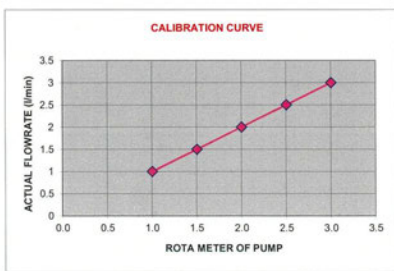


ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน)

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 001/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|-----------------------|-------------------------|----------------------|----------------------------------|-----------------|----------------------|----------------------------------|-----------------|---|---|---|---------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 001 MODEL : GILAIR - 5RP SERIAL NO : 16064 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 10 / JAN / 2023 NEXT DUE TIME : 10 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.004</td> <td>1.002</td> <td>1.006</td> <td>1.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.505</td> <td>1.501</td> <td>1.508</td> <td>1.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.006</td> <td>2.004</td> <td>2.002</td> <td>2.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.502</td> <td>2.506</td> <td>2.508</td> <td>2.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.004</td> <td>3.002</td> <td>3.006</td> <td>3.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | 1 | 2 | 3 | AVERAGE | 1 | 1.004 | 1.002 | 1.006 | 1.004 | 0.004 | ± 0.03 | PASS | 1.5 | 1.505 | 1.501 | 1.508 | 1.505 | 0.005 | ± 0.03 | PASS | 2 | 2.006 | 2.004 | 2.002 | 2.004 | 0.004 | ± 0.03 | PASS | 2.5 | 2.502 | 2.506 | 2.508 | 2.505 | 0.005 | ± 0.03 | PASS | 3 | 3.004 | 3.002 | 3.006 | 3.004 | 0.004 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.002 | 1.006 | 1.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.505 | 1.501 | 1.508 | 1.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.006 | 2.004 | 2.002 | 2.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.502 | 2.506 | 2.508 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.004 | 3.002 | 3.006 | 3.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 003/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|-----------------------|-------------------------|----------------------|----------------------------------|-----------------|----------------------|----------------------------------|-----------------|---|---|---|---------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 003 MODEL : GILAIR - 5RP SERIAL NO : 15945 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 10 / JAN / 2023 NEXT DUE TIME : 10 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.004</td> <td>1.008</td> <td>1.010</td> <td>1.007</td> <td>0.007</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.508</td> <td>1.506</td> <td>1.504</td> <td>1.506</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.002</td> <td>2.006</td> <td>2.008</td> <td>2.005</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.506</td> <td>2.504</td> <td>2.510</td> <td>2.507</td> <td>0.007</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.006</td> <td>3.004</td> <td>3.005</td> <td>3.005</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | 1 | 2 | 3 | AVERAGE | 1 | 1.004 | 1.008 | 1.010 | 1.007 | 0.007 | ± 0.03 | PASS | 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS | 2 | 2.002 | 2.006 | 2.008 | 2.005 | 0.005 | ± 0.03 | PASS | 2.5 | 2.506 | 2.504 | 2.510 | 2.507 | 0.007 | ± 0.03 | PASS | 3 | 3.006 | 3.004 | 3.005 | 3.005 | 0.005 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.008 | 1.010 | 1.007 | 0.007 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.002 | 2.006 | 2.008 | 2.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.506 | 2.504 | 2.510 | 2.507 | 0.007 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.006 | 3.004 | 3.005 | 3.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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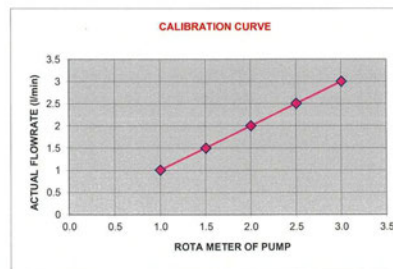
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(ENGINEER / SUPERVISOR)

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APPROVED BY :
(SECTION MANAGER)

10 / 1 / 66



CAL BY :

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CHECKED BY :
(ENGINEER / SUPERVISOR)

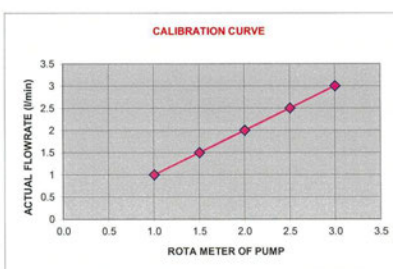
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APPROVED BY :
(SECTION MANAGER)

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| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 002/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|-----------------------|-------------------------|----------------------|----------------------------------|-----------------|----------------------|----------------------------------|-----------------|---|---|---|---------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 002 MODEL : GILAIR - 5RP SERIAL NO : 15944 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 10 / JAN / 2023 NEXT DUE TIME : 10 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th rowspan="2">DEVIATION (l/min)</th> <th rowspan="2">PERMISSIBLE DEVIATION (l/min)</th> <th rowspan="2">PASS / NOT PASS</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.008</td> <td>1.004</td> <td>1.004</td> <td>1.005</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.505</td> <td>1.506</td> <td>1.504</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.005</td> <td>2.006</td> <td>2.002</td> <td>2.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.508</td> <td>2.502</td> <td>2.504</td> <td>2.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.001</td> <td>3.004</td> <td>3.008</td> <td>3.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | 1 | 2 | 3 | AVERAGE | 1 | 1.008 | 1.004 | 1.004 | 1.005 | 0.005 | ± 0.03 | PASS | 1.5 | 1.502 | 1.505 | 1.506 | 1.504 | 0.004 | ± 0.03 | PASS | 2 | 2.005 | 2.006 | 2.002 | 2.004 | 0.004 | ± 0.03 | PASS | 2.5 | 2.508 | 2.502 | 2.504 | 2.505 | 0.005 | ± 0.03 | PASS | 3 | 3.001 | 3.004 | 3.008 | 3.004 | 0.004 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.008 | 1.004 | 1.004 | 1.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.502 | 1.505 | 1.506 | 1.504 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.005 | 2.006 | 2.002 | 2.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.508 | 2.502 | 2.504 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.001 | 3.004 | 3.008 | 3.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 004/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|-----------------------|-------------------------|----------------------|----------------------------------|-----------------|----------------------|----------------------------------|-----------------|---|---|---|---------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 004 MODEL : GILAIR - 5RP SERIAL NO : 15946 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 10 / JAN / 2023 NEXT DUE TIME : 10 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.002 | 1.008 | 1.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.508 | 1.504 | 1.506 | 1.506 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.004 | 2.008 | 2.002 | 2.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.505 | 2.502 | 2.510 | 2.505 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.006 | 3.001 | 3.008 | 3.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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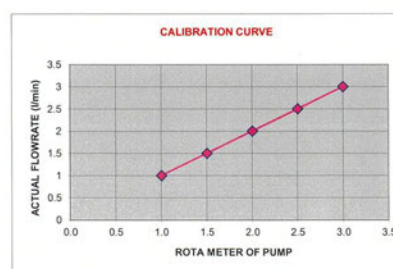
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CHECKED BY :
(ENGINEER / SUPERVISOR)

10 / 1 / 66

APPROVED BY :
(SECTION MANAGER)

10 / 1 / 66



CAL BY :
(TECHNICIAN)

10 / 1 / 66

CHECKED BY :
(ENGINEER / SUPERVISOR)

10 / 1 / 66

APPROVED BY :
(SECTION MANAGER)

10 / 1 / 66

| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 005/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 005
 MODEL : GILAIR - 5RP
 SERIAL NO : 15947
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DATE : 10 / JAN / 2023
 NEXT DUE TIME : 10 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.010 | 1.008 | 1.006 | 1.008 | 0.008 | ± 0.03 | PASS |
| 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS |
| 2 | 2.005 | 2.006 | 2.008 | 2.006 | 0.006 | ± 0.03 | PASS |
| 2.5 | 2.508 | 2.504 | 2.508 | 2.507 | 0.007 | ± 0.03 | PASS |
| 3 | 3.010 | 3.008 | 3.006 | 3.008 | 0.008 | ± 0.03 | PASS |

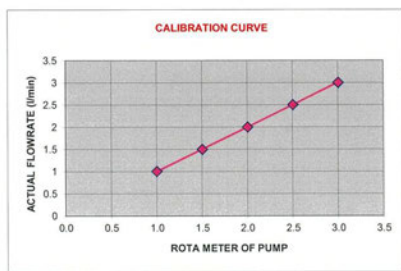
| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 007/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 007
 MODEL : GILAIR - 5RP
 SERIAL NO : 15950
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DATE : 11 / JAN / 2023
 NEXT DUE TIME : 11 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

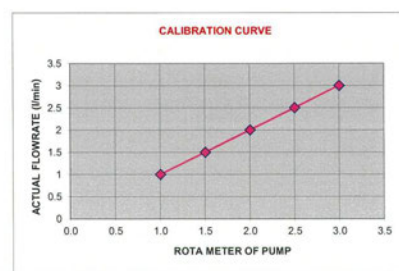
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.006 | 1.008 | 1.004 | 1.006 | 0.006 | ± 0.03 | PASS |
| 1.5 | 1.508 | 1.502 | 1.505 | 1.505 | 0.005 | ± 0.03 | PASS |
| 2 | 2.006 | 2.004 | 2.005 | 2.005 | 0.005 | ± 0.03 | PASS |
| 2.5 | 2.506 | 2.504 | 2.508 | 2.506 | 0.006 | ± 0.03 | PASS |
| 3 | 3.004 | 3.008 | 3.004 | 3.005 | 0.005 | ± 0.03 | PASS |



CAL BY : [REDACTED]
 (TECHNICIAN)
 10 / 1 / 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 10 / 1 / 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 10 / 1 / 66



CAL BY : [REDACTED]
 (TECHNICIAN)
 11 / 1 / 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 11 / 1 / 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 11 / 1 / 66

| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 006/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 006
 MODEL : GILAIR - 5RP
 SERIAL NO : 15948
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DATE : 11 / JAN / 2023
 NEXT DUE TIME : 11 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.004 | 1.002 | 1.006 | 1.004 | 0.004 | ± 0.03 | PASS |
| 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS |
| 2 | 2.004 | 2.008 | 2.002 | 2.005 | 0.005 | ± 0.03 | PASS |
| 2.5 | 2.505 | 2.504 | 2.508 | 2.506 | 0.006 | ± 0.03 | PASS |
| 3 | 3.002 | 3.004 | 3.006 | 3.004 | 0.004 | ± 0.03 | PASS |

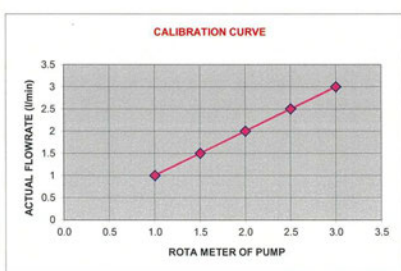
| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 008/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 008
 MODEL : GILAIR - 5RP
 SERIAL NO : 20041202016
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DAT : 11 / JAN / 2023
 NEXT DUE TIME : 11 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

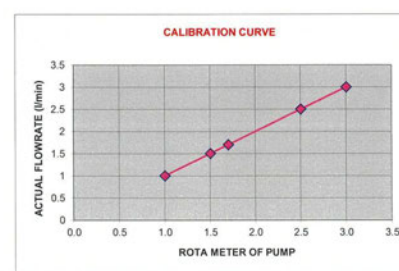
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.005 | 1.004 | 1.006 | 1.005 | 0.005 | ± 0.03 | PASS |
| 1.5 | 1.506 | 1.504 | 1.508 | 1.506 | 0.006 | ± 0.03 | PASS |
| 1.7 | 1.708 | 1.702 | 1.706 | 1.705 | 0.005 | ± 0.03 | PASS |
| 2.5 | 2.502 | 2.506 | 2.505 | 2.504 | 0.004 | ± 0.03 | PASS |
| 3 | 3.005 | 3.006 | 3.004 | 3.005 | 0.005 | ± 0.03 | PASS |



CAL BY : [REDACTED]
 (TECHNICIAN)
 11 / 1 / 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 11 / 1 / 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 11 / 1 / 66



CAL BY : [REDACTED]
 (TECHNICIAN)
 11 / 1 / 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 11 / 1 / 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 11 / 1 / 66

| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 009/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 009
 MODEL : GILAIR - 5RP
 SERIAL NO : 1000
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DAT : 11 / JAN / 2023
 NEXT DUE TIME : 11 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.001 | 1.002 | 1.008 | 1.004 | 0.004 | ± 0.03 | PASS |
| 1.5 | 1.502 | 1.506 | 1.502 | 1.503 | 0.003 | ± 0.03 | PASS |
| 1.7 | 1.704 | 1.702 | 1.706 | 1.704 | 0.004 | ± 0.03 | PASS |
| 2.5 | 2.502 | 2.506 | 2.501 | 2.503 | 0.003 | ± 0.03 | PASS |
| 3 | 3.004 | 3.002 | 3.006 | 3.004 | 0.004 | ± 0.03 | PASS |

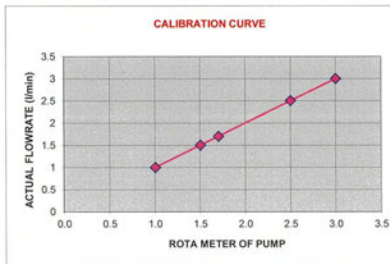
| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 011/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 011
 MODEL : GILAIR - 5RP
 SERIAL NO : 1008
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DAT : 12 / JAN / 2023
 NEXT DUE TIME : 12 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

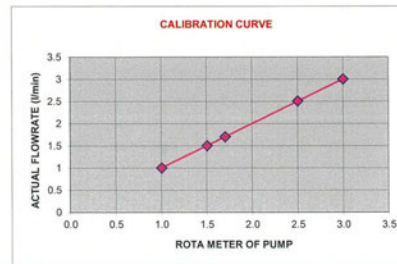
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.006 | 1.004 | 1.004 | 1.005 | 0.005 | ± 0.03 | PASS |
| 1.5 | 1.510 | 1.504 | 1.506 | 1.507 | 0.007 | ± 0.03 | PASS |
| 1.7 | 1.708 | 1.704 | 1.704 | 1.705 | 0.005 | ± 0.03 | PASS |
| 2.5 | 2.506 | 2.508 | 2.504 | 2.506 | 0.006 | ± 0.03 | PASS |
| 3 | 3.004 | 3.006 | 3.004 | 3.005 | 0.005 | ± 0.03 | PASS |



CAL BY : [REDACTED]
 (TECHNICIAN)
 11 1 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 11 1 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 11 1 66



CAL BY : [REDACTED]
 (TECHNICIAN)
 12 1 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 12 1 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 12 1 66

| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 010/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 010
 MODEL : GILAIR - 5RP
 SERIAL NO : 1007
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DAT : 11 / JAN / 2023
 NEXT DUE TIME : 11 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.002 | 1.006 | 1.005 | 1.004 | 0.004 | ± 0.03 | PASS |
| 1.5 | 1.508 | 1.506 | 1.502 | 1.505 | 0.005 | ± 0.03 | PASS |
| 1.7 | 1.702 | 1.702 | 1.708 | 1.704 | 0.004 | ± 0.03 | PASS |
| 2.5 | 2.506 | 2.508 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS |
| 3 | 3.001 | 3.006 | 3.004 | 3.004 | 0.004 | ± 0.03 | PASS |

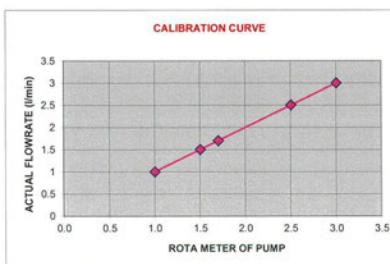
| | | |
|--|--|------------|
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 012/66 |
| | | PAGE 1/1 |

INSTRUMENT NAME : WORKING AREA DUST SAMPLER
 INSTRUMENT CODE : Q1300 / 01 / 023 / 012
 MODEL : GILAIR - 5RP
 SERIAL NO : 1009
 PARAMETER RANGE : 1 - 3 L / MIN
 CAL DAT : 12 / JAN / 2023
 NEXT DUE TIME : 12 / JUL / 2023

STRANDARD USED : AMBIENT CONDITIONS :
 PRIMARY FLOW STANDARD (DRY CELL) TEMPERATURE (°C) : 25 °C

CALIBRATION DATA :

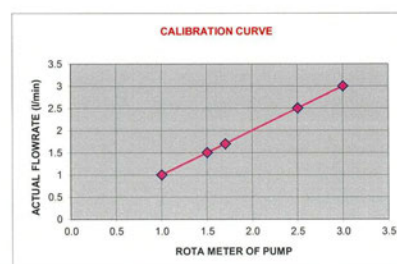
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS |
|-----------------------|-------------------------|-------|-------|---------|----------------------|----------------------------------|-----------------|
| | 1 | 2 | 3 | AVERAGE | | | |
| 1 | 1.002 | 1.006 | 1.002 | 1.003 | 0.003 | ± 0.03 | PASS |
| 1.5 | 1.501 | 1.504 | 1.506 | 1.504 | 0.004 | ± 0.03 | PASS |
| 1.7 | 1.706 | 1.701 | 1.704 | 1.704 | 0.004 | ± 0.03 | PASS |
| 2.5 | 2.502 | 2.506 | 2.501 | 2.503 | 0.003 | ± 0.03 | PASS |
| 3 | 3.004 | 3.001 | 3.006 | 3.004 | 0.004 | ± 0.03 | PASS |



CAL BY : [REDACTED]
 (TECHNICIAN)
 11 1 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 11 1 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 11 1 66



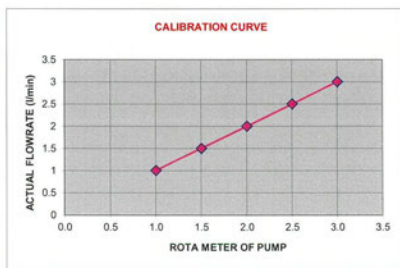
CAL BY : [REDACTED]
 (TECHNICIAN)
 12 1 66

CHECKED BY : [REDACTED]
 (ENGINEER / SUPERVISOR)
 12 1 66

APPROVED BY : [REDACTED]
 (SECTION MANAGER)
 12 1 66

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 013/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 013 MODEL : GILAIR - 5RP SERIAL NO : 1010 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 12 / JAN / 2023 NEXT DUE TIME : 12 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.010</td> <td>1.002</td> <td>1.008</td> <td>1.007</td> <td>0.007</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.508</td> <td>1.506</td> <td>1.504</td> <td>1.506</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.010</td> <td>2.002</td> <td>2.004</td> <td>2.005</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.505</td> <td>2.508</td> <td>2.502</td> <td>2.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.004</td> <td>3.006</td> <td>3.008</td> <td>3.006</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.010 | 1.002 | 1.008 | 1.007 | 0.007 | ± 0.03 | PASS | 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS | 2 | 2.010 | 2.002 | 2.004 | 2.005 | 0.005 | ± 0.03 | PASS | 2.5 | 2.505 | 2.508 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS | 3 | 3.004 | 3.006 | 3.008 | 3.006 | 0.006 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.010 | 1.002 | 1.008 | 1.007 | 0.007 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.508 | 1.506 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.010 | 2.002 | 2.004 | 2.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.505 | 2.508 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.004 | 3.006 | 3.008 | 3.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

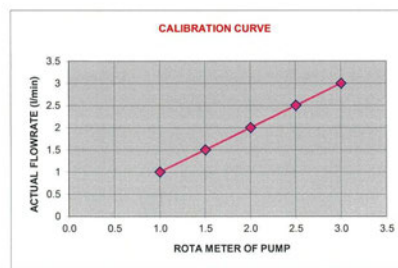
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 017/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 017 MODEL : GILAIR - 5RP SERIAL NO : 20071202002 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 13 / JAN / 2023 NEXT DUE TIME : 13 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.010</td> <td>1.006</td> <td>1.002</td> <td>1.006</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.504</td> <td>1.506</td> <td>1.510</td> <td>1.507</td> <td>0.007</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.010</td> <td>2.006</td> <td>2.002</td> <td>2.006</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.508</td> <td>2.504</td> <td>2.508</td> <td>2.507</td> <td>0.007</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.004</td> <td>3.006</td> <td>3.008</td> <td>3.006</td> <td>0.006</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.010 | 1.006 | 1.002 | 1.006 | 0.006 | ± 0.03 | PASS | 1.5 | 1.504 | 1.506 | 1.510 | 1.507 | 0.007 | ± 0.03 | PASS | 2 | 2.010 | 2.006 | 2.002 | 2.006 | 0.006 | ± 0.03 | PASS | 2.5 | 2.508 | 2.504 | 2.508 | 2.507 | 0.007 | ± 0.03 | PASS | 3 | 3.004 | 3.006 | 3.008 | 3.006 | 0.006 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.010 | 1.006 | 1.002 | 1.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.504 | 1.506 | 1.510 | 1.507 | 0.007 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.010 | 2.006 | 2.002 | 2.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.508 | 2.504 | 2.508 | 2.507 | 0.007 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.004 | 3.006 | 3.008 | 3.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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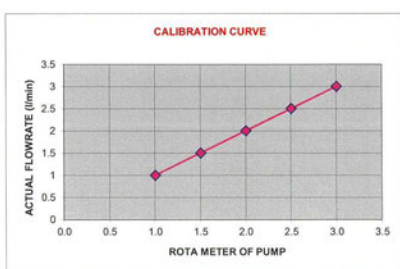
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| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 016/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 016 MODEL : GILAIR - 5RP SERIAL NO : 20071202001 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 12 / JAN / 2023 NEXT DUE TIME : 12 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.002</td> <td>1.004</td> <td>1.005</td> <td>1.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.506</td> <td>1.508</td> <td>1.501</td> <td>1.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.002</td> <td>2.004</td> <td>2.006</td> <td>2.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.504</td> <td>2.504</td> <td>2.506</td> <td>2.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.001</td> <td>3.008</td> <td>3.002</td> <td>3.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.002 | 1.004 | 1.005 | 1.004 | 0.004 | ± 0.03 | PASS | 1.5 | 1.506 | 1.508 | 1.501 | 1.505 | 0.005 | ± 0.03 | PASS | 2 | 2.002 | 2.004 | 2.006 | 2.004 | 0.004 | ± 0.03 | PASS | 2.5 | 2.504 | 2.504 | 2.506 | 2.505 | 0.005 | ± 0.03 | PASS | 3 | 3.001 | 3.008 | 3.002 | 3.004 | 0.004 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.002 | 1.004 | 1.005 | 1.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.506 | 1.508 | 1.501 | 1.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.002 | 2.004 | 2.006 | 2.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.504 | 2.504 | 2.506 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.001 | 3.008 | 3.002 | 3.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

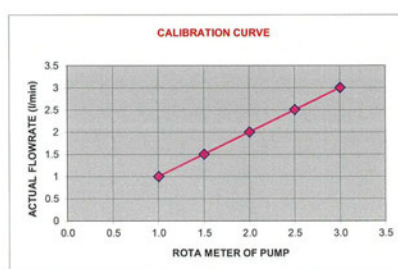
| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 018/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 018 MODEL : GILAIR - 5RP SERIAL NO : 20071202003 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 13 / JAN / 2023 NEXT DUE TIME : 13 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.004 | 1.008 | 1.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.506 | 1.502 | 1.504 | 1.504 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.004 | 2.008 | 2.001 | 2.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.506 | 2.504 | 2.502 | 2.504 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.008 | 3.002 | 3.006 | 3.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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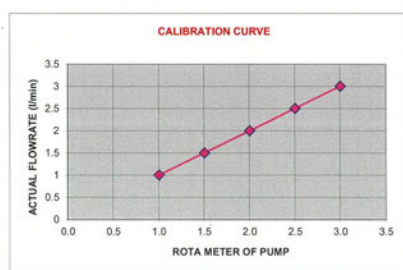


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| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 019/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 019 MODEL : GILAIR - 5RP SERIAL NO : 20071202004 PARAMETER RANGE : 1 - 3 L / MIN CAL DATE : 13 / JAN / 2023 NEXT DUE TIME : 13 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.008 | 1.006 | 1.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.508 | 1.505 | 1.504 | 1.506 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.006 | 2.004 | 2.005 | 2.005 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.508 | 2.504 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.005 | 3.004 | 3.008 | 3.006 | 0.006 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

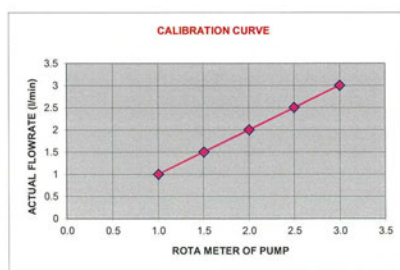


CAL BY : [REDACTED]
(TECHNICIAN)
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CHECKED BY : [REDACTED]
(ENGINEER / SUPERVISOR)
13 / 1 / 66

APPROVED BY : [REDACTED]
(SECTION MANAGER)
13 / 1 / 66

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 021/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 021 MODEL : GILAIR - 5RP SERIAL NO : 20160201017 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 16 / JAN / 2023 NEXT DUE TIME : 16 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.000</td> <td>1.004</td> <td>1.002</td> <td>1.002</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.502</td> <td>1.504</td> <td>1.502</td> <td>1.503</td> <td>0.003</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.002</td> <td>2.001</td> <td>2.002</td> <td>2.002</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.504</td> <td>2.502</td> <td>2.501</td> <td>2.502</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.002</td> <td>3.004</td> <td>3.002</td> <td>3.003</td> <td>0.003</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.000 | 1.004 | 1.002 | 1.002 | 0.002 | ± 0.03 | PASS | 1.5 | 1.502 | 1.504 | 1.502 | 1.503 | 0.003 | ± 0.03 | PASS | 2 | 2.002 | 2.001 | 2.002 | 2.002 | 0.002 | ± 0.03 | PASS | 2.5 | 2.504 | 2.502 | 2.501 | 2.502 | 0.002 | ± 0.03 | PASS | 3 | 3.002 | 3.004 | 3.002 | 3.003 | 0.003 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.000 | 1.004 | 1.002 | 1.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.502 | 1.504 | 1.502 | 1.503 | 0.003 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.002 | 2.001 | 2.002 | 2.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.504 | 2.502 | 2.501 | 2.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.002 | 3.004 | 3.002 | 3.003 | 0.003 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

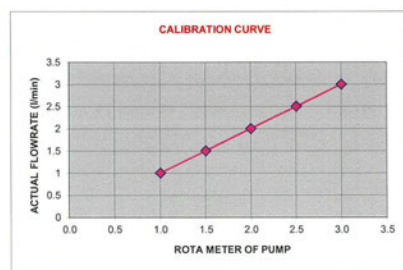


CAL BY : [REDACTED]
(TECHNICIAN)
16 / 1 / 66

CHECKED BY : [REDACTED]
(ENGINEER / SUPERVISOR)
16 / 1 / 66

APPROVED BY : [REDACTED]
(SECTION MANAGER)
16 / 1 / 66

| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 020/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 020 MODEL : GILAIR - 5RP SERIAL NO : 20071202005 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 13 / JAN / 2023 NEXT DUE TIME : 13 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.002</td> <td>1.006</td> <td>1.004</td> <td>1.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.508</td> <td>1.502</td> <td>1.504</td> <td>1.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2</td> <td>2.001</td> <td>2.008</td> <td>2.004</td> <td>2.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.506</td> <td>2.508</td> <td>2.502</td> <td>2.505</td> <td>0.005</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.001</td> <td>3.002</td> <td>3.008</td> <td>3.004</td> <td>0.004</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.002 | 1.006 | 1.004 | 1.004 | 0.004 | ± 0.03 | PASS | 1.5 | 1.508 | 1.502 | 1.504 | 1.505 | 0.005 | ± 0.03 | PASS | 2 | 2.001 | 2.008 | 2.004 | 2.004 | 0.004 | ± 0.03 | PASS | 2.5 | 2.506 | 2.508 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS | 3 | 3.001 | 3.002 | 3.008 | 3.004 | 0.004 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.002 | 1.006 | 1.004 | 1.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.508 | 1.502 | 1.504 | 1.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.001 | 2.008 | 2.004 | 2.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.506 | 2.508 | 2.502 | 2.505 | 0.005 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.001 | 3.002 | 3.008 | 3.004 | 0.004 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

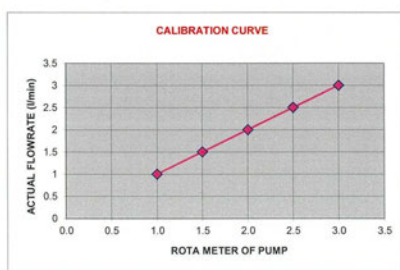


CAL BY : [REDACTED]
(TECHNICIAN)
13 / 1 / 66

CHECKED BY : [REDACTED]
(ENGINEER / SUPERVISOR)
13 / 1 / 66

APPROVED BY : [REDACTED]
(SECTION MANAGER)
13 / 1 / 66


| | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | NO. 022/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|--------------------|-------------------------|-------------------|-------------------------------|-----------------|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 022 MODEL : GILAIR - 5RP SERIAL NO : 20160201018 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 16 / JAN / 2023 NEXT DUE TIME : 16 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.001 | 1.002 | 1.001 | 1.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.500 | 1.504 | 1.502 | 1.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.001 | 2.002 | 2.004 | 2.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.501 | 2.501 | 2.502 | 2.501 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.000 | 3.002 | 3.004 | 3.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |




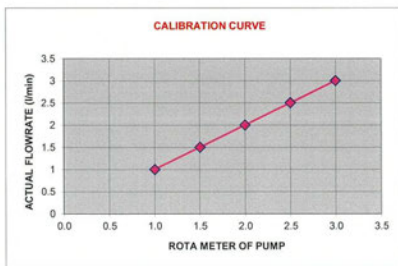
CAL BY : [REDACTED]
(TECHNICIAN)
16 / 1 / 66


