# เอกสารแนบ 16

## เอกสารอนุญาตห้องปฏิบัติการ

สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด เลขทะเบียน ว-๑๕๒
ที่ อก ๐๓๑๐(๑)/ ๑๓๗๖๘ ลงวันที่ ๒๖ กันยายน ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๓๒ ราย

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ที่ อก ๐๓๑๐(๑)/ ๑๓๗๖๘

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๖ กันยายน ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๘ พฤษภาคม ๒๕๖๕

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๓๒ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓๕ ราย
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๕๒ สถานที่ตั้งเลขที่ ๖ ซอยงามวงศ์วาน ๕ ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๓๒ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓๕ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๕ กรกฎาคม ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

[redacted]

ขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด เลขทะเบียน ว-๑๕๒
ที่ อก ๐๓๑๐(๑)/ ๑๓๗๖๘ ลงวันที่ ๒๖ กันยายน ๒๕๖๕

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๐๐ รายการ

น้ำเสีย จำนวน 27 รายการ

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 2 | Barium | 1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 3 | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method[4] |
| | | 2) 5-Day BOD Test, Membrane Electrode Method[4] |
| 4 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 5 | Chemical Oxygen Demand | 1) Open Reflux, Titrimetric Method[4] |
| | | 2) Closed Reflux, Titrimetric Method[4] |
| 6 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 7 | Color | ADMI Weighted-Ordinate Spectrophotometric Method[4] |
| 8 | Copper | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 9 | Cyanide | Distillation, Colorimetric Method[4] |
| 10 | Formaldehyde | Distillation, Colorimetric Method[3] |
| 11 | Free Chlorine | DPD Colorimetric Method[4] |
| 12 | Hexavalent Chromium | Colorimetric Method[4] |
| 13 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 14 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |
| 15 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[4] |
| 16 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[4] |
| | | 2) Digestion, Inductively Coupled Plasma Method[4] |







เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด เลขทะเบียน ว-๑๕๒
ที่ อก ๐๓๑๐(๑)/ ๑๓๗๖๘ ลงวันที่ ๒๖ กันยายน ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓๕ ราย

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| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 17 | Oil & Grease | 1) Liquid-Liquid, Partition-Gravimetric Method[4]<br>2) Soxhlet Extraction Method[4] |
| 18 | pH | Electrometric Method[4] |
| 19 | Phenols | Distillation, Direct Photometric Method[4] |
| 20 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |
| 21 | Sulfide | 1) Iodometric Method[4]<br>2) Methylene Blue Method[4] |
| 22 | Temperature | Laboratory and Field Methods[4] |
| 23 | Total Dissolved Solids | Dried at 180 °C[4] |
| 24 | Total Kjeldahl Nitrogen | 1) Macro-Kjeldahl Method[4]<br>2) Semi-Micro-Kjeldahl Method[4] |
| 25 | Total Suspended Solids | Dried at 103-105 °C[4] |
| 26 | Trivalent Chromium | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[4]<br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[4] |
| 27 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Inductively Coupled Plasma Method[4] |

น้ำใต้ดิน จำนวน 16 รายการ

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Antimony | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 2 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 3 | Barium | 1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 4 | Beryllium | 1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 5 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 6 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 7 | Chromium (III) | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method; Colorimetric Method; Calculation[4]<br>3) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation[4] |
| 8 | Chromium (VI) | Colorimetric Method[4] |
| 9 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 10 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 11 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[4] |
| 12 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 13 | pH | Electrometric Method[4] |
| 14 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 15 | Silver | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |
| 16 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method[4]<br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method[4]<br>3) Digestion, Inductively Coupled Plasma Method[4] |

<u>อากาศเสีย (ปล่องระบาย) จำนวน 25 รายการ</u>

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Antimony | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 2 | Arsenic | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5]<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 3 | Beryllium | 1) Isokinetic Sampling, Digestion, Direct Nitrous Oxide-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 4 | Cadmium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 5 | Carbon Monoxide | Instrumental Analyzer Method[5] |
| 6 | Chlorine | 1) Absorption Sampling, Ion Chromatographic Method<br>2) Isokinetic Sampling, Ion Chromatographic Method[5] |
| 7 | Chromium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 8 | Cobalt | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 9 | Copper | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 10 | Cresol | Absorption Sampling, Gas Chromatographic Method[5] |
| 11 | Hydrogen Chloride | 1) Absorption Sampling, Ion Chromatographic Method<br>2) Isokinetic Sampling, Ion Chromatographic Method[5] |

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 23 | Tin | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 24 | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method[5] |
| 25 | Xylene | Adsorption Sampling, Gas Chromatographic Method[5] |

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 17 รายการ

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Antimony | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 2 | Arsenic | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method [1,6,13]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,13]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 12 | Hydrogen Fluoride | 1) Absorption Sampling, Ion Chromatographic Method[5]<br>2) Isokinetic Sampling, Ion Chromatographic Method[5] |
| 13 | Hydrogen Sulfide | Absorption Sampling, Iodometric Method[5] |
| 14 | Lead | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5].<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 15 | Manganese | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 16 | Mercury | Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[5] |
| 17 | Nickel | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method[5]<br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 18 | Opacity | Ringelmann's Method[2] |
| 19 | Oxides of Nitrogen | Instrumental Analyzer Method[5] |
| 20 | Selenium | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[5]<br>2) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[5]<br>3) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method[5] |
| 21 | Sulfur Dioxide | 1) Isokinetic Sampling, Barium-Thorin Titrimetric Method[5]<br>2) Instrumental Analyzer Method[5] |
| 22 | Sulfuric Acid | Isokinetic Sampling, Barium-Thorin Titrimetric Method[5] |

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 3 | Barium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 4 | Beryllium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 5 | Cadmium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 6 | Chromium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 7 | Chromium (III) | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation[1,6,9,11,14]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation[1,6,9,12,14]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation[1,6,9,10,14]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,11,14]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,12,14]<br>6) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,10,14] |
| 8 | Chromium (VI) | 1) Waste Extraction, Colorimetric Method[1,14]<br>2) Alkaline Digestion, Colorimetric Method[9,14] |



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| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 9 | Cobalt | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 10 | Copper | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 11 | Lead | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 12 | Mercury | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[1,15]<br>2) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[16] |
| 13 | Nickel | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 14 | Selenium | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[1,6,17]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10]<br>4) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,17]<br>5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 15 | Silver | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11]<br>2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12]<br>3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10] |



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| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| | | 4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 6) Digestion, Inductively Coupled Plasma Method[7,10] |
| 16 | Trichloroethylene | Headspace, Gas chromatographic Method[8,18] |
| 17 | Zinc | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method[1,6,11] |
| | | 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[1,6,12] |
| | | 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method[1,6,10] |
| | | 4) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 6) Digestion, Inductively Coupled Plasma Method[7,10] |

<u>ดิน จำนวน 15 รายการ</u>

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 1 | Antimony | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 2 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,13] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 3 | Barium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 4 | Beryllium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 5 | Cadmium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 6 | Chromium | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12] |
| | | 3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 7 | Chromium (III) | 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,11,14] |
| | | 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,12,14] |
| | | 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation[7,9,10,14] |

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 8 | Chromium (VI) | Alkaline Digestion, Colorimetric Method[9,14] |
| 9 | Lead | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 10 | Manganese | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 11 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method[16] |
| 12 | Nickel | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 13 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method[7,17]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |
| 14 | Silver | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |





| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์ |
|---|---|---|
| 15 | Zinc | 1) Digestion, Flame Atomic Absorption Spectrometric Method[7,11]<br>2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method[7,12]<br>3) Digestion, Inductively Coupled Plasma Method[7,10] |

**เอกสารอ้างอิง**


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ที่ อก ๐๓๑๐(๑)/ ๑๑๖๗๖

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๐ สิงหาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๓๑ กรกฎาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๕๒ สถานที่ตั้งเลขที่ ๖ ซอยงามวงศ์วาน ๕ ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย ได้แก่

๑) [redacted]
๒)

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน คือในวันที่ ๕ กรกฎาคม ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

[redacted]

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

Green Industry
"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"

แบบ กภ.บญ
นิติบุคคล

**กรมสวัสดิการและคุ้มครองแรงงาน**

**ใบอนุญาต**

**เป็นนิติบุคคลผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตราย**

**ในบรรยากาศของสถานที่ทำงานและสถานที่เก็บรักษาสารเคมีอันตราย**

**ใบอนุญาตเลขที่ ๐๒๐๑-๐๓-๒๕๖๕-๐๐๕๒**

อนุญาตให้ บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

เลขทะเบียนนิติบุคคล ๐๑๐๕๕๓๙๐๐๗๙๓๙

ตั้งอยู่ เลขที่ ๖ ซอยงามวงศ์วาน ๕ ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี

เป็นนิติบุคคลผู้ให้บริการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน ตามกฎกระทรวงกำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับสารเคมีอันตราย พ.ศ. ๒๕๕๖ ในการเป็นผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงานและสถานที่เก็บรักษาสารเคมีอันตราย ประกอบกับกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๔ โดยมีบุคลากร จำนวน ๔๔ ราย ดังรายชื่อแนบท้ายใบอนุญาตนี้

ทั้งนี้ ตั้งแต่วันที่ ๑๕ มิถุนายน พ.ศ. ๒๕๖๕ ถึงวันที่ ๑๓ มิถุนายน พ.ศ. ๒๕๖๘

ให้ไว้ ณ วันที่ ๑๕ มิถุนายน พ.ศ. ๒๕๖๕

[redacted]

อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

น.16/11

ที่ รง ๐๕๐๔/๔๗๕๐

กรมสวัสดิการและคุ้มครองแรงงาน
ถนนมิตรไมตรี ดินแดง กรุงเทพฯ ๑๐๔๐๐

๑๕ มิถุนายน ๒๕๖๕

เรื่อง การขออนุญาตเป็นนิติบุคคลผู้ให้บริการตรวจวัดและวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายฯ

เรียน กรรมการผู้จัดการบริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

อ้างถึง แบบคำขอและรับคำขอใบอนุญาตฯ ของบริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

สิ่งที่ส่งมาด้วย ๑. ใบอนุญาตเป็นนิติบุคคลผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตรายฯ และรายชื่อบุคลากรแนบท้ายใบอนุญาต ลงวันที่ ๑๕ มิถุนายน พ.ศ. ๒๕๖๕ จำนวน ๑ ฉบับ
๒. ใบอนุญาตเป็นนิติบุคคลผู้ให้บริการวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายฯ และรายชื่อบุคลากรแนบท้ายใบอนุญาต ลงวันที่ ๑๕ มิถุนายน พ.ศ. ๒๕๖๕ จำนวน ๑ ฉบับ

ตามหนังสือที่อ้างถึง บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด ได้ยื่นแบบคำขอและรับคำขอใบอนุญาต แบบ กภ.บญ.๑๑ (นิติบุคคล) เป็นนิติบุคคลผู้ให้บริการตรวจวัดและวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงานและสถานที่เก็บรักษาสารเคมีอันตราย ตามกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ เพื่อให้กรมสวัสดิการและคุ้มครองแรงงานพิจารณา ความละเอียดแจ้งแล้ว นั้น

กรมสวัสดิการและคุ้มครองแรงงาน ได้พิจารณาแล้วเห็นว่าการยื่นแบบคำขอและรับคำขอใบอนุญาตเป็นนิติบุคคลผู้ให้บริการตรวจวัดและวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายฯ ของบริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด เป็นไปตามกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัยฯ ประกอบกับกฎกระทรวงกำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับสารเคมีอันตราย พ.ศ. ๒๕๕๖ จึงออกใบอนุญาตให้บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด เป็นนิติบุคคลผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตรายฯ พร้อมบุคลากร จำนวน ๔๔ ราย โดยมีใบอนุญาตเลขที่ ๐๒๐๑-๐๓-๒๕๖๕-๐๐๕๒ และเป็นผู้ให้บริการวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายฯ พร้อมบุคลากร จำนวน ๕๕ ราย โดยมีใบอนุญาตเลขที่ ๐๒๐๒-๐๓-๒๕๖๕-๐๐๓๗ รายละเอียดปรากฏตามสิ่งที่ส่งมาด้วย ทั้งนี้ ขอให้บริษัทฯ ปฏิบัติตามกฎกระทรวงการขึ้นทะเบียน และการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัยฯ อย่างเคร่งครัด

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

[redacted]

กองความปลอดภัยแรงงาน
โทรศัพท์ ๐ ๒๔๔๘ ๙๑๒๘ - ๓๙ ต่อ ๗๐๓
โทรสาร ๐ ๒๔๔๘ ๙๑๔๓

รายชื่อบุคลากรแนบท้ายใบอนุญาต
เป็นนิติบุคคลผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงาน
และสถานที่เก็บรักษาสารเคมีอันตราย
ของบริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด
ใบอนุญาตเลขที่ ๐๒๐๑-๐๓-๒๕๖๕-๐๐๕๒

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เลขทะเบียนควบคุม
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(ลงนาม).....(นายทะเบียน)
(นายศักดิ์ศิลป์ ตุลาธร)
ผู้อำนวยการกองความปลอดภัยแรงงาน

แบบ กภ.บญ
นิติบุคคล

**กรมสวัสดิการและคุ้มครองแรงงาน**

**ใบอนุญาต**

**เป็นนิติบุคคลผู้ให้บริการวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตราย**

**ในบรรยากาศของสถานที่ทำงานและสถานที่เก็บรักษาสารเคมีอันตราย**

**ใบอนุญาตเลขที่ ๐๒๐๒-๐๓-๒๕๖๕-๐๐๓๗**

อนุญาตให้ บริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด

เลขทะเบียนนิติบุคคล ๐๑๐๕๕๓๙๐๐๗๙๓๙

ตั้งอยู่ เลขที่ ๖ ซอยงามวงศ์วาน ๕ ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี

เป็นนิติบุคคลผู้ให้บริการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน ตามกฎกระทรวงกำหนดมาตรฐานในการบริหาร จัดการ และดำเนินการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับสารเคมีอันตราย พ.ศ. ๒๕๕๖ ในการเป็นผู้ให้บริการวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงานและสถานที่เก็บรักษาสารเคมีอันตราย ประกอบกับกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๔ โดยมีบุคลากร จำนวน ๕๕ ราย ดังรายชื่อแนบท้ายใบอนุญาตนี้

ทั้งนี้ ตั้งแต่วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕ ถึงวันที่ ๑๓ มิถุนายน พ.ศ. ๒๕๖๘

ให้ไว้ ณ วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕

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อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

น.16/13



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ทั้งนี้ ตั้งแต่วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕ ถึงวันที่ ๑๓ มิถุนายน พ.ศ. ๒๕๖๘

ให้ไว้ ณ วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕

[redacted]

อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

รายชื่อบุคลากรแนบท้ายใบอนุญาต
เป็นนิติบุคคลผู้ให้บริการวิเคราะห์ระดับความเข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงาน
และสถานที่เก็บรักษาสารเคมีอันตราย
ของบริษัท เฮลธ์ แอนด์ เอ็นไวเทค จำกัด
ใบอนุญาตเลขที่ ๐๒๐๒-๐๓-๒๕๖๕-๐๐๓๗

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น.16/14

เลขทะเบียนควบคุม
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(ลงนาม)..... [redacted]
ผู้อำนวยการกองความปลอดภัยแรงงาน

**ENVIR SERVICE CO., LTD.**

42 RAMINTHRA 14 YEAK 9, THA RAENG, BANGKHEN, BANGKOK 10230
TAX ID 0105555170865
TEL 029435814-5 FAX 02-9438201

# CALIBRATION CERTIFICATE

Certificate No. : 202211001

Date of issue : 10-Nov.-22

| | | |
|---|---|---|
| Instrument Description | : | Air Quality Monitor |
| Instrument Model | : | aq-5000 pro |
| Instrument Serial No. | : | 1527 |
| Manufacture | : | QUEST TECHNOLOGIES |
| Customer Name | : | Health & Envitech Co., Ltd.<br>6 Soi Ngamwongwan 5, Bang Khen, Nonthaburi,<br>Nonthaburi 11000 |
| Total Page of Certificate | : | 2 Pages |
| Receiving Date | : | 10-Nov.-22 |
| Parameter of Calibration | : | Gas Calibration (Nitrogen (Zero) (ppm),<br>Carbon monoxide 45 (ppm)<br>Carbon dioxide 850 (ppm)) |
| Condition Place | : | 42 Raminthra 14 Yeak 9, Tha Raeng, Bangkhen,<br>Bangkok 10230 |
| Date of Calibration | : | 10-Nov.-22 |

Calibration by [redacted]

Approve by [redacted]

น.16/15

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ทั้งนี้ ตั้งแต่วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕ ถึงวันที่ ๑๓ มิถุนายน พ.ศ. ๒๕๖๘

ให้ไว้ ณ วันที่ ๑๔ มิถุนายน พ.ศ. ๒๕๖๕

[redacted]

อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

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

ilac-MRA ACCREDITED Calibration Cert. # 3884.01 ISO/IEC 17025

# Certificate of Calibration

Certificate No. : MT22-6000
Page : 1 of 2

| | | | | | |
|---|---|---|---|---|---|
| **Customer** | : | Health & Envitech Co.,Ltd. | | | |
| **Address** | : | 77/11 M.2 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000 | | | |
| **Description** | : | Hot Air Oven | **Order No.** | : | 3167/22 |
| **Manufacturer** | : | Memmert | **Received date** | : | Nov 01, 2022 |
| **Model** | : | UNB400 | **Calibration date** | : | Nov 01, 2022 |
| **Serial No.** | : | C410.0346 | **Environment Condition :** | | |
| **Identification No.** | : | LB-HE-030 | **Temperature** | : | ( 25+/-10 ) °C |
| **Calibration Place** | : | Laboratory 2 | **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 | MY49028922 | MT21-6790 | Nov 25, 2022 |

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%

CALIBRATION LABORATORY IMC INCTECH METROLOGICAL CENTER CO.,LTD.

**Calibrated by :** Mr.Arnuparp Sangsrikham
**Issue date :** Nov 04, 2022

**Approved by :** ( Mr.Panuwat Phuklan )

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9.16/16

**ENVIR SERVICE CO., LTD.**
42 RAMINTHRA 14 YEAK 9, THA RAENG, BANGKHEN, BANGKOK 10230
TAX ID 0105555170865
TEL 029435814-5 FAX 02-9438201

ENVIR SERVICE บริษัท เอ็นไวร์ เซอร์วิส จำกัด ENVIR SERVICE CO., LTD.

