1.4}$	Flow Rate Flow Indicate	$C = (P_{air}/P_{ref})(T_{ref}/T)^{1.4}$	$T_{ref} = 273.15$	Pressure	Mean	Mean
	Positive	Negative	Delta H		(m³/min)	(l/min)					
5	1.5	1.6	3.1	1.1404	6.06 (7)	30.0	31.07	101.6	752.0		
7	2.6	3.6	6.2	2.3320	1.0969	40.5	30.43	101.6	752.0		
10	3.8	3.8	7.3	2.7446	1.3296	46.2	30.34	101.6	752.0		
13	6.7	6.7	10.2	3.1652	1.5278	54.0	30.29	101.6	752.0		
15	8.3	8.3	12.6	3.1138	1.5507	60.3	30.33	101.6	752.0		
Linear Regression Y = 0.0001 X + 0								Average	101.6	752.0	
1	Steps (m)			2.0995	Linear Equation		r^2	0.998025	Adjusted	288.0	
2	Intercept (m)			-0.04153	Std. Error Flow Rate (X) (m³/min)	1.133	r	0.0098275	T_{ref}	288.0	
3	Correlation Coefficient (r)			0.99995	Flow Rate Flow Rate = (1)		0	$(P_{air}/P_{ref})(T_{ref}/T)$	9.57961132		
Result		$C = (P_{air}/P_{ref})(T_{ref}/T)^{1.4}$									0.99802514

COMMENT

Anderson Instruments, Inc.



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Technician

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ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Environmental Scientist

FAB 025, Rev. 02, Dec 1, 2019

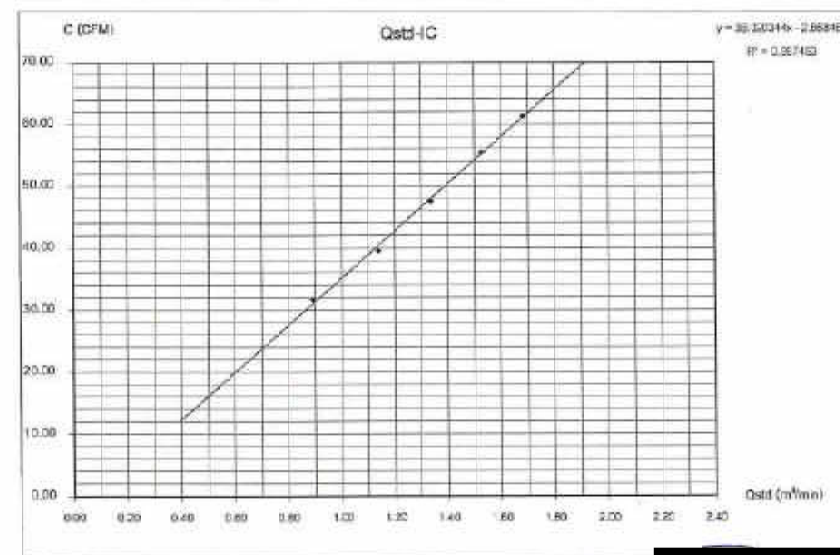
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Question	2020-01-01	Date	August 6, 2020
Sampler Location	Thunamun	Start Time	8:30 AM
Sampler Number	PM10 HVA-20	Transfer Standard Type	Orisk
Instrument Model	HVA-2000R	Calibrator Model	TS-020A
Major Serial Number	2211	Collector Serial Number	3883
Recorder Serial Number	2810	Collected By	

Rate	(Delta F)		(A)	(K)	(T)	Temperature	Barometric	Stat	Gap
No.	Recurrent Step Across Orifice (m ²)		$\Delta L(A/2\pi R^2\rho_{air}(T_{air}/T)^{1.4})$	Orifice = $D^2/4(A/k)$	orifice Flow Rate Indicate	$C = ((P_{atm}/K)(T_{atm}/T)^{1.4})^{0.5}$	Pressure	Mean	Mean
	Positive	Negative	$\Delta T, ^\circ C$	(m ² /min)	(l/min)		(K = 15-273)	(mmHg)	
5	1.7	1.7	3.4	1.6252	0.9694	30.0	31.97	101.6	752.0
7	2.8	2.8	5.6	2.8426	1.1727	40.0	30.39	101.6	752.0
10	3.8	3.8	7.6	2.7042	1.3343	48.0	30.31	101.6	752.0
12	5.1	5.1	10.2	3.1512	1.3779	56.0	30.43	101.6	752.0
15	6.2	6.2	12.4	3.4558	1.4817	62.0	31.30	101.6	752.0
Linear Regression Y = 0.0001 X + 0						Average	30.3	752.0	
1	Slope (m)		2.0995	Linear Equation		r^2	0.997153	Adjusted	288.0
2	Intercept (m)		-0.04153	Std. Error Flow Rate (X) (m ³ /min)		1.133	r	0.0098275	T _{atm}
3	Correlation Coefficient (r)		0.99995	Flow Rate Flow Rate = (1)			0	(Pa/P _{atm})(T _{atm} /T)	9.57961132
Result						C = (Pa/P _{atm})(T _{atm} /T) ^{1.4}			
						0.99802514			

COMMENT

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FAB 025, Rev. 02, Dec 1, 2019



RECALIBRATION

DUE DATE:

January 17, 2024

Certificate of Calibration

Calibration Certification Information

Cal. Date: January 17, 2023 Rootmeter S/N: 439320 Ta: 295 °K
Operator: Jim Tisch Pa: 740.2 mm Hg
Calibration Model #: TE-5025A Calibrator S/N: 3883

Run	Vol. Init. (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4140	3.2	2.00
2	3	4	1	1.0110	5.4	4.00
3	5	6	1	0.9050	8.0	5.00
4	7	8	1	0.8520	8.8	5.50
5	9	10	1	0.7100	12.9	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9795	0.6927	1.4027	0.9957	0.7042	0.8928
0.9753	0.9647	1.9837	0.9914	0.5806	1.2626
0.9732	1.0753	2.2179	0.9892	1.0930	1.4117
0.9721	1.1277	2.3261	0.9882	1.1463	1.4806
0.9666	1.3615	2.8054	0.9826	1.3839	1.7856
QSTD	m=	2.09951	QA	m=	1.31468
	b=	-0.04553		b=	-0.02858
	r=	0.99992		r=	0.99992

Calculations

Vstd = $\Delta Vol / [(Pa - \Delta P) / Pstd] (Tstd / Ta)$ Va = $\Delta Vol / [(Pa - \Delta P) / Pa]$
Cstd = Vstd / ΔTime Qa = Va / ΔTime

For subsequent flow rate calculations:


$$Qstd = 1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right) \quad Qa = 1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$$

Standard Conditions

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

RECALIBRATION

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

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

Weighing Device

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

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

Procedure

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

METTLER TOLEDO Work Instruction: CP/W002/20

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

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

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

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

As Found Calibration Date: 17-Jan-2023

As Left Calibration Date: 17-Jan-2023

Issue Date: 19-Jan-2023

Calibrator:

Chawalit Martsuloke

Approved Signatory:

Technical Manager / Head of Calibration Center

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

www.tisch-env.com

TOLL FREE: (877) 263-7610

FAX: (513) 467-9000

Software Version: 1.23.1.11

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Page 1 of 5

Report Version: 2.16.30

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Form Number: F103C

written permission of the issuing calibration laboratory.