CHECKED BY : [REDACTED]
(ENGINEER / SUPERVISOR)
16 / 1 / 66

APPROVED BY : [REDACTED]
(SECTION MANAGER)
16 / 1 / 66

|  | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | | NO. 023/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|------------|--------------------|-------------------------|-------------------------------|-----------------|--|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 023 MODEL : GILAIR - 5RP SERIAL NO : 20160201019 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 16 / JAN / 2023 NEXT DUE TIME : 16 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.001 | 1.002 | 1.000 | 1.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.502 | 1.501 | 1.502 | 1.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2.001 | 2.001 | 2.002 | 2.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.501 | 2.502 | 2.504 | 2.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.000 | 3.001 | 3.002 | 3.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

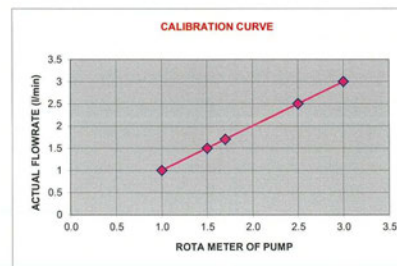
|  | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | | NO. 025/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|------------|--------------------|-------------------------|-------------------------------|-----------------|--|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 025 MODEL : GILAIR - 5RP SERIAL NO : 20160201021 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 16 / JAN / 2023 NEXT DUE TIME : 16 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.004</td> <td>1.001</td> <td>1.002</td> <td>1.002</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.500</td> <td>1.501</td> <td>1.502</td> <td>1.501</td> <td>0.001</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.7</td> <td>1.700</td> <td>1.702</td> <td>1.701</td> <td>1.701</td> <td>0.001</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.501</td> <td>2.504</td> <td>2.502</td> <td>2.502</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.001</td> <td>3.001</td> <td>3.002</td> <td>3.001</td> <td>0.001</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.004 | 1.001 | 1.002 | 1.002 | 0.002 | ± 0.03 | PASS | 1.5 | 1.500 | 1.501 | 1.502 | 1.501 | 0.001 | ± 0.03 | PASS | 1.7 | 1.700 | 1.702 | 1.701 | 1.701 | 0.001 | ± 0.03 | PASS | 2.5 | 2.501 | 2.504 | 2.502 | 2.502 | 0.002 | ± 0.03 | PASS | 3 | 3.001 | 3.001 | 3.002 | 3.001 | 0.001 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.004 | 1.001 | 1.002 | 1.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.500 | 1.501 | 1.502 | 1.501 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.7 | 1.700 | 1.702 | 1.701 | 1.701 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.501 | 2.504 | 2.502 | 2.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.001 | 3.001 | 3.002 | 3.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |





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(TECHNICIAN)


CHECKED BY : 
(ENGINEER)


APPROVED BY : 
(SECTION MANAGER)

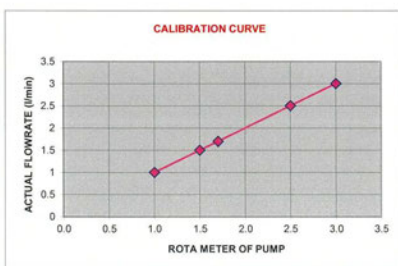



CAL BY : 
(TECHNICIAN)


CHECKED BY : 
(ENGINEER)


APPROVED BY : 
(SECTION MANAGER)

|  | TPI POLENE PUBLIC CO.,LTD. CEMENT QUALITY DEPARTMENT PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL) CERTIFICATE OF CALIBRATION | | NO. 024/66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------------------------|------------|--------------------|-------------------------|-------------------------------|-----------------|--|-------------------|-------------------------------|-----------------|--|---|---|---|---------|--|--|--|---|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|-----|-------|-------|-------|-------|-------|--------|------|---|-------|-------|-------|-------|-------|--------|------|
| | | | PAGE 1/1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTRUMENT NAME : WORKING AREA DUST SAMPLER INSTRUMENT CODE : Q1300 / 01 / 023 / 024 MODEL : GILAIR - 5RP SERIAL NO : 20160201020 PARAMETER RANGE : 1 - 3 L / MIN CAL DAT : 16 / JAN / 2023 NEXT DUE TIME : 16 / JUL / 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STRANDARD USED : | | AMBIENT CONDITIONS : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIMARY FLOW STANDARD (DRY CELL) | | TEMPERATURE (°C) : 25 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CALIBRATION DATA : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ROTA METER OF PUMP</th> <th colspan="4">ACTUAL FLOWRATE (l/min)</th> <th>DEVIATION (l/min)</th> <th>PERMISSIBLE DEVIATION (l/min)</th> <th>PASS / NOT PASS</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>AVERAGE</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1.001</td> <td>1.000</td> <td>1.002</td> <td>1.001</td> <td>0.001</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.5</td> <td>1.504</td> <td>1.501</td> <td>1.502</td> <td>1.502</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>1.7</td> <td>1.701</td> <td>1.701</td> <td>1.704</td> <td>1.702</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>2.5</td> <td>2.502</td> <td>2.501</td> <td>2.500</td> <td>2.501</td> <td>0.001</td> <td>± 0.03</td> <td>PASS</td> </tr> <tr> <td>3</td> <td>3.001</td> <td>3.001</td> <td>3.004</td> <td>3.002</td> <td>0.002</td> <td>± 0.03</td> <td>PASS</td> </tr> </tbody> </table> | | | | ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | 1 | 2 | 3 | AVERAGE | | | | 1 | 1.001 | 1.000 | 1.002 | 1.001 | 0.001 | ± 0.03 | PASS | 1.5 | 1.504 | 1.501 | 1.502 | 1.502 | 0.002 | ± 0.03 | PASS | 1.7 | 1.701 | 1.701 | 1.704 | 1.702 | 0.002 | ± 0.03 | PASS | 2.5 | 2.502 | 2.501 | 2.500 | 2.501 | 0.001 | ± 0.03 | PASS | 3 | 3.001 | 3.001 | 3.004 | 3.002 | 0.002 | ± 0.03 | PASS |
| ROTA METER OF PUMP | ACTUAL FLOWRATE (l/min) | | | | DEVIATION (l/min) | PERMISSIBLE DEVIATION (l/min) | PASS / NOT PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | AVERAGE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1.001 | 1.000 | 1.002 | 1.001 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 1.504 | 1.501 | 1.502 | 1.502 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.7 | 1.701 | 1.701 | 1.704 | 1.702 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 2.502 | 2.501 | 2.500 | 2.501 | 0.001 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 3.001 | 3.001 | 3.004 | 3.002 | 0.002 | ± 0.03 | PASS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



CAL BY : 
(TECHNICIAN)

CHECKED BY : 
(ENGINEER)

APPROVED BY : 
(SECTION MANAGER)

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด

List of Instruments Certification for Air & Noise Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|----------------|---|---|---------------------------|----------------------|--------------------------------------|-------------------|---------------------|-------------------------|--------|
| Stack | | | | | | | | | |
| 1 | Pre-Test Console | Total Suspended Particulate Particular Matter (PM ₁₀) Hydrogen Chloride Lead Cadmium Mercury Dioxin | Apex Instruments, USA. | XC-572-V 0803018 | Envi Equipment Service Co., Ltd. | E22-08038 | 22 Aug 22 | 21 Aug 23 | - |
| 2 | Flue gas Analyzer | Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide | Testo | Testo 350 2376344 | Entech Industrial Sulation Co., Ltd. | G 650522 | 15 Aug 22 | 14 Aug 23 | - |
| Ambient | | | | | | | | | |
| 1 | Sound Level Calibrator (Acoustic Calibrator) | Calibrate Sound Level Meter | Svantek | SV35A 73249 | Innovative Instrument Co.,Ltd. | 22-ACT-406 | 1 Jul 22 | 30 Jun 23 | - |
| 2 | Sound Level Meter | L _{Aeq} 24 hours, L _{Amax} , L _{A90} | Larson Davis | LxT2 0005394 | Innovative Instrument Co.,Ltd. | 22-ACT-034 | 21 Jan 22 | 20 Jan 24 | - |
| 3 | Sound Level Meter | L _{Aeq} 24 hours, L _{Amax} , L _{A90} | Larson Davis | LxT2 0005395 | Innovative Instrument Co.,Ltd. | 22-ACT-247 | 1 Apr 22 | 31 Mar 24 | - |
| 4 | Sound Level Meter | L _{Aeq} 24 hours, L _{Amax} , L _{A90} | Larson Davis | LxT2 0005396 | Innovative Instrument Co.,Ltd. | 22-ACT-105 | 11 Feb 22 | 10 Feb 24 | - |
| 5 | Sound Level Meter | L _{Aeq} 24 hours, L _{Amax} , L _{A90} | Larson Davis | LxT2 0005398 | Innovative Instrument Co.,Ltd. | 22-ACT-035 | 21 Jan 22 | 20 Jan 24 | - |

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|---|--|----------------|---------------------------------|--|-------------------|---------------------|-------------------------|----------|
| Water | | | | | | | | | |
| 1 | pH Meter | pH | Horiba | LAQUA-PH210 HA0D0081 | Technology Promotion Association (Thailand-Japan) | 23CH6 | 5 Jan 23 | 4 Jan 24 | - |
| 2 | DO Meter | DO | Horiba | LAQUA-DO210 HE0H0003 | Technology Promotion Association (Thailand-Japan) | 23TW1 | 5 Jan 23 | 4 Jan 24 | - |
| 3 | Conductivity Meter | Conductivity | Horiba | LAQUA-EC210 HC0J0016 | Technology Promotion Association (Thailand-Japan) | 23CH7 | 5 Jan 23 | 4 Jan 24 | - |
| 4 | pH Meter | ความปั่นกรด-ด่าง (pH) อุณหภูมิ(Temperature) | Mettler-Toledo | Seven Easy S20 / 1231155210 | National Food Institute, Ministry of Industry, Thailand | 2301846-001-01 | 24 Feb 23 | 23 Feb 24 | - |
| 5 | Ion Selective Electrode Meter (ISE) | | Orion | Star A214 / X36836 | Science Tech Co.,Ltd. | FT005/22 | 23 Aug 22 | 22 Aug 23 | - |
| 6 | BOD Incubator | Biochemical Oxygen Demand (BOD) | | UR-1320 / (UAE.WAO.018/2551) | Technology Promotion Association (Thailand-Japan) | 23TM375 | 12 Apr 23 | 10 Apr 24 | - |
| 7 | BOD Incubator | Biochemical Oxygen Demand (BOD) | Arco | UR-1320 / (UAE.WAO.006/2553) | Technology Promotion Association (Thailand-Japan) | 23TM372 | 11 Apr 23 | 9 Apr 24 | - |
| 8 | Analytical Balance (Repeatability 0.1 mg) | น้ำมันและไขมัน (Oil & Grease) | Mettler-Toledo | XSR204 / C117635043 | National Food Institute, Ministry of Industry, Thailand | 2302827-001-01 | 10 May 23 | 8 May 24 | 7 May 25 |
| 9 | COD Reactor (Heating Block) | ซีโอดี (COD) | Hanna | HI839800-02 / H018500I | Hanna Instruments (Thailand) Ltd. | HIT-2312-0342 | 10 Mar 23 | 9 Mar 24 | - |
| 10 | Analytical Balance (Repeatability 0.01 mg) | ของแข็งแขวนลอยทั้งหมด (TSS) ของแข็งละลายทั้งหมด (TDS) | Mettler-Toledo | XSR205DU / C009071872 | Technology Promotion Association (Thailand-Japan) | 23MM112 | 26 Apr 23 | 24 Apr 24 | - |

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|---|--|-------------------------|---|--|---|---------------------|-------------------------|--------|
| Water | | | | | | | | | |
| 11 | Hot Air Oven | ของแข็งทั้งหมด (TS) | Memmert | UF55 / B216.1666 | Technology Promotion Association (Thailand-Japan) | 22TM1490 | 19 Oct 22 | 18 Oct 23 | - |
| 12 | Digestor Unit | ทีเคเอ็น (TKN) | FOSS TECATOR | 2520auto / 91794469 | National Food Institute, Ministry of Industry, Thailand | 2302413-001-01 | 30 Mar 23 | 28 Mar 24 | - |
| 13 | Distillation Unit (Kjeldahl Method) | ทีเคเอ็น (TKN) | FOSS TECATOR | KT8100 / 91889052 | FOSS South East Asia | 6623 | 25 Jul 22 | 24 Jul 23 | - |
| 14 | Conductivity Meter | ความเค็ม (Salinity) | SI Analytics | Lab955 / 16300356 | DKSH Technology Limited | C24230059 | 16 Mar 23 | 14 Mar 24 | - |
| 15 | UV-VIS Spectrophotometer | ฟอสฟอรัสทั้งหมด (Total P), สี (Color), ไนโตรเจนทั้งหมด (Total N), | Agilent Technologies | Cary60 G6860A / MY15410009 | DQE Services Co.,Ltd. | SP23-021 | 20 May 23 | 18 May 24 | |
| 16 | UV-VIS Spectrophotometer | ซัลเฟต (Sulfate) | Hitachi | U-1900 / 2021-064 | DQE Services Co.,Ltd. | SP23-007 | 6 Jan 23 | 5 Jan 24 | - |
| 17 | Turbidity Meter | Turbidity | Oakton | T100IR / 1120501017 | Technology Promotion Association (Thailand-Japan) | 22CH1184 | 5 Sep 22 | 4 Sep 23 | - |
| 18 | Gas Chromatography - Mass Spectrometer (GC-MS) | สารประกอบอินทรีย์ระเหยง่าย (VOCs) | Agilent Technologies | System ID: CN17100005 Intovu 9000 (G3950A) / CN17100005 5977B MSD (G7077B) / US1715M030 | Agilent Technologies (Thailand) Co.,Ltd. | Certificate of System Qualification GSMS-OQ | 24 Apr 23 | 22 Apr 24 | - |
| 19 | Inductively Coupled Plasma (ICP) | เหล็ก (Fe) | Agilent Technologies | System ID:G8015A G8015AA / MY18030001 | Agilent Technologies (Thailand) Co.,Ltd. | Preventive Maintenance Checklist | 30 Nov 22 | 29 Nov 23 | - |
| 20 | Cold Vapor Atomic Absorption Spectrophotometer (CVAAS) | ปรอท (Mercury) | Milestone | DMA-80 / 11030982 | Sithiporn Associates Co.,Ltd. | Service Protocol Report | 18 Nov 22 | 17 Nov 23 | - |

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|--|--|---------------|--------------------------------|--|-------------------------|------------------------|----------------------------|--------|
| Water | | | | | | | | | |
| 21 | Cold Vapor Atomic Absorption Spectrophotometer (CVAAS) | ปรอท (Mercury) | Analytik Jena | mercur DUO plus / K170A0153 | Analytik Jena FarEast Thailand Ltd. | Maintenance Protocol | 2 Feb 23 | 1 Feb 24 | - |
| 22 | Incubator | โคลิฟอร์มแบคทีเรียทั้งหมด (Coliform Bacteria) | Memmert | IPP 260 / V615.0187 | Technology Promotion Association (Thailand-Japan) | 23TM378 | 12 Apr 23 | 10 Apr 24 | - |
| 23 | Incubator | ฟีคัลโคลิฟอร์มแบคทีเรีย (Fecal Coliform Bacteria) | Memmert | IPP 260 / V618.0033 | Technology Promotion Association (Thailand-Japan) | 23TM729 | 27 Apr 23 | 25 Apr 24 | - |
| 24 | Water Bath | | Memmert | WNE 14 / L421.0121 | Technology Promotion Association (Thailand-Japan) | 23TM764 | 27 Apr 23 | 25 Apr 24 | - |
| 25 | Analytical Balance | | OHAUS | PX623 / C236754745 | DKSH (Thailand) Ltd. | C01223732 | 9 Dec 22 | 8 Dec 23 | - |

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 0803018
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 22/08/2022
Issue Date : 22/08/2022

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by :

Approved by

Technical Manager

เอกสารไม่ควบคุม

| Meter Console Information | | | | Calibration Conditions | | | | Factors/Conversions | | |
|---------------------------|----------|--|--|---------------------------|-----------|------------|----------|---------------------|-------|-------|
| Console Model Number | XC-572-V | | | Date | Time | 22/08/2022 | 01:25 PM | Std Temp | 293 | K |
| Console Serial Number | 0803018 | | | Calibration Reference No. | E22-08038 | | | Std Press | 760 | mm Hg |
| DGM Model Number | SK25EX | | | Barometric Pressure | 755.24 | | | K ₁ | 0.386 | |
| DGM Serial Number | 00002780 | | | Calibration Meter Gamma | 0.999 | | | Console Leak Check | PASS | |

| Calibration Data | | | | | | | | | |
|---------------------|---------------------|----------------------|----------------------|-----------|----------------|--------------------|-----------|-------------------------------------|------------------------------|
| Results | | | | | | | | | |
| Standardized Data | | | | | Dry Gas Meter | | | | |
| Dry Gas Meter | | Calibration Meter | | Value (Y) | Variation (ΔY) | Calibration Factor | | Std & Corr (Q _{std/corr}) | Variation (ΔH _g) |
| (V _{std}) | (Q _{std}) | (V _{wstd}) | (Q _{wstd}) | | | Value | Variation | | |
| m ³ | m ³ /min | m ³ | m ³ /min | | | | | mm H ₂ O | |
| 0.137 | 0.012 | 0.132 | 0.012 | 0.964 | 0.012 | | | 41.539 | -1.642 |
| 0.137 | 0.012 | 0.133 | 0.012 | 0.967 | 0.014 | | | 41.946 | -1.236 |
| 0.138 | 0.018 | 0.132 | 0.017 | 0.961 | 0.009 | | | 39.814 | -3.367 |
| 0.138 | 0.018 | 0.132 | 0.017 | 0.959 | 0.007 | | | 39.855 | -3.326 |
| 0.275 | 0.021 | 0.262 | 0.020 | 0.954 | 0.002 | | | 44.587 | 1.405 |
| 0.275 | 0.021 | 0.262 | 0.020 | 0.953 | 0.000 | | | 44.620 | 1.438 |
| 0.275 | 0.028 | 0.261 | 0.027 | 0.947 | -0.005 | | | 44.426 | 1.244 |
| 0.275 | 0.028 | 0.260 | 0.027 | 0.945 | -0.008 | | | 44.495 | 1.313 |
| 0.277 | 0.032 | 0.260 | 0.030 | 0.937 | -0.015 | | | 45.326 | 2.144 |
| 0.277 | 0.032 | 0.259 | 0.030 | 0.937 | -0.016 | | | 45.206 | 2.025 |
| | | | | 0.952 | Y Average | | | 43.181 | ΔH@ Average |

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.

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.

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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

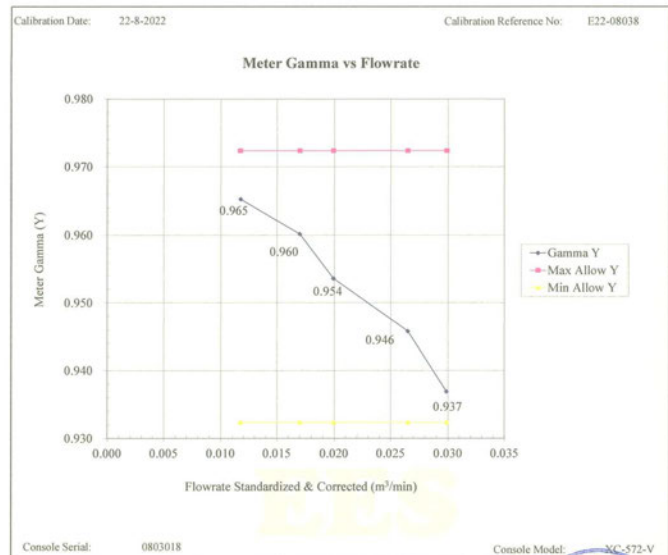
| Meter Console Information | | | | Calibration Conditions | | | | Factors/Conversions | | |
|---------------------------|----------|--|--|---------------------------|-----------|------------|----------|---------------------|-------|-------|
| Console Model Number | XC-572-V | | | Date | Time | 22/08/2022 | 01:25 PM | Std Temp | 293 | K |
| Console Serial Number | 0803018 | | | Calibration Reference No. | E22-08038 | | | Std Press | 760 | mm Hg |
| DGM Model Number | SK25EX | | | Barometric Pressure | 755.24 | | | K ₁ | 0.386 | |
| DGM Serial Number | 00002780 | | | Calibration Meter Gamma | 0.999 | | | Console Leak Check | PASS | |

| Calibration Data | | | | | | | | | | | |
|------------------|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--|--|
| Metering Console | | | | | | Calibration Meter | | | | | |
| Run Time | DGM Orifice | Volume | Volume | Outlet Temp | Outlet Temp | Volume | Volume | Outlet Temp | Outlet Temp | | |
| Elapsed | DH | Initial | Final | Initial | Final | Initial | Final | Initial | Final | | |
| (Q) | (P _o) | (V _{in}) | (V _{out}) | (t _{in}) | (t _{out}) | (V _{wi}) | (V _{wf}) | (t _{wi}) | (t _{wf}) | | |
| min | mm H ₂ O | m ³ | m ³ | °C | °C | m ³ | m ³ | °C | °C | | |
| 11.25 | 13.0 | 898.1510 | 898.2910 | 29 | 29 | 90.45264 | 90.58792 | 24 | 24 | | |
| 11.33 | 13.0 | 898.2910 | 898.4310 | 29 | 29 | 90.58792 | 90.72354 | 24 | 24 | | |
| 7.77 | 26.0 | 898.4420 | 898.5820 | 29 | 29 | 90.73418 | 90.86926 | 24 | 24 | | |
| 7.75 | 26.0 | 898.5820 | 898.7220 | 29 | 29 | 90.86926 | 91.00398 | 24 | 24 | | |
| 13.13 | 40.0 | 898.7330 | 899.0130 | 29 | 29 | 91.01454 | 91.28308 | 25 | 25 | | |
| 13.12 | 40.0 | 899.0130 | 899.2930 | 29 | 29 | 91.28308 | 91.55118 | 25 | 25 | | |
| 9.83 | 70.0 | 899.3120 | 899.5920 | 29 | 29 | 91.56906 | 91.83630 | 25 | 25 | | |
| 9.82 | 70.0 | 899.5920 | 899.8720 | 29 | 29 | 91.83630 | 92.10288 | 25 | 25 | | |
| 8.68 | 90.0 | 899.8850 | 900.1650 | 30 | 30 | 92.11486 | 92.37984 | 24 | 24 | | |
| 8.67 | 90.0 | 900.1650 | 900.4450 | 30 | 30 | 92.37984 | 92.64466 | 24 | 24 | | |



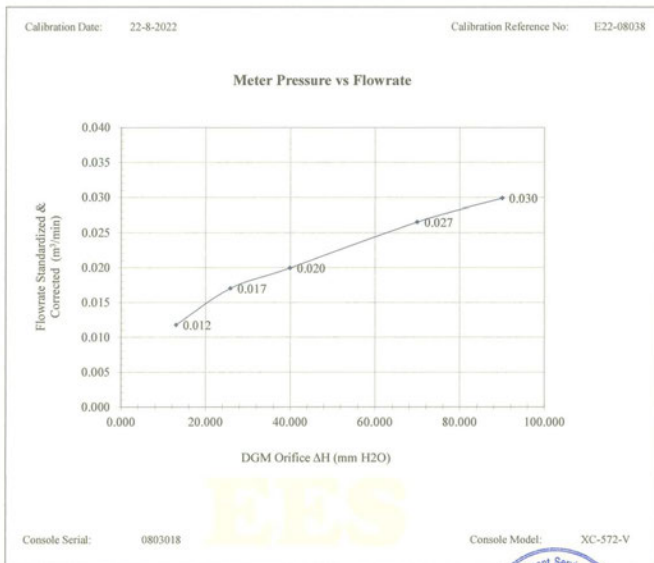
เอกสารไม่ควบคุม

| Meter Console Information | | | | Calibration Conditions | | | | Factors/Conversions | | |
|---------------------------|----------|--|--|---------------------------|-----------|------------|----------|---------------------|-------|-------|
| Console Model Number | XC-572-V | | | Date | Time | 22/08/2022 | 01:25 PM | Std Temp | 293 | K |
| Console Serial Number | 0803018 | | | Calibration Reference No. | E22-08038 | | | Std Press | 760 | mm Hg |
| DGM Model Number | SK25EX | | | Barometric Pressure | 755.24 | | | K ₁ | 0.386 | |
| DGM Serial Number | 00002780 | | | Calibration Meter Gamma | 0.999 | | | Console Leak Check | PASS | |



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| Meter Console Information | | Calibration Conditions | | | | Factors/Conversions | | |
|---------------------------|----------|---------------------------|-----------|------------|----------|---------------------|-------|-------|
| Console Model Number | XC-572-V | Date | Time | 22/08/2022 | 01:25 PM | Std Temp | 293 | K |
| Console Serial Number | 0803018 | Calibration Reference No. | E22-08038 | | | Std Press | 760 | mm Hg |
| DGM Model Number | SK25EX | Barometric Pressure | 755.24 | | | K ₁ | 0.386 | |
| DGM Serial Number | 00002780 | Calibration Meter Gamma | 0.999 | | | Console Leak Check | PASS | |



เอกสารไม่ควบคุม

Instrument description : Flue gas Analyzer
Instrument model : Testo 350XL
Instrument serial no. : 02376344
ID no. or control no. : UAE.EMA2.113/2555
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address : 81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

Total pages of certificate : 3 Pages
Receiving no. : L-222833
Receiving date. : 10-Aug-22
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.00,21.00 %vol, Carbon Monoxide 80.97,309.9,1003 ppm, Nitrogen Dioxide 10.19,80.92,202.2 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.9,601.1 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition. This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid. This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 15-Aug-22



Calibration Technician



Technical Manager

FM-CL-09-C Rev.8

Page 1 of 3

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

| Sampling System Equipment Information | | Calibration Conditions | | | |
|---------------------------------------|--------------|---------------------------|-----------|------------|----------|
| Console Model Number | XC-572-V | Date | Time | 22/08/2022 | 03:15 PM |
| Console Serial Number | 0803018 | Calibration Reference No. | E22-08038 | | |
| DGM Model Number | SK25EX | Reference Thermometer | DIGICON | | |
| DGM Serial Number | 00002780 | Serial Number | 183169105 | | |
| Meter Box Model Number | JENCO 765 KF | | | | |
| Meter Box Serial Number | JC 16095 | | | | |

| Results | | | | | | | | | | |
|--------------------------------|--|------|------|------|-------|-------|-------|-------|-------|--------|
| Console Thermocouple Simulator | | | | | | | | | | |
| Channel and test point | Meter Box Channel Temperature Reading (°C) | | | | | | | | | |
| | -18.0 | 25.0 | 38.0 | 93.0 | 149.0 | 260.0 | 371.0 | 482.0 | 593.0 | 1038.0 |
| Stack | -16.0 | 25.0 | 38.0 | 93.0 | 150.0 | 259.0 | 371.0 | 482.0 | 593.0 | 1037.0 |
| Aux | -16.0 | 25.0 | 38.0 | 93.0 | 150.0 | | | | | |
| Probe | -16.0 | 25.0 | 38.0 | 93.0 | 150.0 | | | | | |
| Filter | -16.0 | 25.0 | 38.0 | 93.0 | 150.0 | | | | | |
| Exit | -16.0 | 25.0 | 38.0 | | | | | | | |

Stack ± 1.50% Absolute Tolerance Range Meter ± 3.0 °C
Probe ± 3.0 °C Exit ± 2.0 °C
Filter ± 3.0 °C



Entech Industrial Solution Co., Ltd.