# CALIBRATION CERTIFICATE

Certificate No. : 202211001

Date of issue : 10-Nov.-22

Standard References

| Standard | Reference No. | Due Date |
|---|---|---|
| Nitrogen (Zero) (ppm) | 8241 | 20-Apr.-27 |
| Carbon monoxide 45 (ppm) | EB0129027 | 29-Oct.-27 |
| Carbon dioxide 850 (ppm) | 3805/21 | 31-Aug.-25 |

Measured room conditions

Temperature : 25 °C Humidity : 51 %RH Pressure : 1010 mbra.

Calibration conditions

Gas Temperature : 25 °C

Calibration Results (Before Adjustment)

| Parameter of Standard | Standard Values | Mean of UUC | Drift | Drift% |
|---|---|---|---|---|
| Nitrogen (Zero) (ppm) | 0.0 | 0.6 | 0.6 | 0.6 |
| Carbon monoxide 45 (ppm) | 45.0 | 45.2 | 0.2 | 0.4 |
| Carbon dioxide 850 (ppm) | 850.0 | 864.0 | 14.0 | 1.6 |

Calibration Results (After Adjustment)

| Parameter of Standard | Standard Values | Mean of UUC | Drift | Drift% |
|---|---|---|---|---|
| Nitrogen (Zero) (ppm) | 0.0 | 0.0 | 0.0 | 0.0 |
| Carbon monoxide 45 (ppm) | 45.0 | 45.0 | 0.0 | 0.0 |
| Carbon dioxide 850 (ppm) | 850.0 | 852.0 | 2.0 | 0.2 |

**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

ilac-MRA A2LA ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

# Certificate of Calibration

**Certificate No.** : MP22-3299-R1
**Page** : 1 of 2

**Supplement to Calibration Report Cert No.MP22-3299**

**Customer** : Health & Envitech Co.,Ltd.
**Address** : 6 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000

**Description** : Barometer
**Manufacturer** : Barigo
**Model** : 960-1070 hPa
**Serial No.** : N/A
**Identification No.** : LB-HE-049
**Calibration Place** : Mechanical Laboratory

**Order No.** : 3486/22
**Received date** : Nov 28, 2022
**Calibration date** : Nov 28, 2022
**Environment Condition :**
**Temperature** : ( 23+/-3 ) °C
**Humidity** : ( 50+/-15 ) %RH

**Calibration Method** : Calibration were conducted using In-house calibration procedure *CP-MP-001*.
According to comparison with Primary Pressure Indicator.
The calibration methods based on DKD-R6-1/03:2014

**Reference Standard Instruments :**

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| Primary Pressure Calibrator | PACE 1000 | 4318561 | MP-0068-22 | Apr 22, 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%

CALIBRATION LABORATORY · INCTECH METROLOGICAL CENTER CO.,LTD. · IMC

**Calibrated by :** Mr.Suppason Kcawkum
**Issue date :** Jan 06, 2023

**Approved by** [redacted]

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Saimai, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com

ilac-MRA A2LA ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

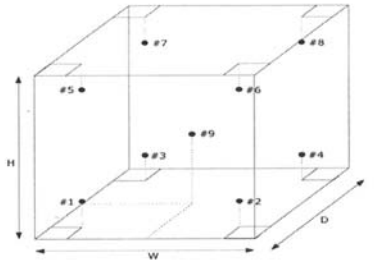


**Function** : Temperature measurement
**Calibration point** : 104, 150, 180 °C

**Result** : Without adjustment
**Resolution** : 0.5 °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 | |
| 104 | 103.575 | 103.640 | 103.599 | 103.733 | 103.749 | 103.876 | 103.928 | 103.965 | 104.220 | 0.49 |
| 150 | 149.590 | 149.851 | 149.906 | 149.846 | 149.924 | 149.835 | 149.983 | 150.198 | 150.042 | 0.45 |
| 180 | 179.608 | 179.845 | 179.863 | 179.864 | 179.951 | 179.917 | 180.096 | 180.175 | 180.151 | 0.46 |

| Setting temperature ( °C ) | Indicating Temperature ( °C ) | Measured stability ( +/- °C ) | Measured uniformity ( °C ) | Overall variation ( °C ) |
|---|---|---|---|---|
| 104.0 | 104.0 | 0.24 | 1.1 | 1.2 |
| 150.0 | 150.0 | 0.23 | 0.81 | 1.1 |
| 180.0 | 180.0 | 0.23 | 0.90 | 1.1 |




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.

-oOo-

**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

ilac-MRA ACCREDITED
Calibration Cert. # 3884.01
ISO/IEC 17025

# Certificate of Calibration

**Certificate No.** : MT22-6449-R1
**Page** : 1 of 2

**Supplement to Calibration Report Cert.No.MT22-6449**

**Customer** : Health & Envitech Co.,Ltd.
**Address** : 6 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000

**Description** : Digital Thermo & Hygrometer
**Manufacturer** : Brannan
**Model** : N/A
**Serial No.** : N/A
**Identification No.** : LB-HE-078
**Calibration Place** : Temperature & Humidity Laboratory

**Order No.** : 3486/22
**Received date** : Nov 28, 2022
**Calibration date** : Nov 29, 2022
**Environment Condition :**
**Temperature** : ( 23+/-3 ) °C
**Humidity** : ( 50+/-15 ) %RH

**Calibration Method** : Calibration were conducted using In-house calibration procedure *CP-MT-007* According to comparison with Standard Temperature & Humidity into Environmental Stability Chamber.

**Reference Standard Instruments :**

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| Standard Digital Hygrometer | One-TH | 0x0000158D000E121E | SG-H-00987/65 | Nov 10, 2023 |
| Standard Digital Thermometer with Probe | UM RTD | 2002Z A21 0181A | MT22-4301 | Jul 18, 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%

CALIBRATION LABORATORY * INCTECH METROLOGICAL CENTER CO.,LTD. * IMC

**Calibrated by :** Miss Jarunee Tubsay
**Issue date :** Jan 06, 2023

**Approved by :** ( Mr.Choophong Khumdet )

9.16/18

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Calibration Cert. # 3884.01
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**Function** : Measurement
**Reference Level** : Vertical
**Range** : 960 to 1070 hPa

**Calibration Result** : Without Adjustment
**Pressure Medium** : Air
**Resolution** : 1 hPa

| | UUC* Value ( hPa ) | Standard Reading ( hPa ) | UUC* Error ( hPa ) | Uncertainty of Measurement ( +/- hPa ) |
|---|---|---|---|---|
| **Increasing :** | | | | |
| | 960 | 960.24 | -0.24 | 0.6 |
| | 980 | 980.33 | -0.33 | 0.6 |
| | 1000 | 1000.44 | -0.44 | 0.6 |
| | 1020 | 1020.50 | -0.50 | 0.6 |
| | 1040 | 1040.82 | -0.82 | 0.6 |
| | 1060 | 1060.79 | -0.79 | 0.6 |

**UUC*** = Unit Under Calibration

-oOo-

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-66/0272 MTC.No.23-66/0272

Number of page(s) 2

# CALIBRATION CERTIFICATE

**Nomenclature : DRYCAL DC-LITE PRIMARY FLOWMETER**

Manufacturer : BIOS International Corporation, USA.

Serial No.: DC-L 2046

Model : DCL-M 12K

Scale range : 100 ml/min to 7 L/min

Subdivision : ( 0.1, 1) ml/min

**Submitted by : HEALTH & ENVITECH CO.,LTD,**

6 Ngamwongwan Rd., Soi 5, Bangkhen,

Mueang, Nontaburi 11000, Thailand.

**Received date :** 24 February 2023 **Condition of measured item :** Normal

**Calibration date :** 10 March 2023

**Standard :**

| Standard | Certificate No. | Date due | Traceability |
|---|---|---|---|
| RTD Thermometer | PSL-T 643/65 | 1-Jun-24 | TISTR |
| Primary Flow Calibrator S/N 119521 | MW-0012-21 | 31-Mar-23 | NIMT |

**Calibrated by :** Terasak Panna (Mr.Terasak Panna)

**Approved by :** (Ms.Kirana Luanghirun)

Director

**Mechanical Engineering Standards Laboratory**

Ref. 20132660224008130O1

Issued Date 13 March 2023

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

u.16/19

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Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com

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**Result** : Without adjustment
**Function** : Temperature measurement
**Calibration point** : 20, 25, 30 °C
**Resolution** : 0.1 °C
**Standard Humidity reading** : 50.15 %RH

| Test point ( °C ) | Standard reading ( °C ) | UUC* reading ( °C ) | UUC* correction ( °C ) | Uncertainty of measurement ( +/- °C ) |
|---|---|---|---|---|
| 20 | 20.04 | 19.6 | 0.44 | 0.36 |
| 25 | 25.02 | 24.5 | 0.52 | 0.36 |
| 30 | 30.02 | 29.5 | 0.52 | 0.36 |

**Result** : Without adjustment
**Function** : Humidity measurement
**Calibration point** : 20, 50, 90 %RH
**Resolution** : 1 %RH
**Standard Temperature reading** : 25.05 °C

| Test point ( %RH ) | Standard reading ( %RH ) | UUC* reading ( %RH ) | UUC* correction ( %RH ) | Uncertainty of measurement ( +/- %RH ) |
|---|---|---|---|---|
| 20 | 20.08 | 16 | 4.08 | 2.3 |
| 50 | 50.14 | 46 | 4.14 | 2.3 |
| 90 | 90.09 | 88 | 2.09 | 2.3 |

**UUC*** = Unit under calibration

-oOo-

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42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

# Analyzer Performance Test

**Calibrated Date:** 26 June 2023

## Instruments Information

| | |
|---|---|
| **Analyzer Type:** CO Analyzer | **Manufacturer** Thermo Environmental |
| **Model:** 48C | **S/N:** 48CHL-63257-339 |

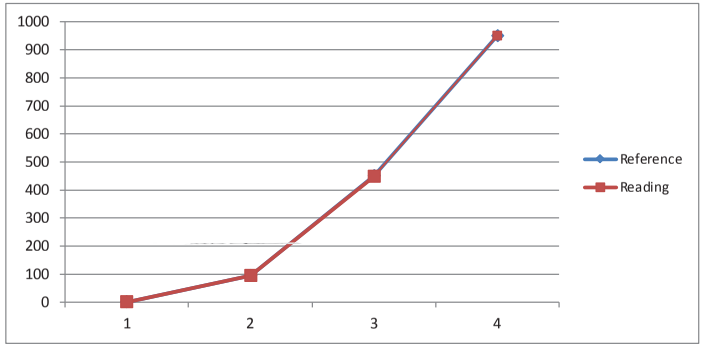
## Calibration System

| *Calibrator Unit* | *Standard Gas* |
|---|---|
| **Dilutor Model** Dasibi Model 5008 | **NO Conc** 957.2 PPM |
| **S/N:** 705 | **SO2 Conc** 960.7 PPM |
| **ZERO AIR Genearator** API MODEL 701 | **CO Conc** 960.4 PPM |
| **S/N:** 1924 | **Expire Date:** 29-Oct-27 |

**Environment:** Temperature 25.5 °C Humidity: 51 %RH

***CALIBRATION RESULTS***

| POINT NO | CALIBRATION RESULTS | | | |
|---|---|---|---|---|
| | Reference | Reading | ERROR | %ERROR |
| ZERO | 0 | 0 | 0.00 | 0.00 |
| 1 | 95 | 95.02 | 0.02 | 0.02 |
| 2 | 450 | 448.6 | -1.40 | -0.31 |
| 3 | 950 | 950 | 0.00 | 0.00 |
| | | | | 0.07 |




**Calibrate By :**
**Mr. PASAGORN SAMOL**

9.16/20

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Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-66/0272 **2/2** MTC.No.23-66/0272

**Calibration point :** (200, 500, 1000, 2500, 5000) ml/min

**Ambient condition :** Temperature ( 23 ± 3 ) °C , Relative humidity ( 55 ± 15 ) %
Atmospheric pressure ( 1010±13) hPa

**Calibration method :** The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.
The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

**Measurement data :**

| UUC Value (ml/min) | Standard Value (ml/min) | Temperature (°C) | Pressure (hPa) | Deviation (%) | Uncertainty (%) |
|---|---|---|---|---|---|
| 200.4 | 198.84 | 24.684 | 1011.42 | +0.78 | 0.89 |
| 501.7 | 500.64 | 24.659 | 1011.60 | +0.21 | 0.86 |
| 1006 | 1006.3 | 24.694 | 1011.83 | -0.03 | 0.86 |
| 2511 | 2512.1 | 24.632 | 1012.43 | -0.06 | 0.86 |
| 5027 | 5031.2 | 24.619 | 1013.42 | -0.09 | 0.86 |

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor $k$=2, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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**สรุปผลการทดสอบ**

ค่า bias เริ่มต้นของระบบ (Initial system bias check; $SB_i$)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

ค่า bias หลังการตรวจวัด (Post run system bias check; $SB_f$)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

การประเมินค่า Driff (Driff assessment)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 3 % |
| ☐ | ไม่ผ่าน > ± 3 % |

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ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

1. **ข้อมูล** Analyzer Calibration Error

| Certified conc of calibration gas; $C_V$ (ppm) | | Measured concentration of calibration gas; $C_{Dir}$ (ppm) | $\lvert C_v - C_{Dir} \rvert$ (ppm) | ACE=$\frac{\lvert C_V - C_{Dir} \rvert}{CS}$ (100) (%) |
|---|---|---|---|---|
| Low | 95 | 95.02 | 0.20 | 0.20 |
| Mid | 450 | 448.60 | 1.40 | 1.00 |
| High | 950 | 950.00 | 0.00 | 0.00 |

**สรุปผลการทดสอบ**

ความผิดพลาดของการสอบเทียบ (Analzer (Direct) calibration error; ACE)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

2. ข้อมูลการปรับเทียบเครื่องมือด้วยก๊าซมาตรฐานที่ระดับความเข้มข้นต่ำ กลาง หรือความเข้มข้นสูง (Initial Analyzer Calibration) และ System Bias Error

| Calibration gas level (ppm) | | Initial values | | | | Final values | | |
|---|---|---|---|---|---|---|---|---|
| | | $C_{Dir}$ (ppm) | System response time (Second) | Measured concentration of calibration gas (System); $C_s$ (ppm) | $SB_i$ = $\frac{(C_s - C_{Dir})}{CS} \times 100$ (%) | $C_s$ (ppm) | $SB_f$ (%) | Driff $\lvert SB_f - SB_i \rvert$ (%) |
| Low level | 95 | 95.02 | 300 | 95.05 | 0.03 | 95.40 | 0.40 | 0.37 |
| High or mid level | 950 | 950 | 300 | 950 | 0.00 | 950.20 | 0.02 | 0.02 |

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1. **ข้อมูล** Analyzer Calibration Error

| Certified conc of calibration gas; $C_V$ (ppm) | | Measured concentration of calibration gas; $C_{Dir}$ (ppm) | $\lvert C_v - C_{Dir} \rvert$ (ppm) | $ACE = \frac{\lvert C_V - C_{Dir} \rvert}{CS}(100)$ (%) |
|---|---|---|---|---|
| Low | 95 | 95.05 | 0.05 | 0.05 |
| Mid | 450 | 451.00 | 1.00 | 1.00 |
| High | 950 | 950.50 | 0.50 | 0.00 |

**สรุปผลการทดสอบ**

ความผิดพลาดของการสอบเทียบ (Analzer (Direct) calibration error; ACE)

| | |
|---|---|
| ☑ | ผ่าน $\leq \pm 5\ \%$ |
| ☐ | ไม่ผ่าน $> \pm 5\ \%$ |

2. ข้อมูลการปรับเทียบเครื่องมือด้วยก๊าซมาตรฐานที่ระดับความเข้มข้นต่ำ กลาง หรือความเข้มข้นสูง (Initial Analyzer Calibration) และ System Bias Error

| Calibration gas level (ppm) | | Initial values | | | | Final values | | |
|---|---|---|---|---|---|---|---|---|
| | | $C_{Dir}$ (ppm) | System response time (Second) | Measured concentration of calibration gas (System); $C_s$ (ppm) | $SB_i = \frac{(C_s - C_{Dir})}{CS} \times 100$ (%) | $C_s$ (ppm) | $SB_f$ (%) | Driff $\lvert SB_f - SB_i \rvert$ (%) |
| Low level | 95 | 95.05 | 300 | 95.05 | 0.00 | 95.40 | 0.37 | 0.37 |
| High or mid level | 950 | 950.50 | 300 | 950 | 0.05 | 950.20 | 0.03 | 0.02 |

น.16/22

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# *Analyzer Performance Test*

**Calibrated Date:** 26 June 2023

## *Instruments Information*

| | |
|---|---|
| **Analyzer Type:** NOx Analyzer | **Manufacturer** Thermo Environmental |
| **Model:** 42C | **S/N:** 42CHL-0527613257 |

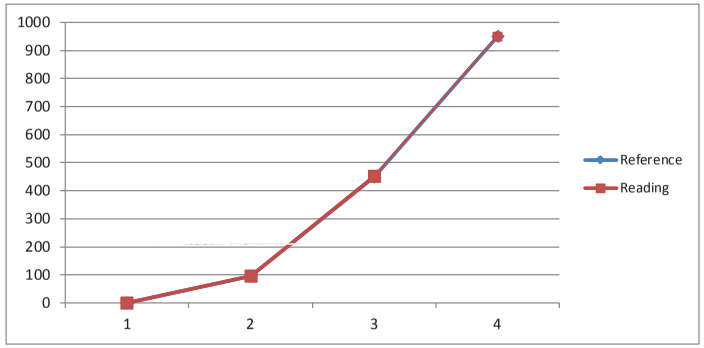
## *Calibration System*

| *Calibrator Unit* | *Standard Gas* |
|---|---|
| **Dilutor Model** Dasibi Model 5008 | **NO Conc** 957.2 PPM |
| **S/N:** 705 | **SO2 Conc** 960.7 PPM |
| **ZERO AIR Genearator** API MODEL 701 | **CO Conc** 960.4 PPM |
| **S/N:** 1924 | **Expire Date:** 29-Oct-27 |

**Environment:** Temperature 25.5 °C Humidity: 51 %RH

***CALIBRATION RESULTS***

| POINT NO | CALIBRATION RESULTS | | | |
|---|---|---|---|---|
| | Reference | Reading | ERROR | %ERROR |
| ZERO | 0 | 0 | 0.00 | 0.00 |
| 1 | 95 | 95.05 | 0.05 | 0.05 |
| 2 | 450 | 451 | 1.00 | 0.22 |
| 3 | 950 | 950.5 | 0.50 | 0.05 |
| | | | | **0.08** |