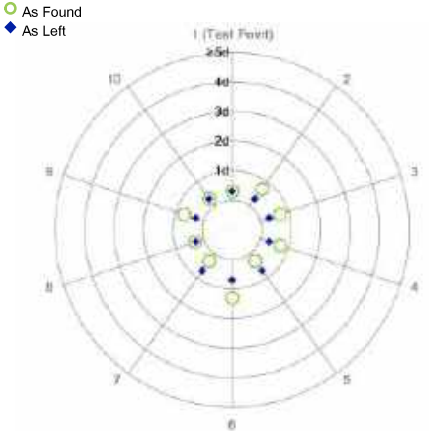
Measurement Results

Repeatability

Test Load: 100 g

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

Standard Deviation	0.00007 g	0.00005 g
--------------------	-----------	-----------



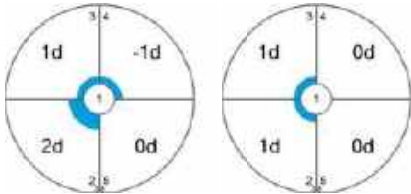
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

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

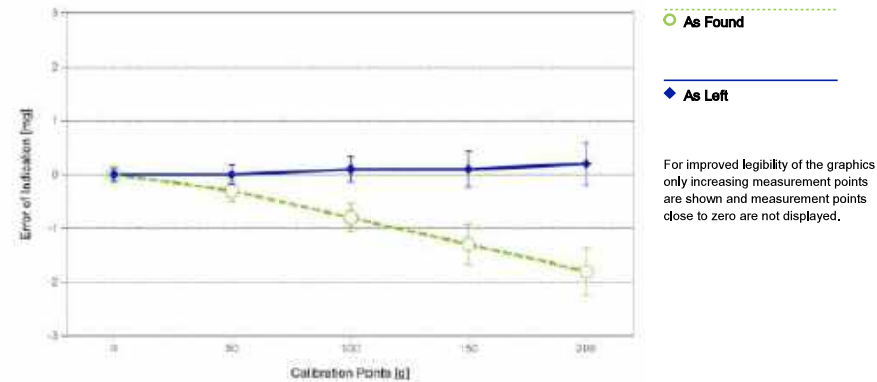
Error of Indication

As Found

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

As Left

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



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

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

Test Equipment

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

Weight Set 1: OIML E2

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

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

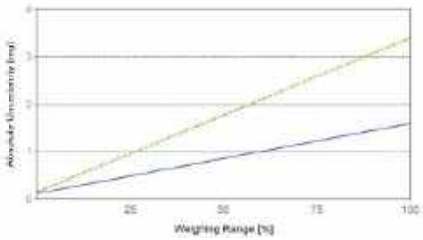
Linearization of Uncertainty Equation

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

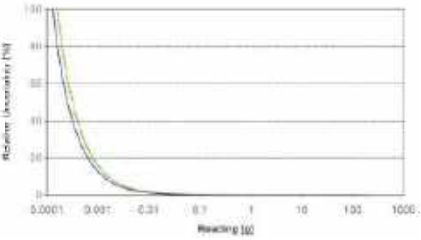
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

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



As Found



As Left

GWP®

Certificate



As Found

✓

As Left

✓

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☒ As Left

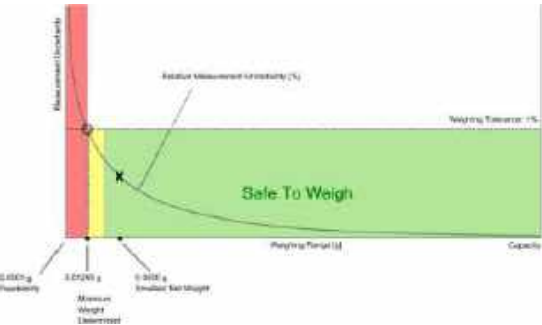
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

Safe Weighing Range



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

Minimum Weight

As Found Minimum Weight Table

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

✓

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

As Left Minimum Weight Table

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

✓

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 100 g

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

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

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

Eccentricity

Test Load: 100 g

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

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

As Found

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

As Left

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

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

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

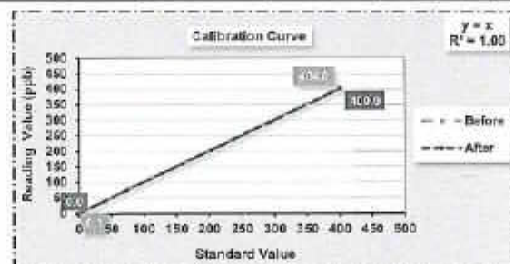
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2023-01006
Serial No.	03358C4029	Calibration Date	August 3, 2023
Analyzer Unit	ppb	Time	2:42 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419029
Dynamic Dilution Calibrator	Tenabyle	300	0165
Standard Gas Components	CO = 4.513 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	0.1	0.0	-	-	-
Span	400	404.0	400.0	-	-	1.0



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	35.5	35.3	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	44	44.1	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	775.3	778.4	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.577	0.579	0.360 to 1,000
Lamp Intensity	INTENSITY	Hz	27.544	28.07E	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	751	752	750 to 1,200
SO ₂ Concentration	SO ₂ CONCENTRATION	ppb	1.5	1.3	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By:

August 3, 2023

Checked By:
envi research
BANGKOK RESEARCH & TECHNOLOGY CO., LTD.

August 3, 2023

Calibration Data of NO_x Analyzer

Analyzer Performance Test

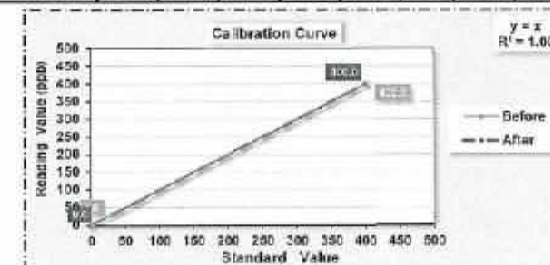
Equipment	Gas Analyzer (NO _x)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Envi Research
Model	APNA-360	Quotation	2023-01006
Serial No.	8517670114	Calibration Date	July 16, 2023
Analyzer Unit	ppm	Time	5:53 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419029
Dynamic Dilution Calibrator	Tenabyle	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						Stability		% Abs Error
		NO _x (ppb)		NO (ppb)		NO ₂ (ppb)				
		Before	After	Before	After	Before	After	Before	After	
Zero	0	0.2	0.0	0.5	0.0	-0.4	0.0	-	-	-
Span	400	401.7	400.0	402.3	400.0	-0.8	0.0	-	-	0.5



STATUS TEST AND VALIDATION OF NO_x ANALYZER MODEL APNA-360

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppm	500.0	500.0	0.1 - 1.0 Standard
Signal NO	mV	5.3	5.4	Voltage of the measured NO value
Signal NO _x	mV	14.4	14.5	Voltage of the measured NO _x value
Detector	kPa	51.2	51.2	(Present Air Pressure) (1.3 x 10 ⁵ - 20) ± 4
Sample Flow	LPM	1.5	1.5	1.1 ± 0.3
NO Slope	-	1.00036	1.00000	0.50000 - 2.00000
NO _x Slope	-	1.00036	1.00000	0.50000 - 2.00000
Motherboard Status	-	OK	OK	OK
Alarm Detected	-	None	None	None

Calibrate By:

July 16, 2023

Checked By:
envi research
BANGKOK RESEARCH & TECHNOLOGY CO., LTD.

July 16, 2023

Calibration Data of NOx Analyzer

Analyzer Performance Test

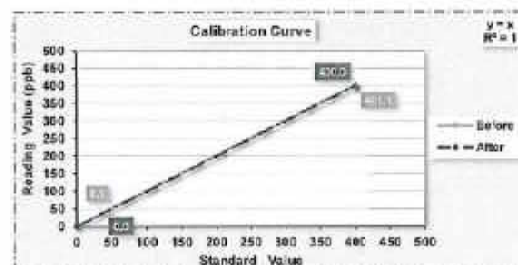
Equipment	Gas Analyzer (NOx)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Env Research
Model	APNA-370	Quotation	2023-01005
Serial No.	KCDVY226	Calibration Date	July 16, 2023
Analyzer Unit	ppb	Time	6:04 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabate	300	0165
Standard Gas Components	CO = 4.516 ppm NO = 55.3 ppm SO ₂ = 54.5 ppm		
Cylinder No. : EB0123013			
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	-0.2	0.0	0.1	0.0	-9.3	0.0	-	-	-
Span	400	401.8	400.0	401.8	400.0	0.5	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	1.2	1.1	Voltage of the measured NO value
Signal NOx	mV	2.8	3.2	Voltage of the measured NOx value
Detector	°C	40.9	40.9	43 °C ± 5 °C
Ambient	kPa	100.1	100.1	Current atmospheric pressure
DC 24V	V	24.0	24.0	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.25550	1.25550	0.50000 - 2.00000
NOx Slope	-	1.25140	1.25140	0.50000 - 2.00000

Calibrate By :

July 16, 2023

Checked By :