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Standard References (Table 1)

| Standard | Certificate No. | Vendor | Due date |
|--|-----------------|--------|-----------|
| Oxygen (O ₂) 2.498 % Vol | 4219/21 | Linde | 30-Sep-25 |
| Oxygen (O ₂) 10.00 % Vol | 2453/19 | Linde | 18-Jul-23 |
| Oxygen (O ₂) 21.00 % Vol | 2426/19 | Linde | 16-Jul-23 |
| Carbon monoxide (CO) 80.97 ppm | 2842/21 | Linde | 24-Jun-23 |
| Carbon monoxide (CO) 309.9 ppm | 2803/21 | Linde | 22-Jun-23 |
| Carbon monoxide (CO) 1003 ppm | 2829/21 | Linde | 23-Apr-23 |
| Nitrogen Dioxide (NO ₂) 10.19 ppm | 3372/21 | Linde | 02-Aug-23 |
| Nitrogen Dioxide (NO ₂) 80.96 ppm | 3240/21 | Linde | 26-Jun-24 |
| Nitrogen Dioxide (NO ₂) 202.2 ppm | 3239/21 | Linde | 20-Jul-23 |
| Nitric Oxide (NO) 30.08 ppm | SGS10068 | Nimr | 13-Jun-24 |
| Nitric Oxide (NO) 150.9 ppm | 2857/21 | Linde | 27-Jun-23 |
| Nitric Oxide (NO) 320.6 ppm | 2944/21 | Linde | 02-Jul-23 |
| Sulphur Dioxide (SO ₂) 50.04 ppm | 3205/21 | Linde | 25-Jul-23 |
| Sulphur Dioxide (SO ₂) 100.9 ppm | 4942/20 | Linde | 20-Nov-22 |
| Sulphur Dioxide (SO ₂) 601.1 ppm | 3204/21 | Linde | 20-Jul-23 |

Measured room conditions

Temperature : 23.6 °C Humidity : 56.6 %RH Pressure : 1015.3 mbar
Calibration conditions
Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.9 mbar

Calibration Results Before Adjustment (Table 2)

| Parameter of Standard | Standard Values | Mean of UUC | Error | Uncertainty (±) |
|------------------------|-----------------|-------------|-------|-----------------|
| O ₂ (%Vol) | 2.498 | 2.53 | 0.032 | 0.20 |
| O ₂ (%Vol) | 10.00 | 9.86 | -0.14 | 0.40 |
| O ₂ (%Vol) | 21.00 | 21.08 | 0.08 | 0.80 |
| CO (ppm) | 80.97 | 80 | -0.97 | 3.0 |
| CO (ppm) | 309.9 | 305 | -4.9 | 6.0 |
| CO (ppm) | 1003 | 993 | -10 | 12 |
| *NO ₂ (ppm) | 10.19 | 7.8 | -2.39 | 1.5 |
| NO ₂ (ppm) | 80.96 | 74.4 | -6.56 | 8.0 |
| NO ₂ (ppm) | 202.2 | 190.8 | -11.4 | 12 |
| NO (ppm) | 30.08 | 25 | -5.08 | 8.0 |
| NO (ppm) | 150.9 | 140 | -10.9 | 8.0 |
| NO (ppm) | 320.6 | 298 | -22.6 | 12 |
| SO ₂ (ppm) | 50.04 | 46 | -4.04 | 6.0 |
| SO ₂ (ppm) | 100.9 | 95 | -5.9 | 6.0 |
| SO ₂ (ppm) | 601.1 | 640 | 38.9 | 13 |

FM-CL-09-C Rev.8

Page 2 of 3

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

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Calibration Results After Adjustment (Table 3)

| Parameter of Standard | Standard Values | Mean of UUC | Error | Uncertainty (±) |
|-----------------------|-----------------|-------------|-------|-----------------|
| O2 (%Vol) | 2.498 | 2.53 | 0.032 | 0.20 |
| O2 (%Vol) | 10.00 | 9.86 | -0.14 | 0.40 |
| O2 (%Vol) | 21.00 | 21.08 | 0.08 | 0.80 |
| CO (ppm) | 80.97 | 80 | -0.97 | 3.0 |
| CO (ppm) | 309.9 | 305 | -4.9 | 6.0 |
| CO (ppm) | 1003 | 993 | -10 | 12 |
| *NO2 (ppm) | 10.19 | 10.2 | 0.01 | 1.5 |
| NO2 (ppm) | 80.96 | 80.2 | -0.76 | 8.0 |
| NO2 (ppm) | 202.2 | 204.5 | 2.3 | 12 |
| NO (ppm) | 30.08 | 31 | 0.92 | 8.0 |
| NO (ppm) | 150.9 | 152 | 1.1 | 8.0 |
| NO (ppm) | 320.6 | 322 | 1.4 | 12 |
| SO2 (ppm) | 50.04 | 51 | 0.96 | 6.0 |
| SO2 (ppm) | 100.9 | 101 | 0.1 | 6.0 |
| SO2 (ppm) | 601.1 | 601 | -0.1 | 13 |

Remark : 1 cmol/mol = 1 %vol., 1 µmol/mol = 1 ppm.

* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report

Certificate No : 22-ACT-406

Request No : Req-2022-1080

Sound pressure level

Calibration Results : Without Adjustment

| Calibration Range (dB) | Without Adjustment (dB) | Adjustment (dB) | Uncertainty (± dB) | Acceptance limit Class 1 (± dB) |
|------------------------|-------------------------|-----------------|--------------------|---------------------------------|
| | Measured | Error | Measured | Error |
| 94 dB / 1000 Hz | 93.82 | -0.18 | - | - |
| 114 dB / 1000 Hz | 113.81 | -0.19 | - | - |

Frequency of Sound pressure level

| Calibration Range (Hz) | Without Adjustment | Adjustment | Uncertainty (± %) | Acceptance limit Class 1 (± %) |
|------------------------|--------------------|------------|-------------------|--------------------------------|
| | Measured (Hz) | Error (%) | Measured (Hz) | Error (%) |
| 94 dB / 1000 Hz | 1000.00 | 0.00 | - | - |
| 114 dB / 1000 Hz | 1000.00 | 0.00 | - | - |

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

| Calibration Range (Hz) | Without Adjustment | Adjustment | Uncertainty (± %) | Acceptance limit Class 1 (± %) |
|------------------------|--------------------|--------------|-------------------|--------------------------------|
| | Measured (%) | Measured (%) | | |
| 94 dB / 1000 Hz | 0.17 | - | 0.40 | 2.5 |
| 114 dB / 1000 Hz | 0.04 | - | 0.40 | 2.5 |

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 22-ACT-406
Request No : Req-2022-1080

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73249
ID : UAE.EFM.105/2561
Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 15 June 2022
Calibration Date : 1 July 2022
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|--------|---------------|-----------|-----------------|
| Sound Calibrator | SV 35A | 58079 | EI | 31 May 2023 |
| THD Multimeter | 2015 | 1047765 | NIMT | 2 February 2023 |

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :

Service Calibration Engineer

Approved By :

Calibration Engineer Supervisor

Issue Date : 1 July 2022

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 22-ACT-034
Request No : Req-2022-0092

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005394
ID : UAE.EFM.031/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329361
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 073810
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|----------------------------|--------|-----------|-----------|-------------------|--------------|
| Standard Microphone | GRAS | 40AN | 188273 | 15 September 2022 | GRAS |
| Multi-frequency Calibrator | Quest | Quest-cal | EFA000234 | 14 June 2022 | TSI |
| Audio Generator | Svante | Svan401 | 131 | 18 October 2022 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibrated By :

Calibration Officer

Approved By :

Calibration Engineer Supervisor

Issue Date : 21 January 2022

Certificate No : 22-ACT-034

Request No : Req-2022-0092

7. Long Term Stability

| UUC Setting | | Measured | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|--|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | | UUC | | |
| STD Setting | | (dB) | | |
| Initial | | 114.0 | | |
| Final | | 114.0 | | |
| Deviated | | 0.0 | 0.1 | 0.3 |

8. Level linearity on the reference level range

| 6. Level linearity on the reference level range | | | | | | |
|---|--|-------------|-------------|-------------|------------------------|--------------------------------|
| UUC Setting | | Anticipated | Deviation | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
| FAST / A / 37-139 | | REF (dB) | UUC (dB) | ERR (dB) | | |
| STD dB | | | | | 0.3 | |
| 139.0 | | 139 | 139.0 | 0.0 | | 1.1 |
| 134.0 | | 134 | 134.0 | 0.0 | | 1.1 |
| 129.0 | | 129 | 129.0 | 0.0 | | 1.1 |
| 124.0 | | 124 | 124.0 | 0.0 | | 1.1 |
| 119.0 | | 119 | 119.0 | 0.0 | | 1.1 |
| 114.0 | | 114 | 114.0 | 0.0 | | 1.1 |
| 109.0 | | 109 | 109.0 | 0.0 | | 1.1 |
| 104.0 | | 104 | 104.0 | 0.0 | | 1.1 |
| 99.0 | | 99 | 99.0 | 0.0 | | 1.1 |
| 94.0 | | 94 | 93.9 | -0.1 | | 1.1 |
| 89.0 | | 89 | 88.9 | -0.1 | | 1.1 |
| 84.0 | | 84 | 83.9 | -0.1 | | 1.1 |
| 79.0 | | 79 | 78.9 | -0.1 | | 1.1 |
| 74.0 | | 74 | 73.9 | -0.1 | | 1.1 |
| 69.0 | | 69 | 69.0 | 0.0 | | 1.1 |
| 64.0 | | 64 | 63.9 | -0.1 | | 1.1 |
| 59.0 | | 59 | 59.0 | 0.0 | | 1.1 |
| 54.0 | | 54 | 54.0 | 0.0 | | 1.1 |
| 49.0 | | 49 | 49.0 | 0.0 | | 0.8 |
| 44.0 | | 44 | 44.1 | 0.1 | 1.1 | |
| 39.0 | | 39 | 39.3 | 0.3 | 1.1 | |
| 38.0 | | 38 | 38.3 | 0.3 | 1.1 | |
| 37.0 | | 37 | 37.5 | 0.5 | 1.1 | |

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Accredited Institution Co., Ltd.

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. **เอกสารไม่ควบคุม**

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Institution of Standards of Thailand.

Certificate No : 22-ACT-034

Request No : Req-2022-0092

9. Level linearity including the level range control

| UUC Setting | STD | Measured | | UNCERTAINTY (\pm dB) | Acceptance |
|-------------|------|----------|------|----------------------------|-------------|
| | | UUC | ERR | | Limit |
| | REF | (dB) | (dB) | | (\pm dB) |
| FAST / A | | | | | |
| UUC Range | | | | | |
| 37-139 | 42.8 | 43.0 | 0.2 | 0.3 | 1.1 |
| | 114 | 114.0 | 0.0 | | 1.1 |

10. Tone burst response

| UUC Setting | | STD | Anticipated | Measured | | UNCERTAINTY (\pm dB) | Acceptance Limit |
|-------------------|------|-----------|-------------|----------|------|--------------------------------|-------------------------|
| A / 37-139 | | Toneburst | Ref | UUC | ERR | | |
| UUC Time Response | | (ms) | (dB) | (dB) | (dB) | | (\pm dB) |
| Fast | 200 | 135.0 | 135.0 | 0.0 | 0.3 | 1 | |
| | 2 | 118.0 | 117.7 | -0.3 | | +1.0,-2.5 | |
| | 0.25 | 109.0 | 108.8 | -0.2 | | +1.5,-5.0 | |
| Slow | 200 | 128.6 | 128.5 | -0.1 | | 1 | |
| | 2 | 109.0 | 108.9 | -0.1 | | +1.0,-5.0 | |
| | 200 | 129.0 | 129.0 | 0.0 | | 1 | |
| SEL | 2 | 109.0 | 109.1 | +0.1 | | +1.0,-2.5 | |
| | 0.25 | 100.0 | 100.0 | 0.0 | | +1.5,-5.0 | |

11. Peak C Sound level

| 11. Peak C sound level | Anticipated | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|----------------------------------|-------------|----------|-------|-----------------------|-------------------------------|
| | | UUC | ERR | | |
| | REF (dB) | (dB) | (dB) | | |
| UUC Setting FAST / C / 95-142 | | | | | |
| STD Setting | | | | | |
| Complete cycle | 137.4 | 136.8 | -0.60 | 0.2 | 3.0 |
| Positive half cycle | 136.4 | 136.1 | -0.30 | | 2.0 |
| Negative half cycle | 136.4 | 136.2 | -0.20 | | 2.0 |

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Institute for Calibration Co., Ltd.

Certificate No : 22-ACT-034
Request No : Req-2022-0092

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|------------|
| FAST / A / 37-139 | UUC | (± dB) | Limit |
| STD Setting | (dB) | | (± dB) |
| Positive one-half cycle | 141.7 | | |
| Negative one-half cycle | 141.8 | | |
| Deviated | -0.1 | 0.2 | 1.5 |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|------------|
| FAST / A / 37-139 | UUC | (± dB) | Limit |
| STD Setting | (dB) | | (± dB) |
| Initial | 138.0 | | |
| Final | 138.0 | | |
| Deviated | 0.0 | 0.1 | 0.3 |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority. Page : 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | | Adjust | | UNCERTAINTY | Acceptance |
|--------------------|---------|---------------|-------|--------|------|-------------|------------|
| FAST / A / 37-139 | Level | UUC | ERR | UUC | ERR | (± dB) | Limit |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) | | (± dB) |
| 1000 Hz 114.00 dB | 113.85 | 113.8 | -0.05 | 113.9 | 0.05 | 0.20 | 0.3 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEX, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | (dB) | (± dB) |
| UUC Weighting | | |
| A | 28.4 | 0.10 |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | (dB) | (± dB) |
| UUC Weighting | | |
| A | 28.1 | 0.10 |
| C | 27.7 | 0.10 |
| Z | 32.0 | 0.10 |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting | Deviation from various Frequency Weighting Response curve | | | UNCERTAINTY | Acceptance |
|---------------|---|------|------|-------------|------------|
| FAST / 37-139 | A | C | Z | (± dB) | Limit |
| STD Setting | (dB) | (dB) | (dB) | | (± dB) |
| 125 Hz | 0.0 | 0.1 | 0.1 | 0.50 | 2.0 |
| 1000 Hz | 0.0 | 0.0 | 0.0 | 0.60 | 1.0 |
| 4000 Hz | 0.4 | 0.5 | 0.5 | 0.60 | 3.0 |
| 8000 Hz | 0.2 | 0.1 | 0.3 | 0.70 | 5.0 |

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เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-247
Request No : Req-2022-0627

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005395
ID : UAE.EFM.032/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329355
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 073797
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

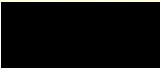
Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------------|----------|-----------|-----------|-------------------|--------------|
| Standard Microphone | GRAS | 40AN | 188273 | 15 September 2022 | GRAS |
| Multifrequency Calibrator | Quest | Quest-cal | EFA000234 | 14 June 2022 | TSI |
| Audio Generator | Svanitek | Svan401 | 131 | 18 October 2022 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Calibration Officer

Approved By : 
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority. Page : 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency Weighting Response curve | | | UNCERTAINTY | Acceptance |
|---------------|---|--------|--------|-------------|------------|
| FAST / 37-139 | Weighting Response curve | | | (± dB) | Limit |
| STD Setting | A (dB) | C (dB) | Z (dB) | | (± dB) |
| 63 Hz | -0.2 | -0.1 | -0.1 | 0.2 | 2.0 |
| 125 Hz | -0.1 | 0.0 | 0.0 | | 1.5 |
| 250 Hz | -0.1 | 0.0 | 0.0 | | 1.5 |
| 500 Hz | -0.1 | 0.0 | 0.0 | | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.0 | | 1.0 |
| 2000 Hz | 0.0 | 0.0 | 0.0 | | 2.0 |
| 4000 Hz | 0.0 | 0.0 | 0.0 | | 3.0 |
| 8000 Hz | -0.1 | -0.1 | 0.0 | | 5.0 |
| 16000 Hz | -0.1 | -0.1 | -0.1 | | +5, -INF. |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | | UNCERTAINTY | Acceptance |
|---------------|--------|----------|------|-------------|------------|
| FAST / 37-139 | REF | UUC | ERR | (± dB) | Limit |
| UUC Weighting | (dB) | (dB) | (dB) | | (± dB) |
| A | 114.00 | 114.0 | 0.0 | 0.2 | 0.2 |
| C | 114.00 | 114.0 | 0.0 | | 0.2 |
| Z | 114.00 | 114.0 | 0.0 | | 0.2 |

| UUC Setting | STD | Measured | | UNCERTAINTY | Acceptance |
|-------------------|--------|----------|------|-------------|------------|
| 37-139 / A | REF | UUC | ERR | (± dB) | Limit |
| UUC Time Response | (dB) | (dB) | (dB) | | (± dB) |
| Fast | 114.00 | 114.0 | 0.0 | 0.2 | 0.1 |
| Slow | 114.00 | 114.0 | 0.0 | | 0.1 |
| Leq | 114.00 | 114.0 | 0.0 | | 0.1 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority. Page : 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC | | |
| STD Setting | (dB) | 0.1 | 0.3 |
| Initial | 114.0 | | |
| Final | 114.0 | | |
| Deviated | 0.0 | | |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|-------------|-------------|-------------|----------------------------|------------------------------------|
| FAST / A / 37-139 | REF (dB) | UUC (dB) | ERR (dB) | | |
| STD dB | (dB) | (dB) | (dB) | 0.3 | 1.1 |
| 139.00 | 139 | 139.0 | 0.0 | | |
| 134.00 | 134 | 134.0 | 0.0 | | |
| 129.00 | 129 | 129.0 | 0.0 | | |
| 124.00 | 124 | 124.0 | 0.0 | | |
| 119.00 | 119 | 119.0 | 0.0 | | |
| 114.00 | 114 | 114.0 | 0.0 | | |
| 109.00 | 109 | 109.0 | 0.0 | | |
| 104.00 | 104 | 104.0 | 0.0 | | |
| 99.00 | 99 | 99.0 | 0.0 | | |
| 94.00 | 94 | 94.0 | 0.0 | | |
| 89.00 | 89 | 89.0 | 0.0 | | |
| 84.00 | 84 | 84.0 | 0.0 | | |
| 79.00 | 79 | 79.0 | 0.0 | | |
| 74.00 | 74 | 74.0 | 0.0 | | |
| 69.00 | 69 | 69.0 | 0.0 | | |
| 64.00 | 64 | 64.0 | 0.0 | | |
| 59.00 | 59 | 59.0 | 0.0 | | |
| 54.00 | 54 | 54.0 | 0.0 | | |
| 49.00 | 49 | 49.0 | 0.0 | | |
| 44.00 | 44 | 44.1 | 0.1 | | |
| 39.00 | 39 | 39.3 | 0.3 | | |
| 38.00 | 38 | 38.4 | 0.4 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------------|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC | | |
| STD Setting | (dB) | 0.2 | 1.5 |
| Positive one-half cycle | 142.2 | | |
| Negative one-half cycle | 142.2 | | |
| Deviated | 0.0 | | |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|----------|----------------------------|------------------------------------|
| FAST / A / 37-139 | UUC | | |
| STD Setting | (dB) | 0.1 | 0.3 |
| Initial | 138.0 | | |
| Final | 138.0 | | |
| Deviated | 0.0 | | |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

9. Level linearity including the level range control

| UUC Setting | STD | Measured | | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------|------|----------|------|----------------------------|------------------------------------|
| FAST / A | REF | UUC | ERR | | |
| UUC Range | (dB) | (dB) | (dB) | 0.3 | 1.1 |
| 37-139 | 43.4 | 43.5 | 0.1 | | |
| | 114 | 114.0 | 0.0 | | |

10. Tone burst response

| UUC Setting | STD | Anticipated | Measured | | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|-------------------|-----------|-------------|----------|------|----------------------------|------------------------------------|
| A / 37-139 | Toneburst | Ref | UUC | ERR | | |
| UUC Time Response | (ms) | (dB) | (dB) | (dB) | 0.3 | 1.0 |
| Fast | 200 | 135.0 | 134.9 | -0.1 | | |
| | 2 | 118.0 | 117.8 | -0.2 | | |
| | 0.25 | 109.0 | 108.7 | -0.3 | | |
| Slow | 200 | 128.6 | 128.4 | -0.2 | | |
| | 2 | 109.0 | 108.8 | -0.2 | | |
| | 200 | 129.0 | 129.0 | 0.0 | | |
| SEL | 2 | 109.0 | 109.1 | +0.1 | | |
| | 0.25 | 100.0 | 99.9 | -0.1 | | |

11. Peak C Sound level

| UUC Setting | Anticipated | Measured | | UNCERTAINTY (\pm dB) | Acceptance Limit (\pm dB) |
|---------------------|-------------|----------|-------|----------------------------|------------------------------------|
| FAST / C / 95-142 | REF | UUC | ERR | | |
| STD Setting | (dB) | (dB) | (dB) | 0.2 | 2.0 |
| Complete cycle | 137.4 | 136.8 | -0.60 | | |
| Positive half cycle | 136.4 | 136.2 | -0.20 | | |
| Negative half cycle | 136.4 | 136.2 | -0.20 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-105
Request No : Req-2022-0229

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005396
ID : UAE.EFM.033/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329350
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 073812
Instrument Status : Used

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------------|---------|-----------|-----------|-------------------|--------------|
| Standard Microphone | GRAS | 40AN | 188273 | 15 September 2022 | GRAS |
| Multifrequency Calibrator | Quest | Quest-cal | EFA000234 | 14 June 2022 | TSI |
| Audio Generator | Svantek | Svan401 | 131 | 18 October 2022 | WK Electric |

Note

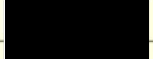
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :



Calibration Officer

Approved By :



Calibration Engineer Supervisor

Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------------|----------|-------------|------------|
| FAST / A / 37-139 | UUC | | Limit |
| STD Setting | (dB) | (± dB) | (± dB) |
| Positive one-half cycle | 141.7 | | |
| Negative one-half cycle | 141.8 | | |
| Deviated | -0.1 | 0.2 | 1.5 |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|------------|
| FAST / A / 37-139 | UUC | | Limit |
| STD Setting | (dB) | (± dB) | (± dB) |
| Initial | 138.0 | | |
| Final | 138.0 | | |
| Deviated | 0.0 | 0.1 | 0.3 |

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

PM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | Adjust | UNCERTAINTY | Acceptance |
|--------------------|---------|---------------|--------|-------------|------------|
| FAST / A / 37-139 | Level | UUC | ERR | UUC | ERR |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) |
| 1000 Hz 114.00 dB | 113.85 | 114.0 | +0.15 | 113.9 | 0.05 |
| | | | | (± dB) | (± dB) |
| | | | | 0.20 | 0.3 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 28.1 | 0.10 |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 27.9 | 0.10 |
| C | 27.3 | 0.10 |
| Z | 31.9 | 0.10 |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting | Deviation from various Frequency | UNCERTAINTY | Acceptance |
|---------------|----------------------------------|-------------|------------|
| FAST / 37-139 | Weighting Response curve | | Limit |
| STD Setting | A (dB) C (dB) Z (dB) | (± dB) | (± dB) |
| 125 Hz | 0.0 0.0 0.0 | 0.50 | 2.0 |
| 1000 Hz | 0.0 0.0 0.0 | 0.60 | 1.0 |
| 4000 Hz | 0.4 0.3 0.3 | 0.60 | 3.0 |
| 8000 Hz | -0.1 -0.2 -0.1 | 0.70 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-035
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0094
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LxT2 Microphone S/N : 328675
Serial Number : 0005398 Preamplifier Model : PRMLxT2C
ID : UAE.EFM.035/2564 Preamplifier S/N : 073793
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------------|---------|-----------|-----------|-------------------|--------------|
| Standard Microphone | GRAS | 40AN | 188273 | 15 September 2022 | GRAS |
| Multifrequency Calibrator | Quest | Quest-cal | EFA000234 | 14 June 2022 | TSI |
| Audio Generator | SvanteK | Svan401 | 131 | 18 October 2022 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :



Calibration Officer

Approved By



Calibration Engineer Supervisor

Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency | UNCERTAINTY | Acceptance |
|---------------|----------------------------------|-------------|------------|
| FAST / 37-139 | Weighting Response curve | | Limit |
| STD Setting | A (dB) C (dB) Z (dB) | (± dB) | (± dB) |
| 63 Hz | -0.2 -0.1 -0.1 | | 2.0 |
| 125 Hz | -0.1 0.0 -0.1 | | 1.5 |
| 250 Hz | -0.1 0.0 -0.1 | | 1.5 |
| 500 Hz | -0.1 0.0 -0.1 | | 1.5 |
| 1000 Hz | 0.0 0.0 0.0 | 0.2 | 1.0 |
| 2000 Hz | 0.0 0.0 0.0 | | 2.0 |
| 4000 Hz | 0.0 0.0 0.0 | | 3.0 |
| 8000 Hz | -0.1 -0.1 0.0 | | 5 |
| 16000 Hz | -0.1 -0.1 -0.1 | | +5, -INF. |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | UNCERTAINTY | Acceptance |
|---------------|--------|----------|-------------|------------|
| FAST / 37-139 | REF | UUC | ERR | Limit |
| UUC Weighting | (dB) | (dB) | (dB) | (± dB) |
| A | 114.00 | 114.0 | 0.0 | 0.2 |
| C | 114.00 | 114.0 | 0.0 | 0.2 |
| Z | 114.00 | 114.0 | 0.0 | 0.2 |

| UUC Setting | STD | Measured | UNCERTAINTY | Acceptance |
|-------------------|--------|----------|-------------|------------|
| 37-139 / A | REF | UUC | ERR | Limit |
| UUC Time Response | (dB) | (dB) | (dB) | (± dB) |
| Fast | 114.00 | 114.0 | 0.0 | 0.1 |
| Slow | 114.00 | 114.0 | 0.0 | 0.1 |
| Leq | 114.00 | 114.0 | 0.0 | 0.1 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance |
|-------------------|----------|-------------|------------|
| FAST / A / 37-139 | UUC | | Limit |
| STD Setting | (dB) | (± dB) | (± dB) |
| Initial | 114.0 | | |
| Final | 114.0 | | |
| Deviated | 0.0 | 0.1 | 0.3 |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) |
|-------------------|-------------|-----------|------|----------------------------|------------------------------------|
| FAST / A / 37-139 | REF | UUC | ERR | | |
| STD dB | (dB) | (dB) | (dB) | | |
| 139.00 | 139 | 139.0 | 0.0 | 0.3 | 1.1 |
| 134.00 | 134 | 134.0 | 0.0 | | 1.1 |
| 129.00 | 129 | 129.0 | 0.0 | | 1.1 |
| 124.00 | 124 | 124.0 | 0.0 | | 1.1 |
| 119.00 | 119 | 119.0 | 0.0 | | 1.1 |
| 114.00 | 114 | 114.0 | 0.0 | | 1.1 |
| 109.00 | 109 | 109.0 | 0.0 | | 1.1 |
| 104.00 | 104 | 104.0 | 0.0 | | 1.1 |
| 99.00 | 99 | 99.0 | 0.0 | | 1.1 |
| 94.00 | 94 | 93.9 | -0.1 | | 1.1 |
| 89.00 | 89 | 88.9 | -0.1 | | 1.1 |
| 84.00 | 84 | 83.9 | -0.1 | | 1.1 |
| 79.00 | 79 | 78.9 | -0.1 | | 1.1 |
| 74.00 | 74 | 73.9 | -0.1 | | 1.1 |
| 69.00 | 69 | 69.0 | 0.0 | | 1.1 |
| 64.00 | 64 | 63.9 | -0.1 | | 1.1 |
| 59.00 | 59 | 59.0 | 0.0 | | 1.1 |
| 54.00 | 54 | 54.0 | 0.0 | | 1.1 |
| 49.00 | 49 | 49.0 | 0.0 | | 0.8 |
| 44.00 | 44 | 44.1 | 0.1 | | 1.1 |
| 39.00 | 39 | 39.3 | 0.3 | 1.1 | |
| 38.00 | 38 | 38.3 | 0.3 | 1.1 | |
| 37.00 | 37 | 37.5 | 0.5 | 1.1 | |



Cert.No.: 23CH6
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 22E2769 | 24 Aug 2023 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 2211305 | 27 Oct 2023 |

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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

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

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

Calibration Results

Function : mV Measurement

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

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement | Coverage factor |
|----------------------------|---------------|------------------------|----------------|-------|----------------------------|-----------------|
| | pH | mV | mV | pH | (±mV) | k |
| pH Meter S/N.: HA0D0081 | 4.00 | 177.48 | 177.4 | 4.01 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.1 | 6.98 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.1 | 6.98 | 0.058 | 2.00 |
| | 10.00 | -177.48 | -177.4 | 10.01 | 0.058 | 2.00 |

เอกสารไม่ควบคุม



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

Cert.No.: 23TW1
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE0H0003
ID No. : UAE.EFM.083/2564(EFM.DO.02/64)
Received Date : 04 January 2023
Test Date : 05 January 2023
Reference : 2301-0061WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phra Khanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by :
Approved by :
Issue Date : 6 January 2023

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Cert.No.: 23CH6
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH measurement (±) | Coverage factor k |
|--------------------------------|-----------------------------|-------------------|------------------------|-------------------------------------|-------------------|
| pH Electrode S/N.: 990C0039 | 4.008 | 4.01 | 138.5 | 0.0065 | 2.05 |
| | 6.987 | 6.98 | -32.1 | 0.011 | 2.00 |
| | 6.987 | 7.00 | -33.1 | 0.011 | 2.00 |
| | 10.008 | 10.03 | -205.2 | 0.0096 | 2.00 |

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 990C0039

Dimension of probe;

- Length : 102 mm.
- Diameter : 15.5 mm.
- Immersion Depth : 85 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor k |
|------------------------|---------------------------|-------------------|------------|-------------------------------------|-------------------|
| 25.0 | 25.004 | 25.0 | -0.004 | 0.13 | 2.00 |
| 30.0 | 30.001 | 30.0 | -0.001 | 0.13 | 2.00 |
| 35.0 | 35.003 | 35.0 | -0.003 | 0.13 | 2.00 |

Remark : - UUC* = Unit Under Calibration

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

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Cert.No.: 23TW1
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

| Instruments | Serial No. | ID No. | Certificate No. | Due Date |
|-------------|------------|----------|-----------------|-------------|
| 1) Burette | - | 130BU10 | 21CG1389 | 25 Mar 2023 |
| 2) Balance | 1126143764 | 140RC004 | 22MM50 | 20 Sep 2023 |

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K0E0260

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|-------------------------------|------------------------------|
| 8.14 | 8.14 | 0.0055 |

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

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เอกสารไม่ควบคุม



Cert. No.: 23LM1
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter With Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE0H0003
ID No. : UAE.EFM.083/2564(EFM.DO.02/64)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 4 January 2023
Calibrated Date : 6 January 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by :

Approved by :

Issue Date : 10 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Cert.No.: 23CH7
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC0J0016
ID No. : UAE.EFM.076/2564(EFM.SCT.02/64)
Condition As-Received: Used Item
Received Date : 04 January 2023
Calibration Date : 05 January 2023
Reference : 2301-0059WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by :

Approved by :

Issue Date : 10 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : DO Meter With Sensor
Condition As-Received : Used Item
Reference : 2301-0051WSC-2
Procedure Used :-
Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration
1. Reference standard instrument:-
Instrument Model Serial No. Cert. No. Due Date
1) Digital Thermometer 1523 2188080 22/1285 21 Oct 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date
1) Digital Thermometer 1523 2188080 22/1285 21 Oct 2023

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement

This instrument was connected with temperature sensor, S/N: 9K0E0260

| Calibration Point (°C) | Immersion Depth (mm) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty (± °C) | Coverage Factor k |
|-----------------------------|---------------------------|--------------------------------|------------------------|-----------------|-------------------------|----------------------|
| 25.0 | 80 | 25.003 | 25.0 | -0.003 | 0.16 | 2.00 |
| 30.0 | 80 | 30.010 | 29.9 | -0.110 | 0.16 | 2.00 |
| 35.0 | 80 | 34.996 | 34.9 | -0.096 | 0.16 | 2.00 |