**Calibrate By:**
**Mr. PASAGORN SAMOL**

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# Analyzer Performance Test

**Calibrated Date:** 26 June 2023

## Instruments Information

| | |
|---|---|
| **Analyzer Type:** SO2 Analyzer | **Manufacturer** Thermo Environmental |
| **Model:** 42C | **S/N:** 43CHL-59690-324 |

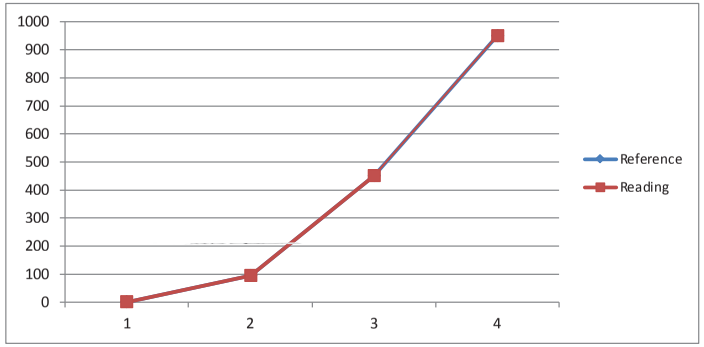
## Calibration System

| *Calibrator Unit* | *Standard Gas* |
|---|---|
| **Dilutor Model** Dasibi Model 5008 | **NO Conc** 957.2 PPM |
| **S/N:** 705 | **SO2 Conc** 960.7 PPM |
| **ZERO AIR Genearator** API MODEL 701 | **CO Conc** 960.4 PPM |
| **S/N:** 1924 | **Expire Date:** 29-Oct-27 |

**Environment:** Temperature 25.5 °C Humidity: 51 %RH

***CALIBRATION RESULTS***

| POINT NO | CALIBRATION RESULTS | | | |
|---|---|---|---|---|
| | Reference | Reading | ERROR | %ERROR |
| ZERO | 0 | 0 | 0.00 | 0.00 |
| 1 | 95 | 94.1 | -0.90 | -0.95 |
| 2 | 450 | 450 | 0.00 | 0.00 |
| 3 | 950 | 950.6 | 0.60 | 0.06 |
| | | | | **0.22** |




**Calibrate By :**
**Mr. PASAGORN SAMOL**

น.16/23

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42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
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## สรุปผลการทดสอบ

ค่า bias เริ่มต้นของระบบ (Initial system bias check; $SB_i$)

| | |
|---|---|
| ☑ | ผ่าน $\leq \pm 5$ % |
| ☐ | ไม่ผ่าน $> \pm 5$ % |

ค่า bias หลังการตรวจวัด (Post run system bias check; $SB_f$)

| | |
|---|---|
| ☑ | ผ่าน $\leq \pm 5$ % |
| ☐ | ไม่ผ่าน $> \pm 5$ % |

การประเมินค่า Driff (Driff assessment)

| | |
|---|---|
| ☑ | ผ่าน $\leq \pm 3$ % |
| ☐ | ไม่ผ่าน $> \pm 3$ % |

**สรุปผลการทดสอบ**

ค่า bias เริ่มต้นของระบบ (Initial system bias check; $SB_i$)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

ค่า bias หลังการตรวจวัด (Post run system bias check; $SB_f$)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

การประเมินค่า Driff (Driff assessment)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 3 % |
| ☐ | ไม่ผ่าน > ± 3 % |



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

1. **ข้อมูล** Analyzer Calibration Error

| Certified conc of calibration gas; $C_V$ (ppm) | | Measured concentration of calibration gas; $C_{Dir}$ (ppm) | $\lvert C_v - C_{Dir} \rvert$ (ppm) | $ACE = \frac{\lvert C_V - C_{Dir} \rvert}{CS}(100)$ (%) |
|---|---|---|---|---|
| Low | 95 | 94.10 | 0.90 | 0.95 |
| Mid | 450 | 450.00 | 0.00 | 1.00 |
| High | 950 | 950.60 | 0.60 | 0.00 |

**สรุปผลการทดสอบ**

ความผิดพลาดของการสอบเทียบ (Analzer (Direct) calibration error; ACE)

| | |
|---|---|
| ☑ | ผ่าน ≤ ± 5 % |
| ☐ | ไม่ผ่าน > ± 5 % |

2. ข้อมูลการปรับเทียบเครื่องมือด้วยก๊าซมาตรฐานที่ระดับความเข้มข้นต่ำ กลาง หรือความเข้มข้นสูง (Initial Analyzer Calibration) และ System Bias Error

| Calibration gas level (ppm) | | Initial values | | | | Final values | | |
|---|---|---|---|---|---|---|---|---|
| | | $C_{Dir}$ (ppm) | System response time (Second) | Measured concentration of calibration gas (System); $C_s$ (ppm) | $SB_i = \frac{(C_s - C_{Dir})}{CS} \times 100$ (%) | $C_s$ (ppm) | $SB_f$ (%) | Driff $\lvert SB_f - SB_i \rvert$ (%) |
| Low level | 95 | 94.10 | 300 | 95.05 | 1.00 | 95.40 | 1.37 | 0.37 |
| High or mid level | 950 | 950.60 | 300 | 950 | 0.06 | 950.20 | 0.04 | 0.02 |

## Calibration object

**Multi range instrument**

| | | |
|---|---|---|
| Model | BP210D | |
| Serial Number | 70406076 | |
| QM Ident. no \| Inventory no. | LB - HE - 003 \| --- | |
| Range | 1 | 2 |
| Maximum capacity (Max. load) | 80.00000 g | 210.0000 g |
| Measured range | 80.00000 g | 210.0000 g |
| Scale interval | 0.00001 g | 0.0001 g |

## Place of calibration

| | |
|---|---|
| Address | According to page 1 |
| Department \| Cost center | QC and RD Department \| --- |
| Building \| Floor | --- \| 1st Floor |
| Room | Laboratory Room. |
| Maximum temperature variation at place of calibration | 5 K |

## Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

## Test equipment

| Test equipment type | Test equipment ID | Valid until |
|---|---|---|
| Thermometer | MHB-382SD Cer No.C19231845,(Traceable to SI unit through DKSH) | 23 Aug 2024 |
| Test weight set OIML R111 E2 | Certificate No.M2308197S ,E2(Traceable to SI unit through TCS) | 24 Aug 2025 |



9.16/25

SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

NSC-TISI-TIS 17025
CALIBRATION 0426

## Calibration certificate

Calibration Certificate No. 23BCI0439

| | |
|---|---|
| Object | Electronic non-automatic weighing instrument |
| Manufacturer | Sartorius |
| Type | BP210D |
| Serial \| QM Ident. no. | 70406076 \| LB - HE - 003 |
| Customer | Health & Envitech Co., Ltd.<br>6 Ngamwongwan Soi 5,Tumbon Bangkhen<br>Muang Nontaburi Nontaburi 11000 Thailand. |
| Order no. | 221429 |
| Number of pages | 6 |
| Date of calibration | 02 Nov 2023 |

This calibration certificate documents the traceability to national standards.

Uncertainties of measurements are taken into account when only statements of compliance are made.

This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.

This certificate relate and apply this equipment only.

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

| Date | Approval of the Calibration Certificate | Person in charge |
|---|---|---|
| 02 Nov 2023 | Mr. Chonchai Inthana | Chonchai Inthana |

# Range 2

## Adjustment Status

The measuring device was internally adjusted before the calibration.

## Environmental and measuring conditions

| | |
|---|---|
| Date of calibration | 02 Nov 2023 |
| Temperature at place of calibration \| Temp. diff. $T_{weights}$ - $T_{place}$ | 24.8 °C \| 0.2 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 44.6 %RH |

## Measurement results | Measurement uncertainties

Repeatability

| Test load (nominal): 100 g | |
|---|---|
| | 100 g |
| 1 | 99.9999 g |
| 2 | 99.9999 g |
| 3 | 99.9999 g |
| 4 | 99.9999 g |
| 5 | 99.9999 g |
| 6 | 100.0000 g |
| 7 | 99.9999 g |
| 8 | 99.9999 g |
| 9 | 99.9999 g |
| 10 | 100.0000 g |
| | $s$ = 0.00004 g |

Eccentricity

| Test load (nominal): | 100 g |
|---|---|
| Center | 99.9999 g |
| Front left | 99.9999 g |
| Back left | 99.9999 g |
| Back right | 100.0000 g |
| Front right | 100.0000 g |
| Maximum deviation from centric loading indication | |
| $\lvert\Delta I_{ecc}\rvert_{max}$ = 0.0001 g | |

Error of indication

| Testload $L$ | Indication $I$ | Error $E$ | Expansion factor $k$ | Uncertainty $U(E)$ | Uncertainty relative $U_{rel}(E)$ |
|---|---|---|---|---|---|
| 0.01000 g | 0.01000 g | 0.00000 g | 2.00 | 0.000024 g | 0.24 % |
| 0.10000 g | 0.10000 g | 0.00000 g | 2.00 | 0.000037 g | 0.037 % |
| 1.00000 g | 1.00000 g | 0.00000 g | 2.00 | 0.000037 g | 0.0037 % |
| 2.00003 g | 2.00003 g | 0.00000 g | 2.00 | 0.000050 g | 0.0025 % |
| 5.00002 g | 5.00002 g | 0.00000 g | 2.00 | 0.000050 g | 0.00100 % |
| 10.00002 g | 10.00002 g | 0.00000 g | 2.00 | 0.000069 g | 0.00069 % |
| 20.00002 g | 20.00002 g | 0.00000 g | 2.00 | 0.000069 g | 0.00034 % |
| 50.00002 g | 50.00002 g | 0.00000 g | 2.00 | 0.000091 g | 0.00018 % |
| 100.0000 g | 99.9999 g | -0.0001 g | 2.00 | 0.00017 g | 0.00017 % |
| 150.0000 g | 149.9999 g | -0.0001 g | 2.00 | 0.00028 g | 0.00019 % |
| 200.0000 g | 199.9999 g | -0.0001 g | 2.00 | 0.00028 g | 0.00014 % |
| Maximum error of indication | | $\lvert E\rvert_{max}$ = 0.0001 g | | | |

$U_{rel}(E)$ is the quotient of $U(E)$ and test load $L$. The uncertainty of measurement $U(E)$ is valid only if error $E$ is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

**End of calibration certificate**

9.16/26





# Range 1

## Adjustment Status

The measuring device was internally adjusted before the calibration.

## Environmental and measuring conditions

| | |
|---|---|
| Date of calibration | 02 Nov 2023 |
| Temperature at place of calibration \| Temp. diff. $T_{weights}$ - $T_{place}$ | 24.8 °C \| 0.2 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 44.6 %RH |

## Measurement results | Measurement uncertainties

Repeatability

| Test load (nominal): 1 g \| 50 g | | |
|---|---|---|
| | 1 g | 50 g |
| 1 | 1.00000 g | 50.00002 g |
| 2 | 1.00000 g | 50.00002 g |
| 3 | 1.00000 g | 50.00002 g |
| 4 | 0.99999 g | 50.00003 g |
| 5 | 1.00000 g | 50.00002 g |
| 6 | 1.00000 g | 50.00003 g |
| 7 | 1.00001 g | 50.00003 g |
| 8 | 1.00000 g | 50.00003 g |
| 9 | 1.00001 g | 50.00002 g |
| 10 | 1.00000 g | 50.00002 g |
| | $s$ = 0.000006 g | $s$ = 0.000005 g |

Eccentricity

| Test load (nominal): | 50 g |
|---|---|
| Center | 50.00002 g |
| Front left | 50.00000 g |
| Back left | 50.00000 g |
| Back right | 50.00004 g |
| Front right | 50.00000 g |
| Maximum deviation from centric loading indication | |
| $\lvert\Delta I_{ecc}\rvert_{max}$ = 0.00002 g | |

Error of indication

| Testload $L$ | Indication $I$ | Error $E$ | Expansion factor $k$ | Uncertainty $U(E)$ | Uncertainty relative $U_{rel}(E)$ |
|---|---|---|---|---|---|
| 0.01000 g | 0.01000 g | 0.00000 g | 2.00 | 0.000024 g | 0.24 % |
| 0.10000 g | 0.10000 g | 0.00000 g | 2.00 | 0.000037 g | 0.037 % |
| 1.00000 g | 0.99999 g | -0.00001 g | 2.00 | 0.000037 g | 0.0037 % |
| 2.00003 g | 2.00003 g | 0.00000 g | 2.00 | 0.000050 g | 0.0025 % |
| 5.00002 g | 5.00002 g | 0.00000 g | 2.00 | 0.000050 g | 0.00100 % |
| 10.00002 g | 10.00003 g | 0.00001 g | 2.00 | 0.000069 g | 0.00069 % |
| 20.00002 g | 20.00002 g | 0.00000 g | 2.00 | 0.000069 g | 0.00034 % |
| 30.00004 g | 30.00003 g | -0.00001 g | 2.00 | 0.000093 g | 0.00031 % |
| 50.00002 g | 50.00002 g | 0.00000 g | 2.00 | 0.000091 g | 0.00018 % |
| 60.00004 g | 60.00003 g | -0.00001 g | 2.00 | 0.00017 g | 0.00028 % |
| 77.00008 g | 77.00006 g | -0.00002 g | 2.00 | 0.00018 g | 0.00023 % |
| Maximum error of indication | | $\lvert E\rvert_{max}$ = 0.00002 g | | | |

$U_{rel}(E)$ is the quotient of $U(E)$ and test load $L$. The uncertainty of measurement $U(E)$ is valid only if error $E$ is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

# Uncertainty of measurement in use

**Range 2**

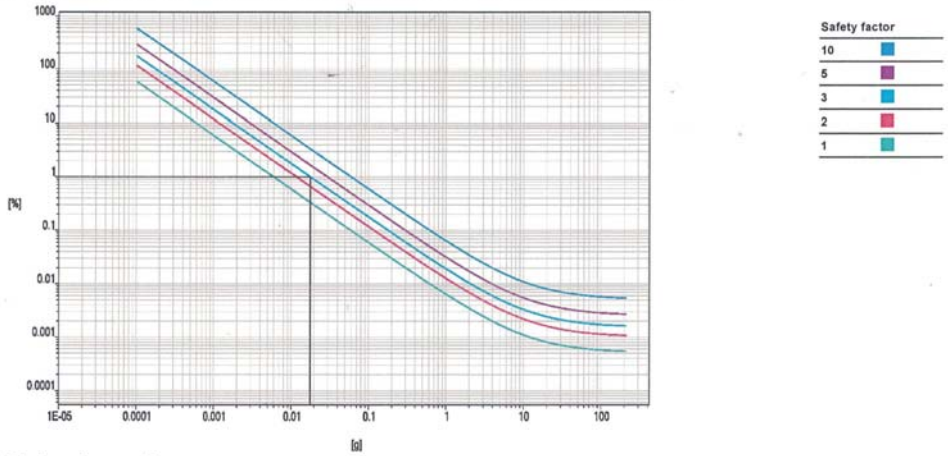
| | |
|---|---|
| Device adjusted before measurement | Yes |
| Temperature deviation considered | 5 K |
| Temperature coefficient considered | $1 \cdot 10^{-6}$/K |

**Uncertainty of the weighing result $U_{gl}(W)$** $U_{gl}(W) = 0.000059\ g + 5.14 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading *R* into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from max load | Net indication *R* | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|---|---|---|---|
| 1 % | 2.10000 g | 0.000070 g | 0.0033 % |
| 25 % | 52.50000 g | 0.00033 g | 0.00063 % |
| 50 % | 105.0000 g | 0.00060 g | 0.00057 % |
| 75 % | 157.5000 g | 0.00087 g | 0.00055 % |
| 100 % | 210.0000 g | 0.0011 g | 0.00054 % |

**Graphic realization of the relative uncertainty of measurement | process accuracy**




**Displayed example**

| | |
|---|---|
| Process accuracy | 1.00 % |
| Safety factor | 3 |
| Minimum sample weight | 0.01771 g |





# Uncertainty of measurement in use

**Range 1**

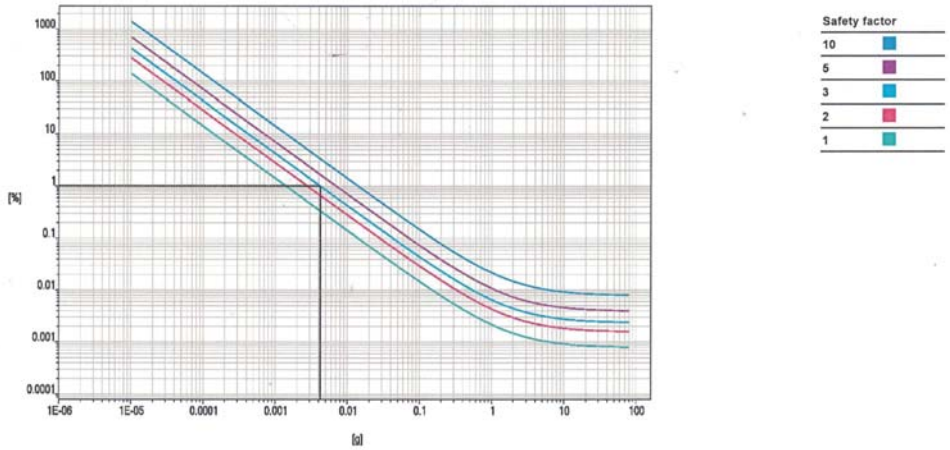
| | |
|---|---|
| Device adjusted before measurement | Yes |
| Temperature deviation considered | 5 K |
| Temperature coefficient considered | $1 \cdot 10^{-6}$/K |

**Uncertainty of the weighing result $U_{gl}(W)$** $U_{gl}(W) = 0.000014\ g + 7.84 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading *R* into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from max load | Net indication *R* | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|---|---|---|---|
| 1 % | 0.80000 g | 0.000020 g | 0.0025 % |
| 25 % | 20.00000 g | 0.00017 g | 0.00085 % |
| 50 % | 40.00000 g | 0.00033 g | 0.00082 % |
| 75 % | 60.00000 g | 0.00048 g | 0.00081 % |
| 100 % | 80.00000 g | 0.00064 g | 0.00080 % |

**Graphic realization of the relative uncertainty of measurement | process accuracy**




**Displayed example**

| | |
|---|---|
| Process accuracy | 1.00 % |
| Safety factor | 3 |
| Minimum sample weight | 0.00421 g |