July 16, 2023

Calibration Data of SO₂ Analyzer

Analyzer Performance Test

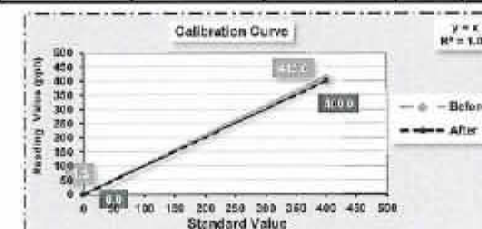
Equipment	Gas Analyzer (SO ₂)	Customer Name	Vision E.
Manufacture	HORIBA	Location	Env Research
Model	APSA-370	Quotation	2023-01005
Serial No.	V4-IC9082	Calibration Date	July 16, 2023
Analyzer Unit	ppb	Time	6:03 PM

Instruments for Calibration

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

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppb)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	1.3	0.0	-	-	-
Span	400	413.0	400.0	-	-	3.3



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	12.1	11.9	Voltage of the measured SO ₂ value
LAMP	mV	205.5	205.5	200 mV - 1200 mV
CELL	°C	37.8	37.8	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	45.5	45.5	65 KPa or less
AMBIENT	kPa	101.1	101.1	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 :

July 16, 2023

Checked By :

July 16, 2023

Calibration Data of CO Analyzer

Analyzer Performance Test

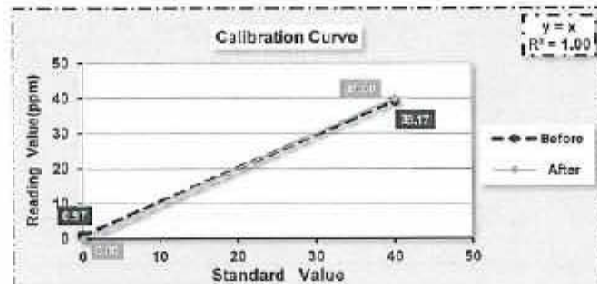
Equipment	Gas Analyzer (CO)	Customer Name	Vision E
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01035
Serial No.	Y06LRYAD	Calibration Date	August 4, 2023
Analyzer Unit	ppm	Time	1:40 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700416829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.487 ppm		
Cylinder No.:	EB0123013		
NO =	46.1 ppm		
SO ₂ =	46.0 ppm		
Expire Date:	Oct 22, 2027		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.37	0.00	-	-	-
Span	40	39.17	40.00	-	-	2.08



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	8.5	7.4	Voltage of the measured CO Value
SIGNAL (COMP)	mV	20.3	11.2	Voltage of the interference component Value
CELL	°C	29.7	29.8	Ambient + (5 to 10 °C)
PUMP	kpa	54.3	54.3	less than 65
AMBIENT	kpa	101.3	101.4	Atmospheric pressure
DC 24V	mV	23.5	23.9	24±/- 0.5 V
DC 5V	mV	4.8	4.8	5±/- 0.5 V

Calibrate By :



August 4, 2023



August 4, 2023

Calibration Data of CO Analyzer

Analyzer Performance Test

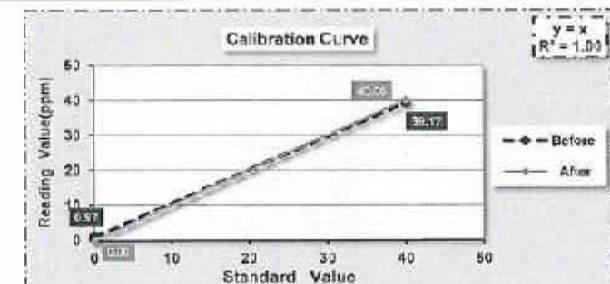
Equipment	Gas Analyzer (CO)	Customer Name	Vision E
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2023-01035
Serial No.	KRP3Y7LA	Calibration Date	August 4, 2023
Analyzer Unit	ppm	Time	1:40 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700416829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4.487 ppm		
Cylinder No.:	EB0123013		
NO =	46.1 ppm		
SO ₂ =	46.0 ppm		
Expire Date:	Oct 22, 2027		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value (ppm)		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.37	0.00	-	-	-
Span	40	39.17	40.00	-	-	2.08



STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	8.5	7.4	Voltage of the measured CO Value
SIGNAL (COMP)	mV	20.3	11.2	Voltage of the interference component Value
CELL	°C	29.7	29.8	Ambient + (5 to 10 °C)
PUMP	kpa	54.3	54.3	less than 65
AMBIENT	kpa	101.3	101.4	Atmospheric pressure
DC 24V	mV	23.5	23.9	24±/- 0.5 V
DC 5V	mV	4.8	4.8	5±/- 0.5 V

Calibrate By :



August 4, 2023



August 4, 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A0292 Reference Number: 16C-401604495-1
Cylinder Number: EB0123013 Cylinder Volume: 144.4 Cubic Feet
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 66C
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-12/011, 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 the 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	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.5% NIST Traceable	10/14/2019
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15010429	KAL004123	97.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Jul 23, 2025
NTRM	15010429	KAL004123	97.6 PPM NITROGEN	+/- 0.5%	Jul 23, 2025
NTRM	16010235	KAL004419	97.66 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Dec 23, 2021
NTRM	06012318	KAL004620	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Jun 07, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000926781	FTIR	Sep 25, 2019
MKS FTIR - NO - 000926781	FTIR	Oct 16, 2019
MKS FTIR - NOx - 000926781	FTIR	Oct 16, 2019
MKS FTIR - SO2 - 000926781	FTIR	Oct 23, 2019

Triad Data Available Upon Request

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



Approved for Release

Page 1 of 16C-401604495-1



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. (81-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 12 April, 2023

Certification No. : 157/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC61112A76 ID No. : No.15

Customer : Environment Research & Technology Company Limited,
25/113-114 Moo 5 Soi Chinakri 1, Ngamwongwan Road,
Toongsonghong, Lakai, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9C23

N.I.S.T. Test Reference Number 731/241480 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-350-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity 30 - 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. 157/23

12 April, 2023

Page : 2 of 2

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches Hg	inches Hg	m/sec	m/sec	m/sec
1.00	-	-	-	0.5	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.7	0.31
17.02	-	-	-	16.5	0.52
19.02	-	-	-	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

Call

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 : 20 August, 2022

Certification No. 340/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WCE0110A05 ID No. : No.11

Customer : Environment Research & Technology Company Limited,
25/113-114 Moo 5 Soi Chinakiet 1, Ngamwongwan Road,
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 542 S/N 91563

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

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

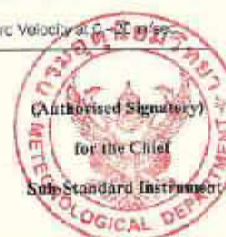
: Ultrasonic Anemometer Model DA-550-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120829588)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 30 m/sec

Mechanical Engineer

Sig
M





Calibration Chart

BSWA TECH BSWA-IV-C021-03-0048A

Sound Calibrator model

2A111

Serial Number

590338

Appearance

OK

Power Supply

1.5V LR6 (AA Battery) x2

Sound Pressure Level

94.06 / 114.09 dB

Frequency

1000.5 / 1000.5 Hz

THD (@1000Hz)

0.35 / 0.51 %

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:

Temperature: 20 °C

Humidity: 40 %RH

Pressure: 1025 hPa

This equipment is qualified!

Calibrated

2023-3-7

Date



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

5344 PATTANAKARN ROAD SOI 11, SUANLUANG, SUANLUANG BANGKOK 10250

TEL: 0-2717-3009-21 FAX: 0-2718-9484



Cert.No.: 22CH1754

Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter

Manufacturer : Eutech

Model : pHTestr 30

Serial No. : 3066320

ID No. :

Condition As-Received: Used Item

Received Date : 27 December 2022

Calibration Date : 27 December 2022

Reference : 2212-0734VVN-10

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

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

Calibration Procedure : In - house method :

- CP-CHS by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by : Warakorn Lemgagtrakul

Approved by :

Approved Signatory

() Malee Bulkruea

() Saitip Meangmai

(✓) Ponpan Palpin

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.