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม



Condition of this result of calibration

1. Reference Standard Instrument :-

| Instrument | Serial No. | ID No. | Certificate No. | Due date |
|--------------------------|------------|----------|-----------------|-------------|
| 1) Thermometer | 9549224 | 130RC003 | 221484 | 17 Apr 2023 |
| 2) Ref. Std. Thermometer | 4982054 | 110RC044 | 2211306 | 27 Oct 2023 |

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

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

2. Certified Reference Materials :-

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

| Conductivity Solution | Manufacturer | Lot No. | Exp. date |
|-----------------------|--------------|---------|--------------|
| 1413.0 µS/cm | CPA Chem | 823328 | 20 June 2023 |
| 12.880 mS/cm | CPA Chem | 823329 | 20 June 2023 |

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 9B0K0160

| Standard Conductivity Solution | Before Adjustment UUC* Reading | After Adjustment UUC* Reading | Uncertainty of Measurement (±) | Coverage factor k |
|--------------------------------|--------------------------------|-------------------------------|----------------------------------|-------------------|
| 1413.0 µS/cm | 1375 µS/cm | 1413 µS/cm | 9.2 µS/cm | 2.00 |
| 12.880 mS/cm | 12.43 mS/cm | 12.70 mS/cm | 0.086 mS/cm | 2.00 |

Remark - UUC* = Unit Under Calibration

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Cert.No.: 23CH7
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement
(°) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. : 980K0160

Dimension of probe;

- Length : 104 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of Measurement (± °C) | Coverage factor k |
|------------------------|---------------------------|-------------------|------------|-----------------------------------|-------------------|
| 25.0 | 25.000 | 25.0 | 0.000 | 0.13 | 2.00 |
| 30.0 | 29.999 | 30.1 | 0.101 | 0.13 | 2.00 |
| 35.0 | 34.999 | 35.1 | 0.101 | 0.13 | 2.00 |

Remark : - UUC* = Unit Under Calibration

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

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มูลนิธิสถาบันวิจัยและพัฒนาอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2301846-001-01

Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 24 February 2023

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (25.1 ± 1.5) °C Relative Humidity: (50 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

| Instruments | Serial / ID No. | Manufacturer | Certificate No. | Due Date |
|--|-----------------|--------------|-----------------|-----------------|
| 2.1 DC Voltage Calibrator | 2709007 | Fuke | 22E1959 | 17 June 2023 |
| 2.2 Digital Thermometer | 2709007 | Fuke | CC 850577-01 | 30 October 2023 |
| 2.3 Thermo-Hygro Meter | NFI.BTH 007118 | PONPE 490 | QR22-0886 | 26 April 2023 |
| Certified Reference Material | | | | |
| | Lot No. | Manufacturer | Ref N | Expiry Date |
| 2.4 pH buffer 4.008 (Primary pH buffer Solution) | 832606 | CPAchem | PH216.L5 | 8 August 2024 |
| 2.5 pH buffer 6.865 (Primary pH buffer Solution) | 832607 | CPAchem | PH217.L5 | 8 August 2024 |
| 2.6 pH buffer 10.01 (Primary pH buffer Solution) | 832609 | CPAchem | PH220.L5 | 8 August 2023 |
| 2.7 pH buffer 7.00 (Standard pH buffer Solution) | 832610 | CPAchem | PH107.L5 | 8 August 2023 |

3. This certification is traceable to The International System of Unit (SI Unit)

| | | |
|---|--------------|---|
| 3.1 Instruments No.2.1 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008 |
| 3.2 Instruments No.2.2 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061 |
| 3.3 Instruments No.2.3 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292 |
| 3.4 Certified Reference Material No. 2.4 to 2.6 | traceable to | Primary measurement method- Hamed cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025 |
| 3.5 Certified Reference Material No.2.7 | traceable to | BIM RefH Hi-27 LoN 04.06.2021; BIM RefH Hi-28 LoN 28.05.2021; BIM RefH Hi-27 LoN 04.06.2021; BIM RefH Hi-28 LoN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025 |

4. This certificate was certified only for the instrument we calibrated.

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

FCS-012 Revision: 01 Date: 20-04-65



มูลนิธิสถาบันวิจัยและพัฒนาอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2301846-001-01

Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 24 February 2023

Page 3 of 5

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

| Nominal pH | DC Voltage Standard (mV) | Average Indicator Reading | | Uncertainty (± mV) | Coverage Factor (k) |
|------------|--------------------------|---------------------------|-------|--------------------|---------------------|
| | | mV | pH | | |
| 0 | 414.120 | 414 | 0.00 | 0.58 | 2.00 |
| 2 | 295.814 | 296 | 2.00 | 0.58 | 2.00 |
| 4 | 177.464 | 178 | 4.00 | 0.58 | 2.00 |
| 6 | 59.160 | 59 | 6.00 | 0.58 | 2.00 |
| 7 | 0.000 | 0 | 7.00 | 0.58 | 2.00 |
| 8 | -59.156 | -59 | 8.00 | 0.58 | 2.00 |
| 10 | -177.460 | -177 | 10.00 | 0.58 | 2.00 |
| 12 | -295.811 | -296 | 12.00 | 0.58 | 2.00 |
| 14 | -414.117 | -414 | 14.00 | 0.58 | 2.00 |

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: Mettler Toledo Model: InLab Solids
Serial No.: 9018311 ID.No. N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

| Certified Value @25 °C (pH) | Average Indicator Reading | | Relative Slope (%) | Uncertainty (± pH) | Coverage Factor (k) |
|-----------------------------|---------------------------|------|--------------------|--------------------|---------------------|
| | pH | mV | | | |
| 4.008 | 4.01 | 186 | - | 0.0071 | 2.00 |
| 6.865 | 6.90 | 19 | 97.68 | 0.0075 | 2.00 |
| 10.008 | 10.01 | -160 | 97.29 | 0.0095 | 2.00 |
| 6.985 | 6.99 | 15 | - | 0.0092 | 2.00 |

FCS-012 Revision: 01 Date: 20-04-65



มูลนิธิสถาบันวิจัยและพัฒนาอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2301846-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2301846
Operation No.: 2301846-001
Date of Receipt: 17 February 2023
Date of Calibration: 24 February 2023

Calibrated by

Specialist, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 24 February 2023

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

2008 ๒๕๕๓-๒๕๖๓ 36 หมู่๕ ต.บางนา-สวนหลวง ร.๖ แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545



มูลนิธิสถาบันวิจัยและพัฒนาอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



เอกสารไม่ควบคุม

2008 ๒๕๕๓-๒๕๖๓ 36 หมู่๕ ต.บางนา-สวนหลวง ร.๖ แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545





Calibration Report

Certificate No.: 2301846-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C Model: SevenEasy TM S20 pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: Mettler Toledo
Date of Calibration: 24 February 2023 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 25 °C ± 1 °C
Relative Humidity 48 % ± 3 %

Condition of this results of Calibration:

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|---------------------------------------|-------|------------|-----------------|-----------|---------|
| HANDHELD THERMOMETER | 1523 | 2118154 | PSL-T 0673/65 | 07-Jun-23 | TISTR |
| Platinum Resistance Thermometer (PRT) | 5627A | 877332 | | | |

Support Equipment : - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538,AN65 A85181.

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C Model: SevenEasy TM S20 pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: Mettler Toledo
Date of Calibration: 24 February 2023 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : - S/N : -
Dimension of probe : Diameter 9 mm., Length 120 mm.,
Sheath material : Stainless Steel

| UUC* Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|-------------------|---------------------------|-----------------------|--------------------|
| 15.1 | 15.015 | - 0.1 | 0.11 |
| 25.0 | 25.014 | 0.0 | 0.11 |
| 35.1 | 35.016 | - 0.1 | 0.11 |

Note

- UUC* : Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor of approximately 95 %.

***** End *****

F-CS-012 Revision: 01 Date: 20-04-65

Job No. : JF005/22

Certificate No. : FT005/22

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA.
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Ion Selective Model : 9409BN
Serial No. : ZW1-18420
Reference Electrode Model : 900100
Serial No. : ZW1-16834
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
Submitted by : บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Issue date : Tuesday, August 23, 2022
Calibrated by : [Redacted]
Approved by : [Redacted]
Laboratory manager



Certificate of Calibration

Job No. : JF005/22

Certificate No. : FT005/22

Received date : Tuesday, August 23, 2022

Page : 2 of 2

Calibration date : Tuesday, August 23, 2022

Condition of this calibration result

- 1 Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)
- 2 This certificate was certified only for the instrument we calibrated
- 3 This result of calibration was found accurate as shown on date and place of calibration only

Result of Calibration

Function : pH/ISE Meter with Probe

Direct Measurement

| | | | |
|---------------------------------|---|-------|---------|
| First Standard concentrated | = | 0.1 | ppm |
| Secondary Standard concentrated | = | 1 | ppm |
| Tertiary Standard concentrated | = | 10 | ppm |
| Fourthly Standard concentrated | = | 100 | ppm |
| Slope | = | -58.7 | mV/Dec. |

Channel : 1

| Unit Under Calibration | Standard Concentrated (ppm) | UUC Reading (ppm) | Correction (ppm) | Stddev (ppm) |
|------------------------|-------------------------------|---------------------|--------------------|----------------|
| Model : | 0.1 | 0.11 | -0.01 | 0.01 |
| 9409BN S/N. ZW1-18420 | 1 | 1.02 | -0.01 | 0.01 |
| 900100 S/N. ZW1-16834 | 10 | 10.10 | -0.10 | -0.10 |
| | 100 | 99.77 | 0.23 | 0.24 |

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Cert. No.: 23TM375
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approved Signatory

Issue Date :

24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0053360



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM375
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor k |
|------------------------|-------------------|-------------------|------------------------------|-----------------------------|------------------------|-------------------|
| 20.0 | 20.0 | 20.0 | 0.48 | 0.42 | 1.2 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|----------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 20.0 | 20.040 | 20.170 | 20.263 | 20.093 | 19.749 | 19.704 | 19.920 | 20.191 | 20.020 | 0.66 |

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1158258



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2
Procedure Used :-

Cert. No.: 23TM375
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |

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

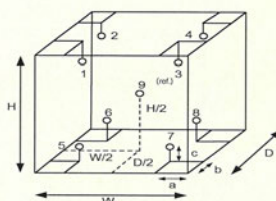
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 28 | 27 |
| REL.Humid. (%) | 42 | 45 |
| AC Supply (Volt) | 219 | 220 |



| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 20RTD-2/1 |
| 2 | 20RTD-2/2 |
| 3 | 20RTD-2/3 |
| 4 | 20RTD-2/4 |
| 5 | 20RTD-2/5 |
| 6 | 20RTD-2/6 |
| 7 | 20RTD-2/7 |
| 8 | 20RTD-2/8 |
| 9 (ref.) | 20RTD-2/9 |

Probe Installation Details :

Dimension of Chamber :

| | |
|-----------|--------------------|
| a = 10 cm | D = 0.62 m |
| b = 10 cm | W = 1.2 m |
| c = 10 cm | H = 1.2 m |
| | Capacity = 0.89 m³ |

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.006/2553
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Issue Date :

24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

a 1158259

เอกสารไม่ควบคุม

A 0053361



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-3

Cert. No.: 23TM372
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |

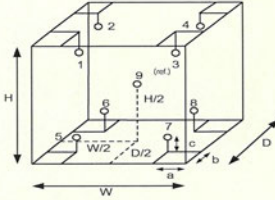
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 27 | 28 |
| REL.Humid. (%) | 44 | 41 |
| AC Supply (Volt) | 221 | 220 |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 20RTD-2/1 |
| 2 | 20RTD-2/2 |
| 3 | 20RTD-2/3 |
| 4 | 20RTD-2/4 |
| 5 | 20RTD-2/5 |
| 6 | 20RTD-2/6 |
| 7 | 20RTD-2/7 |
| 8 | 20RTD-2/8 |
| 9 (ref.) | 20RTD-2/9 |

Probe Installation Details :

Dimension of Chamber :

| | |
|-----------|--------------------------------|
| a = 10 cm | D = 0.62 m |
| b = 10 cm | W = 1.2 m |
| c = 10 cm | H = 1.2 m |
| | Capacity = 0.89 m ³ |

เอกสารไม่ควบคุม

a 1158257



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการการปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.:

2302827-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment:

Electronic Balance

Manufacturer:

METTLER TOLEDO

Model:

XSR204

Serial No.:

C117635043

ID No.:

UAE.WAS.012/2564

Order No.:

2302827

Operation No.:

2302827-001

Date of Receipt:

10 May 2023

Date of Calibration:

10 May 2023

Calibrated by

Approve

Date of Issue: 18 May 2023

Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 01 Date: 20-04-65



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการการปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model:

XSR204

Resolution: 0.0001 g

Serial No.:

C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 2 of 4

Environment Condition: Ambient Temperature: 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

| Reference Standard | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|--------------------------|-------------|------------|---------------|-----------------|--------------|
| Standard Weight Class E2 | 1mg to 200g | B505567572 | TCS | M23040535 | 8 April 2024 |

| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|--------------------|--------|----------------|----------------|-----------------|------------------|
| Thermo-Hygro Meter | 608-H1 | NFI.BTH 016/23 | Quality Reborn | QR23-0489 | 21 February 2024 |

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

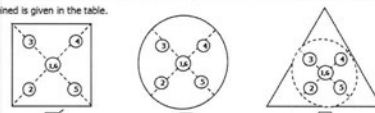
1. Repeatability of Reading:

| Nominal Value (g) | Standard Deviation of Reading (g) |
|---------------------|-------------------------------------|
| 100 | 0.000032 |
| 200 | 0.000032 |

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



| 1 | 2 | 3 | 4 | 5 | 6 | (Maximum Difference) |
|----------|----------|----------|----------|----------|----------|----------------------|
| (g) | (g) | (g) | (g) | (g) | (g) | (g) |
| 100.0002 | 100.0002 | 100.0002 | 100.0002 | 100.0003 | 100.0002 | 0.0001 |

FCS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

a 1151821



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการการปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (±g) | Coverage Factor k |
|----------------------|-----------------------|------------------------|-------------------|---------------------|----------------------|
| Unload | 0.00000 | 0.0000 | 0.0000 | 0.000085 | 2.00 |
| 0.01 | 0.01000 | 0.0100 | 0.0000 | 0.000085 | 2.00 |
| 0.02 | 0.02001 | 0.0200 | 0.0000 | 0.000085 | 2.00 |
| 0.05 | 0.05000 | 0.0500 | 0.0000 | 0.000085 | 2.00 |
| 0.1 | 0.10001 | 0.1000 | 0.0000 | 0.000085 | 2.00 |
| 0.2 | 0.20001 | 0.2000 | 0.0000 | 0.000085 | 2.00 |
| 0.5 | 0.50002 | 0.5000 | 0.0000 | 0.000085 | 2.00 |
| 1 | 1.00000 | 1.0000 | 0.0000 | 0.000086 | 2.00 |
| 2 | 2.00002 | 2.0000 | 0.0000 | 0.000086 | 2.00 |
| 3 | 3.00003 | 3.0000 | 0.0000 | 0.000087 | 2.00 |
| 5 | 5.00002 | 5.0000 | 0.0000 | 0.000087 | 2.00 |
| 10 | 10.00001 | 10.0000 | 0.0000 | 0.000088 | 2.00 |
| 20 | 20.00003 | 20.0000 | 0.0000 | 0.000092 | 2.00 |
| 30 | 30.00004 | 30.0000 | 0.0000 | 0.000098 | 2.00 |
| 40 | 40.00007 | 40.0000 | 0.0000 | 0.00011 | 2.00 |
| 45 | 45.00009 | 45.0001 | 0.0000 | 0.00013 | 2.00 |

FCS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (±g) | Coverage Factor k |
|----------------------|-----------------------|------------------------|-------------------|---------------------|----------------------|
| 50 | 50.00003 | 50.0000 | 0.0000 | 0.00011 | 2.00 |
| 55 | 55.00005 | 55.0000 | 0.0000 | 0.00012 | 2.00 |
| 60 | 60.00004 | 60.0000 | 0.0000 | 0.00012 | 2.00 |
| 65 | 65.00005 | 65.0000 | 0.0000 | 0.00013 | 2.00 |
| 70 | 70.00006 | 70.0001 | -0.0001 | 0.00013 | 2.00 |
| 75 | 75.00008 | 75.0002 | -0.0001 | 0.00013 | 2.00 |
| 80 | 80.00007 | 80.0002 | -0.0001 | 0.00014 | 2.00 |
| 85 | 85.00009 | 85.0002 | -0.0001 | 0.00014 | 2.00 |
| 90 | 90.00010 | 90.0002 | -0.0001 | 0.00015 | 2.00 |
| 100 | 100.00006 | 100.0002 | -0.0001 | 0.00016 | 2.00 |
| 120 | 120.00009 | 120.0002 | -0.0001 | 0.00018 | 2.00 |
| 150 | 150.00009 | 150.0002 | -0.0001 | 0.00021 | 2.00 |
| 200 | 200.00016 | 200.0003 | -0.0001 | 0.00028 | 2.00 |

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

FCS-012 Revision: 01 Date: 20-04-65

Certificate No.: HIT-2312-0342

Page: 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 Serial No. : H0185001
Tube Heater : 25 Vial Capacity Accuracy : ±2°C
Temperature Range : -10 °C to 160 °C Temperature of Reaction : 150°C
Ambient Temperature : (25 ± 2) °C Relative Humidity : (50 ± 15) % RH
Manufacturer : Hanna Instruments Made in : Romania
Condition As-Received : Used Product Reference : RE230392
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 8 March 2023
Calibrate date : 10 March 2023
Issue date : 20 March 2023
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material.

Calibrated by :

Approved by :

Authorized Signatory

HANNA
instruments
(Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Certificate No.: HIT-2312-0342

Page: 2 of 2

Condition of this calibration result

Reference Standard Instruments:

| Instruments | Model | Serial No. | Certificate No. | Traceable |
|---------------------------------|--------|------------|-----------------|-----------------------|
| Data Acquisition Switch Unit | 34970A | MY44065265 | WK2207-065-1 | WK Electric Co., Ltd. |

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

| Capacity (Vial) | Nominal Value (°C) | Average Value (°C) | ± Uncertainty (°C) | ± Tolerance of UUC (°C) | Acceptance Criteria |
|--------------------|-----------------------|-----------------------|-----------------------|----------------------------|------------------------|
| 25 Vial | 150.0 | 150.3 | 0.59 | 2 | Pass |

Figure: Shows the location of the temperature source.

| | | | | |
|----------|----------|----------|----------|----------|
| (1A) | (2A) | (3A) | (4A) | (5A) |
| 149.78°C | 150.31°C | 150.63°C | 149.93°C | 150.31°C |
| (1B) | (2B) | (3B) | (4B) | (5B) |
| 150.35°C | 150.18°C | 149.93°C | 150.18°C | 150.21°C |
| (1C) | (2C) | (3C) | (4C) | (5C) |
| 150.24°C | 151.10°C | 150.80°C | 150.36°C | 150.86°C |
| (1D) | (2D) | (3D) | (4D) | (5D) |
| 150.16°C | 149.77°C | 150.22°C | 150.67°C | 150.43°C |
| (1E) | (2E) | (3E) | (4E) | (5E) |
| 149.94°C | 150.44°C | 150.06°C | 150.63°C | 149.29°C |

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **

เอกสารไม่ควบคุม



Cert.No.: 23MM112
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by :
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai
Issue Date : 2 May 2023

The Uncertainties are for a confidence probability of approximately 95%

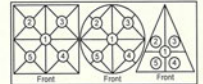
This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1
Result of calibration

Cert.No.: 23MM112
Page: 3 of 3



2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

| Position 1 (g) | Position 2 (g) | Position 3 (g) | Position 4 (g) | Position 5 (g) | Maximum difference between off-center and central loading (g) |
|-------------------|-------------------|-------------------|-------------------|-------------------|---|
| -0.0001 | -0.0001 | 0.0000 | -0.0001 | -0.0001 | 0.0001 |

3. Departure from nominal value

| Applied Weight (g) | Balance Reading (g) | Correction (g) | Measurement Uncertainty (± mg) | Coverage Factor (k) |
|-----------------------|---------------------------|-------------------|--------------------------------------|---------------------------|
| Unload | 0.00000 | 0.00000 | 0.014 | 2.13 |
| 0.05 | 0.05001 | -0.00001 | 0.015 | 2.09 |
| 0.1 | 0.10001 | -0.00001 | 0.015 | 2.09 |
| 1 | 1.00001 | -0.00001 | 0.018 | 2.04 |
| 5 | 5.00003 | -0.00003 | 0.026 | 2.00 |
| 20 | 20.00006 | -0.00006 | 0.045 | 2.00 |
| 50 | 50.00006 | -0.00006 | 0.080 | 2.00 |
| 80 | 80.00004 | -0.00004 | 0.15 | 2.00 |
| 100 | 100.00000 | 0.00000 | 0.16 | 2.00 |
| 150 | 150.00000 | 0.00000 | 0.29 | 2.00 |
| 200 | 200.00000 | 0.00000 | 0.29 | 2.00 |

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

-o0o-

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1
Procedure used :-

Cert.No.: 23MM112
Page: 2 of 3

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

Condition of this result of calibration

1. Reference standard instruments:-

| Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |

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

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

| Range capacity : | 0 g to 81 g | Resolution | 0.00001 g |
|------------------|---------------|------------|-----------|
| | 81 g to 220 g | Resolution | 0.0001 g |

Before Adjustment :

| Applied Weight (g) | Balance Reading (g) | Correction (g) | Measurement Uncertainty (± mg) | Coverage Factor (k) |
|-----------------------|---------------------------|-------------------|--------------------------------------|---------------------------|
| 80 | 80.00005 | -0.00005 | 0.15 | 2.00 |
| 200 | 199.9999 | +0.0001 | 0.29 | 2.00 |

After Adjustment :

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

| Applied Weight (g) | Standard Deviation of Reading (g) |
|-----------------------|--------------------------------------|
| 80 | 0.000007 |
| 200 | 0.00000 |

เอกสารไม่ควบคุม



Cert. No.: 22TM1490
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B216.1666
ID No. : UAE.WAO.027/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 19 October 2022
Calibration Date : 19 October 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by :
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai
Issue Date : 31 October 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0046800

Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 **Serial No.:** 91794469
Resolution: 1 °C **ID No.:** UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 30-31 March 2023 **Page 3 of 4**
Calibration point: 380 °C
Calibration result:

Reporting of Temperature

| Block No. | UUC* Setting (°C) | UUC* Reading (°C) | Stability (±°C) | Standard Thermometer (°C) | Uncertainty (±°C) |
|-----------|-------------------|-------------------|-----------------|---------------------------|-------------------|
| 1 | 380 | 380 | 0.96 | 377.74 | 2.1 |
| 2 | 380 | 380 | 0.40 | 377.28 | 2.1 |
| 3 | 380 | 380 | 1.18 | 377.82 | 2.1 |
| 4 | 380 | 380 | 0.44 | 377.19 | 1.6 |
| 5 | 380 | 380 | 0.11 | 377.30 | 1.6 |
| 6 | 380 | 380 | 0.14 | 377.90 | 1.6 |
| 7 | 380 | 380 | 1.17 | 373.85 | 2.1 |
| 8 | 380 | 380 | 0.33 | 376.96 | 2.1 |
| 9 | 380 | 380 | 0.14 | 374.18 | 2.1 |
| 10 | 380 | 380 | 0.96 | 378.56 | 2.0 |
| 11 | 380 | 380 | 1.04 | 378.34 | 2.0 |
| 12 | 380 | 380 | 0.35 | 378.06 | 2.0 |
| 13 | 380 | 380 | 0.48 | 377.05 | 1.6 |
| 14 | 380 | 380 | 0.38 | 379.19 | 1.6 |
| 15 | 380 | 380 | 0.50 | 377.48 | 1.6 |
| 16 | 380 | 380 | 0.48 | 378.33 | 1.7 |
| 17 | 380 | 380 | 0.71 | 377.60 | 1.7 |
| 18 | 380 | 380 | 0.35 | 376.77 | 1.7 |
| 19 | 380 | 380 | 0.84 | 377.06 | 1.8 |
| 20 | 380 | 380 | 0.41 | 378.58 | 1.8 |

Note:

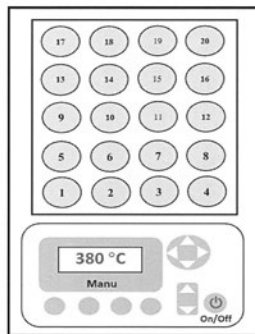
- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

F-CS-009 Revision: 01 Date: 20-04-65

Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 **Serial No.:** 91794469
Resolution: 1 °C **ID No.:** UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 30-31 March 2023 **Page 4 of 4**
Calibration point: 380 °C
Calibration result: Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit
TOP VIEW



Sensor Installation Location

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

----- End -----

F-CS-009 Revision: 01 Date: 20-04-65

FOSS

FOSS South East Asia
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No.: 6623

Date: 25/25/2022
Customer: United Analyst and Engineering
Address:
Instrument: KT9100
Serial: 31989052

| Hours | Travel To Customer | Labour | Travel From Customer |
|--------|--------------------|-------------|----------------------|
| Start | 9:00 | 9:00-12:00 | 16:30 |
| Finish | 9:50 | 12:00-16:00 | 17:30 |
| | 30 mins | 3 + 3 | 1 hrs. |

| Application | Special | Standard |
|-----------------|----------------|--------------|
| Normal | Courtesy Visit | Installation |
| Distributor | PMA Onboarding | Quote |
| Internal | Warranty | Repair |
| Digital Service | Sales Support | Remote |
| | | Other |

PO/Quote Number: 722010218

PMA Type: 722010218 **Contract No.:** 722010218

| Details of Work / Test | Condition / Status |
|--|--------------------|
| Unpack - ตรวจสอบเครื่อง - ไม่พบความผิดปกติ | OK |
| Accessories - Accessory Kit | OK |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | OK |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | OK |

Instrument Ready for Use: ☒ OK ☐ Not OK

| Part No. | Batch | Description | Qty |
|----------|-------|-------------|-----|
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I confirm this report is accurate and complete

Signed FOSS: **Signed Customer:**

Name: **Name:**

Would you be willing to participate in a brief survey in order to tell us how we performed? ☐ Yes ☐ No

เอกสารไม่ควบคุม

FOSS

FOSS South East Asia
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No.: 6534

Date: 25/7/2022
Customer: United Analyst and Engineering
Address:
Instrument: KT9100
Serial: 91989052

| Hours | Travel To Customer | Labour | Travel From Customer |
|--------|--------------------|-------------|----------------------|
| Start | 9:00 | 9:00-12:00 | 16:30 |
| Finish | 9:50 | 12:00-16:00 | 17:30 |
| | 30 mins | 3 + 3 | 1 hrs. |

| Application | Special | Standard |
|-----------------|----------------|--------------|
| Normal | Courtesy Visit | Installation |
| Distributor | PMA Onboarding | Quote |
| Internal | Warranty | Repair |
| Digital Service | Sales Support | Remote |
| | | Other |

PO/Quote Number: 722010218

PMA Type: 722010218 **Contract No.:** 722010218

| Details of Work / Test | Condition / Status |
|--|--------------------|
| Initial - ตรวจสอบเครื่อง - ไม่พบความผิดปกติ | Done |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |
| Initial - ตรวจสอบระดับน้ำ - ไม่พบความผิดปกติ | |

Instrument Ready for Use: ☒ OK ☐ Not OK

| Part No. | Batch | Description | Qty |
|----------|-------|-------------|-----|
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I confirm this report is accurate and complete

Signed FOSS: **Signed Customer:**

Name: **Name:**

Would you be willing to participate in a brief survey in order to tell us how we performed? ☐ Yes ☐ No

เอกสารไม่ควบคุม

Kjeltec™ 8100 Distillation Unit

This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.

1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

2 Purpose

This installation Qualification is designed to assure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable
- The instrument is assembled and configured correctly
- Suitable electricity and water are supplied to the instrument, see table 2 for requirements.

3 Identification

| Description | Serial Number |
|--------------------------------|---------------|
| Kjeltec 8100 Distillation Unit | 91889052 |

Dedicated Analytical Solutions

FOSS Analytical AS
69 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Högåns
Sweden

Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

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5 Installation

5.1 The equipment must be installed in a suitable location with power, water and draining available

Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write "Y" in the right column of the table immediately following.

| Location Requirements | Acceptance Criteria | Pass (Y/N) |
|------------------------------------|---|------------|
| Adequate space for instrument | Dimensions 48x58x69 cm | Y |
| AC supply available for instrument | 200-240 V 50/60Hz | Y |
| Current | 10 A | Y |
| Cold water supply available | 2 L/min at 30°C | Y |
| Drain | For cooling water and waste (depending on local waste disposal legislation) | Y |
| Ambient temperature | Max. 40°C | Y |
| Ambient humidity | Max. 80% relative | Y |
| Internal fuses | T10A AH | Y |

Customer Support, 6003 7242 / Rev. 1

เอกสารไม่ควบคุม 3(6)

4 Control of Received Equipment

4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write "Y" in the right column of the table immediately following.