9.16/27

VCR-1

## Inlet Pressure Accuracy Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.FLOW**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **3186-GFM**
System ID: **LB-HE-069**
Gas Type: **He**

The result reference to raw data on page: 1

| Setpoint Inlet Pressure PSI. | Observed Inlet Pressure PSI. | Deviation Inlet pressure. % Error |
|---|---|---|
| 5.00 | 4.80 | 4.00 |
| 10.00 | 9.90 | 1.00 |
| 20.00 | 20.20 | 1.00 |
| 30.00 | 30.60 | 2.00 |
| 40.00 | 41.00 | 2.50 |

Acception criteria of absolute deviation ≤ 5%.
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR 82 Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com
VCR-CARRFLOW

VCR-2

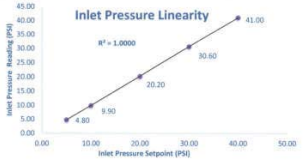
## Inlet Pressure Linearity Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.FLOW**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4075-GSM**
System ID: **LB-HE-069**
Gas Type **He**

The result reference to raw data on page: 1

| Inlet pressure Setpoint (PSI) | Inlet pressure (PSI) Reading |
|---|---|
| 5.00 | 4.80 |
| 10.00 | 9.90 |
| 20.00 | 20.20 |
| 30.00 | 30.60 |
| 40.00 | 41.00 |
| R-Square | 1.0000 |




Acception criteria of $R^2$ > 0.9990
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR-3

## Detector Gas Flow Rate Accuracy Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.FLOW**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4075-GSM**
System ID: **LB-HE-069**
Gas Type: **H2**

The result reference to raw data on page: 2

| Setpoint Flow Rate ml/min. | Observed Flow Rate ml/min. | Deviation ml/min. % Error |
|---|---|---|
| 20.00 | 21.00 | 5.00 |
| 30.00 | 31.00 | 3.33 |
| 40.00 | 40.80 | 2.00 |
| 50.00 | 50.80 | 1.60 |
| 60.00 | 61.50 | 2.50 |

Acception criteria of absolute deviation ≤ 5%.
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR 82 Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com
VCR-CARRFLOW

9.16/28

VCR-4

## Detector Gas Flow Rate Accuracy Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.FLOW**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4075-GSM**
System ID: **LB-HE-069**
Gas Type: **Air**

The result reference to raw data on page: 3

| Setpoint Flow Rate ml/min. | Observed Flow Rate ml/min. | Deviation ml/min. % Error |
|---|---|---|
| 100.00 | 100.00 | 0.00 |
| 200.00 | 194.30 | 2.85 |
| 300.00 | 293.80 | 2.07 |
| 400.00 | 397.40 | 0.65 |
| 500.00 | 497.40 | 0.52 |

Acception criteria of absolute deviation ≤ 5%.
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR 82 Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com
VCR-CARRFLOW

VCR No. GC-0623-055

# Validation Calibration Report

**Customer Name:** Health & Envitech Co.,Ltd

**Department:** LAB Analytical

**Present By:** Meshcotech Co., Ltd.

**Instrument System ID:** LB-HE-069

**Instrument List in System**

| Name and Model | Serial Number | Manufacturer |
|---|---|---|
| Clarus 500 GC | 650N6091604 | Perkin Elmer |

This report confirms that the above instrument has been calibrated.

The actual measurement results are stated on the inside of Validation Calibration Report.

Qualifier's signature / Date 1/6/2023

(Mr. Prasittisent Maliphan)

Acceptor's signature / Date _____

(...Ms. Wathu Krongsut..)

VCR-9

## GC Injections Carry Over Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **177-FID**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.LINPRC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **177-FID**
System ID: **LB-HE-069**

The result reference to raw data on page: 8-10

| Injections | Peak Retention Time | Area |
|---|---|---|
| Carry Over Blank1 | - | 0.000 |
| Standard 0.08% Tetradecane | 1.461 | 1131130.47 |
| Carry Over Blank2 | - | 0.000 |
| %Carry Over | | 0.000 |

Acception criteria of %Carry Ove ≤ 0.01%

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR 82 Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com

VCR-GCCAROVER

VCR-10

## GC Injections Area Precision Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **177-FID**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.LINPRC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **177-FID**
System ID: **LB-HE-069**

The result reference to raw data on page: 11-16

| Number of Injections | Retention Time | Area Peak Number 2 |
|---|---|---|
| Precision 1 0.08% Tetradecane | 1.461 | 1146805.50 |
| Precision 2 0.08% Tetradecane | 1.462 | 1142966.78 |
| Precision 3 0.08% Tetradecane | 1.460 | 1131811.87 |
| Precision 4 0.08% Tetradecane | 1.463 | 1159745.44 |
| Precision 5 0.08% Tetradecane | 1.461 | 1158710.81 |
| Precision 6 0.08% Tetradecane | 1.461 | 1150475.11 |
| Average 0.08% Tetradecane | | 1148419.25 |
| STDEV | | 10455.28 |
| %RSD | | 0.91 |

Acception criteria of Precision (%RSD) ≤ 1%

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

VCR 82 Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com

VCR-CGPRE

VCR-5

## GC Column OvenTemperature Performance Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.TEMPACC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4077-DTM**
System ID: **LB-HE-069**

The result reference to raw data on page: 4

| Setpoint Temperature (°C) | Collected 1 Temperature (°C) | Collected 2 Temperature (°C) | Collected 3 Temperature (°C) | Collected 4 Temperature (°C) | Collected 5 Temperature (°C) | Average Temperature (°C) | Deviation of Accuracy Absolute/°C. (Set Temp-Average Temp) |
|---|---|---|---|---|---|---|---|
| 40.0 | 39.5 | 39.5 | 39.6 | 39.6 | 39.6 | 39.6 | 0.44 |
| 100.0 | 99.5 | 99.7 | 99.7 | 99.8 | 99.7 | 99.7 | 0.32 |
| 150.0 | 149.8 | 150.0 | 150.0 | 150.1 | 150.1 | 150.0 | 0.00 |
| 200.0 | 199.7 | 199.8 | 199.9 | 199.8 | 199.9 | 199.8 | 0.18 |
| 280.0 | 279.8 | 279.9 | 280.1 | 280.1 | 280.1 | 280.0 | 0.00 |

Acception criteria ≤ 1 °C.
of absolute deviation Accuracy

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-GCOVENACC

VCR-6

## GC Column OvenTemperature Stability Performance Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.TEMPACC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4077-DTM**
System ID: **LB-HE-069**

The result reference to raw data on page: 5

| Setpoint Temperature (°C) | Collected Point1 Temperature (°C) | Collected Point2 Temperature (°C) | Collected Point3 Temperature (°C) | Collected Point4 Temperature (°C) | Collected Point5 Temperature (°C) | Average Temperature (°C) | STDEV Temperature (°C) |
|---|---|---|---|---|---|---|---|
| 100.0 | 99.5 | 99.7 | 99.7 | 99.8 | 99.7 | 99.68 | 0.11 |

Acception criteria ≤ 0.5 °C.
of absolute deviation Stability

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com

VCR-GCOVENSTAB

VCR-11

## GC Injections Retention Precision Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **177-FID**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.LINPRC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **177-FID**
System ID: **LB-HE-069**

The result reference to raw data on page: 11-16

| Number of Injections | Peak Retention time Peak Number 2 |
|---|---|
| Precision 1 0.08% Tetradecane | 1.461 |
| Precision 2 0.08% Tetradecane | 1.462 |
| Precision 3 0.08% Tetradecane | 1.460 |
| Precision 4 0.08% Tetradecane | 1.463 |
| Precision 5 0.08% Tetradecane | 1.461 |
| Precision 6 0.08% Tetradecane | 1.461 |
| Average | 1.461 |
| STDEV | 0.001 |
| %RSD | 0.07 |

Acception criteria of Peak Retention (%RSD) ≤ 0.5%

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com

VCR-CGPRE

VCR-12

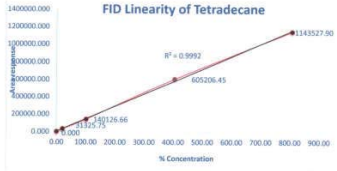
## FID Lineaity Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.LINPRC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **177-FID**
System ID: **LB-HE-069**

The result reference to raw data on page: 17-21

| Injection | Tetradecane concentration (µg/ml) | Area |
|---|---|---|
| Linearity 1 0.000% Tetradecane | 0.00 | 0.000 |
| Linearity 2 0.002% Tetradecane | 20.30 | 31325.75 |
| Linearity 3 0.010% Tetradecane | 101.40 | 140126.66 |
| Linearity 4 0.040% Tetradecane | 404.60 | 605206.45 |
| Linearity 5 0.080% Tetradecane | 807.10 | 1143527.90 |
| R-Square | | 0.9992 |




Acception criteria of Linearity ($R^2$) >0.9990

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-GCLIN

VCR-7

## GC Injector Temperature Performance Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.TEMPACC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4077-DTM**
System ID: **LB-HE-069**

The result reference to raw data on page: 6

| Setpoint Temperature (°C) | Collected Temperature (°C) | Deviation of Accuracy Absolute/°C. (Set Temp-Average Temp) |
|---|---|---|
| 150.0 | 147.4 | 2.6 |
| 200.0 | 196.4 | 3.6 |
| 250.0 | 245.4 | 4.6 |

Acception criteria ≤ 10 °C.
of absolute deviation Accuracy

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-INTEMPACC

VCR-8

## GC Base Detector Temperature Performance Result

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Serial No: **650N6091604**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **VKIT.GC.TEMPACC**
Model: **Clarus 500 GC**
Detector Type: **FID**
Traceable To: **4077-DTM**
System ID: **LB-HE-069**

The result reference to raw data on page: 7

| Setpoint Temperature (°C) | Collected Temperature (°C) | Deviation of Accuracy Absolute/°C. (Set Temp-Average Temp) |
|---|---|---|
| 250.0 | 245.5 | 4.50 |
| 300.0 | 296.4 | 3.60 |

Acception criteria ≤ 10 °C.
of absolute deviation Accuracy

Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-DETTEMPACC

9.16/29

VCR-17

## Data System Retention Time Reproduced Check

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Version: **6.3**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **Validator Method**
Model: **TotalChrom**
Detector Type: **FID**
Traceable To: **Validator ™**
System ID: **LB-HE-069**

The result reference to raw data on page: 40

| Peak Number# | Retention Time Apex | Previuos peak-Curent peak Absulute time /min. | Evaluate Result |
|---|---|---|---|
| 1 | **0.476** | N/A | |
| 2 | **1.897** | 1.421 | **PASS** |
| 3 | **3.318** | 1.421 | **PASS** |
| 4 | **4.738** | 1.420 | **PASS** |
| 5 | **6.159** | 1.421 | **PASS** |
| 6 | **7.580** | 1.421 | **PASS** |
| | | Acception criteria of absolute deviation | 1.41-1.43 Minute |
| | | Evaluate Result | **PASS** |

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-13

## Data System Linearity of Detection Check

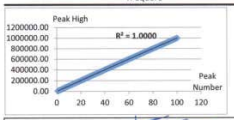
Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Version: **6.3**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **Validator Method**
Model: **TotalChrom**
Detector Type: **FID**
Traceable To: **Validator ™**
System ID: **LB-HE-069**

The result reference to raw data on page: 22-24

| Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) |
|---|---|---|---|---|---|---|---|
| 1 | 10002.00 | 26 | 260002.43 | 51 | 509996.49 | 76 | 759996.98 |
| 2 | 20003.00 | 27 | 270002.06 | 52 | 519993.03 | 77 | 769993.79 |
| 3 | 30004.00 | 28 | 281599.30 | 53 | 529994.64 | 78 | 780631.83 |
| 4 | 40004.00 | 29 | 290001.64 | 54 | 539997.42 | 79 | 789994.06 |
| 5 | 50004.53 | 30 | 300003.60 | 55 | 549996.61 | 80 | 799996.06 |
| 6 | 60006.00 | 31 | 310002.06 | 56 | 559996.06 | 81 | 809994.61 |
| 7 | 70005.00 | 32 | 320005.98 | 57 | 569994.06 | 82 | 819996.97 |
| 8 | 80003.00 | 33 | 330004.52 | 58 | 579991.43 | 83 | 829996.57 |
| 9 | 90004.06 | 34 | 340005.72 | 59 | 589993.16 | 84 | 839996.61 |
| 10 | 100006.38 | 35 | 350005.35 | 60 | 599994.14 | 85 | 849995.05 |
| 11 | 110004.48 | 36 | 360003.49 | 61 | 609991.62 | 86 | 859996.12 |
| 12 | 120004.00 | 37 | 370003.06 | 62 | 619995.56 | 87 | 869995.92 |
| 13 | 130005.06 | 38 | 380005.12 | 63 | 629990.37 | 88 | 879994.61 |
| 14 | 140006.36 | 39 | 390002.44 | 64 | 639993.06 | 89 | 889995.06 |
| 15 | 150004.44 | 40 | 400000.84 | 65 | 649994.62 | 90 | 899994.59 |
| 16 | 160005.06 | 41 | 410003.61 | 66 | 659993.58 | 91 | 909996.23 |
| 17 | 170004.67 | 42 | 420001.49 | 67 | 669990.49 | 92 | 919995.29 |
| 18 | 180004.49 | 43 | 429999.68 | 68 | 679996.01 | 93 | 929995.41 |
| 19 | 190006.49 | 44 | 440000.06 | 69 | 689994.78 | 94 | 939994.44 |
| 20 | 200005.14 | 45 | 449998.44 | 70 | 699993.99 | 95 | 949993.25 |
| 21 | 210002.03 | 46 | 459996.88 | 71 | 709992.6 | 96 | 959996.12 |
| 22 | 220004.44 | 47 | 469999.06 | 72 | 719992.75 | 97 | 969992.63 |
| 23 | 230003.37 | 48 | 479996.98 | 73 | 729996.12 | 98 | 979995.09 |
| 24 | 240003.12 | 49 | 489994.06 | 74 | 739995.6 | 99 | 989993.96 |
| 25 | 250002.84 | 50 | 499996.99 | 75 | 749995.66 | 100 | 999993.66 |

R-Square 1.0000




Linearity Correlation Calculated
Acception criteria of $R^2$ ≥0.9960
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-14

## Data System Precision of Detection Check

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Version: **6.3**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **Validator Method**
Model: **TotalChrom**
Detector Type: **FID**
Traceable To: **Validator ™**
System ID: **LB-HE-069**

The result reference to raw data on page: 22-36

| Collected 3 Peak Data 4-1 | | Collected 3 Peak Data 4-2 | | Collected 3 Peak Data 4-3 | | Collected 3 Peak Data 4-4 | | Collected 3 Peak Data 4-5 | |
|---|---|---|---|---|---|---|---|---|---|
| Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) | Peak Number# | Peak High (uVolt) |
| 1 | 10002.000 | 1 | 10002.120 | 1 | 10003.000 | 1 | 10001.000 | 1 | 10005.560 |
| 50 | 499996.990 | 50 | 499986.060 | 50 | 499995.890 | 50 | 499996.120 | 50 | 499974.610 |
| 100 | 999993.660 | 100 | 999979.490 | 100 | 999996.270 | 100 | 999996.540 | 100 | 999952.560 |

%RSD at peak Number 1 = 0.02
%RSD at peak Number 50 = 0.00
%RSD at peak Number 100 = 0.00

Acception criteria of Precision deviation %RSD ≤ 0.5
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-15

## Data System Number of Detection Check

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Version: **6.3**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **Validator Method**
Model: **TotalChrom**
Detector Type: **FID**
Traceable To: **Validator ™**
System ID: **LB-HE-069**

The result reference to raw data on page: 37-38

| Peak Count# Peak Detected Specify | Peak count Detected |
|---|---|
| ≥ 32 Peak Number | 43 Peak Number |

Acception criteria of absolute deviation ≥ 32 Peak
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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VCR-16

## Data System Square Peak High Check

Customer: **Health & Envitech Co.,Ltd.**
Department: **LAB Analytical**
Manufacturer: **PERKIN ELMER**
Version: **6.3**
Standard Batch: **N/A**
Expiry Date: **June 01,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **Validator Method**
Model: **TotalChrom**
Detector Type: **FID**
Traceable To: **Validator ™**
System ID: **LB-HE-069**

The result reference to raw data on page: 39

| Peak Number# Peak Detection Specify | Peak high /1000 Collected ( millivolt ) | %deviation | Evaluate Result |
|---|---|---|---|
| 1 500 millivolt | **499.992** | 0.00 | **PASS** |
| 2 1000 millivolt | **999.999** | 0.00 | **PASS** |

Acception criteria of % deviation ≤1%
Evaluate Result **PASS**

Qualifier's signature: Date: 1/6/2023
Authorised by: Date: 1/6/2023

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Tel. (6698)970-7090, Fax.(662)540-2541 Email: sales.meshcotect@gmail.com

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MESHCOTECH CO.,LTD.

## Flow Rate Accuracy Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **07090143**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-EA v5r0**
Flow Meter Model: **VKIT-LFM**
Model: **ICS-1000**
Flow Meter S/N: **L-2330**
Traceable To: **4072-LFM**

The result reference to raw data on page: 1

| Theoretical Flow Rate ml/min. | Observed Flow Rate ml/min. | | Deviation ml/min. %Error |
|---|---|---|---|
| 0.5000 | 0.4979<br>0.4963<br>0.4982<br>0.4996<br>0.4990 | 0.4982 | 0.36 |
| 1.0000 | 0.9967<br>0.9987<br>0.9977<br>0.9980<br>0.9969 | 0.9976 | 0.24 |
| 1.5000 | 1.4980<br>1.4983<br>1.4989<br>1.4986<br>1.4998 | 1.4987 | 0.09 |
| 2.0000 | 2.0010<br>2.0009<br>2.0009<br>2.0010<br>2.0011 | 2.0010 | 0.05 |

Acception criteria of absolute deviation ≤ 1 %
Evaluate Result **PASS**

Qualifier's signature: [redacted] Date: 08/09/2023

Authorised's signatur[redacted] Date: 08/09/2023

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Tel. (6698)970 7090 , Fax.(662)560 2541





# Equipment Qualification Plan To IC System

This Qualified has Included

## Performance Qualifications (PQ)

To Instrument Lists on below:

| Name and Model | Serial Number | Manufacturer |
|---|---|---|
| ICS-1000 | 07090143 | Dionex |
| AS-1 | 09090418 | Dionex |
| Chromeleon | Version6.80 | Dionex |

This report confirms that the above instrument has been installed and performancetests the actual record and measurement results are stated on the inside of Equipment Qualification Report.