Cert.No.: 22CH1754
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	4.01	N/A	0.0071	2.00
S/N: 3066320	6.987	7.01	N/A	0.011	2.00
	10.008	10.01	N/A	0.0082	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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PL

a 1142231



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

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

TEL: 0-2717-3000 FAX: 0-2719-0484

Cert.No.: 22TW242
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115
Serial No. : 17H104220
ID No. : ERTC-L-In.137
Received Date : 26 October 2022
Test Date : 27 October 2022
Reference : 2210-0840VN-1
Submitted by : Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
Toongsonghong, Lekki, 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 :

Approved Signatory

- (✓) Maise Bulkruea
() Sathip Meangmai
() Warakorn Lergagtrakul

Issue Date : 1 November 2022

B 0300521



Cert No.: 22TV242

Page.: 2 of 2

Condition of this result of calibration**1. Reference Standard Instruments :**

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1123143764	14CRC004	22MMS0	20 Sep 2023

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15K100353

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

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization if 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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Intech Metrological Center Co., Ltd.
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,
Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Certificate of Calibration

Certificate No. : MT22-6773

Page : 1 of 2

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

Description	: Incubator	Order No.	: 3555/22
Manufacturer	: Sanyo	Received date	: Dec 06, 2022
Model	: MIR-254	Calibration date	: Dec 12, 2022
Serial No.	: 1103017	Environment Condition :	
Identification No.	: ERTC-LIN-066	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 Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

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

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

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

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



Calibrated by :
Issue date : Dec 19, 2022

Approved by :

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



Inctech Metrological Center Co.Ltd.
59/1 Soi 82, Sukhaphiban 5 Rd. O ngoen,
Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Certificate No. : MT22-6773

Page : 2 of 2

Function : Temperature measurement

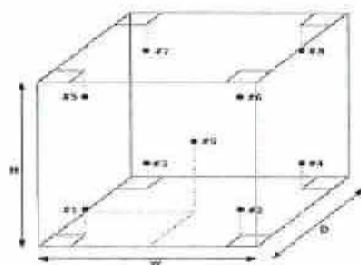
Calibration point : 20 °C

Result : Without adjustment

Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
20	19.634	19.407	19.345	19.268	19.687	19.616	19.630	19.642	19.568	0.05

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



Front view

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

UUC* = Unit under calibration

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

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

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
53/46 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3009-27 FAX. 0-2789-9884



Cert. No.: 23TM1

Page : 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Ehret

Model : EK 4106

Serial No. : 22162

ID No. : ERTC-L-In-022

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

Location : ห้องปฏิบัติการนมลาพาร์เลี้ยงเชื้อ (4C8/2)

Received Order : 4 January 2023

Calibration Date : 4 January 2023

Ambient Temperature : (20 ± 1C) °C

Relative Humidity : (50 ± 3C) %

Calibrated by :

Approved by :

() Pornthippa Tameyakul

(✓) Msilee Butkrusaa

() Suwit Imjai

Approved Signatory

Issue Date : 17 January 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written

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



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2301-00020N-E
 Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1. Data Acquisition	34970A	MY44073381	22LM7B/1	12 May 2023

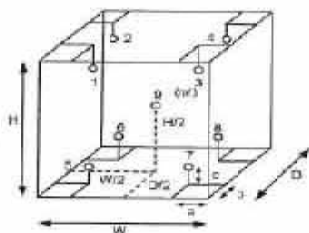
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.3 cm
 b = 5.3 cm
 c = 5.3 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	27
REL.Humid. (%)	49	47
AC Supply (Volt)	221	220

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



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2301-00020N-E
 Result of Calibration :- (°) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
44.5	44.5	44.5	0.34	1.3	1.6	0.80	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
44.5	44.627	45.501	45.139	45.606	43.898	44.165	44.411	44.551	45.204

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

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

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

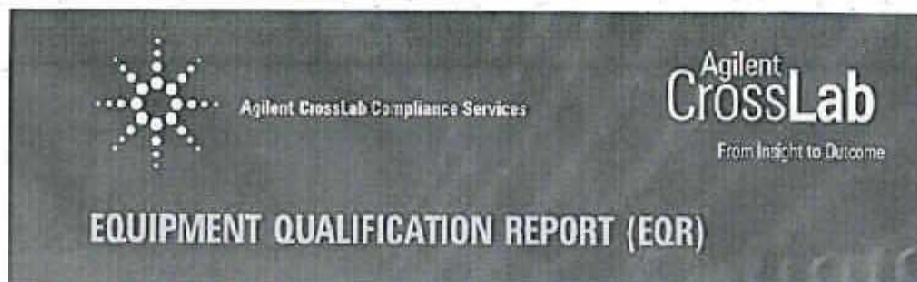
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

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

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

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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, 2022 4:15:06 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 VCV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1

Overall Qualification Status
Pass

Service Details

Purpose

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

General Details

Service Order No./Request:	5005573434
EQP Name:	Agilent Recommended
EQP Revision:	ES.02.60
Report Type:	Report

Organization Details

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

Local Contact Details

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

Operator Details

Name:	Worawit Timakul
Job Title:	Field Service Engineer

Data Acquisition Details

Acquisition Software Name:	ICP Expert
Acquisition Software Revision:	7.1.0.6621

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

Instrument Details

Overview

This section describes the as found system configuration.

Details

Spectrometer 1

Manufacturer	Agilent Technologies
Name	5130 VDV
Model Number	G6C11A
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	1A1500367

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AUH5220240

Vapor Generator 1

Manufacturer	Agilent Technologies
Name	VGA77P
Model Number	G8475A
Serial Number	MY15330002

Test Unit Details

Overview

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

Image Details:

Was the detector calibration performed and completed successfully?

Date and Time:

November 28, 2022 4:07:22 PM

Host Name:

5CG0202NQ4



Image Details:

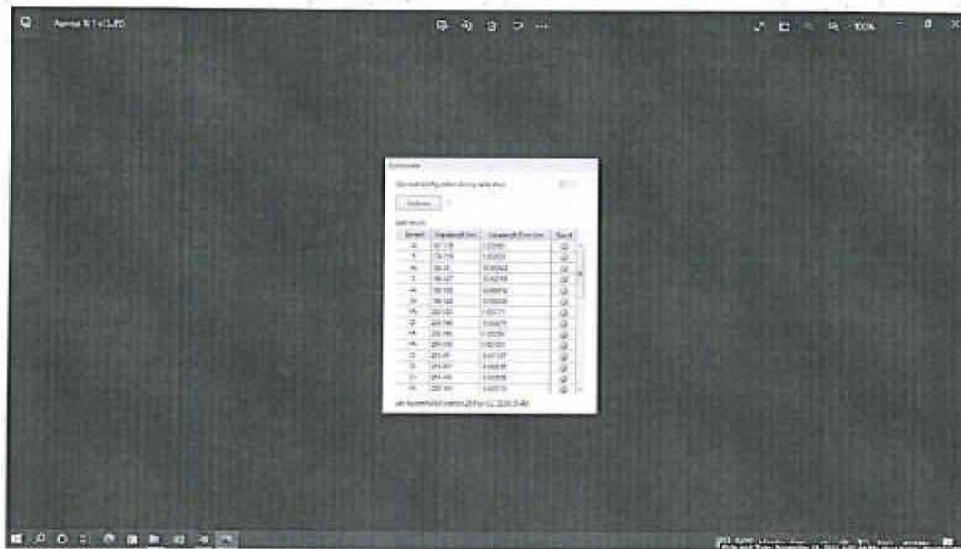
Was the instrument calibration performed and completed successfully?

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.