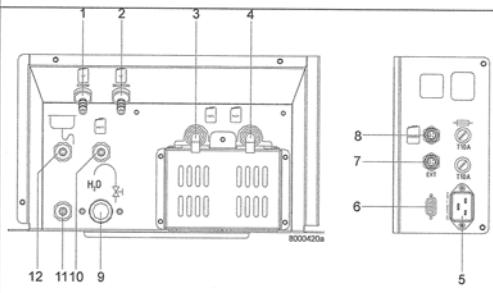
| Packing List Item | Acceptance Criteria | Pass(Y/N) |
|--|--|-----------|
| Kjeltec 8100 Distillation Unit | No visible damage, received in undamaged FOSS Analytical's standard shipping container | Y |
| Accessory kit, according to packing list | Included. No visible damage, received in undamaged FOSS Analytical's standard shipping container | Y |
| Handling device for digestion tube | Included. No visible damage. | Y |
| Tanks with level sensors for Waste, Alkali and Water | Included. No visible damage. | Y |
| Receiver flask | Included. No visible damage. | Y |
| One digestion tube 250ml | Included. No visible damage. | Y |
| One digestion tube 100 ml | Included. No visible damage. | Y |
| Tube adapter | Included. No visible damage. | Y |
| User manual | Kjeltec 8100 Distillation Unit | Y |
| Owners guide | Kjeltec 8100 Distillation Unit | Y |
| Quick guide | Kjeltec 8100 Distillation Unit | Y |
| Spare parts manual | Kjeltec 8100 Distillation Unit | Y |
| Application notes | AN 300 included AN 303 included | Y |

Customer Support, 6003 7242 / Rev. 1

เอกสารไม่ควบคุม 2(6)

5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write "Y" in the right column of the table immediately following.

| Instrument Tubing Connections | Acceptance Criteria | Pass (Y/N) |
|---|----------------------------------|------------|
|  <p>1. Deionised water in (steam generator) 2. Deionised water in (dilution water) 3. *) Receiver solution in 4. Alkali in 5. Power 6. Not used 7. External titration module 8. Level sensors 9. Cooling water in (tap water) 10. Waste water out (tube drain vessel) 11. Drain 12. Cooling water out (tap water) *) Only on Kjeltec 8200</p> | Visual verification by installer | Y |

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เอกสารไม่ควบคุม 4(6)

5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start up procedure and check that the expected response is obtained. If so, write "Y" in the right column of the table immediately following.

| Action | Expected Response | Pass (Y/N) |
|--|---|------------|
| Switch on the power | The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software. | Y |
| | After start-up, Program 1 is loaded and the Analyse menu is displayed. | Y |
| Turn on the cold water tap | No visible reaction | Y |
| Press the "Manual" view | The Manual menu is opened | Y |
| Open the door with the handle, place the test tube and receiver flask in position. Close the door. | | Y |
| Select Dilution and press Start | Water is added to the tube | Y |
| Select Alkali and press Start | Alkali is added to the tube | Y |
| Select Steam and press start | After heating up, steam is entering the tube | Y |
| Select Drain and press Start | The tube is drained | Y |

Kjeltec™ 8100 Distillation Unit

This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.

1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical Application Notes.

2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

3 Identification

| Description | Serial Number |
|--|---------------|
| Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz | 9189052 |

Dedicated Analytical Solutions

FOSS Analytical AS
69 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Höganäs
Sweden

Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

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เอกสารไม่ควบคุม

5(6)

เอกสารไม่ควบคุม

1(7)

6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

| Deviation | Action | Comment |
|-----------|--------|---------|
| | | |
| | | |
| | | |
| | | |
| | | |

7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Installed By: [Signature]

Company: Foss SEA

Customer Name: United Analyst and Engineering

Company: United Analyst and Engineering

Date completed: July 25, 2022

4 Performance

4.1 Verify the dispensed volumes of reagents

Note! To verify the dispensed volumes of reagents a triple test should be done to be statistic correct. Then calculate a mean value.

1. Choose "Manual" in the menu. (When starting up the instrument Program 1 is loaded)
2. Open the safety door by pressing **Open** and place a tube in the instrument. Close the safety door.

Water

1. Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Note! If the water volume needs to be calibrated, go to 4.8.5 Dilution Pump Calibration in the User Manual.

Alkali

1. Press **Alkali** and then press **Start**. 50 ml of alkali will be filled into the tube.
2. Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Table 1 Volume control

| Test | Result | Expected result | Passed (Y/N) |
|---------------|--|-----------------|--------------|
| Water volume | <u>83</u> ml <u>85</u> ml <u>81</u> ml Mean <u>82.67</u> ml | 76- 84 ml | Y |
| Alkali volume | <u>42</u> ml <u>52</u> ml <u>53</u> ml Mean <u>52.33</u> ml | 47- 54 ml | Y |

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium (NH_4^+) into ammonia (NH_3) by using an alkali (NaOH) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following.

Chemical Check

Use ammonium sulphate ($\text{NH}_4)_2\text{SO}_4$, purity > 99.5 % *)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (99.5 %) = 21.09% *)

Analysis conditions according to AN 300

| | |
|-------------------|-----------------------|
| Water | 80 ml |
| Alkali | 50 ml NaOH (40%w/w) |
| Receiver solution | 30 ml boric acid (4%) |
| Distillation time | 5 minutes |
| SAFE | 5 seconds |
| Titration | 0.2N HCl |

For reagent preparation see Appendix A

- Start the instrument and run two blanks without chemicals according to above analysis conditions, distil into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0.2 ml continue with the recovery tests:
- Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
- Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
- Calculate the recovery according to below equations. Expected results of recovery should be 100%±1%.

| Recovery test | Result | Expected result | Passed (Y/N) |
|---------------------------|--|-----------------|--------------|
| Blank value (water blank) | 1. 0.03 ml 2. 0.19 ml | 0.05-0.20 ml | Y |
| Recovery | 1. 100.30 % 2. 100.30 % 3. 100.63 % 4. 99.81 % 5. 99.97 % 6. 100.01 % | | |
| Accuracy | Mean Value: 100.0% | 99-101% | Y |
| Precision | SD: 0.552 | SD <1% | Y |

Customer Support, 6003 7246 / Rev. 1

เอกสารไม่ควบคุม

3(7)

5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

| Deviation | Action | Comment |
|-----------|--------|---------|
| | | |
| | | |
| | | |
| | | |

6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: _____

Company: _____

Customer Name: _____

Company: _____

Date completed: _____

Customer Support, 6003 7246 / Rev. 1

เอกสารไม่ควบคุม

5(7)

*) Note! Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available

| Purity | Nitrogen content |
|--------|------------------|
| 99.5% | 21.09% ✓ |
| 99.6% | 21.12% |
| 99.7% | 21.14% |
| 99.8% | 21.16% |
| 99.9% | 21.18% |

$$\% \text{ Nitrogen} = \frac{(ml_{\text{sample}} - ml_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} \nearrow 0.1095 \\ 21.72 \end{matrix}$$

N = Normality of titrant to 4 places of decimal.

$$\% \text{ Recovery} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

$$mg_{\text{sample}} \quad \begin{matrix} 0.1599 \\ 23.56 \end{matrix}$$

①
②
③
④
⑤
⑥
⑦

7 Appendix A

7.1 Preparation of Reagents

7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

Standard substance

Weigh approx. 10 g of anhydrous sodium carbonate (Na_2CO_3). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.

Indicator solutions

Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1 g bromocresol green in 100 ml methanol.

Procedure

Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight (W_1). Transfer the sodium carbonate to a receiver flask and add 40 ml of H_2O (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used (A_1). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume

(A_2). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume (A_3)

Note! Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)

Customer Support, 6003 7246 / Rev. 1

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6(7)

Customer Support, 6003 7246 / Rev. 1

เอกสารไม่ควบคุม

4(7)

7.2 Calculation

$$\text{Molarity (M)} = \frac{18,870 \times W_1}{(A_1 + A_2 + A_3)}$$

Note! Concentration must be accurate to four digits, i.e. 0.2000 M.

Note! The colour change of this official procedure (AOAC 936.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05-0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5-6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

Note! The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 - 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

- Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant x 40
- Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
- To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might create irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.

4.2 Ongoing Qualification Tests

Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding a salt (K_2SO_4) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept; please follow recommendation in AN 300 or suggested procedures for a specific kind of sample material.

The block temperature itself can be controlled external by inserting a temperature probe in the intended hole in the aluminium block (front row of holes).

Use the reagents and method procedure specified in AN 300. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or demineralised water or water of equivalent purity.

Suggested standard material for internal quality control:

Ammonium sulphate $[(NH_4)_2SO_4]$, min. 99.5 % (mass fraction), with certified purity.

Note: The above chemical is usually readily available with a certificate specifying the purity.

Alternatively ammonium iron(II) sulphate, $(NH_4)_2Fe(SO_4)_2 \times 6 H_2O$, with certified purity may be used.

Tryptophan ($C_{11}H_{12}N_2O_2$), minimum assay 99 % (mass fraction). Nitrogen content 137.2 g/kg. Do not dry in an oven before use.

Acetanilide (C_8H_9NO), minimum assay 99 % (mass fraction). Nitrogen content 103.6 g/kg. Do not dry in an oven before use.

Sucrose, ($C_{12}H_{22}O_{11}$), with a nitrogen content of not more than 0.002 % (mass fraction). Do not dry in an oven before use.

Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 2 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

Note: The amount of titrant used in the blank test should always be greater than 0.0 ml. Blanks within the same laboratory should be consistent across time.

4.3 Recovery Tests

Regularly run recovery studies to check the accuracy of procedure and equipment:

- Nitrogen loss.** - Use 0.12 g ammonium sulphate and 0.67 g sucrose per flask weighted to the nearest 0.1 mg. Add all other reagents as stated in the method currently used (Kjeltabs, H_2SO_4 , etc). Digest and distil under same conditions as for sample. Recoveries shall be >99 %.
- Digestion efficiency.** - Use a test portion of minimum 0.15 g of tryptophan or acetanilide and 0.67 g sucrose per flask weighed to the nearest 0.1 mg. Determine the nitrogen content according to the current procedure in use. The recoveries of tryptophan shall be >98.5 %; the recoveries of acetanilide shall be >99.5 %.
- Distillation and titration efficiency.** - Distil 0.10 – 0.15 g ± 0.0001 g ammonium sulphate, omitting the digestion step. The recoveries should be >99.5 %.

Note: Results less than 98.5 % or more than 101.0 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimals accuracy according to procedure in AN 300)

Customer Support, 6003 7363 / Rev. 2

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2(11)

Customer Support, 6003 7246 / Rev. 1

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7(7)

FOSS

Performance Qualification

Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digestor

1 Scope

This PQ applies to the Digestion system 2508/2520 (including exhaust and scrubber unit) and Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The user of the instrument performs the PQ.

2 Intended Use

The Digestion system (including exhaust and scrubber) and Kjeltec 8100 Distillation Unit are intended for laboratory use analyzing parameters as specified in FOSS Application Notes.

3 Purpose

The guidelines are intended to assist the user in successfully developing Performance Qualifications for the specific application(s) to which the instrument is applied.

The Performance Qualification (PQ) includes the process of demonstrating that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its routine use. Main activities in the PQ phase are:

- Preventive maintenance
- On-going verification tests

This document suggests routines to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local routines for similar equipment.

4 Definition of Test Procedures

4.1 Preventive Maintenance

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 5. Maintenance. A yearly service is recommended (service agreement).

Maintenance of the Digestion block (including exhaust and scrubber) should be performed according to instruction in the user manual, see User Manual Tecator Digestor, chapter 5. Maintenance.

Dedicated Analytical Solutions

FOSS Analytical AS
69 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Höganäs
Sweden

Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

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1(11)

External Quality Control Program

It is recommended to participate in an external quality control program, such as a proficiency program or ring test, with equivalent sample material as analysed within the laboratory.

Calculation and Expression of Results

$$w_N = \frac{14.007(V_s - V_b)N \times 100\%}{m}$$

Where:

w_N is the nitrogen content of the sample, expressed as a percentage by mass.

V_s is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the sample test, in milliliters, expressed to the nearest 0.05 ml.

V_b is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in milliliters, expressed to the nearest 0.05 ml.

N is the numerical value of the exact normality of the hydrochloric acid standard volumetric solution, expressed to four decimal places.

m is the numerical value of the mass of the test portion, in milligrams, expressed to the nearest 1 mg for sample weights >1 g or to the nearest 0.1 mg for sample weights <1 g.

5 Maintenance

5.1 Maintenance Kjeltec™ 8100

See instructions in User Manual - Kjeltec 8100/8200, chapter 5 Maintenance.

5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 5 Maintenance.

6 The Maintenance Record Charts

This record charts are provided to assist you in keeping your system in good working order. Please make copies and use them regularly as they can often help us to help you in the unlikely event a system malfunction.

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3(11)

6.1 FossCare™ Service Log

[illegible]

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Customer Support, 6003 7363 / Rev. 2

4(11)

Applicable for FOSS sales and service companies.

6.1 FossCare™ Service Log

[illegible]

เอกสารไม่ควบคุม

Customer Support, 6003 7363 / Rev. 2

4(11)

Applicable for FOSS sales and service companies.

6.2.2.2 Weekly Maintenance

[illegible]

เอกสารไม่ควบคุม

Customer Support, 6003 7363 / Rev. 2

Customer Support, 6003 7363 / Rev. 2

6(11)

เอกสารไม่ควบคุม

6.2 FossCare™ Customer Log

6.2.1 Daily Maintenance

[illegible]

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Customer Support, 6003 7363 / Rev. 2

6(11)

เอกสารไม่ควบคุม

6.2.4 Additional Maintenance

[illegible]

เอกสารไม่ควบคุม

6.2.3 Every 1-3 Months Maintenance

[illegible]

เอกสารไม่ควบคุม

6.2.6 Exchange of Parts and Reagents Maintenance

[illegible]

เอกสารไม่ควบคุม

6.2.5 Yearly Maintenance

[illegible]

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

ISO 17025

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ISO 17025

REPORT OF CALIBRATION

Certificate No. : SP23-021Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 95935 | 22 October 2023 |
| Absorbance Standard set | 25757 | 95929 | 22 October 2023 |
| Wavelength Standard set | 25806 | 95916 | 22 October 2023 |
| Wavelength Standard set | 25758 | 95915 | 22 October 2023 |

Traceability This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

FM-708-02 R01 1/11/2021

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DQE Services Co.,Ltd.

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REPORT OF CALIBRATION

Certificate No. : SP23-021Page 4 of 5

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7478 | 0.7436 | 0.0042 | 0.0058 | 2.00 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8686 | 0.8648 | 0.0038 | 0.0064 | 2.00 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2912 | 0.2908 | 0.0004 | 0.0052 | 2.00 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6448 | 0.6398 | 0.0050 | 0.0058 | 2.00 |

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP23-021Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 420 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5787 | 0.5742 | 0.0045 | 0.0031 | 2.00 |
| | 1.0490 | 1.0423 | 0.0067 | 0.0029 | 2.00 |
| | 2.1900 | 2.1847 | 0.0053 | 0.0075 | 2.00 |
| 440 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5607 | 0.5577 | 0.0030 | 0.0034 | 2.00 |
| | 1.0247 | 1.0234 | 0.0013 | 0.0035 | 2.00 |
| | 2.1229 | 2.1171 | 0.0058 | 0.0088 | 2.00 |
| 465 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5236 | 0.5184 | 0.0052 | 0.0029 | 2.00 |
| | 0.9634 | 0.9607 | 0.0027 | 0.0029 | 2.00 |
| | 1.9763 | 1.9715 | 0.0048 | 0.0081 | 2.00 |
| 546.1 | 0.0000 | -0.0001 | 0.0001 | 0.0028 | 2.00 |
| | 0.5191 | 0.5159 | 0.0032 | 0.0031 | 2.00 |
| | 1.0003 | 0.9980 | 0.0023 | 0.0033 | 2.00 |
| | 1.9987 | 1.9917 | 0.0070 | 0.0087 | 2.00 |
| 590 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5523 | 0.5501 | 0.0022 | 0.0030 | 2.00 |
| | 1.0809 | 1.0808 | 0.0001 | 0.0030 | 2.00 |
| | 2.0391 | 2.0336 | 0.0055 | 0.0081 | 2.00 |
| 635 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5601 | 0.5585 | 0.0016 | 0.0031 | 2.00 |
| | 1.0512 | 1.0485 | 0.0027 | 0.0030 | 2.00 |
| | 1.9294 | 1.9317 | -0.0023 | 0.0083 | 2.00 |

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP23-021Page 5 of 5

Wavelength Accuracy :

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor k |
|-------------------|-------------------|------------------|-------------------|-------------------|
| 241.72 | 242.0 | -0.28 | 0.18 | 2.00 |
| 279.45 | 279.5 | -0.05 | 0.18 | 2.00 |
| 287.81 | 287.5 | 0.31 | 0.18 | 2.00 |
| 334.06 | 333.5 | 0.56 | 0.18 | 2.00 |
| 360.93 | 360.3 | 0.63 | 0.18 | 2.00 |
| 418.59 | 418.0 | 0.59 | 0.18 | 2.00 |
| 445.94 | 445.3 | 0.64 | 0.18 | 2.00 |
| 453.66 | 453.0 | 0.66 | 0.18 | 2.00 |
| 460.02 | 459.6 | 0.42 | 0.18 | 2.00 |
| 536.59 | 536.4 | 0.19 | 0.18 | 2.00 |
| 637.98 | 638.3 | -0.32 | 0.18 | 2.00 |
| 431.38 | 431.0 | 0.38 | 0.18 | 2.00 |
| 472.50 | 472.5 | 0.00 | 0.18 | 2.00 |
| 513.47 | 513.5 | -0.03 | 0.18 | 2.00 |
| 528.88 | 529.0 | -0.12 | 0.18 | 2.00 |
| 573.17 | 573.0 | 0.17 | 0.18 | 2.00 |
| 585.35 | 585.0 | 0.35 | 0.20 | 2.00 |
| 684.40 | 684.5 | -0.10 | 0.18 | 2.00 |
| 740.72 | 741.0 | -0.28 | 0.20 | 2.00 |
| 748.55 | 748.5 | 0.05 | 0.18 | 2.00 |
| 807.03 | 807.0 | 0.03 | 0.18 | 2.00 |
| 879.28 | 879.5 | -0.22 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,
which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited


- End of Certificate -

FM-708-02 R01 1/11/2021

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DQEServices

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com


MSC-TB-18 1728
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : [Redacted]Approved by : [Redacted]

Technical ManagerQuality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.


The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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DQEServices

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MSC-TB-18 1728
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. :SP23-007Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 420 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5787 | 0.575 | 0.0037 | 0.0031 | 2.00 |
| | 1.0490 | 1.044 | 0.0050 | 0.0029 | 2.00 |
| | 2.1900 | 2.181 | 0.0090 | 0.0080 | 2.00 |
| 440 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5607 | 0.558 | 0.0027 | 0.0034 | 2.00 |
| | 1.0247 | 1.021 | 0.0037 | 0.0035 | 2.00 |
| | 2.1229 | 2.115 | 0.0079 | 0.0081 | 2.00 |
| 465 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5236 | 0.520 | 0.0036 | 0.0030 | 2.00 |
| | 0.9634 | 0.961 | 0.0024 | 0.0029 | 2.00 |
| | 1.9763 | 1.968 | 0.0083 | 0.0070 | 2.00 |
| 546.1 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5191 | 0.518 | 0.0011 | 0.0031 | 2.00 |
| | 1.0003 | 1.000 | 0.0003 | 0.0033 | 2.00 |
| | 1.9987 | 1.993 | 0.0057 | 0.0084 | 2.00 |
| 590 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5523 | 0.552 | 0.0003 | 0.0030 | 2.00 |
| | 1.0809 | 1.082 | -0.0011 | 0.0030 | 2.00 |
| | 2.0391 | 2.031 | 0.0081 | 0.0080 | 2.00 |
| 635 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5601 | 0.562 | -0.0019 | 0.0032 | 2.00 |
| | 1.0512 | 1.052 | -0.0008 | 0.0030 | 2.00 |
| | 1.9294 | 1.923 | 0.0064 | 0.0079 | 2.00 |

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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP23-007Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 95935 | 22 October 2023 |
| Absorbance Standard set | 25757 | 95929 | 22 October 2023 |
| Wavelength Standard set | 25806 | 95916 | 22 October 2023 |
| Wavelength Standard set | 25758 | 95915 | 22 October 2023 |

Traceability This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.


Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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MSC-TB-18 1728
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. :SP23-007Page 4 of 5

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 235 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7478 | 0.743 | 0.0048 | 0.0057 | 2.00 |
| 257 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8686 | 0.861 | 0.0076 | 0.0059 | 2.00 |
| 313 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2912 | 0.291 | 0.0002 | 0.0051 | 2.00 |
| 350 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6448 | 0.639 | 0.0058 | 0.0055 | 2.00 |

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FM-708-02 R01 1/11/2021


DQE Services Co.,Ltd.

DQE

Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



 ASSOCIATION OF CALIBRATION BODIES THAILAND

REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 5 of 5

Wavelength Accuracy :

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor <i>k</i> |
|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 241.54 | 240.8 | 0.74 | 0.18 | 2.00 |
| 279.40 | 278.5 | 0.90 | 0.18 | 2.00 |
| 288.70 | 288.0 | 0.70 | 0.18 | 2.00 |
| 334.22 | 333.5 | 0.72 | 0.18 | 2.00 |
| 361.26 | 360.5 | 0.76 | 0.18 | 2.00 |
| 418.48 | 417.8 | 0.68 | 0.21 | 2.00 |
| 446.70 | 445.9 | 0.80 | 0.18 | 2.00 |
| 453.20 | 452.5 | 0.70 | 0.18 | 2.00 |
| 460.06 | 459.5 | 0.56 | 0.18 | 2.00 |
| 536.90 | 536.0 | 0.90 | 0.18 | 2.00 |
| 637.94 | 637.1 | 0.84 | 0.18 | 2.00 |
| 440.74 | 440.0 | 0.74 | 0.18 | 2.00 |
| 472.22 | 471.5 | 0.72 | 0.18 | 2.00 |
| 513.70 | 513.0 | 0.70 | 0.18 | 2.00 |
| 528.72 | 528.0 | 0.72 | 0.18 | 2.00 |
| 574.60 | 574.0 | 0.60 | 0.18 | 2.00 |
| 585.48 | 584.6 | 0.88 | 0.20 | 2.00 |
| 684.63 | 684.0 | 0.63 | 0.18 | 2.00 |
| 740.27 | 740.0 | 0.27 | 0.20 | 2.00 |
| 748.28 | 747.5 | 0.78 | 0.18 | 2.00 |
| 807.16 | 806.5 | 0.66 | 0.18 | 2.00 |
| 879.70 | 879.0 | 0.70 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

| <p>Condition of this calibration result</p> | | | | |
|--|-------------------------|--|-------------------------|-----------------|
| <p>1. Reference Standard Instruments :</p> <p>This certification is traceable to the International System of unit (SI unit) through Technology Promotion Association (Thailand-Japan).</p> | | | | |
| Instruments | Serial No. | ID No. | Certificate No. | Due date |
| 1) Thermo-Hygrograph | 1103328 | 130EC010 | 22H1313 | 12 June 2023 |
| 2) Electronic Balance | N03679 | 140RC001 | 21MM429 | 21 Sep 2022 |
| <p>2. Standard Material : The Formazin suspension has been prepared gravimetric from</p> | | | | |
| Material | Manufacturer | Lot No. | Assay | |
| 1) Hexamethylenetetramine | HIMEDIA | 0000493947 | 99.65% | |
| 2) Hydrazinium Sulfate | HIMEDIA | 0000522014 | 99.40% | |
| <p>3. This certificate is valid only to the item calibrated on date and place of calibration.</p> | | | | |
| <p>Calibration result</p> | | | | |
| <p>Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU Turbidity Meter Serial Number : 1120501017</p> | | | | |
| Standard Formazine suspension (NTU) | UUC* Reading (NTU) | Uncertainty of Measurement (± NTU) | Coverage Factor k | |
| 0 | 0.00 | 0.0062 | 2.00 | |
| 20 | 20.1 | 0.39 | 2.00 | |
| 100 | 102 | 0.74 | 2.00 | |
| 400 | 403 | 1.5 | 2.13 | |
| 800 | 804 | 2.1 | 2.20 | |
| <p>Remark</p> <p>- UUC* = Unit Under Calibration</p> <p>- NTU = Nephelometric Turbidity Units</p> | | | | |
| <p>The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.</p> <p>-o0o-</p> | | | | |

เอกสารไม่ควบคุม

a 1124976

| | |
|---|---|
| <p>TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)</p> <p>CALIBRATION AND TESTING EQUIPMENT SERVICES</p> <p>53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250</p> <p>TEL. 0-2717-3000-24 FAX. 0-2719-9484</p> | |
| <p>Certificate of Calibration</p> | |
| <p>Cert.No.: 22CH1184</p> <p>Page.: 1 of 2</p> | |
| Equipment : | Turbidity Meter |
| Manufacturer : | Oakton |
| Model : | T100IR |
| Serial No. : | 1120501017 |
| ID. No. : | UAE.WAT.056/2563 |
| Condition As-Received: | Used Item |
| Received Date : | 31 August 2022 |
| Calibration Date : | 05 September 2022 |
| Reference : | 2208-1106WSC-1 |
| Submitted by : | United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260 |
| Ambient Temperature : | (25 ± 2.5) °C |
| Relative Humidity : | (50 ± 20) % |
| Calibration Procedure : | In - house method : CP-CH11 based on direct measurement by using Formazin standard solution |
| Calibrated by : | |
| Approved by : | Approved Signatory |
| Issue Date : | 6 September 2022 |
| <p>The Uncertainties are for a confidence probability of approximately 95%.</p> <p>This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration and Testing Equipment Services.</p> | |

เอกสารไม่ควบคุม

A 0009588

| | |
|---|--|
| <p>Agilent CrossLab Start Up Services</p> <p>Agilent Intuvo 9000 Gas Chromatograph</p> <p>Preventive Maintenance Checklist</p> | |
| <p>Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.</p> <p>Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.</p> | |
| <p>Agilent</p> | |

เอกสารไม่ควบคุม

Introduction

Customer Information

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

Important Customer Web Links

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

Revision: 2.0001, Issued: December 30, 2020 September 15, 2021
 Agile Document Number: D0007059D0013614
 DE number: 44166.759722222
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Page ____ of ____



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System Information

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

Instrument System Name and ID

Instrument System Site and Location

UAE, Bangkok

List System Component Product Numbers

List the Serial Numbers of each Component

| | | |
|-----|--------|------------|
| 1. | G450A | CN12100009 |
| 2. | G4513A | CN12120121 |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |
| 9. | | |
| 10. | | |

Preparation

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

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 Agile Document Number: D0007059D0013614
 DE number: 44166.759722222
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Page ____ of ____



เอกสารไม่ควบคุม

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

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

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Page ____ of ____



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Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify operation of all instrument fans.

Inlet and detector consumable replacement

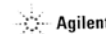
- ☒ For the inlet installed, perform inlet maintenance using the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace column Compression Bolts.
- ☒ Replace the split vent trap for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary. Use the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace the Guard Chip or Jumper Chip for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.

Inlet and Detector Tests

- ☒ Zero all pressure sensors.
- ☒ Perform the inlet pressure leak test.
- ☒ Perform the inlet restriction test.
- ☒ Perform the FID jet restriction test if FID installed.
- ☒ Perform the FID leakage test if FID installed.
- ☒ Record if test passed or failed in the results table.

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Page ____ of ____



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ALS Maintenance

- ☐ Check all cabling and configuration settings between GC, tray, and injectors.
- ☐ Vacuum or removed any dust, especially around fans.
- ☐ Check operation of all fans.
- ☐ Check syringe for smooth plunger operation.
- ☐ Check for smooth operation of the needle support rod – clean if necessary
- ☐ Check for correct operation of syringe volume stops

Restore Instrument

- ☒ Restore the normal operating conditions using the Keyboard Local User Interface or Data System.
- ☒ Check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Guidance:

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

Intuvo Parts List Table

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

| Part Description | Part Number | Product/Model # where used | Quantity Consumed |
|------------------------------|-------------|----------------------------|-------------------|
| FID Jet 0.11inch ID | G4591-20320 | G3950A | 1 |
| Split Vent Trap Filter (2pk) | G5188-6497 | G3950A | 1 |
| Bus Bolt with Washer | G4581-60260 | G3950A | 1 |
| Guard Chip for SS inlet | G4587-60565 | G3950A | 1 |
| Guard Chip for MMI | G4587-60665 | G3950A | N/A |
| Jumper Chip for SS inlet | G4587-60575 | G3950A | 1 |
| Jumper Chip for MMI | G4587-60675 | G3950A | 1 |

Service Engineer Comments

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

Service Completion

Service request number: [REDACTED] Date service completed: 24 Apr 23
 Agilent signature: [REDACTED] Customer signature: _____
 Total number of pages in this document: _____

Signature Page

Service Review

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

PM Test Results Table

| Detector Signal Outputs | Before PM Service | After PM Service |
|-------------------------|-------------------|------------------|
| Detector output [D1] | N/A | N/A |
| Detector output [D2] | N/A | N/A |

| Tests | Expected Result | Actual Result or N/A |
|---|-----------------|----------------------|
| Inlet Leak Test | Pass | Pass |
| Inlet Restriction Test | Pass | Pass |
| FID jet restriction test if FID installed | Pass | N/A |
| FID leakage test if FID installed | Pass | N/A |

Agilent Preventive Maintenance Services

Agilent GCMS
Preventive Maintenance

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

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

Introduction

This checklist covers the following model(s):

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

Customer Information

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

Important Customer Web Links

- To access Agilent training and education, visit <https://www.agilent.com/chem/training> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.

Additional Instruction Notes

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

- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilent/resources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** Flexible Repair Options - Agilent

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section
- Complete Signature Page and attach Signature Page to Service Order.

Instrument Maintenance

Select the appropriate service to be performed.