**Present to Customer Name:** Health & Envitech Co.,Ltd.
**Address:** 6 Ngamwongwan Soi 5, Tumbon Bangkhen, Muangnontaburi, Nontaburi 11000
**Department:** Analytical Lab
**Present By:** Meshcotech Co., Ltd.
**Instrument System ID:** LB-HE-108

Qualifier'S Signature/Date [redacted]

Acceptor's Signature/Date [redacted]

(.....)

บริษัท เมชโคเทค จำกัด
MESHCOTECH CO.,LTD.

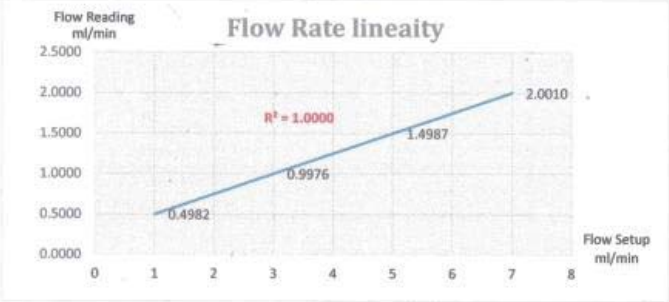
## Flow Rate Linearity Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **07090143**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-GX v5r0 HPLC**
Flow Meter Model: **VKIT-LFM**
Model: **ICS-1000**
Flow Meter S/N: **L-2330**
Traceable To: **4072-LFM**

The result reference to raw data on page: 1

| | Flow Rate 0.5 (ml/min) | Flow Rate 1.0000 (ml/min) | Flow Rate 1.5000 (ml/min) | Flow Rate 2.0000 (ml/min) |
|---|---|---|---|---|
| 1 | **0.4979** | **0.9967** | **1.4980** | **2.0010** |
| 2 | **0.4963** | **0.9987** | **1.4983** | **2.0009** |
| 3 | **0.4982** | **0.9977** | **1.4989** | **2.0009** |
| 4 | **0.4996** | **0.9980** | **1.4986** | **2.0010** |
| 5 | **0.4990** | **0.9969** | **1.4998** | **2.0011** |
| Average | **0.4982** | **0.9976** | **1.4987** | **2.0010** |
| **R-Square** | | | **1.0000** | |




Acception criteria of $R^2$ > 0.9980

Evaluate Result **PASS**

Qualifier's signature [redacted]

Date: 08/09/2023

Authorised's signatu [redacted]

Date: 08/09/2023

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POR-PUMF



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MESHCOTECH CO.,LTD.

## Flow Rate Precision Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **07090143**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-EA v5r0**
Flow Meter Model: **VKIT-LFM**
Model: **ICS-1000**
Flow Meter S/N: **L-2330**
Traceable To: **4072-LFM**

The result reference to raw data on page: 1

| | Flow Rate 0.5000 ml/min | Flow Rate 1.0000 ml/min | Flow Rate 1.5000 ml/min | Flow Rate 2.0000 ml/min |
|---|---|---|---|---|
| 1 | **0.4979** | **0.9967** | **1.4980** | **2.0010** |
| 2 | **0.4963** | **0.9987** | **1.4983** | **2.0009** |
| 3 | **0.4982** | **0.9977** | **1.4989** | **2.0009** |
| 4 | **0.4996** | **0.9980** | **1.4986** | **2.0010** |
| 5 | **0.4990** | **0.9969** | **1.4998** | **2.0011** |
| **Average** | **0.4982** | **0.9976** | **1.4987** | **2.0010** |
| **%RSD** | **0.2519** | **0.0821** | **0.0461** | **0.0042** |

Acception criteria of %RSD ≤ 1 %

Evaluate Result **PASS**

Qualifier's signature: [redacted]

Date: 08/09/2023

Authorised's signatu [redacted]

Date: 08/09/2023

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MESHCOTECH CO.,LTD.

## Autosampler Injection Precision Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **09090418**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-FL v5r0 HPLC**
Model: **AS-1**
Lot Number: **201006**
Traceable To: **060254**

The result reference to raw data on page: 14-23

| Injection Repeations | Area Injection 20ul | Area Injection 50ul |
|---|---|---|
| Injections Repeat 1 | **62117.557** | **168996.834** |
| Injections Repeat 2 | **62504.412** | **169948.976** |
| Injections Repeat 3 | **62685.539** | **169400.425** |
| Injections Repeat 4 | **62137.204** | **169054.271** |
| Injections Repeat 5 | **62632.355** | **167041.198** |
| Injections Repeat 6 | **62266.866** | **170099.238** |
| Injections Repeat 7 | **62824.089** | **169268.542** |
| Injections Repeat 8 | **62075.598** | **169668.971** |
| Injections Repeat 9 | **62053.576** | **169109.679** |
| Injections Repeat 10 | **62005.139** | **169011.021** |
| **Average of STD Area** | **62330.234** | **169159.916** |
| **% RSD of Injections** | **0.401** | **0.651** |

Acception criteria of %RSI ≤ 1 %

Evaluate Result **PASS**

Qualifier's signature [redacted] Date: 08/09/2023

Authorised's signatu [redacted] Date: 08/09/2023

PQR
82, Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970 7090 , Fax.(662)560 2541

POR-DECODE



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MESHCOTECH CO.,LTD.

## Autosampler Injection Carry Over Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **09090418**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-EA v5r0**
Model: **AS-1**
Lot Number: **220701**
Traceable To: **060254**

The result reference to raw data on page: 2-13

| Blank | Area |
|---|---|
| Carry Over Blank 1 | **0** |
| Carry Over Blank 2 | **0** |
| **Standard** | **Area** |
| Standard 1 | **62117.557** |
| Standard 2 | **62504.412** |
| Standard 3 | **62685.539** |
| Standard 4 | **62137.204** |
| Standard 5 | **62632.355** |
| Standard 6 | **62266.866** |
| Standard 7 | **62824.089** |
| Standard 8 | **62075.598** |
| Standard 9 | **62053.576** |
| Standard 10 | **62005.139** |
| **Area Average** | **62330.234** |
| **% Carry Over :** | **0.00** |

Acception criteria of % Carry Over ≤ 1%

Evaluate Result **PASS**

Qualifier's signatu [redacted] Date: 08/09/2023

Authorised's signa [redacted] Date: 08/09/2023

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MESHCOTECH CO.,LTD.

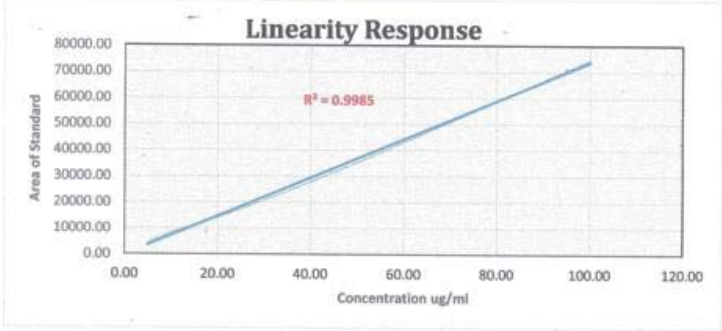
## CD Detector Response Linearity Result

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **07090143**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-FS v5r0 HPLC**
Model: **ICS-1000**
Lot Number: **201006**
Traceable To: **060254**

The result reference to raw data on page: 24-28

| Concentration (ug/ml) | | Area of standard |
|---|---|---|
| **Standard 1** | 5.02 | **4378.816** |
| **Standard 2** | 9.86 | **8139.765** |
| **Standard 3** | 25.02 | **17456.702** |
| **Standard 4** | 50.54 | **35820.801** |
| **Standard 5** | 100.00 | **74596.992** |
| **R-Square** | | **0.9985** |




Acception criteria of $R^2$ >0.9980

Evaluate Result **PASS**

Qualifier's signature: [redacted] Date: 08/09/2023

Authorisedr's signatur[redacted] Date: 08/09/2023

PQR 82, Moo.18, Buengkamproi, Lamlukka,Pathum thani, Thailand 12150
Tel. (6698)970 7090 , Fax.(662)560 2541



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## Detector MS Signal to Noise Test

Customer Name: **Health & Envitech Co.,Ltd.**
Department: **Analytical Lab**
System ID: **IC-01**
Manufacturer: **Dionex**
Serial No: **07090143**
Report Expiry Date: **Sep 08,2024**

Qualifier: **Meshcotech Co., Ltd.**
Procedure: **SOP V5-GS.v5r0 HPLC**
Model: **ICS-1000**
Lot Number: **201006**
Traceable To: **060254**

The result reference to raw data on page: 29

| | Actual Reading | Signal to Noise |
|---|---|---|
| Standard Response / Noise Response at 11-15 Minute | 18.141480 / 0.014090 | 1287.542938 |

Acception criteria
Signal to Noise ≥ 50
Evaluate Result **Pass**

Qualifier's signature: [redacted] Date: 08/09/2023

Authorised's signature[redacted] Date: 08/09/2023

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Tel. (6698)970 7090 , Fax.(662)560 2541
PQR-STN

**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



**Result** : Without adjustment
**Calibration Point** : 50, 90, 100, 110 ml

| Nominal value ( ml ) | Standard reading ( ml ) | UUC* correction ( ml ) | Uncertainty of measurement ( +/- ml ) |
|---|---|---|---|
| 50 | 50.0176 | 0.0176 | 0.056 |
| 90 | 90.0217 | 0.0217 | 0.063 |
| 100 | 100.0269 | 0.0269 | 0.063 |
| 110 | 110.0290 | 0.0290 | 0.073 |

**UUC*** = Unit under calibration



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# Certificate of Calibration

**Certificate No.** : MC22-2790
**Page** : 1 of 2

**Customer** : Health & Envitech Co.,Ltd.
**Address** : 77/11 M.2 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000

**Description** : Personal Sampler Calibrator
**Manufacturer** : SKC
**Model** : 303
**Serial No.** : N/A
**Identification No.** : PC-001
**Calibration Place** : Chemical Laboratory 2

**Order No.** : 3486/22
**Received date** : Nov 28, 2022
**Calibration date** : Nov 29, 2022
**Environment Condition :**
**Temperature** : ( 20+/-2 ) °C
**Humidity** : ( 50+/- 15 ) %RH

**Calibration Method** : Calibration were conducted using In-house calibration procedure *CP-MC-004* According to comparison with Analytical Balance. The calibration methods based on ASTM E542-01.

**Reference Standard Instruments :**

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| Analytical Balance | AE-FA220 | 201907106 | MM22-2494 | Aug 29, 2023 |
| Humidity / Baro / Temp. Data Recorder | MH-382SD | N/A | MT22-4415 | Jul 27, 2023 |
| Digital Thermometer | EFT-4 | EFT42020033 | MT22-3124 | May 03, 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%

CALIBRATION LABORATORY IMC INCTECH METROLOGICAL CENTER CO.,LTD.

**Calibrated by :** Miss Nuengruethai Siripoch
**Issue date :** Nov 29, 2022

**Approved by :** ( Mr.Choophong Khumdet )

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



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## Calibration Results:

**Without Adjustment**

**Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm**

| Standard Wavelength | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|
| 418.61 | 418.8 | -0.19 | 0.13 |
| 460.05 | 460.0 | 0.05 | 0.13 |
| 536.66 | 536.4 | 0.26 | 0.13 |
| 637.98 | 638.4 | -0.42 | 0.13 |
| 748.48 | 748.9 | -0.42 | 0.13 |
| 807.03 | 807.1 | -0.07 | 0.13 |

**Photometric Accuracy (Absorbance)**

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|---|
| 420 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2899 | 0.290 | -0.0001 | 0.0045 |
| | 0.5170 | 0.520 | -0.0030 | 0.0045 |
| | 1.0286 | 1.033 | -0.0044 | 0.0045 |
| 440 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2837 | 0.284 | -0.0003 | 0.0045 |
| | 0.5074 | 0.509 | -0.0016 | 0.0045 |
| | 1.0071 | 1.010 | -0.0029 | 0.0045 |
| 465 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2487 | 0.249 | -0.0003 | 0.0045 |
| | 0.4593 | 0.461 | -0.0017 | 0.0045 |
| | 0.9322 | 0.934 | -0.0018 | 0.0045 |
| 546.1 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2434 | 0.244 | -0.0006 | 0.0045 |
| | 0.4649 | 0.466 | -0.0011 | 0.0045 |
| | 0.9457 | 0.947 | -0.0013 | 0.0045 |
| 590 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2570 | 0.257 | 0.0000 | 0.0045 |
| | 0.5035 | 0.504 | -0.0005 | 0.0045 |
| | 1.0022 | 1.003 | -0.0008 | 0.0045 |
| 635 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2560 | 0.256 | 0.0000 | 0.0045 |
| | 0.4968 | 0.498 | -0.0012 | 0.0045 |
| | 0.9713 | 0.973 | -0.0017 | 0.0045 |

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# Certificate of Calibration

| | | | |
|---|---|---|---|
| **Equipment:** | SPECTROPHOTOMETER | Certificate No.: | C06230019 |
| Model: | DR 5000 | Issued Date: | 17 January 2023 |
| Serial No. (or ID.): | 1293028 (LB-HE-101) | Job No.: | KSPR2300722 |
| Manufacturer: | HACH | Page: | 1 of 3 |
| Condition: | In Condition | | |

**Customer:** Health & Envitech Co.,Ltd.
6 Ngamwongwan Soi 5,
Tumbon Bangkhen, Mueangnontaburi, Nontaburi 11000 Thailand

**Environment Condition:**

| | | | | | | |
|---|---|---|---|---|---|---|
| Temperature | 25.8 | °C | ± | 0.4 | °C |
| Humidity | 54.5 | %RH | ± | 2.3 | %RH |

**Calibration Place:** Health & Envitech Co.,Ltd. ( Laboratory 2 )
6 Ngamwongwan Soi 5,
Tumbon Bangkhen, Mueangnontaburi, Nontaburi 11000 Thailand

**Calibration By:** Mr.Siwapan Srijan

**Calibration Date:** 17 January 2023

**The Method used:** In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

**Traceability:** This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 91418 and 91435
The standard for Photometric Certificate No. 9112739 and 103073
The standard for Stray light Certificate No. 103141 and 103142
The standard for Spectral resolution Certificate No. 103140

(Mr. Siwapan Srijan)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

**Decision rule :**

- ☐ Choice A — Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA.
- ☑ Choice B — Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C — Customer defined, Customers may define arbitrary multiple of r to have applied as guard band (w = r U) .

; PFA – Probability of False Accept

Authorized signatory

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand





## Calibration Results:

### Without Adjustment

**Photometric Accuracy (Absorbance)**

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|---|
| 235 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.7361 | 0.740 | -0.0039 | 0.0080 |
| 257 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.8585 | 0.860 | -0.0015 | 0.0080 |
| 313 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.2861 | 0.289 | -0.0029 | 0.0080 |
| 350 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.6378 | 0.639 | -0.0012 | 0.0080 |

**Stray light ***

| Standard: cut-off | UUC: Wavelength (nm) | UUC: Transmission (%T) | Absorbance ( A) |
|---|---|---|---|
| 260.67 +/- 0.11 nm | 260.7 | 1.0 | 2.000 |
| 391.7 +/- 0.11 nm | 391.7 | 1.4 | 1.854 |

**Spectral Resolution ***

| Nominal Concentration 0.02 % v/v | Peak | Trough | Ratio | SBW |
|---|---|---|---|---|
| Standard Wavelength ( nm ) | 268.73 | 266.77 | 1.46 | 2.00 |
| UUC: Wavelength (nm) | 268.5 | 266.4 | | |
| Std Absorbance ( A) | 0.4237 | 0.2591 | | |
| Absorbance ( A) | 0.380 | 0.261 | | |

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

**The End of Certificate**

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**Without Adjustment**

**Photometric Accuracy (Absorbance)**

| Wavelength | Unit Under Calibration | Correction | Guard Band (w) | Tolerance (±) | Conformity |
|---|---|---|---|---|---|
| 420 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.290 | -0.0001 | 0.0045 | 0.015 | Pass |
| | 0.520 | -0.0030 | 0.0045 | 0.015 | Pass |
| | 1.033 | -0.0044 | 0.0045 | 0.015 | Pass |
| 440 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.284 | -0.0003 | 0.0045 | 0.015 | Pass |
| | 0.509 | -0.0016 | 0.0045 | 0.015 | Pass |
| | 1.010 | -0.0029 | 0.0045 | 0.015 | Pass |
| 465 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.249 | -0.0003 | 0.0045 | 0.015 | Pass |
| | 0.461 | -0.0017 | 0.0045 | 0.015 | Pass |
| | 0.934 | -0.0018 | 0.0045 | 0.015 | Pass |
| 546.1 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.244 | -0.0006 | 0.0045 | 0.015 | Pass |
| | 0.466 | -0.0011 | 0.0045 | 0.015 | Pass |
| | 0.947 | -0.0013 | 0.0045 | 0.015 | Pass |
| 590 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.257 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.504 | -0.0005 | 0.0045 | 0.015 | Pass |
| | 1.003 | -0.0008 | 0.0045 | 0.015 | Pass |
| 635 nm | 0.000 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.256 | 0.0000 | 0.0045 | 0.015 | Pass |
| | 0.498 | -0.0012 | 0.0045 | 0.015 | Pass |
| | 0.973 | -0.0017 | 0.0045 | 0.015 | Pass |

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.