Contents

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
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Table

Document Name: Certificate of Qualification for ACE


Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: April 17, 2022 11:11:13 PM
Drive Serial #: 60593816x **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 console summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and QO 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	5	Conforms
Gas Chromatography - GC/MS	17	Conforms
Gas Chromatography	29	Conforms
Gel Permeation Chromatography	5	Conforms
ICP-MS	8	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LC/MS	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

Generic

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Worawit Timakul

Title Of Course: ANV-CB-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, correct parts, and parts sources. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Generic

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Worawit Timakul

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

Completion Date: October 30, 2020

Certified By Company: Learning at Agilent

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General

Document Name: Certificate of System Qualification



Certificate of Completion

Learner Name: Worawit Traakul

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:

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General

Document Name: Instrument's Test Report

Report Summary

Instrument Model: Agilent 5100 MDV ICP-OES
Instrument ID: 64011A
Instrument Serial Number: MY15300001
Software Version: 7.1.0.0021
Firmware Version: 2994
Tested By: Worawit T.
Test Completed On: 23-Nov-22 3:28:24 PM

Result Summary

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

Resolution Test

Pass

Element Wavelength	Specification	Width
Na (789.013 nm)	≤ 9.40	7.40
As (188.980 nm)	≤ 8.20	5.45
C (193.027 nm)	≤ 11.50	9.05
Mo (202.032 nm)	≤ 8.20	6.86
Cr (268.163 nm)	≤ 15.40	10.29
Zn (213.857 nm)	≤ 9.70	7.43
Pb (220.353 nm)	≤ 9.50	8.05
Ce (278.615 nm)	≤ 17.20	10.55
Be (230.484 nm)	≤ 9.40	7.87
Mn (257.610 nm)	≤ 15.30	9.47
Mn (250.658 nm)	≤ 25.30	15.41
Cr (267.716 nm)	≤ 11.00	8.93
Cu (824.754 nm)	≤ 25.00	15.01
Cu (827.395 nm)	≤ 14.20	12.72
Sr (308.071 nm)	≤ 33.50	23.00
Ba (455.403 nm)	≤ 44.00	33.00
Sr (407.793 nm)	≤ 36.00	23.22
Ba (483.405 nm)	≤ 36.00	33.03
Ba (514.171 nm)	≤ 42.00	23.54
Ar (696.282 nm)	≤ 74.00	65.50
K (776.481 nm)	≤ 60.00	61.34

Document Name:

Instrument's Test Report

Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (195.980 nm)	≥ 40.0	GBR	124.4	1283.4	89.1
Se (196.026 nm)	≥ 61.0	GBR	74.4	293.6	112.9
Zn (213.857 nm)	≥ 1421.0	GBR	4159.5	5879.5	189.6
Pb (220.353 nm)	≥ 43.0	GBR	191.9	3092.4	223.5
Mn (257.610 nm)	≥ 3518.0	GBR	13083.1	303064.1	626.5
Al (306.132 nm)	≥ 3.4	GBR	8.6	11307.1	4500.0
Ba (455.408 nm)	≥ 31.0	GBR	103.1	1275727.6	13253.0
K (766.491 nm)	≥ 1.8	GBR	0.9	111105.8	22733.2
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (195.980 nm)	≥ 230.0	GBR	250.5	3667.4	192.0
Se (196.026 nm)	≥ 195.0	GBR	172.2	2602.2	235.1
Zn (213.857 nm)	≥ 234.0	GBR	1350.5	17846.2	165.6
Zn (213.857 nm)	≥ 1143.0	GBR	5129.7	300193.0	490.0
Cd (214.439 nm)	≥ 4227.0	GBR	2255.6	156409.2	557.4
Pb (220.353 nm)	≥ 320.0	GBR	865.7	16532.1	571.0
Mn (257.610 nm)	≥ 10525.0	GBR	30160.3	1593731.8	1651.2
Cr (267.716 nm)	≥ 1648.0	GBR	4852.3	176423.2	1297.2
Cu (324.754 nm)	≥ 19.0	GBR	65.7	358073.8	4000.3
Al (306.132 nm)	≥ 5.0	GBR	24.3	271032.8	10722.4
Ba (455.408 nm)	≥ 50.0	GBR	273.4	8034589.2	28068.7
K (766.491 nm)	≥ 24.0	GBR	91.9	3677604.4	44370.4

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Document Name:

Instrument's Test Report

Precision Test		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.00	0.39
Se (196.026 nm)	≤ 2.00	1.01
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.00	0.41
Mn (257.610 nm)	≤ 1.50	0.43
Al (306.132 nm)	≤ 1.50	0.38
Ba (455.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.25
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.87
Se (196.026 nm)	≤ 1.50	0.70
Zn (208.280 nm)	≤ 1.50	0.42
Zn (213.857 nm)	≤ 1.50	0.51
Cd (214.435 nm)	≤ 1.50	0.50
Pb (220.353 nm)	≤ 1.50	0.48
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 (306.132 nm)	≤ 1.50	0.48
Ba (492.498 nm)	≤ 1.50	0.71
K (766.491 nm)	≤ 1.50	0.50

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General

Document Name: Software verification

Software Verification Report

Date: Monday, November 28, 2022 Time: 2:44:24 PM (UTC 4C70000) User Name: SMOYDYN-IP
 Worksheet Name: Activa Run Method Number: 2.0.1 Product Name: ICP Export
 Label Type: MFA Additional Packages: NA

Run Reference File Name: ICPExport.mfand

Summary:

Overall Evaluation of Instrument Check: PASS

File Report Summary

No missing files or invalid file found.

No system file differences found.

File Registration Report Summary

File Registration check not required for this product.

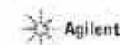
Registry Report Summary

Registry entries check not required for this product.

Date: November 28, 2022 4:16:05 PM
 System ID: MY16330001

Materials

Document Name: Certificate of Analysis Wavelength calibration solution



CERTIFICATE OF ANALYSIS

Agilent Product Name: Wavelength Calibration Solution for ICP-OES & MP-AES, 8 mg/L, 600mL
 Agilent Part No: 661000000
 Lot No: 001703521

Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7704-275-2	3.001 ± 0.028 mg/L	Na	Na	7440-23-5	3.001 ± 0.028 mg/L
As	As	7440-38-2	5.001 ± 0.028 mg/L	Nb	(NH ₄)NbO ₄	13104-26-1	3.000 ± 0.028 mg/L
Ba	Ba(NO ₃) ₂	10101-51-8	3.000 ± 0.028 mg/L	Rh	Rh	2440-01-4	3.000 ± 0.028 mg/L
Cd	Cd	7440-43-9	3.000 ± 0.028 mg/L	Re	Re	24499-11-1	3.000 ± 0.028 mg/L
Co	Co	7440-48-4	3.000 ± 0.028 mg/L	Se	Se	7782-49-2	3.000 ± 0.028 mg/L
Cr	Cr(NO ₃) ₃	13101-90-4	3.000 ± 0.028 mg/L	Sr	Ba/SrOx	10045-26-8	3.000 ± 0.028 mg/L
Cu	Cu	7440-80-4	3.000 ± 0.028 mg/L	Zn	Zn	2440-01-4	3.000 ± 0.028 mg/L
K	KNO ₃	7727-37-1	30.00 ± 0.23 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 spectrometry (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), atomic absorption spectrometry (flame AAS or D/AAS), microwave plasma atomic emission spectrometry (MP-AES), x-ray fluorescence spectrometry (XRF), and other techniques for elemental analysis.


Certification & Traceability: This CRM was manufactured under a quality management system that is registered to ISO 18011, ISO 17024 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single element concentrations 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 (0.22 µm), 18 M-ohm deionized water. The balance 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: 3011a, 21-016, 2004a, 2101a, 2112, 2112a, 2118, 3011a, 2132, 3034, 2136, 2102, 2143, 3012a, and 2110a. 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-washed containers and transferware, (2) avoid pipetting directly from the CRM's original container, (3) use a minimum sub-sample size of 500 µL, (4) make dilutions using calibrated glassware or certified volumetric glassware and apertures, (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 ambient light handling.

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

Document Name: Certificate of Analysis Wavelength calibration solution



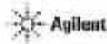
Period of Validity: Agilent ensures the accuracy of this solution until the expiration date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to one or more changes in the stability of the solution.

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

Sample for signature:

 Chad Anderson, Certifying Officer

Page 2 of 2

Document Name: Certificate of Analysis Wavelength calibration solution



Related 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 analysis of the Solution solution have analyzed to confirm its homogeneity. In accordance with ISO 17034, assessment of homogeneity was performed. To ensure homogeneity, users should not take a sample into sample that specified in the instructions for use, as doing so will invalidate the certified release and certification.