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

System Information

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

| |
|-------------------------------------|
| Instrument System Name and ID |
| Instrument System Site and Location |

UAE, Bangkok

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. ๔๖๖๖๖ | US1215M030 |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |
| 9. | |

Preparation

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

Customer Responsibilities

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

Important notice for customers

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

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

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

Definition of the Task/Recommended items within the document

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

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

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

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

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

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

Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

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

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

| Yes/No | Interim/Major | System Checks |
|-------------------------------------|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Verify that calibration peaks were seen prior to starting the PM |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Vent the instrument |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear. |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Visually inspect calibrant levels – P1 TBA PFDTD (if appl.), IRM (if appl.). Refill if available. |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Look for any obvious external damage or problems. |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Clean air intake(s). Cosmetic cover(s) may need to be removed. |
| <input type="checkbox"/> | <input type="checkbox"/> | Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | For HydroInert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/> |

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

| Yes/No | Interim/Major | Wet Mechanical vacuum pumps |
|-------------------------------------|-------------------------------------|-----------------------------|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Wet Mechanical vacuum pumps |
| <input type="checkbox"/> | <input type="checkbox"/> | Description |

| | | |
|-------------------------------------|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Check for evidence of oil leakage. Check pump gasket for leakage. |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Drain and replace mechanical pump oil. |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Replace Oil Mist Filter if applicable. |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Discuss with customer the need for more frequent oil changes if the oil is dirty |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Don't use mist filters with Chemical Ionization. |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose. |

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

☒ Service Not Applicable

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

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

☒ Service Not Applicable

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

Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

| Cleaning System and Filters | |
|--|--|
| Yes/No Interim/Major | Description |
| Fans | |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Remove dust from fans and vent covers. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Verify fans are functional and that there is enough space around the instrument for proper cooling. |
| Source cleaning (all sources except HydroInert) | |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Open analyzer and remove the source. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Disassemble, Clean, Re-assemble source. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Re-install source and close analyzer. |
| HydroInert Source | |
| <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and lens stack), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier. |
| Filters | |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Replace RMSH-2 Helium gas filter – if applicable. |
| <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Replace RMSN-2 Nitrogen gas filter – if applicable. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Replace RMSHY-2 Hydrogen gas filter – if applicable. |
| <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium, Bracket, Mount, and Filter – if applicable. |
| <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | CP17974 – Gas Clean Filter Kit GC/MS 1/8", Mount and Filter – if applicable. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | CP17973 – Gas Clean Filter, Replacement Filter – if applicable. |
| <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | 5190-9071 – Methane Gas Filter – if applicable. |

Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

Service Review

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

Test Results

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

| System post-check | |
|--|---|
| Yes/No Interim/Major | Description |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Pump system back down. Wait until system stability has been achieved. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Verify system vacuum reading(s) via the gauge controller. |
| Leak Check | |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Verify system in manual tune |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Compare against previous tune file report(s) |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Change to 1 tune and verify that all temperatures, pressures, and gas flows reach method set points |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Check manually that you have calibration peaks. |
| <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | EI Autotune Performed |

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

Consumed PM Parts

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

| Part Description | Part Number | Interim | Major | As Needed |
|--|-------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Helium gas filter – if required | RMSH-2 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Nitrogen gas filter – if required | RMSN-2 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Big Universal Trap, 1/8" fittings, Hydrogen, if required | RMSHY-2 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium, Bracket, Mount and Filter – if required | CP17988 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Gas Clean Filter Kit GC/MS 1/8 in (complete replacement kit) – if required | CP17974 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Gas Clean GC/MS Filter – if required | CP17973 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Chemical Ionization Gas Purifier (CI systems) – if required | 5190-9071 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Agilent AVF Platinum, 1 quart | 5191-5851 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Gas filters need to be changed only if required | | | | |

MS Maintenance Supplies for 5973/5975/5977 Series

| Part Description | Part Number | Interim | Major | As Needed |
|--|-----------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Diffusion pump fluid (Diffusion Pump Models) | 6040-0809 Qty 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| IDP-3 Tip Seal Replacement Kit (IDP-3 Dry Pump Models) | G7077-67018 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| IDP-3 Tip Seal Replacement Kit (no tools – CSD P/N) | 5190-9561 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| IDP-3 Tip Seal Replacement Kit (no tools – VPD P/N) | IDP31S | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Filter element for IDP-3 | REPLSLRFILTER 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| DS42 Oil Mist Eliminator 3/4G & 3/8 | SR03706556 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Exhaust oil mist trap (thread) Edwards/Pfeiffer | G1099-80039 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Repeller Insulator | G1099-20133 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lens stack insulator | G3870-20530 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lens insulator for Extractor (ring insulator) | G3870-20445 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| HydroInert Extractor lens (9mm) | G7078-20909 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| HydroInert Repeller | G7078-20902 | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

MS Maintenance Supplies for 7000/7010 Series

| Part Description | Part Number | Interim | Major | As Needed |
|---|------------------|---------|-------|-----------|
| Nitrogen gas filter | RMSN-2 | | ✓ | ✓ |
| IDP-10 Tip Seal Replacement Kit (IDP-10 Dry Scroll Pump Models) | G7004-67023 | | ✓ | ✓ |
| IDP-10 Tip Seal Replacement Kit (no tools - VPD P/N) | X3807-67000 | | ✓ | ✓ |
| Oil Mist Filter RV5 | G6600-80043 | | ✓ | ✓ |
| Filter element for the IDP-10 | REFPLSLRFLITER 1 | | ✓ | ✓ |
| Repeller insulator | G1099-20133 | | | ✓ |
| Lens stack insulator | G3870-20530 | | | ✓ |
| Lens insulator for Extractor (ring insulator) | G3870-20445 | | | ✓ |
| HydroInert Extractor lens (9mm) | G7078-20909 | | | ✓ |
| HydroInert Repeller | G7078-20902 | | | ✓ |

MS Maintenance Supplies for 7200/7250 Series

| Part Description | Part Number | Interim | Major | As Needed |
|---|------------------|---------|-------|-----------|
| Nitrogen gas filter - if required | RMSN-2 | | ✓ | ✓ |
| RIS Probe Maintenance Kit (7200 Series only) | G7004-67023 | | ✓ | ✓ |
| DS202 Oil Mist Eliminator | X3807-67000 | | ✓ | ✓ |
| IDP-15 Tip Seal Replacement Kit (IDP-15 Dry Pump Models) | G6600-80043 | | ✓ | ✓ |
| IDP-15 Tip Seal Replacement Kit (no tools - VPD P/N) | REFPLSLRFLITER 1 | | ✓ | ✓ |
| Filter element, for SH-110/SH-112/IDP-15 exhaust silencer | G1099-20133 | | ✓ | ✓ |
| DS 3/8 MAG. PLUG AND GASKET | G3870-20530 | | ✓ | ✓ |

MS Maintenance Supplies for JetClean

| Part Description | Part Number | Interim | Major | As Needed |
|--|-------------|---------|-------|-----------|
| Big Universal Trap, 1/8" fittings, Hydrogen, if required | RMSHY-2 | | ✓ | ✓ |

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Page 14 of 19


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MS Maintenance Supplies for 7000/7010 Series

| Part Description | Part Number | Interim | Major | As Needed |
|---|-------------------|---------|-------|-----------|
| CI Interface tip seal - 7000 | G1999-60412 | | | ✓ |
| CI Interface tip seal - 7010 | G7002-60412 | | | ✓ |
| CI Interface tip seal (tip only) | G3870-20542 | | | ✓ |
| CI Interface tip seal spring (spring only) | G1999-20023 | | | ✓ |
| Repeller insulator - 7000 | G1099-20133 Qty 2 | | | ✓ |
| Lens insulator/holder (HES) | G7002-20074 | | | ✓ |
| Ring heater/sensor assembly (HES) | G7002-60043 | | | ✓ |
| Ceramic insulator for Extractor (HES) | G7002-20064 | | | ✓ |
| Transfer-Line Tip Cap, Threaded | G3870-20547 | | | ✓ |
| Transfer-Line Tip Base, Threaded | G3870-20548 | | | ✓ |
| Lens stack insulator | G3870-20530 | | | ✓ |
| Lens insulator for Extractor (ring insulator) | G3870-20445 | | | ✓ |
| HydroInert Extractor lens (9mm) | G7078-20909 | | | ✓ |
| HydroInert Repeller | G7078-20902 | | | ✓ |

MS Maintenance Supplies for 7200 Series

| Part Description | Part Number | Interim | Major | As Needed |
|-----------------------------|-------------|---------|-------|-----------|
| Extractor Lens Insulator | G7005-20133 | | | ✓ |
| Ion Focus Insulator | G7005-20442 | | | ✓ |
| Ring Heater/Sensor Assembly | G7005-60110 | | | ✓ |
| RIS Xfer Tip | G7005-20542 | | | ✓ |
| RIS Xfer Tip Spring | G7005-20024 | | | ✓ |

MS Maintenance Supplies for 7250 Series

| Part Description | Part Number | Interim | Major | As Needed |
|---------------------------------------|-------------|---------|-------|-----------|
| Lens insulator/holder (HES) | G7002-20074 | | | ✓ |
| Ring heater/sensor assembly (HES) | G7002-60043 | | | ✓ |
| Ceramic insulator for Extractor (HES) | G7002-20064 | | | ✓ |
| Transfer-Line Tip Cap, Threaded | G3870-20547 | | | ✓ |

 Revision A.03, Issued: August 2022
 DE Number DE79964283
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Page 16 of 19


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

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

| Part Description | Part Number | Interim | Major | As Needed |
|---|-------------------|---------|-------|-----------|
| EI High Temperature Filaments | G7005-60061 Qty 2 | | | ✓ |
| HES EI Filaments | G7002-60001 | | | ✓ |
| LE-EI Filaments | G3850-60021 | | | ✓ |
| CI High Temperature Filament - all MSDs | G7005-60072 | | | ✓ |
| PFTBA GCMS Tuning Standard calibrant | 05971-60571 | | | ✓ |
| PFTD calibrant, 1 mL | 8500-8510 | | | ✓ |
| PFET, IRM calibrant for GC QTOF 0.5 mL | 5190-0531 | | | ✓ |

MSD Maintenance Supplies 5973/5975/5977 Series

| Part Description | Part Number | Interim | Major | As Needed |
|---|-------------------|---------|-------|-----------|
| CI Interface tip seal (tip and spring combo) | G1999-60412 | | | ✓ |
| CI Interface tip seal (tip only) | G3870-20542 | | | ✓ |
| CI Interface tip seal spring (spring only) | G1999-20023 | | | ✓ |
| Repeller insulator | G1099-20133 Qty 2 | | | ✓ |
| Lens insulator/holder (HES) | G7002-20074 | | | ✓ |
| Ring heater/sensor assembly (HES) | G7002-60043 | | | ✓ |
| Ceramic insulator for Extractor (HES) | G7002-20064 | | | ✓ |
| Transfer-Line Tip Cap, Threaded | G3870-20547 | | | ✓ |
| Transfer-Line Tip Base, Threaded | G3870-20548 | | | ✓ |
| Lens stack insulator | G3870-20530 | | | ✓ |
| Lens insulator for Extractor (ring insulator) | G3870-20445 | | | ✓ |
| HydroInert Extractor lens (9mm) | G7078-20909 | | | ✓ |
| HydroInert Repeller | G7078-20902 | | | ✓ |

 Revision A.03, Issued: August 2022
 DE Number DE79964283
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Page 15 of 19


 Agilent
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| Part Description | Part Number | Interim | Major | As Needed |
|----------------------------------|-------------|---------|-------|-----------|
| Transfer-Line Tip Base, Threaded | G3870-20548 | | | ✓ |
| EI Extractor Transfer Tip | G3870-20542 | | | ✓ |
| CI Tip Compression Spring | G1999-20023 | | | ✓ |

MS Maintenance Supplies for Intuvo 9000 MS Series

| Part Description | Part Number | Interim | Major | As Needed |
|---------------------------------|-------------|---------|-------|-----------|
| Swaged MS Tail - Packaged | G4590-60009 | | | ✓ |
| Swaged MS Tail (HES) - Packaged | G4590-60109 | | | ✓ |

Common MS Maintenance Supplies

| Part Description | Part Number | Interim | Major | As Needed |
|-------------------------------|-------------|---------|-------|-----------|
| Abrasive paper, 30 um | 5061-5896 | | | ✓ |
| Alumina powder | 393706201 | | | ✓ |
| Cloths, clean (pkg of 15) | 05980-60051 | | | ✓ |
| Cloths, cleaning (pkg of 300) | 9310-4828 | | | ✓ |
| Cotton swabs (pkg of 100) | 5080-5400 | | | ✓ |
| Gloves, clean, large | 8650-0030 | | | ✓ |
| Gloves, clean, small | 8650-0029 | | | ✓ |

 Revision A.03, Issued: August 2022
 DE Number DE79964283
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Page 17 of 19


 Agilent
เอกสารไม่ควบคุม

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number: [REDACTED] Date of Service Completion: 24 Apr 2023

Service Engineer Name: [REDACTED] Customer Name:

Service Engineer Signature: [REDACTED] Total number of pages in this document:

Introduction

Customer Information

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

Agilent CrossLab Start Up Services

Agilent 7697A Headspace Sampler
Preventive Maintenance - Standard

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

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

Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:

Sample Prep and Containment
 Chemical Standards
 Analysis
 Service and Support
 Application Workflows

- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call? <https://www.agilent.com/go/service>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- It is important to consult with the customer prior to a PM to determine which parts are installed in the instrument to decide if individual components need to be purchased rather than the 7697A Standard PM Kit. The 7697A Standard PM Kit contents are based off of the contents of the original shipment. Different types of deactivated treatment for the sample probe and sample loop, different sample loop sizes, and transfer line sizes may require for individual parts to be ordered to perform the PM procedure. If different parts are required, reference the Agilent supplies catalog for part numbers.
- Ask the customer to sign the Service Verification section including the customer's and your signature.

Preparation

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

Instrument Maintenance

Select the appropriate service to be performed.

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

System Information

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

| |
|-------------------------------------|
| Instrument System Name and ID |
| Instrument System Site and Location |

UAE, Bangkok

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. 64577-19000 | CN17110041 |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |
| 9. | |

Preventive Maintenance Procedures

- ☐ Service Not Applicable

Inspect and Clean Sampler

- ☐ Service Not Applicable.
- ✓ ☒ If a tray is part of the system, remove the tray and pneumatics to allow for access to the oven.
- ✓ ☒ If a tray is part of the system, check that the shutter sensor is not dusty. If it is, use air duster to remove the dust.
- ✓ ☒ Check for any debris in the carousel and clean if necessary.
- ✓ ☒ If a tray is part of the system, reinstall the tray and pneumatics unit.
- ✓ ☒ Remove the front panel of the instrument.
- ✓ ☒ Check the carousel belt for wear. If it is worn, consult with the customer to determine if it should be replaced.
- ✓ ☒ Use a dry, clean cloth to wipe the lifter rod(s) clean. Do not apply any lubricant.
- ✓ ☒ Vacuum the inside of the unit.
- ✓ ☒ Reinstall the front panel of the instrument.
- ✓ ☒ Using the Manual Operations function under the Service Mode Key on the instrument keypad, confirm that the following components work:
 - Tray Lifter (if applicable)
 - Sampler Lifter
 - Carousel Motor
 - Shutter Motor (if applicable)

Pneumatic Components

- ☐ Service Not Applicable.
- ✓ ☒ Remove the sample probe.
- ✓ ☒ Remove the sample loop.
- ✓ ☒ Install the new sample loop.
- ✓ ☒ Install the new sample probe.
- ✓ ☒ Remove the fused silica transfer line.
- Special note: If OQ will be performed after the PM, remove the fused silica transfer line and do not reinstall it until the transfer line measurement is taken for the OR procedure.
- ✓ ☒ Reinstall the fused silica transfer line.

- ☒ Use Service Reminders under the Service Mode Key on the instrument keypad to run the instrument restriction and leak test. Verify that it passes (make a note below the tests results table). If it fails, consult the customer for repair options.

Tray Components

- ☐ **Service Not Applicable.**
- ☒ Check for any debris in the sample trays and clean if necessary.
- ☒ Check that the tray gantry rod is clean. If it is dirty or dusty, wipe it clean with a dry cloth. Do not apply any kind of lubrication.
- ☒ Check that the sensors are not dusty. If they are, use air dusters to remove the dust.
- ☒ Check the tray belts for any wear. If they are worn, consult with the customer to determine if they should be replaced.
- ☒ Verify the three LED's for the tray racks light up when the trays are installed.
- ☒ Run the tray calibration.
- ☒ Reset the counter (pressing the OFF key) of the tray calibration.

7697A Headspace Sampler Parts List

| Part Description | Part Number | Product or Model# where used | Quantity consumed |
|--|-------------|------------------------------------|--------------------------------------|
| 7697A Standard PM Kit ¹ | G4556-67011 | 7697A HS Sampler | 1 |
| Ferrule Flexi Inert 0.53 mm Col 10/IPK NFS | G3188-27503 | 7697A HS Sampler AND G3520A module | 1 (Optional, not included in PM kit) |

¹ Part numbers and descriptions for the kit contents

| Part Description | Part Number | Quantity |
|--|-------------|----------|
| Sample Probe | G4556-63825 | 1 |
| Sample Loop (1mL) | G4556-80106 | 1 |
| Thermal Gap Insulation Foam | G3530-00610 | 1 |
| 7697A Fused Silica and ProSteel Kit | G3903-61001 | 1 |
| Polyimide, Valcon Ferrule, 5 pack | 0100-2595 | 1 |
| Nut and reducing union for 6 port valve transfer line connection | 0100-2594 | 1 |
| Liner, direct, 2mm ID, deactivated | 5181-8818 | 1 |

Restore Instrument

- ☐ **Service Not Applicable.**
- ☒ Connect the headspace transfer line if it has not been already reconnected.
- ☒ Return instrument to initial condition.
- ☒ Perform system checkout procedure or test.

Guidance

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

Service Review

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

7697A Headspace Sampler Test Results

| Test Description | Expected Test Result | Actual Test Result |
|------------------------|----------------------|--------------------|
| Tray Calibration | Pass | Pass |
| Leak Test | Pass | Pass |
| Chemical Checkout Test | | |

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number: [REDACTED] Date Service Completed: 24 Apr 2023

Service Engineer Name: [REDACTED] Customer Name:

Service Engineer Signature: [REDACTED] Customer Signature:

Total number of pages in this document:

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

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

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

Customer Information

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

Service Engineer's Responsibilities

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

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Page 1 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- Discuss any specific questions or issues with the customer prior to starting.
- Review the instrument logbook.
- Perform general external inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware/software updates and verify with customers if they would like it installed.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *N/A*
- Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

- Look for any obvious external damage or problems.
- Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- Record the instrument operating conditions in the ICP-OES Status Results Table.
- Replace the polychromator purge filter.
- Replace the radial pre-optics window
- Replace the axial pre-optics window for SVDV and VDV instruments.
- Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- Replace air inlet dust filter.
- Replace high capacity air inlet dust filter element if installed. *N/A*
- Remove and clean instrument water inlet filter.

G8481A Cooling water system

- Section NOT Applicable
- Drain cooling fluid and remove any particles from the chiller reservoir
- Remove, clean and reinstall water inlet metal mesh filter.
- Re fill with Polyclear cooling fluid.
- Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.

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Page 3 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

| | |
|---------------------------------------|---|
| Instrument system name and ID | ICP 5110 VDV |
| Instrument system site and location | UAE / 3rd Floor Laboratory |
| List system component product numbers | List the serial numbers of each component |
| 1. G8015A | 1. MY18030001 |
| 2. G8481A | 2. 1801-01988 |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |
| 6. | 6. |
| 7. | 7. |
| 8. | 8. |
| 9. | 9. |
| 10. | 10. |

| | |
|-----------------------------|---|
| ICP-OES Configuration table | Circle the type or write in the type if other |
| Nebulizer Type | SeaSpray (OneNeb) other |
| Spray Chamber | Cyclonic Single Pass Cyclonic Double Pass other |
| Torch | Radial (Dual View) other |
| Injector Diameter | 2.4mm 1.8mm 1.4mm 0.8mm other |
| Injector Material | Quartz (Ceramic) other |

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Page 2 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

- Section NOT Applicable
- Power cycle the autosampler and verify successful initialization.
- Inspect X and Z axis belts for wear. Replace is necessary.
- Clean X and Z axis slide shafts.
- Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

- Section NOT Applicable
- Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

- Section NOT Applicable
- Replace valve rotor seal
- Check fittings for signs of leaks
- Check tubing including autosampler tubing for kinks or excessive wear
- Check high flow pump for signs of leaks

Instrument Adjustment

- Check position of Zn peak, adjust if required.
- Check Argon Ratio, adjust to specified value if required.
- Perform Detector Calibration.
- Perform Instrument Calibration.
- Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
 - Subsystem Communications Test
 - Air Flow

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Page 4 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

Instrument Performance Test Results Table

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

| | Pre PM Sensitivity Check | | Post PM Sensitivity Check | |
|--------------------|--------------------------|---------|---------------------------|---------|
| | Radial | Axial * | Radial | Axial* |
| Zn 213.857 nm SRBR | 4100.6 | 8364.0 | 4375.0 | 8400.8 |
| Mn 257.610 nm SRBR | 11064.7 | 31842.1 | 12801.7 | 30846.2 |
| Al 396.152 nm SBR | 7.5 | 14.9 | 9.9 | 16.8 |
| K 766.491 nm SBR | 5.1 | 36.8 | 6.4 | 39.7 |

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

| Instrument Test | Result |
|-------------------------------|--------|
| Subsystem Communications Test | Pass |
| Air Flow | Pass |
| Water Flow | Pass |
| Gas Flows | Pass |
| RF Generator | Pass |
| Camera Test | Pass |
| Optics Test | Pass |
| Nebulizer test | Pass |

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Page 5 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Parts List Table

| Part description | Part Number | Product /Model # where used | Quantity Consumed |
|--|-------------|-------------------------------|-------------------|
| Axial Pre-Optic Window | G8010-68014 | G8010A, G8011A, G8014A/G8015A | 1 |
| Radial Pre-Optic Window | G8010-68015 | All | 1 |
| Polyclear Cooling Fluid | G3292-80010 | G8481A | |
| Purge Gas Filter | G8010-60136 | All | 1 |
| Air inlet filter | G8000-68002 | All | 1 |
| High Capacity Air Filter | G8010-60189 | Optional | |
| Rotor seal for 6-7 port valve for AVS6/7 | G8494-60002 | G8494A/G8495 | |
| Rotor seal for 4 port valve for AVS4 | G8493-60002 | G8493A | |
| Rinse solution to rinse station 2.5mm id x 1m | G8410-80123 | SPS 4 | |
| Barb connector 2.5mm-1.5mm ID | G8410-80124 | SPS 4 | |
| PVC waste tubing, 8mm od x 5mm id, 2m | G8410-80122 | SPS 4 | |
| Additional Parts may be required from engineers stock: | | | |
| X axis drive belt | 5410047500 | SPS 3 | |
| Z axis drive belt | 5410047400 | SPS 3 | |
| Peristaltic pump tubing, PVC SolvaFlex, 3 bridged, | 3710049000 | SPS 4 | |

Restore system

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

Leave system in an idle state: on and purging.

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

Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

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Page 7 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Status Results Table

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

| Measurement | Standby Mode | | Plasma On | |
|------------------------------|----------------|-------|-----------|-------|
| Mains Voltage | 224.540 | VAC | 227.973 | VAC |
| Mains Current | 0.804 | A | 0.104 | A |
| Instrument Temperature | 22.8 | °C | 22.7 | °C |
| RF Air Flow (sensor speed) | 15.0 | Hz | 13.0 | Hz |
| Plasma Exhaust Temperature | No measurement | | 26.7 | °C |
| Water Flow Oscillator | No measurement | | 1.64 | L/min |
| Water Flow Detector | 1.06 | L/min | 1.06 | L/min |
| Water Inlet Temperature | 18.0 | °C | 18.0 | °C |
| Polychromator Temperature | 35.0 | °C | 35.0 | °C |
| CCD Temperature | -39.8 | °C | -39.8 | °C |
| Thermal Stabilizer | 35.0 | °C | 35.0 | °C |
| Argon Supply Pressure | 677.94 | kPa | 627.33 | kPa |
| Purge Gas Supply Pressure*1 | 674.30 | kPa | 645.40 | kPa |
| Option Gas Supply Pressure*1 | N/A | kPa | N/A | kPa |
| Nebulizer Flow | No measurement | | 0.70 | L/min |
| Nebulizer Back Pressure | No measurement | | 164.63 | kPa |
| Plasma Gas Flow | No measurement | | 11.92 | L/min |
| Auxiliary Gas Flow | No measurement | | 1.00 | L/min |
| RF Power | No measurement | | 1200 | W |
| RF Supply Current | No measurement | | 8.663 | A |
| RF Supply Voltage | No measurement | | 184.660 | V |

*1 If option installed

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Page 6 of 8

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☒ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number [REDACTED] Date service completed 30 Nov 2022

Agilent signature [REDACTED] Customer signature [REDACTED]

Document part number: G8014-90075

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Page 8 of 8

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Report Summary

| | |
|--------------------------|-------------------------------|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES |
| Instrument ID | G8011A/G8015A |
| Instrument Serial Number | MY18030001 |
| Software Version | 7.3.1.9507 |
| Firmware Version | 3442 |
| Tested By | Test Before PM |
| Test Completed On | 11/30/2022 9:35:32 AM |

Result Summary

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

เอกสารไม่ควบคุม

Sensitivity Test

Pass

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|--------------------|---------------|--------|---------|-----------|---------|
| As (188.980 nm) | ≥ 46.0 | SRBR | 147.7 | 1156.5 | 55.5 |
| Se (196.026 nm) | ≥ 41.0 | SRBR | 111.1 | 1195.3 | 97.7 |
| Zn (213.857 nm) | ≥ 1421.0 | SRBR | 4100.6 | 51959.5 | 159.6 |
| Pb (220.353 nm) | ≥ 46.0 | SRBR | 192.5 | 2808.6 | 185.7 |
| Mn (257.610 nm) | ≥ 3518.0 | SRBR | 11064.7 | 264165.0 | 567.6 |
| Al (396.152 nm) | ≥ 3.4 | SBR | 7.5 | 49047.9 | 5770.5 |
| Ba (493.408 nm) | ≥ 34.0 | SBR | 107.4 | 1887710.3 | 17407.5 |
| K (766.491 nm) | ≥ 1.8 | SBR | 5.1 | 100805.9 | 16626.4 |

| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
|--------------------|---------------|--------|---------|------------|---------|
| As (188.980 nm) | ≥ 208.0 | SRBR | 234.9 | 3056.4 | 152.9 |
| Se (196.026 nm) | ≥ 159.0 | SRBR | 218.1 | 3865.1 | 271.6 |
| Zn (206.200 nm) | ≥ 234.0 | SRBR | 1306.5 | 15850.4 | 144.5 |
| Zn (213.857 nm) | ≥ 1743.0 | SRBR | 8364.0 | 183037.8 | 476.4 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 7718.5 | 143240.2 | 342.8 |
| Pb (220.353 nm) | ≥ 320.0 | SRBR | 576.3 | 14465.2 | 580.4 |
| Mn (257.610 nm) | ≥ 10625.0 | SRBR | 31842.1 | 1411257.3 | 1958.9 |
| Cr (267.716 nm) | ≥ 1048.0 | SRBR | 4492.1 | 183110.6 | 1632.2 |
| Cu (324.754 nm) | ≥ 19.0 | SBR | 46.2 | 371487.5 | 7862.9 |
| Al (396.152 nm) | ≥ 6.0 | SBR | 14.9 | 278447.4 | 17552.6 |
| Ba (493.408 nm) | ≥ 60.0 | SBR | 190.6 | 10061527.3 | 52519.8 |
| K (766.491 nm) | ≥ 24.0 | SBR | 38.8 | 1922163.4 | 50858.1 |

เอกสารไม่ควบคุม

Resolution Test

Pass

| Element Wavelength | Specification | Width |
|--------------------|---------------|-------|
| N (174.213 nm) | ≤ 9.40 | 6.62 |
| As (188.980 nm) | ≤ 8.20 | 6.20 |
| C (193.027 nm) | ≤ 11.50 | 8.35 |
| Mo (202.032 nm) | ≤ 8.20 | 6.41 |
| Cr (206.158 nm) | ≤ 13.40 | 9.04 |
| Zn (213.857 nm) | ≤ 8.70 | 6.62 |
| Pb (220.353 nm) | ≤ 9.50 | 7.13 |
| Co (228.615 nm) | ≤ 17.20 | 11.71 |
| Ba (230.424 nm) | ≤ 9.40 | 7.21 |
| Mn (257.610 nm) | ≤ 13.30 | 9.50 |
| Mn (260.568 nm) | ≤ 20.30 | 14.33 |
| Cr (267.716 nm) | ≤ 11.00 | 8.14 |
| Cu (324.754 nm) | ≤ 25.00 | 18.98 |
| Cu (327.395 nm) | ≤ 14.20 | 11.24 |
| Sr (338.071 nm) | ≤ 33.50 | 24.47 |
| Ba (455.403 nm) | ≤ 44.00 | 33.88 |
| Sr (460.733 nm) | ≤ 36.00 | 17.22 |
| Ba (493.408 nm) | ≤ 36.00 | 25.48 |
| Ba (614.171 nm) | ≤ 42.00 | 25.47 |
| Ar (675.283 nm) | ≤ 74.00 | 59.82 |
| K (766.491 nm) | ≤ 80.00 | 64.94 |

เอกสารไม่ควบคุม

Precision Test

Pass

| Element Wavelength | Specification | Measured Value % RSD |
|--------------------|---------------|----------------------|
| As (188.980 nm) | ≤ 2.60 | 0.82 |
| Se (196.026 nm) | ≤ 2.60 | 0.71 |
| Zn (213.857 nm) | ≤ 1.50 | 0.43 |
| Pb (220.353 nm) | ≤ 2.60 | 0.76 |
| Mn (257.610 nm) | ≤ 1.50 | 0.60 |
| Al (396.152 nm) | ≤ 1.50 | 0.48 |
| Ba (493.408 nm) | ≤ 1.50 | 0.89 |
| K (766.491 nm) | ≤ 1.50 | 0.42 |

| Element Wavelength | Specification | Measured Value % RSD |
|--------------------|---------------|----------------------|
| As (188.980 nm) | ≤ 1.50 | 0.57 |
| Se (196.026 nm) | ≤ 1.50 | 0.76 |
| Zn (206.200 nm) | ≤ 1.50 | 0.61 |
| Zn (213.857 nm) | ≤ 1.50 | 0.51 |
| Cd (214.439 nm) | ≤ 1.50 | 0.55 |
| Pb (220.353 nm) | ≤ 1.50 | 0.52 |
| Mn (257.610 nm) | ≤ 1.50 | 0.54 |
| Cr (267.716 nm) | ≤ 1.50 | 0.54 |
| Cu (324.754 nm) | ≤ 1.50 | 0.69 |
| Al (396.152 nm) | ≤ 1.50 | 0.91 |
| Ba (493.408 nm) | ≤ 1.50 | 0.85 |
| K (766.491 nm) | ≤ 1.50 | 1.22 |