**Without Adjustment**

**Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm**

| Unit Under Calibration | Correction | Guard Band (w) | Tolerance (±) | Conformity |
|---|---|---|---|---|
| 418.8 | -0.19 | 0.13 | 3.0 | Pass |
| 460.0 | 0.05 | 0.13 | 3.0 | Pass |
| 536.4 | 0.26 | 0.13 | 3.0 | Pass |
| 638.4 | -0.42 | 0.13 | 3.0 | Pass |
| 748.9 | -0.42 | 0.13 | 3.0 | Pass |
| 807.1 | -0.07 | 0.13 | 3.0 | Pass |

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

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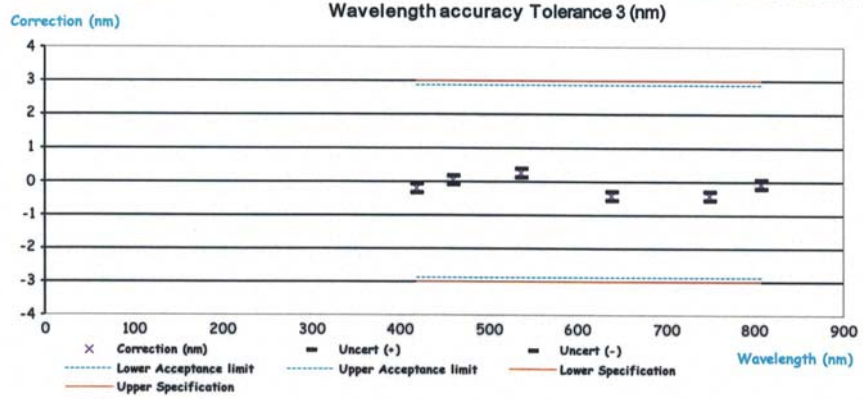
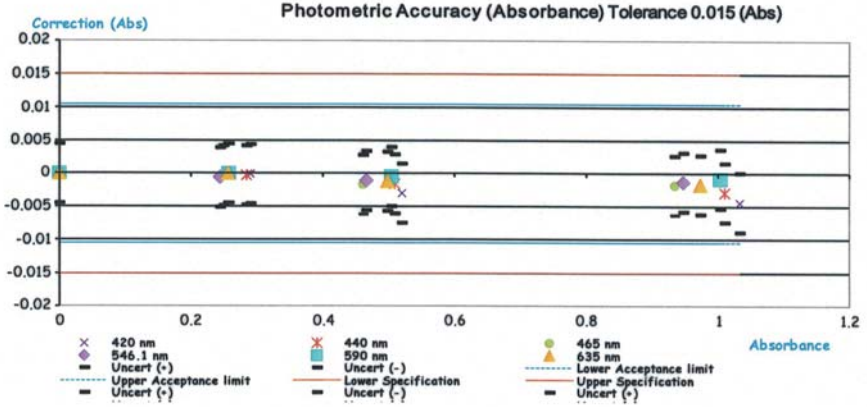
Without Adjustment

Job No.: KSPR2300722

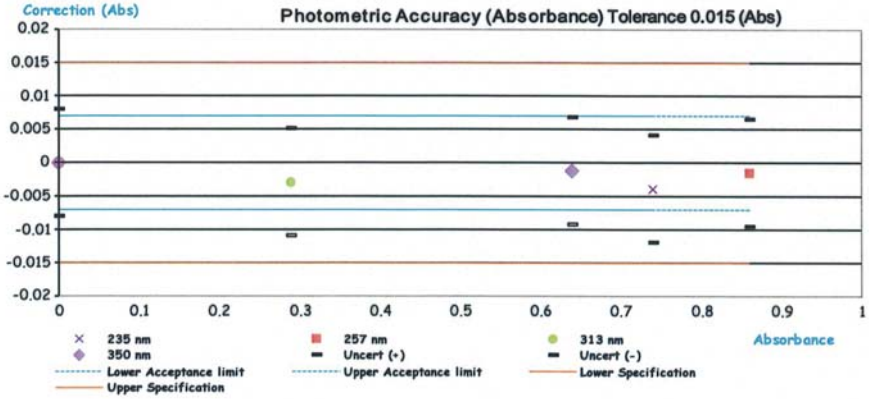
Wavelength accuracy Tolerance 3 (nm)




Photometric Accuracy (Absorbance) Tolerance 0.015 (Abs)




Photometric Accuracy (Absorbance) Tolerance 0.015 (Abs)

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Without Adjustment

Photometric Accuracy (Absorbance)

| Wavelength | Unit Under Calibration | Correction | Guard Band (w) | Tolerance (±) | Conformity |
|---|---|---|---|---|---|
| 235 nm | 0.000 | 0.0000 | 0.0080 | 0.015 | Pass |
| | 0.740 | -0.0039 | 0.0080 | 0.015 | Pass |
| 257 nm | 0.000 | 0.0000 | 0.0080 | 0.015 | Pass |
| | 0.860 | -0.0015 | 0.0080 | 0.015 | Pass |
| 313 nm | 0.000 | 0.0000 | 0.0080 | 0.015 | Pass |
| | 0.289 | -0.0029 | 0.0080 | 0.015 | Pass |
| 350 nm | 0.000 | 0.0000 | 0.0080 | 0.015 | Pass |
| | 0.639 | -0.0012 | 0.0080 | 0.015 | Pass |

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

**The End of Statements of Conformity**

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# Maintenance Protocol

## PlasmaQuant PQ 9000 (Elite)
## ICP-OES

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# ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2300722

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR 5000 หมายเลขเครื่อง: 1293028

| ตรวจสอบ (รับ) 17 Jan 2023 ปกติ | ตรวจสอบ (รับ) 17 Jan 2023 ไม่ปกติ | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) 17 Jan 2023 ปกติ | ตรวจสอบ (ส่ง) 17 Jan 2023 ไม่ปกติ | หมายเหตุ |
|---|---|---|---|---|---|
| | | ***General*** | | | |
| ☑ | ☐ | 1. ความสมบูรณ์เครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | ☑ | ☐ | |
| ☑ | ☐ | 3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth) | ☑ | ☐ | |
| ☑ | ☐ | 4. ปุ่มกด (Keypad) | ☑ | ☐ | |
| ☑ | ☐ | 5. หน้าจอ (Display, Screen Contrast) | ☑ | ☐ | |
| | | ***Spectrophotometer*** | | | |
| ☐ | ☐ | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | ☐ | ☐ | |
| ☐ | ☐ | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | ☐ | ☐ | |
| ☑ | ☐ | 8. ความยาวคลื่น (Wavelength Check) | ☑ | ☐ | 656.1 = 656.2 nm |
| ☑ | ☐ | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | ☑ | ☐ | 15.3 Hours |
| ☑ | ☐ | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | ☑ | ☐ | 135.4 Hours |
| ☐ | ☐ | 11. ช่องวัดหลายตัวอย่าง (Carousel Module) | ☐ | ☐ | |
| | | ***pH Meter and Conductivity Meter*** | | | |
| ☐ | ☐ | 12. อิเล็คโทรด ( Electrode and Connection Cable ) | ☐ | ☐ | |
| ☐ | ☐ | 13. ระดับสารละลายใน Electrode (Level KCl ) | ☐ | ☐ | |
| ☐ | ☐ | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | ☐ | ☐ | |
| ☐ | ☐ | 15. ขาจับอิเล็คโทรด (Stand) | ☐ | ☐ | |
| | | ***Turbidimeter*** | | | |
| ☐ | ☐ | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | ☐ | ☐ | |
| ☐ | ☐ | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0) | ☐ | ☐ | |
| | | ***Automatic titrator*** | | | |
| ☐ | ☐ | 18. สภาพ Piston Burettes | ☐ | ☐ | |
| ☐ | ☐ | 19. Function Rinsing and Dosing | ☐ | ☐ | |
| ☐ | ☐ | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ | ☐ | ☐ | |

เพิ่มเติม/ข้อแนะนำ : _____

Mr.Siwapan Srijan

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

# 1 Customer and service data

## Customer address

| | |
|---|---|
| Company | บ.เฮลธ์ แอนด์ เอ็นไวเทค จำกัด |
| Department | QC |
| Address (street, number, zip code, city) | 6 ซอยงามวงศ์วาน 5 ต.บางเขน อ.เมือง จ.นนทบุรี 11000 |
| Phone | |
| E-mail | |
| Customer number | |
| Order number | |

## Device data (model and serial number)

| | |
|---|---|
| ICP OES | PQ9000 |
| Mobile cooling unit | PolyScience |
| Autosampler | - |

## Analytik Jena representative information

| | |
|---|---|
| Name | Mr.Pukitja somton |
| Company | Analytik Jena Instrument Thailand |

## Maintenance date

| | |
|---|---|
| Date | 11 October 2023 |

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# 3 Maintenance work on the base unit

## Update firmware and software

| | Complies | Does not comply |
|---|---|---|
| Save device parameters and neon table | ☑ | ☐ |
| Check the firmware version and FPGA | ☑ | ☐ |
| Check the version of the ASpect PQ software | ☑ | ☐ |
| Update software, FPGA and firmware<br>Approval for firmware and software updates was given by the customer. | ☑ | ☐ |
| The customer's was informed that the Operational Qualification (OQ) and software validation may have to be repeated for validated systems after a firmware/software update. | ☑ | ☐ |
| Update ASpect PQ | ☑ | ☐ |
| ■ Current version: 1.2.3.0 | | |
| ■ Version after update: – | | |
| Update FPGA | ☑ | ☐ |
| ■ Current version: h09; h00 | | |
| ■ Version after update: – | | |
| Updating the firmware | ☑ | ☐ |
| ■ Current version: 1.36 | | |
| ■ Version after update: – | | |
| Record running time (in hours) | ☑ | ☐ |
| ■ Base unit: 3339 | | |
| ■ RF generator: 1949 | | |

## Service the rear of the device

| | Complies | Does not comply |
|---|---|---|
| Replace the air filter mat | ☑ | ☐ |





# 2 Maintenance with subsequent Operational Qualification (OQ)

- If an Operational Qualification (OQ) is carried out after maintenance, there is no need to check analytical parameters in the maintenance report.
- The analytical parameters are then checked in the separate OQ report.

| | Yes | No |
|---|---|---|
| Maintenance with subsequent Operational Qualification (OQ) | ☐ | ☑ |



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Comments:

## Service the spectrometer

| | Complies | Does not comply |
|---|---|---|
| Clean and lubricate the spindle of the prism and grating with a little oil | ☑ | ☐ |

## Check gas flows at the gas box

| Gas flow | Rated value | Actual value | Complies | Does not comply |
|---|---|---|---|---|
| Nebulizer gas flow | 0.5 L/min ± 15 % | 0.493 | ☑ | ☐ |
| Auxiliary gas flow | 0.5 L/min ± 15 % | 0.496 | ☑ | ☐ |
| Cone gas flow | 1,7 ... 2,8 L/min | 2.7 | ☑ | ☐ |
| Oxygen is used (optional) | | | ☐ | ☐ |
| Oxygen flow | 00.5 L/min ± 15 % | - | ☐ | ☐ |

Comments:





## Service the sample introduction system

| | Complies | Does not comply |
|---|---|---|
| Remove, disassemble and clean the torch<br>■ Check the surface of the glass parts (injector, inner tube, outer tube and glass holder) for damage, heavily coated and broken parts. Replace glass parts, if necessary<br>■ Clean glass parts in aqua regia | ☑ | ☐ |
| Check the sealing rings, replace if necessary<br>■ Sealing rings in torch holder (3 pieces) and torch shuttle (2 pieces)<br>■ Sealing rings in injector and mixing chamber mount<br>(Check sealing rings for porous and hardened areas, replace if necessary) | ☑ | ☐ |
| Check pump tubing (sample, waste), replace if necessary | ☑ | ☐ |
| Check peristaltic pump, disassemble and lubricate if necessary | ☑ | ☐ |
| Check the nebulizer for damage and clean it | ☑ | ☐ |
| Remove and clean the mixing chamber | ☑ | ☐ |
| Check the sealing ring of the mixing chamber | ☑ | ☐ |
| Check and clean torch height adjustment drive | ☑ | ☐ |
| Lubricate the linear drive with a little oil | ☑ | ☐ |
| Check the igniting pin for signs of wear | ☑ | ☐ |

Comments:

## Service the plasma compartment

| | Complies | Does not comply |
|---|---|---|
| Disassemble the cone, check geometry and clean it if necessary | ☑ | ☐ |
| Take out the windows (axial/radial) and clean or replace them | | |
| Replacing the sealing rings | | |
| Check the surface of the first mirror, clean or replace it if necessary | ☑ | ☐ |
| Check the air outlet for deposits and blockages, clean it if necessary | ☑ | ☐ |
| Remove the cover plate below the plasma compartment and clean it | ☑ | ☐ |
| Renew the filter mat | | |
| Check the coil for its material condition, position, geometry and for the tightness of connections | ☑ | ☐ |
| Clean or replace bonnet | ☑ | ☐ |
| Check RF deflector spring, replace it if necessary | ☑ | ☐ |



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| | Complies | Does not comply |
|---|---|---|
| Check the functionality of the washing cup | ☑ | ☐ |
| Check the hose connections for leaks | ☑ | ☐ |





# 4 Maintenance work on accessories

## Service the mobile cooling unit

| | | Complies | Does not comply |
|---|---|---|---|
| Vacuum or clean the condenser | | ☑ | ☐ |
| Record the condition of the cooling water before maintenance: | | ☑ | ☐ |
| Particles and discoloration present: | ☐ yes ☑ No | | |
| cooling water flow rate | 1.50 | | |
| Cooling water primary pressure | 49 psi | | |
| Conductivity of the cooling water | 120 | | |
| Clean the water filter on the base unit (if filter is installed) | | ☑ | ☐ |
| Renew cooling water<br>■ Prepare cooling water according to Analytik Jena's specifications<br>■ Use cooling water additive from Analytik Jena | | ☑ | ☐ |
| Check filling level of cooling water, top up if required | | ☑ | ☐ |

Cooling water circuit after maintenance

| | Rated value | Actual value | Complies | Does not comply |
|---|---|---|---|---|
| cooling water flow rate | 1.5 to 2.0 L/min | 1.50 | ☑ | ☐ |
| Cooling water primary pressure | max. 6 bar (85 psi) | 55 psi | ☑ | ☐ |
| Conductivity of the cooling water | 50 to 200 µS/cm | 100 | ☑ | ☐ |
| Cooling water temperature (in mobile cooling unit) | 18 °C | 18 | ☑ | ☐ |

## Service the autosampler

| | Complies | Does not comply |
|---|---|---|
| Check cannula and tubing to the base unit | ☑ | ☐ |
| Check pump tubing (washing solution, waste), replace if necessary | ☑ | ☐ |
| Clean the covers, rack mount and accessories | ☑ | ☐ |
| Check the condition of the toothed belts for cracks, gaps and changes in color | ☑ | ☐ |
| Check the peristaltic pump for smooth operation | ☑ | ☐ |

## 5.3 Check of neon energy

The plasma must be ignited for this test (CCD cooling active).

| | Rated value (Steps) | Actual value (Steps) | Complies | Does not comply |
|---|---|---|---|---|
| 585.2462 nm | > 4000 ct/s | 30337 | ☑ | ☐ |
| 594.4807 nm | > 3000 ct/s | 11135 | ☑ | ☐ |
| 640.2217 nm | > 3000 ct/s | 4286 | ☑ | ☐ |
| 849.5322 nm | > 3000 ct/s | 3653 | ☑ | ☐ |
| 607.4311 nm | > 3000 ct/s | 26711 | ☑ | ☐ |
| 659.8923 nm | > 3000 ct/s | 21792 | ☑ | ☐ |
| 743.8864 nm | > 3000 ct/s | 32092 | ☑ | ☐ |
| 703.2381 nm | > 10000 ct/s | 19529 | ☑ | ☐ |

Comments:

–

## 5.4 Adjustment of transfer optics (Mn 257.610 nm)

| Adjust detection (axial) | | Complies | Does not comply |
|---|---|---|---|
| X offset | -0.6 | ☑ | ☐ |
| Y offset | -2.1 | ☑ | ☐ |





# 5 Checking basic functions and device parameters

## 5.1 Check of correction functions

| | Rated value (Steps) | Actual value (Steps) | Complies | Does not comply |
|---|---|---|---|---|
| As (193.6950 nm) | ± 500 | 143 | ☑ | ☐ |
| Cu (324.7540 nm) | ± 500 | 98 | ☑ | ☐ |
| Na (588.9953 nm) | ± 500 | 75 | ☑ | ☐ |
| K (766.4908 nm) | ± 500 | 89 | ☑ | ☐ |

Comments:

–

## 5.2 Check of safety circuits

| | Complies | Does not comply |
|---|---|---|
| Safety circuit for torch position | ☑ | ☐ |
| Safety circuit for door of plasma compartment | ☑ | ☐ |
| Safety circuit for interrupted cooling water flow (cooling water flow < 0.85 L/min ) | ☑ | ☐ |
| Safety circuit for suction power (check the setting Par[85]) | ☑ | ☐ |
| Value Par[85]: 4115 | | |
| Safety circuit for argon inlet pressure (p < 4 bar)* * if sensor is installed (Par[116] = 1) | – | ☐ |

Comments:

–



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| Line | Peak position before correction | Peak position after correction | Difference Rated value | Difference Actual value |
|---|---|---|---|---|
| Zn 213.8560 nm | 181.0 ± 2.1 | 181.0 ± 1.6 | ± 1.0 | 0.5 |
| Mn (257.6100 nm) | 181.0 ± -0.3 | 181.0 ± -0.3 | ± 1.0 | 0.0 |
| Cu (324.7540 nm) | 181.0 ± -0.2 | 181.0 ± -0.1 | ± 1.0 | -0.1 |
| Li 670.7910 nm | 181.0 ± -2.5 | 181.0 ± -3.5 | ± 1.0 | 1.0 |

Comments:

### Robustness factor

Calculation according to the following formula:

$$F_r = \frac{\text{intensity } Mg_{280.271} \,/\, \text{intensity } BG\ Mg_{280.271}}{\text{intensity } Mg_{285.213} \,/\, \text{intensity } BG\ Mg_{285.213}}$$

| Intensity / calculated factor | Value |
|---|---|
| Intensity Mg 280.271 | 1538110 |
| Intensity BG Mg 280.271 | 8481 |
| Intensity Mg 285.213 | 175650 |
| Intensity BG Mg 285.213 | 8437 |
| $F_r$ | 8.71 |

Comments:





| Adjust detection (axial) | | Complies | Does not comply |
|---|---|---|---|
| Intensity value | 2420277 | ☑ | ☐ |

| Adjust detection (radial) | | Complies | Does not comply |
|---|---|---|---|
| X offset | 14.7 | ☑ | ☐ |
| Y offset | -0.7 | ☑ | ☐ |
| Intensity value | 395776 | ☑ | ☐ |

Comments:

## 5.5 Verification of the wavelength accuracy, generator robustness and analytical performance

- Requirements
  - Start ASpect PQ
  - Perform measurements with the standard sample introduction kit
  - Load the sequence "maintenance_PQ9000"
  - Plasma burn-in time 15 min
  - 1 mg/L multi-element solution (Merck standard IV for ICP) in 3 % $HNO_3$
  - Plasma conditions 12 L/min plasma gas, 0.5 L/min auxiliary gas, 0.6 L/min nebulizer gas
  - Plasma power 1200 W
  - Measurement time 10 s
- Start the sequence "maintenance_PQ9000" (duration approx. 40 min).
  The sequence automatically loads the methods that are necessary to determine the data.