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 System – Requirements (ISO 9001:2015, Doc. No. 44-ISO-16000001)
- Accredited to ISO 17034 – General Requirements for the Certification of Reference Material Providers (AFLAC Cert. No. 2018002)
- ISO 17034 reference additional requirements specified in ISO Guide 35 and ISO Guide 35.
- Accredited to ISO/IEC 17025 – General Requirements for the Certification of Testing and Calibration Laboratories (AGLA Cert. No. 2018001)
- U.S. Department of Defense (DoD) 5010.108-01

Page 1 of 2

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

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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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Print Name: worawit.timakul
 Username: SCG1112121

System ID: MY15330001
 Print Date: November 28, 2022 4:16:05 PM

CQ HW / CP 2140 Eval-research Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2022 4:02:15 PM	Audit	Session Created	Session	None
November 28, 2022 4:02:15 PM	Start	Configuration	Session	None
November 28, 2022 4:02:15 PM	Audit	Entitlement	Joining	User is Field Engineer and does not require an unlock code
November 28, 2022 4:36:33 PM	Audit	Exp/Loaded	Session	SCP details for primary technique [54] - File path: [ProtocolPacks\Gc\Configuration\ons02_SCP's 02_50.scg] SCP File Name: [02_02_50.scg], SCP Name: [AgilentRecommended]
November 28, 2022 4:48:52 PM	End	Configuration	Session	None
November 28, 2022 4:49:35 PM	Start	Qualification	Session	OQ
November 28, 2022 4:06:36 PM	Start	Execution	Preparation : 5100 VOV; Qualitative Test - No setpoints associated	None
November 28, 2022 4:07:38 PM	End	Execution	Preparation : 5100 VOV; Qualitative Test - No setpoints associated	Run Count : 1
November 28, 2022 4:07:35 PM	Start	Execution	Instrument Tests : 5100 VOV; Qualitative Test - No setpoints associated	None
November 28, 2022 4:08:52 PM	End	Execution	Instrument Tests : 5100 VOV; Qualitative Test - No setpoints associated	Run Count : 1



User Name: wvnsat@agilent.com
 Resource: 5008231401
 System ID: MY1633001
 Print Date: November 24, 2022 4:16:18 PM

Q1 HW ICP 6100 Enviresearch Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 28, 2022 4:09:31 PM	Start	Execution	Autosampler Operation: Autosampler 1 - SP54 Qualitative Test - No setpoints associated	None
November 28, 2022 4:09:40 PM	End	Execution	Autosampler Operation: Autosampler 1 - SP54 Qualitative Test - No setpoints associated	Run Count: 1
November 28, 2022 4:09:09 PM	End	Qualification	Session	DQ
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: Q1 HW ICP 6100 Enviresearch_20221128_Certificate_1.pdf User Name: wvnsat@agilent.com Full Name of Signer: Wvnsat Timakul Reason for signature: Executed protocol and published this original version of document
November 28, 2022 4:15:43 PM	Audit	Reporting	Session	Report Generated: Report

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PinAAcle 900Z Preventive Maintenance Report


Company Name: ENVIRONMENT RESEARCH

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

Instrument Serial No.: PZAS19031401

Date: 30-Jun-2023

PinAAcle 900Z Preventive Maintenance (PM)			
Company Name:	ENVIRONMENT RESEARCH		
Address (Instrument Location):	25/114 M.6, THANON NGAMWONGWAN, THUNGSONGHONG, LAKSI, BANGKOK		
Serial Number:	PZAS19031401	PM Number:	1/2
Customer Name (if applicable):		Telephone Number:	099-182-9241
Customer Support Engineer Name:		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	\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

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

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

Review of Preventive Maintenance:

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



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

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

TEL: 0-2717-3000-39 FAX: 0-2710-9484

Cert.No.: 23CH706

Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
 Manufacturer : HM Digital
 Model : COM-100
 Serial No. : PONPE5831384
 ID No. : NO.06
 Condition As-Received: Used Item
 Received Date : 02 June 2023
 Calibration Date : 06 June 2023
 Reference : 2306-0067DN-6
 Submitted by : Environment Research & Technology Company Limited,
 25/114 Moo 6, Soi Chinsaket 1, Ngamwongwan Road,
 Toongsoorhong, Leksi, 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 reference material (RTM)

Calibrated by :

Approved by :

() Malee Butkruea
 (x) Saithip Meangmai
 () Warakorn Lemgagrakul

Issue Date : 8 June 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 Calibration and Testing Equipment Services.



Cert.No.: 23CH708

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	1963878	130RC095	2211140	12 Sep 2023

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

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

2. Certified Reference Materials :-

- Conductivity calibration solution Thermo Scientific (traceable to NIST)

Conductivity Solution	Manufacturer	Lot No.	Exp. date
100 $\mu\text{S/cm}$	Thermo Scientific	282/01	15 July 2023
1413 $\mu\text{S/cm}$	Thermo Scientific	132/02	01 Apr 2025

- Control Conductivity calibration solution temperature by Water bath (25 ± 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 100 $\mu\text{S/cm}$** **Conductivity Electrode Serial No.: PONPE5851384**

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
100 $\mu\text{S/cm}$	84.9 $\mu\text{S/cm}$	101 $\mu\text{S/cm}$	5.1 $\mu\text{S/cm}$	2.00
1413 $\mu\text{S/cm}$	1030 $\mu\text{S/cm}$	1410 $\mu\text{S/cm}$	16 $\mu\text{S/cm}$	2.00

Remark - UUC* = Unit Under CalibrationThe 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 1165237

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

53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-23 FAX. 0-2719-9484

Cert.No.: 22CH1756

Page.: 1 of 2

Certificate of Calibration

Equipment :	Salinity Meter
Manufacturer :	AZ
Model :	AZ8371
Serial No. :	414717
ID No. :	NO.5
Condition As-Received:	Used Item
Received Date :	27 December 2022
Calibration Date :	27 December 2022
Reference :	2212-0734WN-4
Submitted by :	Environment Research & Technology Company Limited, 25/114 Moo 6, Soi Chinakot 1, Ngamwongwan Road, Tongsohong, Laksi, Bangkok 10210
Ambient Temperature :	(25 ± 2.6) $^{\circ}\text{C}$
Relative Humidity :	(65 ± 15) %
Calibration Procedure:	In - house method : based on direct measurement by using Sodium Chloride Solution

Calibrated by :

Approved by :

Approved Signatory

() Malee Butkruea
() Sathip Meangmai
(x) Varakorn Lerngagraku

Issue Date :

28 December 2022

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

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

A 0010259



Cert.No.: 22GH1756

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	1903684	130RC114	22H1141	12 Sep 2023
2) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023

2. Reference Standard Material :

- Conductivity calibrated solution, Eutech (traceable to NIST)
- Calibrated Total Dissolved Solids solution temperature controlled by Water bath at $(25 \pm 0.1) ^\circ\text{C}$
- 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(*) Adjustment at **2.84 ppt**

Probe Serial No. : 414717


Standard NaCl Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
2.50 ppt	2.63 ppt	2.44 ppt	0.027 ppt	2.00
2.84 ppt	2.95 ppt	2.84 ppt	0.030 ppt	2.00

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, providing a level of confidence of approximately 95 %.

-000-

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

Contact: Ramita Taengthai

Weighing Device

Manufacturer: Mettler Toledo
Model: MS204S/01
Serial No.: B334691537
Building: N/A
Floor: 5
Room: 504

Instrument Type: Weighing Instrument
Asset Number: ERTC-L-IN-088
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

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

METTLER TOLEDO Work Instruction: CP/W002/20

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

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

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

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

As Found Calibration Date: 17-Jan-2023

As Left Calibration Date: N/A

Issue Date: 19-Jan-2023

Calibrator:

Chawalit Martsuloke

Approved Signatory:

Technical Manager / Head of Calibration Center

a 1142227

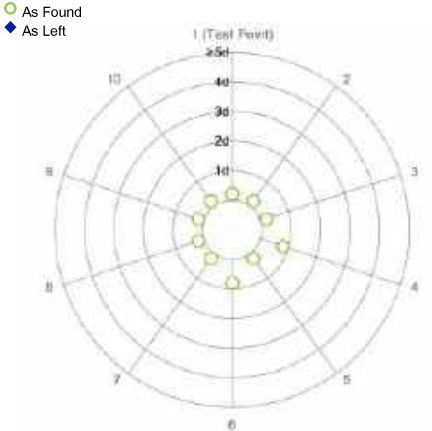
Measurement Results

Repeatability

Test Load: 100 g

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

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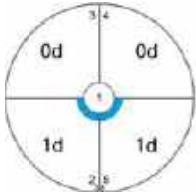
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0001 g	N/A
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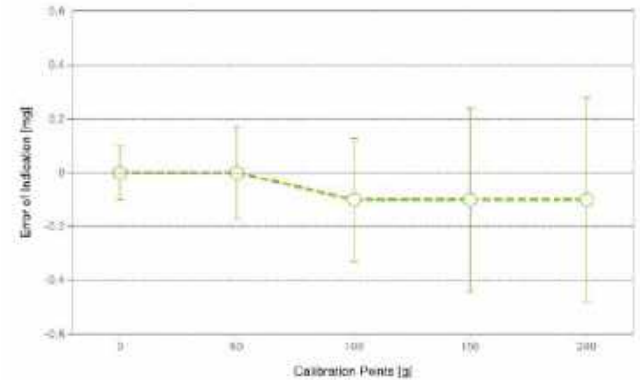