เอกสารไม่ควบคุม

| Report Summary | | |
|-------------------------------|-------------------------------|------------------------------|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES | |
| Instrument ID | G8011A/G8015A | |
| Instrument Serial Number | MY18030001 | |
| Software Version | 7.3.1.9507 | |
| Firmware Version | 3442 | |
| Tested By | PM Functional test | |
| Test Completed On | 11/30/2022 11:43:36 AM | |
| Result Summary | | |
| Subsystem Communications Test | Pass | |
| Air Flow Test | Pass | |
| Water Flow Test | Pass | |
| Gas Flows Test | Pass | |
| RF Generator Test | Pass | |
| Camera Test | Pass | |
| Optics Test | Skipped | |
| Advanced Valve System Test | Skipped | |
| Resolution Test | Skipped | |
| Sensitivity Test | Skipped | |
| Precision Test | Skipped | |
| Subsystem Communications Test | Pass | |
| Air Flow Test | Pass | |
| 30% Air Flow (relative speed) | 75% Air Flow (relative speed) | |
| 14.00 | 19.00 | |
| Water Flow Test | Pass | |
| RF Water Flow(L/min) | Camera Water Flow (L/min) | Water Inlet Temperature (°C) |
| 1.44 | 1.05 | 18.51 |

Page 1 of 2

เอกสารไม่ควบคุม

| Report Summary | | |
|-------------------------------|-------------------------------|---------|
| Instrument Model | Agilent 5100/5110 VDV ICP-OES | |
| Instrument ID | G8011A/G8015A | |
| Instrument Serial Number | MY18030001 | |
| Software Version | 7.3.1.9507 | |
| Firmware Version | 3442 | |
| Tested By | PM Performance test | |
| Test Completed On | 11/30/2022 12:10:42 PM | |
| Result Summary | | |
| Subsystem Communications Test | Skipped | |
| Air Flow Test | Skipped | |
| Water Flow Test | Skipped | |
| Gas Flows Test | Skipped | |
| RF Generator Test | Skipped | |
| Camera Test | Skipped | |
| Optics Test | Pass | |
| Advanced Valve System Test | Skipped | |
| Resolution Test | Pass | |
| Sensitivity Test | Pass | |
| Precision Test | Pass | |
| | | Pass |
| Optics Test | | Pass |
| | Radial | Axial |
| Intensity | 5674608 | 5823476 |
| Wavelength | 737.212 | 737.212 |

Page 1 of 4

เอกสารไม่ควบคุม

| Gas Flows Test | | | Pass | | |
|-------------------------------|-----------------------|--------------------|-----------------------|-------------|---------------|
| Nebulizer Target Flow | Actual Flow | Back Pressure | Auxiliary Target Flow | Actual Flow | Back Pressure |
| 0.70 | 0.70 | 163.37 | 2.00 | 1.99 | 108.49 |
| Makeup Target Flow | Actual Flow | Back Pressure | Plasma Target Flow | Actual Flow | Back Pressure |
| 2.00 | 2.00 | 112.85 | 18.00 | 17.91 | 23.46 |
| RF Generator Test | | | Pass | | |
| RF Power Supply Test | Passed | | | | |
| RF Power Supply (V) | 147.437 | | | | |
| RF Oscillator Test | Passed | | | | |
| RF Oscillator Frequency (MHz) | 0.000 | | | | |
| Work Coil Current (A) | 45.069 | | | | |
| RF Power Supply Current (A) | 1.997 | | | | |
| Camera Test | | | Pass | | |
| | Integration Time (ms) | Standard Deviation | Status | | |
| Electronic Offset Test | 1000 | 5.305 | Passed | | |
| Dark Current Test | 6000 | 0.578 | Passed | | |
| Array Test | 5 | 0.024 | Passed | | |
| Linearity Test | | 0.118 | Passed | | |

Page 2 of 2

เอกสารไม่ควบคุม

| Resolution Test | | |
|--------------------|---------------|-------|
| Element Wavelength | Specification | Width |
| N (174.213 nm) | ≤ 9.40 | 6.79 |
| As (188.980 nm) | ≤ 8.20 | 6.09 |
| C (193.027 nm) | ≤ 11.50 | 8.29 |
| Mo (202.032 nm) | ≤ 8.20 | 6.30 |
| Cr (206.158 nm) | ≤ 13.40 | 9.05 |
| Zn (213.857 nm) | ≤ 8.70 | 6.77 |
| Pb (220.353 nm) | ≤ 9.50 | 7.02 |
| Co (228.615 nm) | ≤ 17.20 | 11.67 |
| Ba (230.424 nm) | ≤ 9.40 | 7.39 |
| Mn (257.610 nm) | ≤ 13.30 | 9.48 |
| Mn (260.568 nm) | ≤ 20.30 | 14.25 |
| Cr (267.716 nm) | ≤ 11.00 | 7.94 |
| Cu (324.754 nm) | ≤ 25.00 | 18.99 |
| Cu (327.395 nm) | ≤ 14.20 | 11.33 |
| Sr (338.071 nm) | ≤ 33.50 | 24.44 |
| Ba (455.403 nm) | ≤ 44.00 | 33.86 |
| Sr (460.733 nm) | ≤ 36.00 | 17.51 |
| Ba (493.408 nm) | ≤ 36.00 | 25.56 |
| Ba (614.171 nm) | ≤ 42.00 | 24.96 |
| Ar (675.283 nm) | ≤ 74.00 | 59.38 |
| K (766.491 nm) | ≤ 80.00 | 65.63 |

Page 2 of 4

เอกสารไม่ควบคุม

DMA-80 Direct Mercury Analyzer SERVICE PROTOCOL REPORT

To be filled in before service visit (1st page)**Customer information:**

| | |
|-------------------|-----------------------------------|
| Company: | บริษัท อุตสาหกรรมปิโตรเลียม จำกัด |
| Department: | Lab |
| Person in charge: | [Redacted] |
| Address: | 3 ถนนสุขุมวิท กรุงเทพฯ |
| Tel.: | |
| E-mail: | |

Technical data:

| | | | |
|--|--------------|------------|------------|
| Unit Serial Number: | 110300932 | SN | 1012000091 |
| Terminal type or USB-640 Gateway: | Terminal 640 | Rev. | 02-D |
| Software, type and revision: | Easy control | SN | - |
| Air Compressor (if present) | - | SN | - |
| Gas system pump (if present) | - | SN | - |
| Installation and last maintenance dates: | Inst. on: | Maint. on: | |

NOTE: after achievement of the following protocol a filled and signed copy of this report has to be sent to Milestone srl at: service@milestonesrl.com

For the best result of the test below we recommended to use the Milestone DMA-80 Service Kit (PN DMA-SKIT).

| Sensitivity Test | | | | | |
|--------------------|---------------|--------|---------|------------|---------|
| Pass | | | | | |
| Radial | | | | | |
| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
| As (188.980 nm) | ≥ 46.0 | SRBR | 147.8 | 1149.3 | 54.8 |
| Se (196.026 nm) | ≥ 41.0 | SRBR | 111.6 | 1222.8 | 101.0 |
| Zn (213.857 nm) | ≥ 1421.0 | SRBR | 4375.0 | 52592.3 | 143.7 |
| Pb (220.353 nm) | ≥ 46.0 | SRBR | 199.8 | 2744.4 | 166.5 |
| Mn (257.610 nm) | ≥ 3518.0 | SRBR | 12801.7 | 285591.3 | 496.0 |
| Al (396.152 nm) | ≥ 3.4 | SBR | 9.9 | 52888.6 | 4873.6 |
| Ba (493.408 nm) | ≥ 34.0 | SBR | 154.6 | 2287291.6 | 14698.1 |
| K (766.491 nm) | ≥ 1.8 | SBR | 6.4 | 106701.6 | 14350.9 |
| Axial | | | | | |
| Element Wavelength | Specification | Method | Ratio | Standard | Blank |
| As (188.980 nm) | ≥ 208.0 | SRBR | 242.4 | 3170.1 | 154.8 |
| Se (196.026 nm) | ≥ 159.0 | SRBR | 226.1 | 4134.5 | 289.3 |
| Zn (206.200 nm) | ≥ 234.0 | SRBR | 1126.6 | 13782.0 | 146.5 |
| Zn (213.857 nm) | ≥ 1743.0 | SRBR | 8400.8 | 177166.3 | 442.5 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 7001.9 | 125884.2 | 321.6 |
| Pb (220.353 nm) | ≥ 320.0 | SRBR | 536.3 | 12909.3 | 532.6 |
| Mn (257.610 nm) | ≥ 10625.0 | SRBR | 30846.2 | 1287989.0 | 1738.8 |
| Cr (267.716 nm) | ≥ 1048.0 | SRBR | 4396.0 | 167335.6 | 1424.4 |
| Cu (324.754 nm) | ≥ 19.0 | SBR | 52.1 | 373690.7 | 7033.1 |
| Al (396.152 nm) | ≥ 6.0 | SBR | 16.8 | 268357.7 | 15112.4 |
| Ba (493.408 nm) | ≥ 60.0 | SBR | 225.2 | 10173441.5 | 44971.7 |
| K (766.491 nm) | ≥ 24.0 | SBR | 39.7 | 1874136.2 | 46055.7 |

Page 3 of 4

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

| Precision Test | | | |
|--------------------|---------------|----------------------|--|
| Pass | | | |
| Radial | | | |
| Element Wavelength | Specification | Measured Value % RSD | |
| As (188.980 nm) | ≤ 2.60 | 0.60 | |
| Se (196.026 nm) | ≤ 2.60 | 0.84 | |
| Zn (213.857 nm) | ≤ 1.50 | 0.29 | |
| Pb (220.353 nm) | ≤ 2.60 | 0.59 | |
| Mn (257.610 nm) | ≤ 1.50 | 0.28 | |
| Al (396.152 nm) | ≤ 1.50 | 0.28 | |
| Ba (493.408 nm) | ≤ 1.50 | 0.59 | |
| K (766.491 nm) | ≤ 1.50 | 0.23 | |
| Axial | | | |
| Element Wavelength | Specification | Measured Value % RSD | |
| As (188.980 nm) | ≤ 1.50 | 0.71 | |
| Se (196.026 nm) | ≤ 1.50 | 0.43 | |
| Zn (206.200 nm) | ≤ 1.50 | 0.46 | |
| Zn (213.857 nm) | ≤ 1.50 | 0.37 | |
| Cd (214.439 nm) | ≤ 1.50 | 0.48 | |
| Pb (220.353 nm) | ≤ 1.50 | 0.48 | |
| Mn (257.610 nm) | ≤ 1.50 | 0.74 | |
| Cr (267.716 nm) | ≤ 1.50 | 0.26 | |
| Cu (324.754 nm) | ≤ 1.50 | 0.51 | |
| Al (396.152 nm) | ≤ 1.50 | 0.45 | |
| Ba (493.408 nm) | ≤ 1.50 | 0.81 | |
| K (766.491 nm) | ≤ 1.50 | 0.84 | |

Page 4 of 4

เอกสารไม่ควบคุม

1. VISUAL INSPECTION

| | Good | Damaged | Corroded/Dirty |
|------------------|------|---------|----------------|
| External chassis | ✓ | | |
| Inside | ✓ | | |
| Electric parts | ✓ | | |
| Screws | ✓ | | |

2. ELECTRICAL SAFETY TEST

Using a suitable testing device check the below reported parameters and take note of the results.

| Parameter | Result | OK | Not OK |
|--|----------------------|----|--------|
| Insulating resistance: $R_{500} \geq 0.5M\Omega$ | Actual value: 225 MΩ | ✓ | |
| Grounding resistance: $R_{PE-S} < 100m\Omega$ | Actual value: 0.7 MΩ | ✓ | |

3. PRESSURE CHECK

| Gas carrier | Oxygen (purity O ₂ > 99.95%) | Milestone air compressor |
|-------------|---|--------------------------|
| Oxygen | Purity: 99.95% | |

The pressure at the supply source manometer should be approx. 4.0 bar
The flow rate depends by type of cuvette installed on the DMA-80 unit.

| | Correct value | Actual value | Final value | Correct value | Actual value | Final value | Correct value | Actual value | Final value |
|----------------|---------------|--------------|-------------|---------------|--------------|-------------|---------------|--------------|-------------|
| Inlet pressure | 3.1 bar | - | - | 3.1 bar | - | - | 3.1 bar | 3.1 bar | Pass |
| Flow rate | 10-12 l/h | - | - | 8-10 l/h | - | - | 6-8 l/h | 7 l/h | Pass |

Check all possible leakage points and their conditions:

| | Good | Damaged | Corroded |
|-------------------------|------|---------|----------|
| Tubing | ✓ | | |
| Silicon joints | ✓ | | |
| O-rings | ✓ | | |
| Cuvette sealing O-rings | ✓ | | |
| Gas connections | ✓ | | |
| Valves | ✓ | | |
| Sample boat carrier | ✓ | | |
| Catalyst flange | ✓ | | |

2

เอกสารไม่ควบคุม

4. AUTOSAMPLER SYSTEM

| | OK | Not OK | Re-Adjusted |
|----------------------------------|------|--------|-------------|
| Calibration of autosampler motor | ✓ | | |
| Cylinders alignment | ✓ | | |
| | Fast | Slow | Normal |
| Speed of pneumatic cylinders | | | ✓ |

Using the maintenance grease, periodically lightly lubricate all exposed steel rods of the horizontal and vertical cylinders.

5. COMPONENTS CHECK

Conditions of the different parts used/installed on DMA unit:

| | OK | Not OK | Replaced | Cleaned |
|---------------------|----|--------|----------|---------|
| Catalyst tube | | | ✓ | |
| Amalgamator | | | ✓ | |
| Quartz boats | | | ✓ | |
| Nickel boats | - | - | - | - |
| Autosampler plate | ✓ | | | |
| Gas kit accessories | - | - | - | - |

6. TEMPERATURES

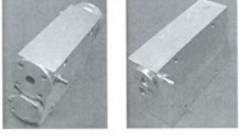
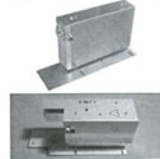
| | Correct value | Actual value | Final value |
|----------------------------------|--|--------------|-------------|
| Drying/ Decomposition furnace | If controlled by Infrared sensor 850°C ± 10°C | - | - |
| | If controlled by thermocouple 650°C ± 10°C | 650 °C | Pass |
| Catalyst furnace | 915°C ± 10°C | 915 °C | Pass |
| Amalgamator stand by temperature | 170°C ± 10°C | 170 °C | Pass |
| Amalgamator heating temperature | 850°C ± 10°C | 850 °C | Pass |
| Cuvette | 125°C ± 5°C | 125 °C | Pass |

7. SPECTROMETER

3

เอกสารไม่ควบคุม

The spectrometer can be equipped with a single beam system (ducon lamp) or with a dual beam system (tricon lamp)

| | Old cuvette type | | | Actual cuvette type | | |
|-----------------|---|--------------|-------------|---|--------------|-------------|
| |  | | |  | | |
| | Gain | | | Gain | | |
| | Correct value | Actual value | Final value | Correct value | Actual value | Final value |
| Dualcell system | 3.6VDC | - | - | 0.015VDC ± 0.005VDC | - | - |
| Tricell system* | - | - | - | 3.96VDC | 3.96 V | Pass |

(*)The recommended Hg lamp operating signal should be around 3.96VDC (for detector 2) and 3.93VDC (for detector 1).

| | OK | Not OK |
|--|----|--------|
| Conditions of the spectrometer system | ✓ | |
| Alignment between lamp, cuvette and detector | ✓ | |
| Cuvette cleaning (glass windows, sealing O-rings...) | ✓ | |
| Lamp intensity | ✓ | |
| Operation of the mechanical shutter (if present) | ✓ | |

8. MILESTONE AIR COMPRESSOR

N.A.

| Maintenance | OK | Date last service |
|------------------------------------|----|-------------------|
| Drain (compressor) | | |
| Replacing air filters (air filter) | | |
| Check sealing connections | | |

9. PARTS TO BE REPLACED

| PN | DESCRIPTION | Replaced | Not |
|----|-------------|----------|-----|
|----|-------------|----------|-----|

4

เอกสารไม่ควบคุม

| | | Replaced |
|-----------|--|----------|
| DMA8133 | Catalyst tube: 6 months if the unit runs daily, 1 year if the unit is used rarely. <i>In case of analysis of sample with high organic concentration the lifetime of the catalyst can be less than 6 months.</i> | ✓ |
| DMA8134 | Amalgamator: 6 months if the unit runs daily 1 year if the unit is used rarely | ✓ |
| DMA8195A | Hg lamp tri-cell (model 2011) (for kit p/n DMA8355): 2 years | - |
| DMA8137 | Hg lamp dual-cell: 2 years | ✓ |
| 70200 | Hg trap 1 year | ✓ |
| DMA8058/B | Amalgamator coil 1 year or as soon as the heating is not more homogeneous | ✓ |
| DMA8142 | Nickel sample boats (set of 40pcs) 2 years if strongly used, replace after 1 year | - |
| DMA8347 | Quartz sample boats (set of 10pcs) 4 years | ✓ |
| DMA8335 | Metal sample boat carrier 2 years | ✓ |
| SL0108 | PU-tube diam. 6/4 mm for internal Oz/air supply 2 years | ✓ |
| SO0376D | Heating coil for drying/decomposition 2 years | ✓ |

10. TESTING PROCEDURE

It consists to run some measurements for the evaluation of the analytical performance of the unit, like: absorbance, peaks shape, temperatures, lamp signal and verify the proper working of whole system.

- Run minimum 2 blanks on the same sample boat (quartz if possible) in manner to clean it
- Run blanks until absorbance value (Height) decrease under 0.0020
- Set a fresh and stabilized 100µg/L Hg standard according to the prescriptions reported on the DMA80 User Manual. The quality of the used standard is fundamental for the success of the entire procedure
- Weight approximately 100µg of the fresh 100µg/L – Standard (10ng) and start the analysis as a single measurement mode
- Repeat five times the test
- Run again two blanks measurements

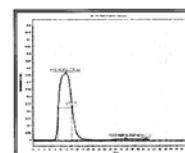
5

เอกสารไม่ควบคุม

| Pos | Sample | Amount | Area | Remarks |
|-----|------------|----------|----------|-------------|
| 1 | clean boat | 0.1113µg | 0.0000 | |
| 2 | clean boat | 0.1000µg | 0.0000 | POINT 1-2 |
| 3 | 122 ppb | 0.1000µg | 0.1770µg | |
| 4 | 122 ppb | 0.1000µg | 0.1770µg | POINT 4 - 5 |
| 5 | 122 ppb | 0.1000µg | 0.1770µg | |
| 6 | clean boat | 0.1000µg | 0.0000 | POINT 6 |
| 7 | clean boat | 0.1770µg | 0.1770µg | |

Now, it is possible to evaluate:

- Peaks



- The shape of the peak must be regular.
- The distance between Peak Cell 1 and Peak Cell 2 must be between 11 to 15 seconds.

- Results

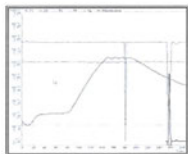
| Time | Area | Height | Width | Baseline |
|----------|-----------|--------|--------|----------|
| 11.5 min | 0.1770 µg | 0.1770 | 0.0000 | 0.0000 |

- The obtained absorbance (height) of the Blank must be < 0.0020.
- The obtained absorbance (height) must be > 0.42 for each 100ppb analysis (0.22 with cuvette installed until December 2005, DMA s/n 05120292.)
- The relative standard deviation (rsd) is < 1.5 %.
- After two blanks (after 10ng measurements), the absorbance is < 0.0020.

- Temperatures & signal profiles

6

เอกสารไม่ควบคุม



- The Hg lamp signal must be between 3.8 and 4.5V and stable. A few minutes after the start of the analysis the lamp does switch off because of the zero detection but then it instantly returns to the original condition. In case of Tricell configuration two green colour graphics are reported. After the zero shuttering the time necessary to return to full signal is longer on Tricell compare to Ducon lamp.
- During the run the catalyst oven temperature must be stable around to 615°C.
- The drying and ashing furnace must follow the set temperature method.
- During the run the Amalgamator furnace temperature must be stable at the stand by temperature (170°C). Then at the release step it must raise up to 850/900°C.
- The Cuvette temperature must be stable at approximately 125°C.
- The Hg absorbance peaks must be correctly detected and reported.

11. FINAL REPORT

| | |
|---|------|
| All screws inserted and tightened | Pass |
| All tubing sealing connections checked, cleaned or replaced and tightened | Pass |
| All heating elements are working | Pass |
| Sensors installed, checked and tightened | Pass |
| Safety devices (thermo switch) fully checked | Pass |
| All exhaust and cooling fans are functioning | Pass |
| Testing procedure successfully passed | Pass |
| Necessary tools available at customer's site | Pass |
| Last revision of User Manual available at customer's site | Pass |
| Advised customer about care and maintenance instructions | Pass |

Remarks:

7

เอกสารไม่ควบคุม

| |
|--|
| |
| |
| |
| |
| |
| |
| |

Working hours of Service Engineer

| Date | Service Engineer Name | Signature |
|----------|-----------------------|-----------|
| 18/11/66 | | |

Laboratory Manager / Operator acceptance signature:

8

เอกสารไม่ควบคุม

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

Serial-No.: K170A0153 Customer-No.:

Date: 2 February 2023 Carried out by:

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)

☐

| | |
|----------------|--|
| Company | บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริงคอนซัลแตนท์ จำกัด |
| User | |
| Department | ห้องปฏิบัติการ (Mercur Analysis) |
| Street | 3 ซอยอุดมสุข 44 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง |
| Zip Code, City | กรุงเทพมหานคร 10260 |
| Country | ประเทศไทย |
| Phone | |
| Fax | |
| E-mail | |

เอกสารไม่ควบคุม 2/5

Maintenance works basic unit

tightness visual check inside the Mercur ☒

visual check if gold-traps are broken ☒

visual check if spectrometer is contaminated ☒

visual check of the fluorescence cell ☒

visual check of the absorption cell, incl. window ☒

reactor cleaning ☒

check pump-hose, if necessary change it ☒

check swivel drive (SEV) ☒

check drying-hose, output gas-liquid-separator ☒

test Bubble-Sensor ☒

check gas flows ☒

check volume flows, reagents ☒

recording stray light values ☒

measurement with 30 ng/l ☒

Maintenance works Autosampler

Serial No.: N/A

lubricate the dosing-winding (Teflon-grease-spray) ☐

clean the dosing cylinder, if necessary exchange it ☐

lubricate the winding system of the height drive with some drops of oil ☐

check the toothed belt ☐

check the position of the mechanical stopper (height: 13mm) ☐

check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s) ☐

check the pump rate of washing cup ☐

check the electrical hose connections for good contact ☐

check the connectors of the magnetic valves ☐

check the dosing hose for buckling, if necessary exchange it ☐

| Device parameter | nominal value | actual value |
|---|----------------------------|----------------------------|
| Analytical parameters Fluorescence cell | | |
| Conditions.: max.conc.: 10µg/L PMT-voltage:V | 453 | |
| Blank-solution | | Int. 0.0007 |
| without enrichment / FBR 30 ng/L | Int > 0.0015 RSD < 3 % | Int. 0.0031 RSD 1.13 % |
| Conditions.: max.conc.: 1.7µg/L PMT-voltage:V | 444 | |
| Blank-solution | | Int. 0.0012 |
| with enrichment / FBR 30 ng/L | Int > 0.008 RSD < 3 % | Int. 0.0117 RSD 2.90 % |
| Fok.- factor (Int ₂ / Int ₁) | > 3.5 | 3.77 |
| Analytical parameters Absorption cell | | |
| Blank-solution | | Ext. 0.00168 |
| without enrichment / FBR 100 ng/L | Ext. > 0.0012 RSD < 5 % | Ext. 0.00500 RSD 1.39 % |
| Comments | | |
| # Sensitivity check (Without enrichment / FBR / 100 ng/L) | | |
| Int. Blank = 0.000811 | | |
| Int. 100 ng/L = 0.009981 | | |

Signature Technician

3 February 2023

Place, Date (DD/MM/YYYY)

Signature Customer

3 February 2023

Place, Date (DD/MM/YYYY)

| Device parameter | nominal value | actual value |
|--|---|------------------------------------|
| visual check general tightness inside the Mercur | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| visual check Goldtraps | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| visual check spectrometer | | |
| Fluorescence cell | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| Absorption cell, incl. window | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| lens | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| Swivel drive (SEV) | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| check pump hoses | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| check hoses and hose connectors | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| check and clean reactor | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| check drying hose output Gas-liquid-separator | o.k.: <input checked="" type="checkbox"/> | changed: <input type="checkbox"/> |
| check bubble-sensor | o.k.: <input checked="" type="checkbox"/> | not o.k.: <input type="checkbox"/> |
| Check gasflow | | |
| Argon pressure valve 4 | 1.2 – 1.5 bar | 1.5 bar |
| Valve 1 | 10 Nl/h or 0.166 NL/min | 0.167 NL/min |
| Valve 2 | 50 Nl/h or 0.833 NL/min | 0.833 NL/min |
| Valve 3 | 5 Nl/h or 0.083 NL/min | 0.084 NL/min |
| Valve 4 | 10 Nl/h or 0.166 NL/min | 0.166 NL/min |
| Check liquidflow | | |
| Acid | 2.5ml/min ± 1 ml | 2.5 ml/min |
| Red.-agent | 2.5ml/min ± 1 ml | 2.5 ml/min |
| Sample | 10ml/min ± 2 ml | 10 ml/min |
| Adventitious light - values | | |
| (V) | from file | |
| 100 | 0 | 0 |
| 200 | 0 | 0 |
| 300 | 0 | 0 |
| 350 | 0 | 0 |
| 400 | 1 | 1 |
| 450 | 3 | 3 |
| 500 | 8 | 8 |
| 550 | 18 | 18 |
| 575 | 26 | 26 |
| 600 | 37 | 35 |

8/02/2023 10:16 Page 1/4

Mercur

Report file: C:\WinAAS\TMP\2023\Result\WO\Pro_019

Program version: 4.7.9.0 Printed on: 8/02/2023 10:16

Recording started on 8/02/2023 10:07 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Method Without Enrichment / FBR / 30 µg/L_PM_3-02-2023

Created on 8/02/2023 Time 10:06

Program ---

Parameters Mercur Technique: Hg fluorescence

| | | | |
|------------------|-------------|-----------------|---------|
| Line | 253.7 nm | | |
| Lamp type | Hg-LP | | |
| Integr. mode | Peak height | Integr. time | 35 s |
| PMT | 451 V | | |
| AZ time | 5 s | Peak smoothing | 12/5 |
| Delay | 0 s | | |
| | --- | | |
| Working mode | w/o enrich. | System cleaning | Off |
| FBR technique | on | Wash time acid | 10 s |
| Pump speed | 3 | Soaking time | 20 s |
| Sample load time | 12 s | Gas load time | 10 NL/h |
| Reaction time | 12 s | | |
| Waiting time AZ | 5 s | | |
| Delay | 0 s | | |
| Purge time1 | 30 s | | |
| Purge time2 | 15 s | Gas wash time2 | 10 NL/h |

QC parameters

| | | | |
|--------------------|-----------------|------------------|-----------------|
| QC type | Conc. check | QC check samp. 2 | --- |
| QC check samp. 1 | --- | Conc. | --- |
| Conc. | --- | Error limit | --- |
| Error limit | off | Reaction | flag + continue |
| Rep. measurement | 1(30.000 ng/L) | QC std.2 no. | 3(0.100 ng/L) |
| QC std.1 no. | ± 20.00% | QC std.2 limit | ± 20.00% |
| QC std.1 limit | flag + continue | Reaction | flag + continue |
| QC std. act. | 0.0100± 0.0100 | QC Recal.factor | Off |
| Expect. blank abs. | off | | |
| QC precision | | | |

Calibration settings

| | | | |
|---------------------|-----------------|-------------------|----------|
| Calib. meth | Standard calib. | Calibr. unit | ng/L |
| No. standards | 1 | Conversion fac. | 1000000 |
| Type of standards | --- | Standard prep. | Premixed |
| | | Blank correct. | --- |
| | | Recalib. std. no. | --- |
| Output unit | µg/L | Conversion fac. | 1000 |
| Calib. stat. | Mean | Meas. cycles | 3 |
| | | Blind cycles | 1 |
| Stock sol. 1 | --- | Stock sol. 2 | --- |
| Stock sol. 3 | --- | Stock sol. 4 | --- |
| Type of cal. curve | linear | Intercept | Zero |
| Weighted cal. | off | Grubbs stat. | off |
| Check of cal. curve | no outlier test | | |

Sample statistics

| | | | |
|---------------|--------|--------------|---|
| Stat. mode | Mean | Meas. cycles | 3 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat. | off | | |

Calibration standards

Hg

| No | Name | State | Pos | Conc./ ng/L | Ints | SD | RSD/% |
|----|----------|-------|-----|----------------|---------------------------|----------------------|----------------|
| 1 | Cal-Zero | (--) | ## | 0.000 | H: 0.000774 A: 0.01847 | 0.000038 0.000554 | 4.995 3.002 |
| 2 | Cal-Std1 | (--) | ## | 30.000 | H: 0.003169 A: 0.05036 | 0.000036 0.000069 | 1.137 0.138 |