### Wavelength accuracy

- Open the spectra display of the measured lines one after the other. Read off the peak position (peak position before correction). Carry out the peak correction by clicking on **[Find peak center]** and read off the peak position again (peak position after correction). Calculate the difference between the two values (peak position before correction - peak position after correction).



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| | | Rated value | Actual value |
|---|---|---|---|
| | Relative standard deviation (RSD) [%] | < 2 | 0.23 |
| Mn (257.6100 nm) | Limit of detection LOD [mg/L] | < 0.0004 | 0.000045 |
| | Recovery [%] | 100 ± 10 | 101.5 |
| | Relative standard deviation (RSD) [%] | < 1.5 | 0.42 |
| Cu (324.7540 nm) | Limit of detection LOD [mg/L] | < 0.0015 | 0.000403 |
| | Recovery [%] | 100 ± 10 | 101.1 |
| | Relative standard deviation (RSD) [%] | < 1.5 | 0.29 |
| Li 670.7910 nm | Limit of detection LOD [mg/L] | < 0.003 | 0.00037 |
| | Recovery [%] | 100 ± 10 | 101.9 |
| | Relative standard deviation (RSD) [%] | < 1.5 | 0.52 |

Comments:

–





## Analytical performance

PlasmaQuant PQ 9000 Elite

| | | Rated value | Actual value |
|---|---|---|---|
| Zn 213.8560 nm | Limit of detection LOD [mg/L] | < 0.0015 | – |
| | Recovery [%] | 100 ± 10 | – |
| | Relative standard deviation (RSD) [%] | < 2 | – |
| Mn (257.6100 nm) | Limit of detection LOD [mg/L] | < 0.0002 | – |
| | Recovery [%] | 100 ± 10 | – |
| | Relative standard deviation (RSD) [%] | < 1.5 | – |
| Cu (324.7540 nm) | Limit of detection LOD [mg/L] | < 0.0010 | – |
| | Recovery [%] | 100 ± 10 | – |
| | Relative standard deviation (RSD) [%] | < 1.5 | – |
| Li 670.7910 nm | Limit of detection LOD [mg/L] | < 0.0025 | – |
| | Recovery [%] | 100 ± 10 | – |
| | Relative standard deviation (RSD) [%] | < 1.5 | – |

PlasmaQuant PQ 9000

| | | Rated value | Actual value |
|---|---|---|---|
| Zn 213.8560 nm | Limit of detection LOD [mg/L] | <0.002 | 0.000198 |
| | Recovery [%] | 100 ± 10 | 98.8 |



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# 6 Comments and objections

Comments and possible objections raised during installation and commissioning are to be recorded in writing in this section.





# 7 Completing maintenance

| | Complies | Does not comply |
|---|---|---|
| Maintenance on the analyzer has been completed. | ☑ | ☐ |
| The functionality and analytical performance of the device was checked in the presence of the user. The device meets its technical specification. | ☑ | ☐ |

| Name | Function | Date | Signature |
|---|---|---|---|
| Wipawan pathumwan | Representative Customer | 11/10/2023 | |
| Mr.Pukitja Somton | Representative Analytik Jena AG | 11/10/2023 | |
| | | | |
| | | | |

# Certificate of Calibration

**Method 5 Pre-Test Calibration - Liters (L)**

| UUT Meter Console Information | | Calibration Conditions | | Factors/Conversions | | Reference Equipment | |
|---|---|---|---|---|---|---|---|
| Model #: | XC-572-OV | Bar. Pressure (mm Hg): | 756.8 | Std. Temp. (K): | 293.15 | Calibration Meter Model: | DGMR-200H |
| Serial #: | 1204012 | Ambient Temperature (°C): | 24.7 | Std. Press. (mm Hg): | 760 | Cal. Due Date: | 25-Jul-24 |
| DGM Model #: | G1.6 | Relative Humidity (%): | 51.0 | $K_1$ (K/mm Hg): | 0.3857 | Serial No.: | 0000026 |
| DGM Serial #: | 2012-006454 | Altitude (m): | 1.83 | | | Gamma: | 1.0000 |
| | | Bar. Pressure Corr. (mm Hg): | 756.7 | | | | |

**UUT Meter (DGM)** / **Reference Meter (WTM)**

| Run Time (seconds) | Orifice, ΔH (mm H2O) | UUT Meter Volume (L) | | | UUT Meter Temperature (°C) | | Meter Pressure (in H2O) | Reference Meter Volume (L) | | | Reference Meter Outlet Temperature (°C) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Total | Initial | Final | | Initial | Final | Total | Initial | 0.00 |
| Θ | $P_{m(g)}$ | $V_{mi}$ | $V_{mf}$ | $V_m$ | $t_{mi}$ | $t_{mf}$ | $P_w$ | $V_{wi}$ | $V_{wf}$ | $V_w$ | $t_{wi}$ | $t_{wf}$ |
| 840.00 | 13.00 | 338514.6 | 338674.4 | 159.8 | 24.0 | 24.0 | 0.3 | 0.00 | 156.99 | 156.99 | 24.0 | 24.0 |
| 600.00 | 25.00 | 338674.4 | 338836.0 | 161.6 | 24.0 | 24.0 | 0.5 | 0.00 | 159.88 | 159.88 | 24.0 | 24.0 |
| 455.00 | 50.00 | 338836.0 | 339005.2 | 169.2 | 25.0 | 26.0 | 0.6 | 0.00 | 167.42 | 167.42 | 24.0 | 24.0 |
| 350.00 | 80.00 | 339005.2 | 339173.8 | 168.6 | 26.0 | 27.0 | 2.0 | 0.00 | 166.72 | 166.72 | 24.0 | 24.0 |
| 300.00 | 120.00 | 339173.8 | 339347.0 | 173.2 | 27.0 | 27.0 | 2.4 | 0.00 | 171.38 | 171.38 | 24.0 | 24.0 |

**Standardized Data**

| Reference Meter (L) | | UUT Meter (L) | | Correction Factor | | ΔH @ (mm H2O) | |
|---|---|---|---|---|---|---|---|
| Std. Vol. | Std. Flow | Std. Vol. | Std. Flow | Value | Variation | 0.0212 SCMM | Variance |
| $V_{w(std)}$ | $Q_{w(std)}$ | $V_{m(std)}$ | $V_{w(std)}$ | Y | ΔY | ΔH@ | ΔΔH@ |
| 154.31 | 11.02 | 157.15 | 11.0 | 0.9819 | -0.0080 | 47.5 | 1.219 |
| 157.23 | 15.72 | 159.11 | 15.7 | 0.9882 | -0.0017 | 45.0 | -1.296 |
| 164.68 | 21.72 | 166.16 | 21.7 | 0.9911 | 0.0012 | 47.1 | 0.786 |
| 164.57 | 28.21 | 165.49 | 28.2 | 0.9944 | 0.0045 | 45.0 | -1.372 |
| 169.33 | 33.87 | 170.38 | 33.9 | 0.9938 | 0.0039 | 47.0 | 0.663 |
| | | | | **0.9899** | = Y Avg. | **46.3** | = ΔH@ Avg. |

Metric

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

Note: For $\Delta H_@$, orifice pressure differential that equates to 0.0212$m^3$/min at standard temperature and pressure, acceptable tolerance of individual values from the average is +-0.2inches (5.1mm) $H_2O$.

**Pass/Fail Judgment :** Pass

Calibrate By : Apppoved By: Date: 29 Aug 23

The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.) and in reference to EPA Method 5, Section 10.3.1.

neediss
Neediss Supply Instrument Co.,Ltd.

# Certificate of Calibration - Supplemental

**Nomenclature**

$P_b$ - Barometric Pressure
DGM - Dry Gas Meter
$K_1$ - Constant based on standard temp and press
Θ - Run time, in minutes
$P_m$ - ΔH (Meter Pressure, gauge)
$V_m$ - Volume collected by test meter, corrected for STP
$Q_{m(std)}$ - Calculated flow rate of test meter
K' - Critical orifice coefficient
$P_w$ - Measured pressure of reference meter
$t_w$ - Temperature measured in reference meter

**Equations**

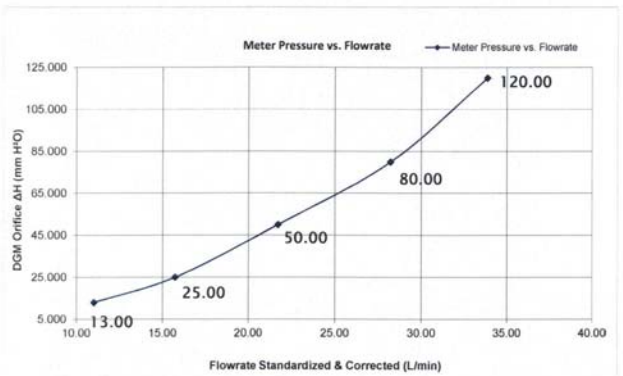
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{w(g)}}{13.6})}{T_w}$$

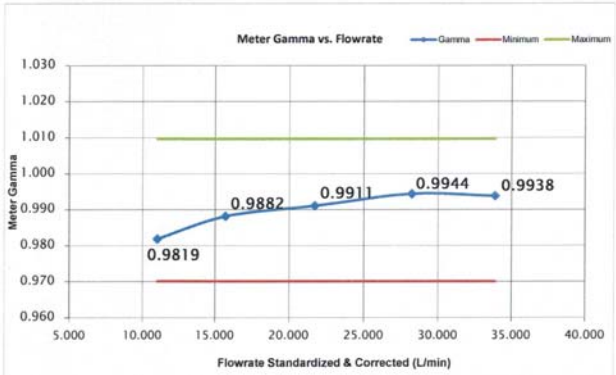
$$V_{m(std)} = \frac{K_1 V_m (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

$$K_1 = \frac{T_{std}}{P_{std}} \qquad Y = \frac{V_{cr(std)}}{V_{m(std)}} \qquad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric\ \Delta H_\Theta = \frac{P_{m(g)} * 0.0011696 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m} * \left(\frac{T_w * \Theta}{V_w * P_{bar}}\right)^2$$

**Calibration Train**



# Console Sensor Calibration Data Sheet

**Console Information**

Model #: XC-572-OV
Serial #: 1204012
Units: Metric
Type: "English"

**Calibration Conditions**

| | |
|---|---|
| Pbar (mm. Hg): | 756.8 |
| Humidity (%): | 51.0 |
| Tamb (°C): | 24.7 |
| Corr. Pbar (mm. Hg): | 756.7 |

**Reference Devices**

| | |
|---|---|
| TC Simulator Model: | CC-VTR-SH |
| Reference #: | 091109269 |
| Barometer Model: | 736930 |
| Reference #: | EBARODIALSPE01 |
| Digital Pressure Calibrator Model: | 718 30G |
| Reference #: | 3891001 |

## Pressure Gauge / Manometer Calibration Data

| Console Vacuum Calibration | | | |
|---|---|---|---|
| Reference Point | Reference Vacuum | Console Vacuum | Reference Point Status[6] |
| # | *in. Hg* | *in. Hg* | *Pass/Fail* |
| 1 | -5.0 | -5.0 | PASS |
| 2 | -15.0 | -15.0 | PASS |
| 3 | -20.0 | -20.0 | PASS |

| Reference Point[1] | ΔH_Manometer Calibration | | | Reference Point Status[2] |
|---|---|---|---|---|
| | Reference | Positive (+) Pitot | Negative (-) Pitot | |
| # | *mm H2O* | *mm H2O* | *mm H2O* | *Pass/Fail* |
| 1 | -200.000 | 0.0 | -200.0 | PASS |
| 2 | -150.000 | 0.0 | -150.0 | PASS |
| 3 | -100.000 | 0.0 | -100.0 | PASS |
| 4 | -80.000 | 0.0 | -80.0 | PASS |
| 5 | -50.000 | 0.0 | -50.0 | PASS |
| 6 | 0.000 | 0.0 | 0.0 | PASS |
| 7 | 50.000 | 50.0 | 0.0 | PASS |
| 8 | 80.000 | 80.0 | 0.0 | PASS |
| 9 | 100.000 | 100.0 | 0.0 | PASS |
| 10 | 150.000 | 150.0 | 0.0 | PASS |
| 11 | 200.000 | 200.0 | 0.0 | PASS |
| | | | *ΔH Overall Audit Status* | PASS |

| Reference Point[1] | ΔP_Manometer Calibration | | | Reference Point Status[2] |
|---|---|---|---|---|
| | Reference | Positive (+) Pitot | Negative (-) Pitot | |
| # | *mm H2O* | *mm H2O* | *mm H2O* | *Pass/Fail* |
| 1 | -200.000 | 0.0 | -200.0 | PASS |
| 2 | -150.000 | 0.0 | -150.0 | PASS |
| 3 | -100.000 | 0.0 | -100.0 | PASS |
| 4 | -80.000 | 0.0 | -80.0 | PASS |
| 5 | -50.000 | 0.0 | -50.0 | PASS |
| 6 | 0.000 | 0.0 | 0.0 | PASS |
| 7 | 50.000 | 50.0 | 0.0 | PASS |
| 8 | 80.000 | 80.0 | 0.0 | PASS |
| 9 | 100.000 | 100.0 | 0.0 | PASS |
| 10 | 150.000 | 150.0 | 0.0 | PASS |
| 11 | 200.000 | 200.0 | 0.0 | PASS |
| | | | *ΔP Overall Audit Status* | PASS |

Calibrate By : Appproved By: Date: 29 Aug 23

**Notes**

[1] Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.

[2] For valid test results, the maximum difference between temperature and reference readings should be less than ±5.4 °F (±3 °C), for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than ±2°F (±1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[3] Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions"

[4] Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information"

[5] For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ±0.1 in. Hg (±2.5 mm Hg), (EPA Method 5, Section 6.1.2)

[6] For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.5 in. Hg (±12.5 mm Hg)

[7] For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.05 in. H2O (±1.25 mm H2O), or 5% of full scale

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60.

Neediss Supply Instrument Co.,Ltd

9.16/50

# Certificate of Calibration

**Method 5 Console Sensor Calibration - Metric Units**

**Console Information**

Model #: XC-572-OV
Serial #: 1204012
Units: Metric

**Calibration Conditions**

| | |
|---|---|
| Pbar (mm. Hg): | 756.8 |
| Humidity (%): | 51 |
| Tamb (°C): | 24.7 |
| Elevation (m): | 1.8 |
| Corr. Pbar (mm. Hg): | 756.7 |

**Reference Devices**

| | |
|---|---|
| TC Calibrator Model: | CC-VTR-SH |
| Reference #: | 091109269 |
| Barometer Model: | 736930 |
| Reference #: | EBARODIALSPE01 |
| Pressure Model: | 718 30G |
| Reference #: | 9543013 |

## Temperature Display Calibration Data

| Reference Point[1] | Reference Temp. | Test Thermocouple Calibrations | | | | | | Reference Point Status[2] |
|---|---|---|---|---|---|---|---|---|
| | | Aux | Stack | Probe | Oven | Filter | Exit | |
| # | °C | °C | °C | °C | °C | °C | °C | *Pass/Fail* |
| 1 | -18 | -17 | -16 | -17 | -17 | -17 | -18 | PASS |
| 2 | 38 | 37 | 37 | 36 | 36 | 36 | 37 | PASS |
| 3 | 93 | 92 | 93 | 92 | 92 | 92 | 92 | PASS |
| 4 | 149 | 148 | 149 | 148 | 148 | 148 | 148 | PASS |
| 5 | 260 | 259 | 258 | 258 | 258 | 259 | 259 | PASS |
| 6 | 371 | 370 | 371 | 370 | 370 | 370 | 370 | PASS |
| 7 | 482 | 481 | 481 | 480 | 480 | 480 | 481 | PASS |
| 8 | 593 | 592 | 593 | 591 | 591 | 592 | 592 | PASS |
| 9 | 816 | 815 | 815 | 814 | 814 | 814 | 815 | PASS |
| 10 | 1038 | 1038 | 1038 | 1037 | 1037 | 1037 | 1038 | PASS |
| | | | | | | | | PASS |
| | | | | | | | | *Overall Audit Status* |

NIST Reference Thermocouple ID: 12702001

| | Ref Point | Theoretical Temp. | DGM Thermocouple Sensor Reading | $\Delta T_{ads}$[4] |
|---|---|---|---|---|
| | # | °C | °C | °C |
| *Ice Water* | 1 | 0.9 | 1 | 0.04% |
| *Ambient*[3] | 2 | 24.7 | 24 | 0.14% |
| | | | *Maximum*[2] | 0.14% |
| | | | *Status* | PASS |

*Internal temperature thermocouple is not audited to EPA standards, and should not be used as an official reference for ambient temperature.*

Calibrate By : Appproved By: Date: 29 Aug 23

**Notes**

[1] Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.