As Found
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

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



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

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

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

Test Equipment

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

Weight Set 1: OIML E2

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

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: 1,5 · 10⁻⁶ / K

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

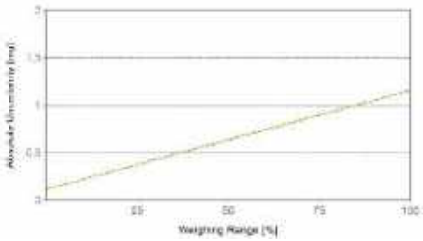
Linearization of Uncertainty Equation

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

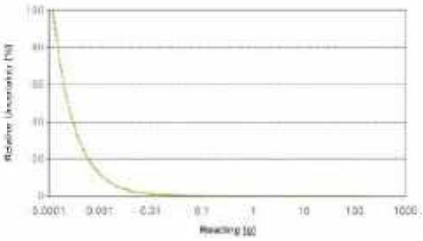
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

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



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.

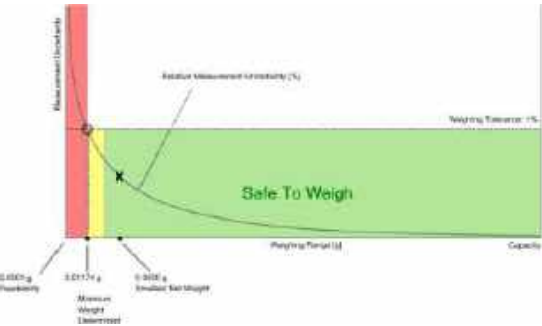
Process Requirements

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%	0.11794 g	0.23700 g	0.35721 g	0.60113 g	1.23215 g
0.2%	0.05883 g	0.11794 g	0.17733 g	0.29696 g	0.60113 g
0.5%	0.02350 g	0.04704 g	0.07063 g	0.11794 g	0.23700 g
1%	0.01174 g	0.02350 g	0.03526 g	0.05883 g	0.11794 g
2%	0.00587 g	0.01174 g	0.01762 g	0.02938 g	0.05883 g
5%	0.00235 g	0.00470 g	0.00704 g	0.01174 g	0.02350 g

✓

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

As Left Minimum Weight Table

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

✓

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

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

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

Notes on minimum weight values in above table:

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

Measurement Results

Results Summary

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

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

Repeatability

Test Load: 100 g

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

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

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

Eccentricity

Test Load: 100 g

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

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

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
100,0000 g	-0,0001 g	0,0500 g	0,1000 g	0,2500 g	0,5000 g	1,0000 g	2,5000 g
150,0000 g	-0,0001 g	0,0750 g	0,1500 g	0,3750 g	0,7500 g	1,5000 g	3,7500 g
200,0000 g	-0,0001 g	0,1000 g	0,2000 g	0,5000 g	1,0000 g	2,0000 g	5,0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

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

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5346 PATTANAKARN ROAD SOI 15, RUAMLUANG, SUANLUMPHANG BANGKOK 10250
TEL: 0-2717-5000-27 FAX: 0-2719-9884



Cert. No.: 23TM31
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Binder
Model : FED 115 E2
Serial No. : 11-22923
ID No. : ERTC-LIn.-078
Submitted by : Environment Research & Technology Company Limited,
25/114 Moo 6, Soi Chiraket 1, Ngamwongwan Road,
Toongsoenghong, Laks,
Bangkok 10210
Location : Laboratory (ERTC)
Received Order : 4 January 2023
Calibration Date : 4 January 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Preecha Hsieh

Approved by :

Approved Signatory

() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

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.

A 0049316



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2301-0002ON-2
Procedure Used :-

Cert. No.: 23TM31
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

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

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

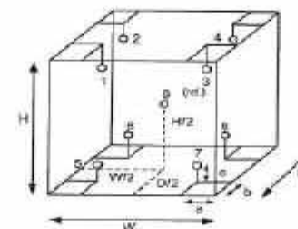
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



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

Ref. Std. ID No.: @
Calibration Point

Position :	(104) °C	(180) °C
1	21-17RTD-01	22-17TC-01
2	21-17RTD-02	19-17TC-02
3	17RTD-03	19-17TC-03
4	17RTD-04	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	17RTD-08	19-17TC-08
9 (ref.)	17RTD-09	19-17TC-09

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

a 1142806



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2301-COC2ON-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 23TM31
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104	104	104	0.16	2.4	2.6	0.86	2
180	180	180	0.34	6.1	3.8	1.8	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104	104.819	105.334	104.674	104.185	103.981	103.001	105.408	103.368	103.014
180	176.454	179.253	182.386	180.810	181.999	178.253	184.628	179.227	178.888

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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
 TEL: 0-27-7-3030-07 FAX: 0-2713-9484



Cert. No.: 23TM32
 Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
 Manufacturer : Memmert
 Model : UF 110
 Serial No. : B414.0652
 ID No. : ERTC-Lin.-098
 Submitted by : Environment Research & Technology Company Limited.
 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road,
 Toongseenghong, Lakel,
 Bangkok 10210
 Location : Laboratory (ERTC)
 Received Order : 4 January 2023
 Calibration Date : 4 January 2023
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Preecha Hlahib

Approved by : 
 Approved Signatory

() Ponthippa Tamayakul
 () Malee Butkruea
 () Suwit Imjai

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

Cert. No.: 23TM32
 Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT32 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

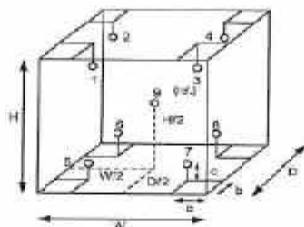
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :

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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	32
REL. Humid. (%)	60	55
AC Supply (Volt)	220	221

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



Equipment : Hot Air Oven
 Condition As-Received : Used Item
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Cert. No.: 23TM32
 Page : 3 of 3

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.10	0.95	1.6	0.42	2
180.0	180.0	180.0	0.29	1.8	3.5	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.630	103.574	103.239	103.951	104.422	104.052	103.192	104.041	104.089
180.0	179.591	179.815	178.321	178.612	181.116	179.997	178.605	179.735	179.508

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 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" checkboxes 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	ERP-L-In-175	US2125A011
Instrument System Site and Location	Environment Research	Laboratory

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

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

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

Inlet and detector consumable replacement

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

Zero Sensors and Leak test

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

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

ALS Maintenance

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

Restore Instrument

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

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	286.6
Back detector output	N/A	243.2
AUX 1 detector output	N/A	282.6
AUX 2 detector output: CFPD+	N/A	243.2 126
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 M/M, 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 605950179 Date service completed 12-13 June 2023

Agilent signature [Redacted] Customer signature _____

Total number of pages in this document 9 pages

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist

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

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Introduction

Customer Information

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- 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

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- 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 on line, 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 / 5437B
Instrument System Site and Location	Environmental Research & Technology, Bangalore

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3940B	CN16493726
2. G4513D	CN16500132
3. G4514D	CN18330130
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

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

Inlet and detector consumable replacement

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

Zero Sensors and Leak test

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

ALS Maintenance

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

Restore Instrument

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

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	11/h
Back detector output	5	5
AUX detector output		
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

7890 Parts List Table

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

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-5144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	
PP Inlet PM kit	5188-6498	7890A/B	
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	
MMI Cleaning Kit	G3510-60820	7890A/B	
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	2
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-5144	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: 606465126 Date service completed: 25 Nov 2022

Agilent signature: [Signature] Customer signature: [Signature]

Total number of pages in this document: _____

Agilent CrossLab Start Up Services

Agilent GCMS Preventive Maintenance Checklist



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

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

Introduction

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

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

This checklist covers the following model(s):

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

Customer Information

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

Important Customer Web Links

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

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the *Service Review* section together with the customer.
- Ask the customer to sign the *Service Completion* section including the customer's and your signature.