Mercur

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Calibration function 1

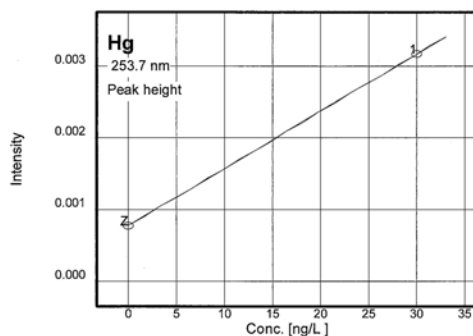
8/02/2023 10:16 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000775 k2=0.000080

Recal. factor: ---

| | | | |
|-----------------|---------------------|--------------|-----------|
| Slope | 0.00008 Ints/(ng/L) | R2-adjusted | 1.0000 |
| sc0 | 1.00000 ng/L | | |
| Lower limit | 0 ng/L | Upper limit | 33.0 ng/L |
| Detection limit | --- | Deter. limit | --- |



Measurements and events (sorted by time)

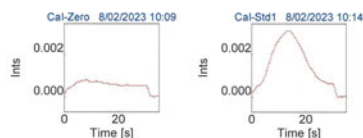
| Hg | Without Enrichment / FBR / 30 µg/L_PM_3-02-2023 | | | | | 8/02/2023 | 10:07 |
|-------------|---|----------|----|-------------|-------|-----------|-------|
| ID | Conc. | Ints | BG | SD | RSD/% | Int. type | Time |
| Cal-Zero | | 0.000816 | | | | PkH | 10:09 |
| | | 0.000765 | | | | | 10:10 |
| | | 0.000741 | | | | | 10:11 |
| | 0ng/L | 0.000774 | | 0.000038690 | 4.995 | | 10:11 |
| Cal-Std1 | | 0.003130 | | | | PkH | 10:14 |
| | | 0.003177 | | | | | 10:15 |
| | | 0.003201 | | | | | 10:16 |
| | 30.00ng/L | 0.003169 | | 0.000036050 | 1.137 | | 10:16 |
| Calibration | Calibration function: 01 | | | | | | 10:16 |

Mercur

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Peak plots

Hg



Mercur

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Mercur

Report file:

C:\WinAAS\TMP\2023\Result\WO\Pro_017

Program version:

4.7.9.0

Printed on:

3/02/2023 14:44

Recording started on 3/02/2023 14:25 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Hg

| | |
|------------|---|
| Method | Enrichment / FBR / 30 µg/L_PM 3-02-2023 |
| Created on | 3/02/2023 Time 13:41 |
| Program | --- |

Parameters Mercur Technique: Hg fluorescence

| | | | |
|------------------|------------------|-------------------|---------|
| Line | 253.7 nm | | |
| Lamp type | Hg-LP | | |
| Integr. mode | Peak height | Integr. time | 20 s |
| PMT | 444 V | | |
| AZ time | 5 s | Peak smoothing | 8/5 |
| Delay | 0 s | | |
| | --- | | |
| Working mode | Enr. w/o reload. | System cleaning | Off |
| | on | Wash time acid | 10 s |
| Pump speed | 3 | Soaking time | 20 s |
| Sample load time | 10 s | Gas load time | 10 NL/h |
| Reaction time | 10 s | | |
| Waiting time AZ | 5 s | | |
| Delay | 0 s | | |
| Purge time1 | 20 s | | |
| Purge time2 | 15 s | Gas wash time2 | 10 NL/h |
| Purge time3 | 10 s | Gas wash time3 | 10 NL/h |
| Heat.time coll.1 | 20 s | Cool. time coll.1 | 30 s |

Mercur

เอกสารไม่ควบคุม

QC parameters

| | | | |
|--------------------|-----------------|------------------|-----------------|
| QC type | Conc. check | QC check samp. 2 | --- |
| QC check samp. 1 | --- | Conc. | --- |
| Conc. | --- | Error limit | --- |
| Error limit | --- | Reaction | flag + continue |
| Rep. measurement | off | QC std.2 no. | 1(30.000 ng/L) |
| QC std.1 no. | 1(30.000 ng/L) | QC std.2 limit | ± 50.00% |
| QC std.1 limit | ± 50.00% | Reaction | flag + continue |
| QC std. act. | flag + continue | QC Recal.factor | Off |
| Expect. blank abs. | 0.0100± 0.0100 | | |
| QC precision | off | | |

Calibration settings

| | | | |
|---------------------|-----------------|-------------------|------------|
| Calib. meth | Standard calib. | Calibr. unit | ng/L |
| No. standards | 1 | Conversion fac. | 1000000 |
| Type of standards | --- | Standard prep. | Premixed |
| | | Blank correct. | --- |
| | | Recalib. std. no. | --- |
| Output unit | µg/L | Conversion fac. | 1000 |
| Calib. stat. | Mean | Meas. cycles | 3 |
| | | Blind cycles | 1 |
| Stock sol. 1 | --- | Stock sol. 2 | --- |
| Stock sol. 3 | --- | Stock sol. 4 | --- |
| Type of cal. curve | linear | Intercept | calculated |
| Weighted cal. | off | Grubbs stat. | off |
| Check of cal. curve | no outlier test | | |

Sample statistics

| | | | |
|---------------|--------|--------------|---|
| Stat. mode | off | Meas. cycles | 1 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat. | --- | | |

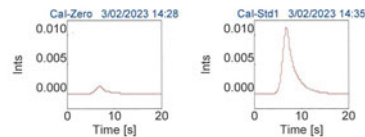
Calibration standards

Hg

| No | Name | State | Pos | Conc./ ng/L | Ints | SD | RSD/% |
|----|----------|-------|-----|----------------|----------------------------|----------------------|----------------|
| 1 | Cal-Zero | (--) | ## | 0.000 | H: 0.001256 A: 0.003771 | 0.000060 0.000252 | 4.833 6.708 |
| 2 | Cal-Std1 | (--) | ## | 30.000 | H: 0.01174 A: 0.03281 | 0.000341 0.000721 | 2.909 2.200 |

Peak plots

Hg



Mercur

เอกสารไม่ควบคุม

Mercur

เอกสารไม่ควบคุม

Calibration function 1

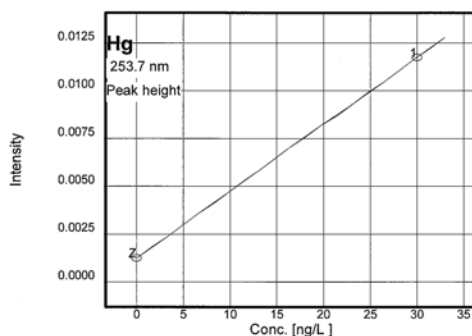
3/02/2023 14:38 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.001256 k2=0.000349

Recal. factor: ---

| | | | |
|-----------------|---------------------|--------------|-----------|
| Slope | 0.00035 Ints/(ng/L) | R2-adjusted | 1.0000 |
| sc0 | 1.00000 ng/L | | |
| Lower limit | 0 ng/L | Upper limit | 33.0 ng/L |
| Detection limit | --- | Deter. limit | --- |



Measurements and events (sorted by time)

| Hg | Enrichment / FBR /30 µg/L_PM 3-02-2023 | | | | 3/02/2023 | 14:25 |
|-------------|--|----------|----|-------------|-----------|----------------|
| ID | Conc. | Ints | BG | SD | RSD/% | Int. type Time |
| Cal-Zero | | 0.001263 | | | | PkH 14:28 |
| | | 0.001313 | | | | 14:30 |
| | | 0.001192 | | | | 14:31 |
| | 0ng/L | 0.001256 | | 0.000060700 | 4.833 | 14:31 |
| Cal-Std1 | | 0.01135 | | | | PkH 14:35 |
| | | 0.01189 | | | | 14:36 |
| | | 0.01198 | | | | 14:38 |
| | 30.00ng/L | 0.01174 | | 0.0003415 | 2.909 | 14:38 |
| Calibration | Calibration function: 01 | | | | | 14:38 |

Mercur

เอกสารไม่ควบคุม

Mercur

Report file:

C:\WinAAS\TMP\2023\Result\WO\Pro_025

Program version:

4.7.9.0

Printed on:

8/02/2023 11:44

Recording started on

8/02/2023 11:31 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

| | | | |
|------------|--|------|-------|
| Method | Without enrichment / FBR 100 ng/L PM_3-02-2023 | | |
| Created on | 3/02/2023 | Time | 11:53 |
| Program | --- | | |

Parameters Mercur Technique: Hg absorption

| | | | |
|------------------|-------------|-----------------|---------|
| Line | 253.7 nm | | |
| Lamp type | Hg-LP | | |
| Integr. mode | Peak height | Integr. time | 55 s |
| PMT | 238 V | | |
| AZ time | 5 s | Peak smoothing | 12/5 |
| Delay | 0 s | | |
| | --- | | |
| Working mode | w/o enrich. | System cleaning | Acid |
| FBR technique | off | Wash time acid | 15 s |
| Pump speed | 4 | Soaking time | 20 s |
| Sample load time | 8 s | Gas load time | 10 NL/h |
| Reaction time | 12 s | | |
| Waiting time AZ | 15 s | | |
| Purge time1 | 40 s | | |

QC parameters

| | | | |
|--------------------|-----------------|------------------|-----------------|
| QC type | Conc. check | QC check samp. 2 | --- |
| QC check samp. 1 | --- | Conc. | --- |
| Conc. | --- | Error limit | --- |
| Error limit | --- | Reaction | flag + continue |
| Rep. measurement | off | QC std.2 no. | 1(100.00 ng/L) |
| QC std.1 no. | 1(100.00 ng/L) | QC std.2 limit | ± 0.00% |
| QC std.1 limit | ± 50.00% | Reaction | flag + continue |
| QC std. act. | flag + continue | QC Recal.factor | Off |
| Expect. blank abs. | 0.0100± 0.0100 | | |
| QC precision | off | | |

Mercur

เอกสารไม่ควบคุม

Calibration settings

| | | | |
|---------------------|-----------------|-------------------|------------|
| Calib. meth | Standard calib. | Calibr. unit | ng/L |
| No. standards | 1 | Conversion fac. | 1000000 |
| Type of standards | --- | Standard prep. | Premixed |
| | | Blank correct. | --- |
| | | Recalib. std. no. | --- |
| Output unit | µg/L | Conversion fac. | 1000 |
| Calib. stat. | Mean | Meas. cycles | 3 |
| | | Blind cycles | 1 |
| Stock sol. 1 | --- | Stock sol. 2 | --- |
| Stock sol. 3 | --- | Stock sol. 4 | --- |
| Type of cal. curve | linear | Intercept | calculated |
| Weighted cal. | off | Grubbs stat. | off |
| Check of cal. curve | no outlier test | | |

Sample statistics

| | | | |
|---------------|--------|--------------|---|
| Stat. mode | Mean | Meas. cycles | 2 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat. | --- | | |

Calibration standards

| No | Name | State | Pos | Conc./ ng/L | Abs | SD | RSD/% |
|----|----------|-------|-----|----------------|----------------------------|----------------------|----------------|
| 1 | Cal-Zero | (--) | ## | 0.00 | H: 0.000383 A: 0.009152 | 0.000070 0.002492 | 18.47 27.24 |
| 2 | Cal-Std1 | (--) | ## | 100.00 | H: 0.002931 A: 0.040677 | 0.000034 0.002788 | 1.163 6.855 |

Calibration function 1 8/02/2023 11:43 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000383 k2=0.000025

Recal. factor: ---

| | | | |
|-----------------|--------------------|----------------|-------------------|
| Slope | 0.00003 Abs/(ng/L) | R2-adjusted | 1.0000 |
| sc0 | 1.00000 ng/L | Charact. conc. | 171.082 (ng/L)/1% |
| Lower limit | 0 ng/L | Upper limit | 110. ng/L |
| Detection limit | --- | Deter. limit | --- |

Hg

Mercur

Report file: C:\WinAAS\TMP\2023\Result\WO\Pro_024
 Program version: 4.7.9.0 Printed on: 8/02/2023 11:22
 Recording started on 8/02/2023 11:13 GMT+7.0
 Operator:
 Laboratory:
 Code:
 Remarks:

Method parameters

Method Without Enrichment / FBR / 100 µg/L_PM_3-02-2023
 Created on 8/02/2023 Time 10:56
 Program ---

Parameters Mercur Technique: Hg fluorescence

| | | | |
|------------------|-------------|-----------------|---------|
| Line | 253.7 nm | | |
| Lamp type | Hg-LP | | |
| Integr. mode | Peak height | Integr. time | 35 s |
| PMT | 451 V | | |
| AZ time | 5 s | Peak smoothing | 12/5 |
| Delay | 0 s | | |
| | --- | | |
| Working mode | w/o enrich. | System cleaning | Off |
| FBR technique | on | Wash time acid | 10 s |
| Pump speed | 3 | Soaking time | 20 s |
| Sample load time | 12 s | Gas load time | 10 NL/h |
| Reaction time | 12 s | | |
| Waiting time AZ | 5 s | | |
| Delay | 0 s | | |
| Purge time1 | 30 s | | |
| Purge time2 | 15 s | Gas wash time2 | 10 NL/h |

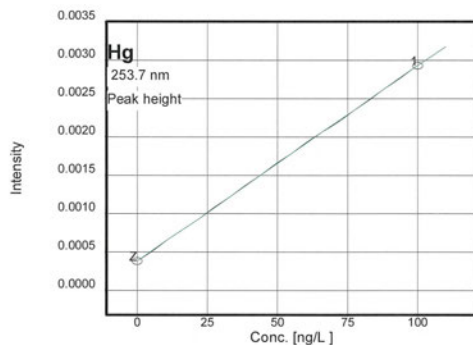
Hg

Mercur

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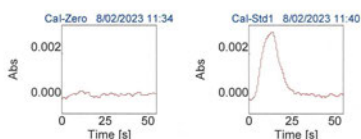
Mercur

เอกสารไม่ควบคุม



Measurements and events (sorted by time)

| Hg | Without enrichment / FBR 100 ng/L_PM_3-02-2023 | 8/02/2023 | 11:31 |
|-------------|--|-------------|-----------|
| ID | Conc. | Abs | Int. type |
| Cal-Zero | | 0.000383 | PkH |
| | | 0.000324 | |
| | | 0.000461 | |
| | 0ng/L | 0.000383 | 11:37 |
| | | 0.00070827 | 18.47 |
| Cal-Std1 | | 0.002954 | PkH |
| | | 0.002948 | |
| | | 0.002892 | |
| | 100.ng/L | 0.002931 | 11:43 |
| | | 0.000034104 | 1.163 |
| Calibration | Calibration function: 01 | | 11:43 |
| Peak plots | | | Hg |



Mercur

เอกสารไม่ควบคุม

QC parameters

| | | | |
|--------------------|-----------------|------------------|-----------------|
| QC type | Conc. check | | |
| QC check samp. 1 | --- | QC check samp. 2 | --- |
| Conc. | --- | Conc. | --- |
| Error limit | --- | Error limit | --- |
| Rep. measurement | off | Reaction | flag + continue |
| QC std.1 no. | 1(100.000 ng/L) | QC std.2 no. | 3(0.100 ng/L) |
| QC std.1 limit | ± 20.00% | QC std.2 limit | ± 20.00% |
| QC std. act. | flag + continue | | |
| Expect. blank abs. | 0.0100± 0.0100 | Reaction | flag + continue |
| QC precision | off | Reaction | off |
| | | QC Recal.factor | Off |

Calibration settings

| | | | |
|---------------------|-----------------|-------------------|----------|
| Calib. meth | Standard calib. | Calibr. unit | ng/L |
| No. standards | 1 | Conversion fac. | 1000000 |
| Type of standards | --- | Standard prep. | Premixed |
| | | Blank correct. | --- |
| | | Recalib. std. no. | --- |
| Output unit | µg/L | Conversion fac. | 1000 |
| Calib. stat. | Mean | Meas. cycles | 3 |
| | | Blind cycles | 1 |
| Stock sol. 1 | --- | Stock sol. 2 | --- |
| Stock sol. 3 | --- | Stock sol. 4 | --- |
| Type of cal. curve | linear | Intercept | Zero |
| Weighted cal. | off | Grubbs stat. | off |
| Check of cal. curve | no outlier test | | |

Sample statistics

| | | | |
|---------------|--------|--------------|---|
| Stat. mode | Mean | Meas. cycles | 3 |
| Confid. level | 95.4 % | Blind cycles | 1 |
| Grubbs stat. | off | | |

Calibration standards

| No | Name | State | Pos | Conc./ ng/L | Ints | SD | RSD/% |
|----|----------|-------|-----|----------------|---------------------------|----------------------|----------------|
| 1 | Cal-Zero | (--) | ## | 0.000 | H: 0.000811 A: 0.01927 | 0.000020 0.000649 | 2.545 3.371 |
| 2 | Cal-Std1 | (--) | ## | 100.000 | H: 0.009981 A: 0.1406 | 0.000073 0.001352 | 0.739 0.961 |

Hg

Mercur

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Calibration function 1

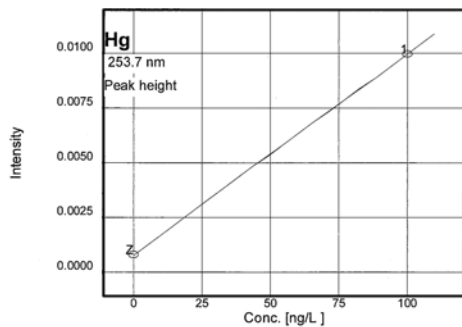
8/02/2023 11:22 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000812 k2=0.000092

Recal. factor: ---

| | | | |
|-----------------|---------------------|--------------|-----------|
| Slope | 0.00009 Ints/(ng/L) | R2-adjusted | 1.0000 |
| sc0 | 1.00000 ng/L | | |
| Lower limit | 0 ng/L | Upper limit | 110. ng/L |
| Detection limit | --- | Deter. limit | --- |



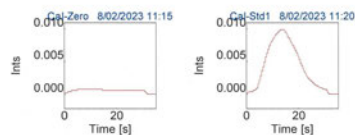
Measurements and events (sorted by time)

| Hg ID | Without Enrichment / FBR / 100 µg/L_PM_3-02-2023 | 8/02/2023 | 11:13 |
|-------------|--|-------------|-------|
| Conc. | Ints | BG | SD |
| Cal-Zero | 0.000796 | | |
| | 0.000803 | | |
| | 0.000835 | | |
| 0ng/L | 0.000811 | 0.000020660 | 2.545 |
| Cal-Std1 | 0.009957 | | |
| | 0.009921 | | |
| | 0.01006 | | |
| 100.0ng/L | 0.009981 | 0.000073720 | 0.739 |
| Calibration | Calibration function: 01 | | 11:22 |

Mercur

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Peak plots



Mercur

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analytikjena

An Endress+Hauser Company

Analytik Jena Instruments (Thailand) Ltd.

35 Moo 5, 345 Road, Khlong Khro, Pak Kret,

Northaburi, 11120 Thailand.

Phone: +662 1062970-72

Fax: +662 1062973

www.analytik-jena.com

DISTRIBUTOR

AS-TH.

Service Report

| | | | |
|--|---------------------|-------------------------------|--|
| Customer's address: | | Customer's Ref. No. | |
| E-mail: | | Phone: | Fax: |
| Job No. 230185 PM | User: | Service Engineer: | Date: 2/2/2023 Page: 1/1 |
| Instrument model: Mercury | Serial no. 41700003 | Software Version No. 4.7.9.0 | |
| <input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep (SP) <input type="checkbox"/> Visit (VI) | | | |
| Fault / Claim: Preventive Maintenance (PM 2/6) <input type="checkbox"/> Error Code | | | |
| Action taken: <ul style="list-style-type: none"> - Maintenance next Basic Unit - Check device parameter. - Check gas flow. - Check liquid flow. - Check Adventitious light - valves | | | |
| # Test run Analytical parameter Fluorescence cell # Test run Analytical parameter Absorption cell | | | |
| Action Pending / Recommendation: | | | |
| <input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration | | | |
| Item No. | Name | Quantity | Unit Price |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| Herewith the undersigned confirm the time devoted, the work performed, the perfect function of the device, and the receipt/delivery of the specified spare parts. *Traveled hours and kilometers can only be entered after the return of the service engineer. | | Date / Signature of Customer: | Work completed? |
| | | 3/2/2023 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

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

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



Cert. No.: 23TM378

Page: 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Memmert

Model : IPP 260

Serial No. : V615.0187

ID No. : UAE.MIC.003/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udumuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 11 April 2023

Calibration Date : 12 April 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : [Signature]

Approved by : [Signature]

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1

Cert. No.: 23TM378
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|----------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY49001451 | 23LM27 | 25 Feb 2024 |

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

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

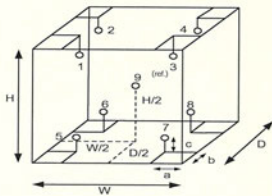
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 25 | 26 |
| REL.Humid. (%) | 57 | 61 |
| AC Supply (Volt) | 220 | 220 |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 19RTD-2/1 |
| 2 | 19RTD-2/2 |
| 3 | 19RTD-2/3 |
| 4 | 19RTD-2/4 |
| 5 | 19RTD-2/5 |
| 6 | 19RTD-2/6 |
| 7 | 19RTD-2/7 |
| 8 | 19RTD-2/8 |
| 9 (ref.) | 19RTD-2/9 |



Probe Installation Details :

Dimension of Chamber :

| | | | | | |
|-----|-----|----|------------|------|----------------|
| a = | 5.0 | cm | D = | 0.50 | m |
| b = | 5.0 | cm | W = | 0.64 | m |
| c = | 5.0 | cm | H = | 0.80 | m |
| | | | Capacity = | 0.26 | m ³ |

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



Cert. No.: 23TM729
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Memmert

Model : IPP 260

Serial No. : V618.0033

ID No. : UAE.MIC.021/2561

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory (302)

Received Order : 27 April 2023

Calibration Date : 27 April 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Issue Date :

11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM378
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor k |
|------------------------|-------------------|-------------------|------------------------------|-----------------------------|------------------------|-------------------|
| 35.0 | 35.0 | 35.0 | 0.052 | 0.53 | 0.60 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|----------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 35.0 | 35.092 | 35.148 | 34.817 | 35.149 | 34.894 | 35.323 | 34.773 | 35.058 | 34.802 | 0.30 |

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-7

Cert. No.: 23TM729
Page : 2 of 3

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|----------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY57013711 | 22LM93 | 02 Jul 2023 |

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

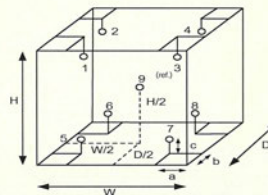
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 20 | 21 |
| REL.Humid. (%) | 72 | 77 |
| AC Supply (Volt) | 230 | 231 |



Probe Installation Details :

Dimension of Chamber :

| | | | | | |
|-----|----|----|------------|------|----------------|
| a = | 10 | cm | D = | 0.50 | m |
| b = | 10 | cm | W = | 0.64 | m |
| c = | 10 | cm | H = | 0.80 | m |
| | | | Capacity = | 0.26 | m ³ |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 18-18RTD-01 |
| 2 | 18-18RTD-02 |
| 3 | 18-18RTD-03 |
| 4 | 18-18RTD-04 |
| 5 | 18-18RTD-05 |
| 6 | 18-18RTD-10 |
| 7 | 18-18RTD-07 |
| 8 | 22-18RTD-08 |
| 9 (ref.) | 18-18RTD-09 |

เอกสารไม่



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-7
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM729
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 22.0 | 22.0 | 22.0 | 0.058 | 0.11 | 0.19 | 2 |
| 44.0 | 44.0 | 44.0 | 0.066 | 0.50 | 0.87 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|--------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 22.0 | 22.009 | 22.038 | 21.971 | 22.005 | 22.004 | 22.009 | 21.941 | 21.959 | 22.022 | 0.30 |
| 44.0 | 44.393 | 44.447 | 44.029 | 44.204 | 43.899 | 43.895 | 43.637 | 43.923 | 44.085 | 0.30 |

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0461OC-3
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|----------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |

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

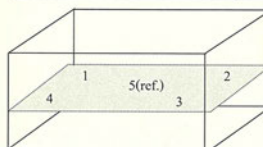
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

| | Environmental | | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
| | (°C) | (%R.H.) | |
| Beginning of Calibration | 23 | 69 | 220 |
| Finished of Calibration | 22 | 73 | 221 |



Front

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 4804539-001 |
| 2 | 4804539-002 |
| 3 | 4804539-003 |
| 4 | 4804539-004 |
| 5(ref.) | 4804539-005 |

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



Cert. No.: 23TM764
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L421.0121
ID No. : UAE.MIC.015/2565
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by :
Approved by :
Issue Date : 11 May 2023

Approved Signatory

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0461OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM764
Page : 3 of 3

| Calibration point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Average* Standard Reading (°C) | | | | | Uncertainty (± °C) |
|--------------------------|---------------------|---------------------|----------------------------------|--------|--------|--------|----------|----------------------|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 44.5 | 44.5 | 44.5 | 44.370 | 44.339 | 44.379 | 44.413 | 44.372 | 0.15 |

| Calibration point (°C) | Uniformity (°C) | Stability (± °C) | Coverage Factor k |
|--------------------------|-------------------|--------------------|-------------------|
| 44.5 | 0.097 | 0.030 | 2 |

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่



Certificate of Calibration

Equipment: Balance
Model: PX623
Serial No. (or ID.): C23675475
Manufacturer: Ohaus
Condition: New

Certificate No.: C01223732
Issued Date: 09 December 2022
Job No.: KSPR2215576
Page: 1 of 2

Customer: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Environment Condition: Temperature 26 °C ± 0.5 °C
Humidity 53 %RH ± 3.9 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Calibration By: Mr. Adisai Maknoi
Calibration Date: 09 December 2022
The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02221765

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 indication 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, UKAS Lab14. 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



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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DKSH Technology Limited
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2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone +66 2639 1000 Email info.calibration@dksh.com Website: www.dksh.com/certidto-thailand

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CAL-FM-C01-14: 12 Sep 2022

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Certificate No.: C01223732

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

| Nominal Test Value 200 (g) | | Reference Points (g) | | | | |
|----------------------------|--|----------------------|-------|-------|-------|-------|
| | | A | B | C | D | E |
| | | - | 0.000 | 0.000 | 0.000 | 0.000 |

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 50 | 0.0004 |
| 500 | 0.0005 |

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

| Nominal Value (g) | Conventional Mass (g) | Displayed Value (g) | Error of Indication (g) | Uncertainty (g) | k |
|-------------------|-----------------------|---------------------|-------------------------|-----------------|------|
| 1 | 1.0000 | 1.000 | 0.000 | 0.0010 | 2.03 |
| 5 | 5.0001 | 5.000 | 0.000 | 0.0010 | 2.03 |
| 10 | 10.0001 | 10.000 | 0.000 | 0.0010 | 2.03 |
| 20 | 20.0001 | 20.000 | 0.000 | 0.0010 | 2.03 |
| 50 | 50.0001 | 50.000 | 0.000 | 0.0010 | 2.03 |
| 100 | 100.0001 | 100.000 | 0.000 | 0.0011 | 2.03 |
| 200 | 200.0004 | 200.000 | 0.000 | 0.0011 | 2.02 |
| 300 | 300.0005 | 300.000 | -0.001 | 0.0013 | 2.01 |
| 400 | 400.0008 | 400.001 | 0.000 | 0.0014 | 2.01 |
| 500 | 500.0003 | 500.000 | 0.000 | 0.0017 | 2.00 |
| 600 | 600.0004 | 600.000 | 0.000 | 0.0019 | 2.00 |

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone +66 2639 1000 Email info.calibration@dksh.com Website: www.dksh.com/certidto-thailand

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CAL-FM-C01-14: 12 Sep 2022

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Refer to Certificate No.: C01223732

Page: 2 of 2

Statements of conformity:

Without Adjustment

Readability; 0.001 g

| Nominal Value (g) | Error of Indication (g) | Guard band (w) (g) | Tolerance (±) (g) | Conformity |
|-------------------|-------------------------|--------------------|-------------------|------------|
| 1 | 0.000 | 0.0010 | 0.002 | Pass |
| 5 | 0.000 | 0.0010 | 0.010 | Pass |
| 10 | 0.000 | 0.0010 | 0.020 | Pass |
| 20 | 0.000 | 0.0010 | 0.040 | Pass |
| 50 | 0.000 | 0.0010 | 0.100 | Pass |
| 100 | 0.000 | 0.0011 | 0.200 | Pass |
| 200 | 0.000 | 0.0011 | 0.400 | Pass |
| 300 | -0.001 | 0.0013 | 0.600 | Pass |
| 400 | 0.000 | 0.0014 | 0.800 | Pass |
| 500 | 0.000 | 0.0017 | 1.000 | Pass |
| 600 | 0.000 | 0.0019 | 1.200 | Pass |

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

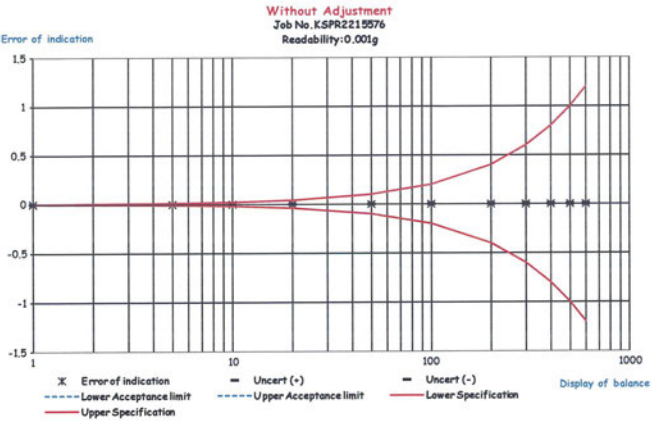
The End of Statements of conformity

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone +66 2639 1000 Email info.calibration@dksh.com Website: www.dksh.com/certidto-thailand

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