[2] For valid test results, the maximum difference between temperature and reference readings should be less than ±5.4 °F (±3 °C), for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than ±2°F (±1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[3] Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions"

[4] Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information"

[5] For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ±0.1 in. Hg (±2.5 mm Hg), (EPA Method 5, Section 6.1.2)

[6] For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.5 in. Hg (±12.5 mm Hg)

[7] For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.05 in. H2O (±1.25 mm H2O), or 5% of full scale

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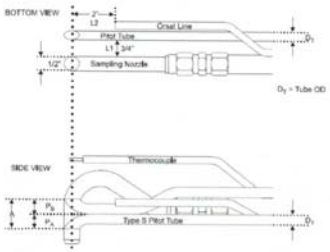
# neediss Sampling Probe and Pitot Validation

| Samplig System Equipment Information | |
|---|---|
| Probe Sheat | Apex 1 in. , 4 ft. |
| Probe Number | W1909261 |
| Pitot tube Number | A8895 |
| Pitot tube Type | S Type 3/8 Inc. |
| Validation method | Standard Probe 1 in. and 1/2 in. Sampling Nozzle |

| Valibration Conditions and Equipment | | |
|---|---|---|
| Digital Calipers | CD-15APX | |
| Reference No. | A22070181 | |
| Digital Inclinometer | BASELINE | |
| Reference No. | FEI 12-1057 | |
| Temperatute | 24.7 | °C±3 |
| Barometric Pressure | 756.8 | mm Hg |



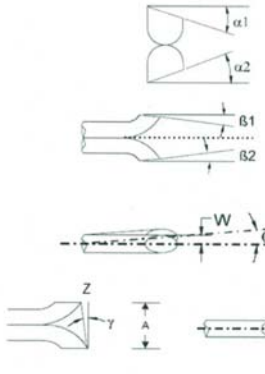

**Sampling Probe Validation with Tune up**

☑ Measure and Alinment with 1/2" Sampling Nozzle( 12.7 mm )

| | Measured | Standard Range |
|---|---|---|
| $L_1$ = | 1.97 cm. | ( 1.905 cm. or 3/4 in. ) |
| $L_2$ = | 4.99 cm. | ( 5.08 cm. or 2.0 in. ) |
| $D_T$ = | 0.961 cm. | ( 3/8 in. ) |
| A = | 2.25 cm. | ( $2.1\ D_T \le A \le 3D_T$ ) |
| $A/2D_T$ = | 1.171 cm. | ( $1.05\ P_A / D_T \le A \le 1.5$ ) |

**Pitot Tube Validations and Engles measurement Result**

☑ : Measure Result after Maintanance and Adjustable




| $P_B$ Size | | | Standard Range |
|---|---|---|---|
| $\alpha_1$ | = | -0.20 ° | ≤ 10° |
| $\beta_1$ | = | -0.20 ° | ≤ 5° |
| $P_A$ Size | | | |
| $\alpha_2$ | = | 1.00 ° | ≤ 10° |
| $\beta_2$ | = | 0.40 ° | ≤ 5° |

| Engles measurement | | Calculated Result | Standard Range |
|---|---|---|---|
| W = | -1.10 ° | -0.043 cm. | W < 0.08 cm ( 1/32 in. ) |
| Z = | 0.60 ° | 0.024 cm. | Z < 0.032 cm ( 1/8 in. ) |

Can be use **0.84** for Cp(s) if the type of face-opening misafgnment show above with not affect the base line value of Cp(s) Solong as standard range

Validation By: Pattarapon P. Appproved By: K Date: 29 Aug 23

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# neediss Console Sensor Audit QA Sheet

| Meter Console Information (UUT) | |
|---|---|
| Model #: | XC-572-OV |
| Serial #: | 1204012 |
| Units: | Metric |

| Calibration Conditions | |
|---|---|
| Pbar (mm. Hg): | 756.8 |
| Humidity (%): | 51.0 |
| Amb. Temp. (°C): | 24.7 |
| Altitude (m): | 1.8 |
| Corrected Pbar (mm. Hg): | 756.7 |

| Reference Devices | |
|---|---|
| TC Simulator Model: | CC-VTR-SH |
| Reference #: | 91109269 |
| Barometer Model: | 369307 |
| Reference #: | EBARODIALSPE01 |
| Digital Pressure Calibrator Model: | 718 30G |
| Reference #: | 9543013 |

**Audit Data**

| Reference Point | Reference Temp. | Thermocouple Probe Audit | | | | | | Reference Point Status[1] |
|---|---|---|---|---|---|---|---|---|
| | | Aux | Stack | Probe | Oven | Filter | Exit | |
| | °C | °C | °C | °C | °C | °C | °C | *Pass/Fail* |
| Ambient | 24.7 | 25 | 25 | 25 | 25 | 25 | 25 | PASS |
| Ice Water | 0.9 | 1 | 1 | 1 | 1 | 1 | 1 | PASS |

**Audit Data**

| Console Vacuum Audit | | | |
|---|---|---|---|
| Reference Point | Reference Vacuum | Console Vacuum | Reference Point Status[3] |
| # | *in. Hg* | *in. Hg* | *Pass/Fail* |
| 1 | 17.0 | 17.0 | PASS |

Calibrate By: Pattarapon P. Appproved By: K Date: 29 Aug 23

**Notes**

[1]For valid test results, the maximum difference between test and reference readings should be less than 5.4 °F (3 °C), for all thermocouples except for the stack thermocouple which should be less than 1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

[2]For valid test results, the maximum difference between console and reference barometric pressure readings should be less than 0.1 in. Hg (2.5 mm Hg), (EPA Method 5, Section 6.1.2)

[3]For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (12.5 mm Hg)

I certify that the above Thermocouple, Barometric, and Vacuum Sensors were calibrated and audited in accordance with US EPA Methods, CFR 40 Part 60.

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Neediss Supply Instrument Co.,Ltd.

**Sartorius (Thailand) Co., Ltd.**
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com

NSC-TISI-TIS 17025
CALIBRATION No.0426

SARTORIUS

# Certificate of Calibration

| | | | |
|---|---|---|---|
| Model Number : | BP210D | Certificate No. : | 22BNA0225 |
| Description : | Semi-micro Balance | Issued Date : | Thursday, November 10, 2022 |
| Serial Number : | 70406076 | Reference No. : | 196389 |
| Manufacturer : | Sartorius | Page No. : | 1 0f 2 |

Customer Name : Health & Envitech Co.,Ltd.
77/11 Moo 2, Ngamwangwan Rd., Soi 5, T.Bangkhen, A.Muang, Nonthaburi 11000

Calibrated Place : Health & Envitech Co.,Ltd.
Weighing Room

Calibrated By : Mr.Nathapol Aeimjangpun
Calibration Date : Tuesday, November 08, 2022

Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 :2019

*Metrological data :*
Capacity : 60/210 g Readability : 0.01/0.1 mg

*Ambients Conditions:*

| | | | |
|---|---|---|---|
| Temperature : | 25.8 °C | ± | 5.0 °C |
| Humidity : | 40.2 % RH | ± | 10.0 % RH |
| Pressure | – | ± | – |

*Reasons for calibration*
☐ New Installation ☐ Service / Repaired ☑ Re-calibration/ Maintenance

*Equipment Condition:* ☑ Good Operate ☐ Fair

## Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

## Traceability:

| Model Number | Description | Traceability | Cetificate No. | Due Date |
|---|---|---|---|---|
| YCS011-612-00 | Sartorius weight set 1mg - 1kg E2,YCS011-612-00 | DKSH | C02222038 | 29-Sep-2024 |
| 608H1 | Thermo-Hygrometer , Testo 608-H1 | SPC-RT | C19210657 | 14-Dec-2022 |
| | | | | |

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

SOP FM-33 03 February 2022

Mr.Chonchai Inthana (Technical Manager)

STAMP

SARTORIUS (THAILAND) CO., LTD. ISO/IEC 17025 Cert no. 2360 / 0229

9.16/52

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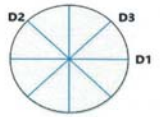
# Nozzle Validation

| Samplig System Equipment Information | |
|---|---|
| Console Model | XC-572-OV |
| Console Number | 1204012 |
| DGM Model | G1.6 |
| DGM Number | 2012-006454 |

| Validation Conditions | | |
|---|---|---|
| Digital Calipers | CD-15APX | |
| Reference No | A22070181 | |
| Temperatute | 24.7 | °C±3 |
| Barometric Pressure | 756.8 | mm Hg |

| Validation Data | | | | | Results | |
|---|---|---|---|---|---|---|
| Nozzle ID | Nozzle Diameter | | | | Different | ( $D_1 + D_2 + D_3$ ) / 3 |
| Sizes | | $D_1$ | $D_2$ | $D_3$ | ΔD | Davg |
| | mm | mm | mm | mm | mm | mm |
| **4** | **3.17** | 3.16 | 3.16 | 3.16 | 0.000 | 3.160 |
| **6** | **4.77** | 4.73 | 4.73 | 4.74 | 0.006 | 4.733 |
| **8** | **6.35** | 6.34 | 6.35 | 6.35 | 0.006 | 6.347 |
| **10** | **7.92** | 7.91 | 7.90 | 7.90 | 0.006 | 7.903 |
| **12** | **9.52** | 9.47 | 9.47 | 9.47 | 0.000 | 9.470 |
| **14** | **11.09** | 11.04 | 11.04 | 11.02 | 0.012 | 11.033 |
| **16** | **12.70** | 12.70 | 12.70 | 12.70 | 0.000 | 12.700 |

Where :
D1, D2, D3 = There difference nozzle diamiters , mm ; diameter must be within 0.025 mm
Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm
D avg = ( $D_1 + D_2 + D_3$ ) / 3




Validation By: Appproved By: Date: 29 Aug 23

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*TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT*

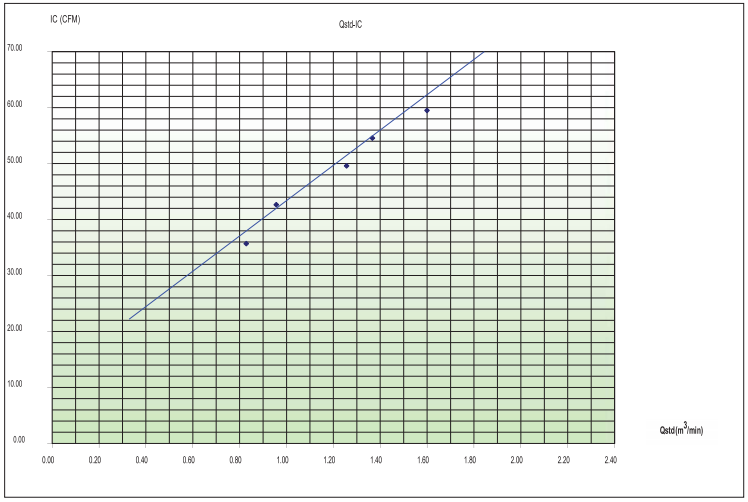
| | | | | | |
|---|---|---|---|---|---|
| ***Sampler Location*** | | | | ***Date*** | October 25, 2023 |
| Project Site | | | | ***Start Time*** | 1:45 PM |
| Sampler Number | TSP No.1067 | Transfer Standard Type | Orifice | ***Stop Time*** | 2:00 PM |
| Motor Serial Number | TSP No.1067 | Calibrator Model | 25A | | |
| Recorder Serial Number | - | Calibrator Serial Number | 307N | ***Person*** | Mr.Patsakron Monthong |

| Plate No. | (Delta H) Pressure Drop Across Orifice (inH$_2$O) | | | ( A ) [$\Delta$H2O/(Pa/P$_{std}$)(T$_{std}$/Ta)]$^{1/2}$ | ( X ) Qstd = ( 1/m[(A- b)] ( m$^3$/min ) | ( I ) ample Flow Rate Indicato ( ft$^3$/min ) | ( Y ) IC = [(Pa/P$_{std}$)(T$_{std}$/Ta)]$^{1/2}$ | Temperature (°K = °C+273) | Barometric Pressure ( mmHg ) | Start Meter | Stop Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Positive | Negative | $\Delta$H2O | | | | | | | | |
| 5 | 1.5 | 1.4 | 2.9 | 1.67716 | 0.82804 | 36.0 | 35.70 | 303.0 | 760.0 | | |
| 7 | 2.0 | 1.8 | 3.8 | 1.94082 | 0.95581 | 43.0 | 42.64 | 303.0 | 760.0 | | |
| 10 | 3.4 | 3.3 | 6.7 | 2.58124 | 1.26946 | 50.0 | 49.59 | 303.0 | 760.0 | | |
| 13 | 4.0 | 3.9 | 7.9 | 2.78743 | 1.36809 | 55.0 | 54.54 | 303.0 | 760.0 | | |
| 18 | 5.5 | 5.4 | 10.9 | 3.28981 | 1.59972 | 60.0 | 59.50 | 303.0 | 760.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | Average | 303.0 | 760.0 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Slope ( m ) | 2.06353 | Linear Equation | | $r^2$ | 0.999555 | Pstd(mmHg) 760.0 |
| 2 | Intercept ( b ) | -0.03151 | Set Point Flow Rate ( X ) (m$^3$/min) | 1.133 | r | 0.9997775 | $T_{NTP}$ 298.0 |
| 3 | Correlation Coefficient ( r ) | 0.99993 | Final Set Flow Rate = ( I ) | 0 | (Pa/Pstd)(Tstd/Ta) | | 0.983491835 |
| Result | | | | | Ch=(Pa/Pstd)(Tstd/Ta)^0.5 | | 0.991714853 |

COMMENT

Andersen Instruments, Inc.




Calibrated by: .....

MR. PATSAKRON MONTHONG

*The end of calibration certificate.*



**Sartorius (Thailand) Co., Ltd.**
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

# Certificate of Calibration

| | | | |
|---|---|---|---|
| Model Number : | BP210D | Certificate No. : | 22BNA0225 |
| Description : | Semi-micro Balance | Issued Date : | Thursday, November 10, 2022 |
| Serial Number : | 70406076 | Reference No. : | 196389 |
| Manufacturer : | Sartorius | Page No. : | 2 of 2 |

## Calibration Results : Without Adjustment

### Repeatability

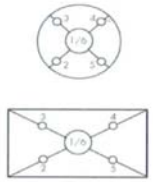
*The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.*

| | | |
|---|---|---|
| Nominal Value : (Low Load) 20 g | 19.99998 | 199.9999 |
| | 19.99998 | 200.0000 |
| Tolerance 0.0001 g | 19.99999 | 199.9999 |
| | 19.99999 | 199.9999 |
| | 19.99998 | 200.0000 |
| Nominal Value : (High Load) 200 g | 19.99996 | 200.0000 |
| | 19.99996 | 199.9999 |
| Tolerance 0.0001 g | 19.99998 | 199.9998 |
| | 19.99998 | 199.9999 |
| | 19.99998 | 199.9998 |
| *Standard Deviation* | 0.00001 | 0.00007 |

### Eccentricity (Off-center loading error)

*The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximim capacity, placed in the middle of the weighing pan and between each of four additional measurement points ( positions defined according to OIML R76).*

Nominal value : 100 g
Tolerance *0.0004* g



| | Difference |
|---|---|
| 1 | - |
| 2 | -0.0002 |
| 3 | -0.0002 |
| 4 | 0.0000 |
| 5 | -0.0001 |
| 6 | - |

### Linearity

*The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.*

Tolerance *0.0002* g

| Nominal Value (g) | Conventional Mass Value (g) | Displayed Value (g) | Deviation (g) | Uncertainty (g) |
|---|---|---|---|---|
| 0.001 | 0.00100 | 0.00100 | 0.00000 | 0.00018 |
| 0.01 | 0.01000 | 0.01001 | 0.00001 | 0.00018 |
| 0.1 | 0.10000 | 0.10000 | 0.00000 | 0.00018 |
| 1 | 1.00001 | 1.00001 | 0.00000 | 0.00018 |
| 2 | 2.00001 | 2.00001 | 0.00000 | 0.00018 |
| 5 | 4.99999 | 5.00000 | 0.00001 | 0.00018 |
| 10 | 10.00000 | 10.00001 | 0.00001 | 0.00018 |
| 50 | 49.99999 | 49.99999 | 0.00000 | 0.00019 |
| 100 | 99.9999 | 100.0000 | 0.0001 | 0.00020 |
| 200 | 199.9999 | 199.9999 | 0.0000 | 0.00029 |

## TSP10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

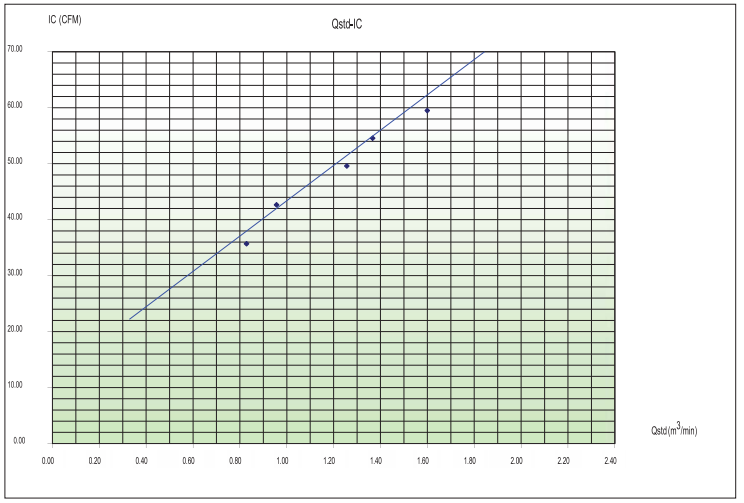
| | | | | | |
|---|---|---|---|---|---|
| **Sampler Location** | | | | **Date** | October 25, 2023 |
| Project Site | | | | **Start Time** | 10:45 AM |
| Sampler Number | TSP10 No.1068 | Transfer Standard Type | Orifice | **Stop Time** | 10:55 AM |
| Motor Serial Number | TSP10 No.1068 | Calibrator Model | 25A | | |
| Recorder Serial Number | - | Calibrator Serial Number | 3077N | **Person** | Mr.Patsakron Monthong |

| Plate No. | (Delta H) Pressure Drop Across Orifice ($inH_2O$) | | | ( A ) $[\Delta H2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | ( X ) Qstd = (1/m)[(A-b)] | ( I ) ample Flow Rate Indicato | ( Y ) IC = $[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ | Temperature | Barometric Pressure | Start Meter | Stop Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Positive | Negative | $\Delta H_2O$ | | ( $m^3$/min ) | ( $ft^3$/min ) | | (°K = °C+273) | ( mmHg ) | | |
| 5 | 1.9 | 1.8 | 3.7 | 1.91163 | 0.94168 | 32.0 | 31.27 | 305.0 | 760.0 | | |
| 7 | 2.8 | 2.7 | 5.5 | 2.32655 | 1.14273 | 42.0 | 41.52 | 305.0 | 760.0 | | |
| 10 | 4.0 | 3.9 | 7.9 | 2.76945 | 1.35731 | 52.0 | 51.40 | 305.0 | 760.0 | | |
| 13 | 5.3 | 5.2 | 10.5 | 3.20449 | 1.56819 | 58.0 | 57.33 | 305.0 | 760.0 | | |
| 18 | 6.4 | 6.3 | 12.7 | 3.52373 | 1.72304 | 62.0 | 61.28 | 305.0 | 760.0 | | |
| Linear Regression Y ON X : Y= mX + b | | | | | | | **Average** | 305.0 | 760.0 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Slope ( m ) | 2.0635 | Linear Equation | | | $r^2$ | 0.982631 | Pstd(mmHg) | 760.0 |
| 2 | Intercept ( b ) | -0.03151 | Set Point Flow Rate ( X ) ($m^3$/min ) | 1.133 | | r | 0.991277 46 | $T_{NTP}$ | 298.0 |
| 3 | Correlation Coefficient ( r ) | 0.999893 | Final Set Flow Rate = ( I ) | 0 | | (Pa/Pstd)*(Tstd/Ta) | | 0.977049 18 | |
| Result | | | | | | C=(Pa/Pstd)*(Tstd/Ta)^0.5 | | 0.988457 681 | |

COMMENT

Andersen Instruments, Inc.




Calibrated by: .....

MR. PATSAKRON MONTHONG

*The end of calibration certificate.*