Additional Instruction Notes

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

System Information

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

Instrument System Name and ID	7810B / 5475B
Instrument System Site and Location	Environmental Research & Technologies, Bangkok

List System Component Product Numbers	List the Serial Numbers of each Component
1. 617017B	US17017011
2.	
3.	
4.	
5.	
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Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and settings as defined by current Service Notes
- ☒ Check for firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

Customer Responsibilities

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

Important notice for customers

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

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

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

Definition of the Task/Recommended items within the document

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

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

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

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

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

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

Preventive Maintenance Procedures

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input 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.

Yes/No	Interim/Major	GC/MS
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument model no.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument serial no.
<input type="checkbox"/>	<input type="checkbox"/>	Record Rough Vacuum
<input type="checkbox"/>	<input type="checkbox"/>	Record Manifold Vacuum
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Type of Column Installed

Yes/No	Interim/Major	System Checks
<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 calibration levels – PPTBA/PFTD (if appl.), IRV (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"/>

Yes/No	Interim/Major	Wet Mechanical vacuum pumps
<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.
Yes/No	Interim/Major	Dry Mechanical vacuum pumps – Diaphragm
<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.

Yes/No	Interim/Major	Dry Mechanical vacuum pumps – Scroll
<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.

Yes/No	Interim/Major	Cleaning System and Filters
<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 RMSG-2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace RMSG-2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Replace RMSG-2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CF17983 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CF17974 – Gas Clean Filter Kit GC/MS 1/8"; Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CF17973 – 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:			
Yes/No	Interim/Major	Description	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system in manual tune
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Compare age (nst) previous tune file report(s)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	EI Autotune Performed

Guidance: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument setup and checkout.

Service Review

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

Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result

Agilent Consumed Parts List Table

☐ Section not applicable

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

Signature Page

Service Engineer Comments (optional)

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

Service Completion

Service request number 60016(45)76 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"/>	<input checked="" type="checkbox"/>	Helium gas filter – if required	RMSH-2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Nitrogen gas filter – if required	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fig. Universal Trap, 1/8" fittings, Hydrogen, if required	RMSHY-2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Clean Carrier Gas Kit for 7390 for Nitrogen or Helium, Bracket, Mount and Filter – if required	CP17988
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Clean Filter Kit GC/MS 1x8 in (complete replacement kit) – if required	CP17974
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Clean SS/MS Filter – if required	CP17973
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Chemical Ionization Gas Purifier (CI systems) – if required	5190-9071
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Agilent AXF Platinum, 1 quart	5191-5651

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"/>	<input checked="" type="checkbox"/>	Diffusion pump fluid (Diffusion Pump Models)	6040-0609 Dry 2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Pump Models)	G7077-67018
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (no tools – CSD P/N)	5190-5561
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-3 Tip Seal Replacement Kit (no tools – VPD P/N)	IDP3TS
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Filter element for IDP-3	REPLSLRFILTER2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	DS42 Oil Mist Eliminator 3/4G & 3/8	SRC3705556
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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"/>	<input checked="" type="checkbox"/>	Nitrogen gas filter	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models)	G7004-67023
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-10 Tip Seal Replacement Kit (no tools – VPD P/N)	X3807-67000
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Oil Mist Filter RV5	G6600-80043
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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"/>	<input checked="" type="checkbox"/>	Nitrogen gas filter – if required	RMSN-2
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	RIS Probe Maintenance Kit (7200 Series only)	G7005-60170
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	DS202 Oil Mist Eliminator	SRC3706800
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Pump Models)	5190-9613
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	IDP-15 Tip Seal Replacement Kit (no tools – VPD P/N)	X3815-67000
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Filter element for SH-110/SH-112/IDP-15 exhaust silencer	REPLSLRFILTER
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	DS 3/8 MAG. PLUG AND GASKET	SRC370-824

MS Maintenance Supplies for JetClean

Yes/No	Interim	Major/As needed	Supplies	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	JetClean Maintenance Kit	JC-MK-1

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Big In Versal Trap, 1/8" fittings, Hydrogen, if required	RM3HY-2
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Consumable Parts Reference – Purchasable by customer, not included as part of PM

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

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	El High Temperature Filaments	G7005-60061 Qty 2
<input type="checkbox"/>	<input type="checkbox"/>	HES El Filaments	G7002-60061
<input type="checkbox"/>	<input type="checkbox"/>	LE-El Filaments	G3850-60021
<input type="checkbox"/>	<input type="checkbox"/>	Cl High Temperature Filament – all MSDs	G7005-60072
<input type="checkbox"/>	<input type="checkbox"/>	PFTBA GCMS Tuning Standard calibrant	G5971-60571
<input type="checkbox"/>	<input type="checkbox"/>	PFTD calibrant, 1 mL	G500-6510
<input type="checkbox"/>	<input type="checkbox"/>	PFET IRM calibrant for GC QTOF Q E mL	G190-0531

MSD Maintenance Supplies 5973/5975/5977 Series

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

MS Maintenance Supplies for 7000/7010 Series

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

MS Maintenance Supplies for 7200 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Extractor Lens Insulator	G7003-20133
<input type="checkbox"/>	<input type="checkbox"/>	Ion Focus Insulator	G7003-20442
<input type="checkbox"/>	<input type="checkbox"/>	Ring Heater/Sensor Assembly	G7003-60110
<input type="checkbox"/>	<input type="checkbox"/>	RIS Xfer Tip	G7003-20542
<input type="checkbox"/>	<input type="checkbox"/>	RIS Xfer Tip Spring	G7003-20024

MS Maintenance Supplies for 7250 Series

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

MS Maintenance Supplies for Intuvo 9000 MS Systems

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Swaged MS Tail - Packaged	G4550-60009
<input type="checkbox"/>	<input type="checkbox"/>	Swaged MS Tail (HES) - Packaged	G4550-60109

Common MS Maintenance Supplies

Yes/No	Interim/Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	Abrasive paper, 90 um	G061-5896
<input type="checkbox"/>	<input type="checkbox"/>	Alumina powder	G9370-5701
<input type="checkbox"/>	<input type="checkbox"/>	Cloths, clean (pkg of 15)	G5980-60051
<input type="checkbox"/>	<input type="checkbox"/>	Cloths, cleaning (pkg of 300)	G9310-4E28
<input type="checkbox"/>	<input type="checkbox"/>	Cotton swabs (pkg of 100)	G080-5400
<input type="checkbox"/>	<input type="checkbox"/>	Gloves, clean, large	G650-0030
<input type="checkbox"/>	<input type="checkbox"/>	Gloves, clean, small	G650-0029

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

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

Customer Information

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

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

System Information

Guidance

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

Instrument system name and ID	ATOMX
Instrument system site and location	Environmental Research & Technologies, Bangalore
List system component product numbers	List the serial numbers of each component
1. TMR-ATOMX	1. US17017 007
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Preparation

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

Check External Supplies

- ☐ Section NOT Applicable
- ☒ Verify the gas source is supplying an input pressure of 50 - 100 psi to the ATOMX. If the customer is using a gas cylinder, verify the cylinder is at 500+ psi.
- ☒ Verify that the waste container has sufficient volume to contain the waste generated. Empty if necessary.
- ☒ Replace the DI water supply with fresh DI water.
 - 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 6-26 of the ATOMX User Manual for lubrication points. Teledyne Tekmar recommends using DuPont Krytox lubrication.
- ☒ Lubricate the ATOMX Elevator. Refer to the diagram on page 6-32 of the ATOMX User Manual for lubrication points. Teledyne Tekmar recommends using DuPont Krytox lubrication.

Restore Instrument

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the PM service activity in the customer's instrument records/logbook
- ☒ Update/reset instrument maintenance counters as appropriate
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments
- ☒ Review the service and any test results with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Product or Product Type Test Results Table

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

Product or Product Type Parts List Table

Part Description	Part Number	Product or Model# where used	Quantity Consumed
Sparger Glassware	Ask the customer what size sparger glassware they are using, refer to the ATOMX parts list for part numbers.	TMR-ATOMX	1
Lubricant, Dupont Krytox	15-0333-000	TMR-ATOMX	1
Tubing, Drain, Self Retracting	15-0087-002	TMR-ATOMX	1

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 6004643124 Date service completed 25 Nov 2022

Agilent signature



Customer signature



Number of pages in this document _____