

# TSI MASS FLOWMETER CALIBRATION CERTIFICATE

APPLICATION NOTE FLOW-009 (A4)

## Mass Flowmeter Calibration Certificate



Model: 4040 (a) (i)  
 Serial Number: 40401640001 (b)  
 Verification date: 29-Sep-2016 (d)

Rev: H (c)

| Summary Status (e)                          |  |
|---|--|
| <input type="checkbox"/> As-Found           | <input checked="" type="checkbox"/> In Tolerance |
| <input checked="" type="checkbox"/> As-Left | <input type="checkbox"/> Out of Tolerance        |

| Environmental Conditions (f) |  |
|------------------------------|--|
| Pressure: 99.5 kPa           |  |
| Temperature: 21.2°C          |  |

### (h) Air Flow

Tolerance:  $\pm 1.75\%$  of reading or 0.050 SLPM\* (h)

| Reference (SLPM) | Measured (SLPM) | Allowable | Range | Max |
|------------------|-----------------|-----------|-------|-----|
| 10.562           | 10.548          | 0.512     | 0.612 |     |
| 2.055            | 2.042           | 2.005     | 2.105 |     |
| 6.004            | 5.992           | 5.899     | 6.109 |     |
| 14.50            | 14.47           | 14.25     | 14.75 |     |
| 28.90            | 28.89           | 28.39     | 29.41 |     |
| 45.52            | 45.53           | 44.72     | 46.32 |     |
| 61.57            | 61.48           | 60.49     | 62.65 |     |
| 79.96            | 79.94           | 78.56     | 81.36 |     |
| 100.0            | 100.5           | 98.29     | 101.8 |     |
| 125.1            | 125.2           | 122.9     | 127.3 |     |
| 160.1            | 160.4           | 157.3     | 162.9 |     |
| 200.2            | 200.2           | 196.7     | 203.7 |     |
| 240.0            | 240.0           | 235.8     | 244.2 |     |
| 280.6            | 280.7           | 275.7     | 285.6 |     |

### (h) Oxygen Flow

Tolerance:  $\pm 1.75\%$  of reading or 0.050 SLPM\* (h)

| Reference (SLPM) | Measured (SLPM) | Allowable | Range | Max |
|------------------|-----------------|-----------|-------|-----|
| 0.533            | 0.518           | 0.483     | 0.583 |     |
| 2.059            | 2.050           | 2.009     | 2.109 |     |
| 5.966            | 5.966           | 5.862     | 6.070 |     |
| 14.45            | 14.46           | 14.20     | 14.70 |     |
| 28.94            | 28.98           | 28.43     | 29.44 |     |
| 45.55            | 45.56           | 44.75     | 46.35 |     |
| 61.49            | 61.44           | 60.42     | 62.57 |     |
| 80.22            | 80.23           | 78.81     | 81.62 |     |
| 98.98            | 99.47           | 97.24     | 100.7 |     |
| 125.1            | 125.3           | 122.9     | 127.3 |     |
| 160.1            | 160.5           | 157.3     | 162.9 |     |
| 199.8            | 199.8           | 196.3     | 203.3 |     |
| 240.5            | 240.7           | 236.3     | 244.7 |     |
| 281.3            | 281.5           | 276.4     | 286.3 |     |

### (h) Temperature

Tolerance:  $\pm 1.000$  °C

| Reference (°C) | Measured (°C) | Allowable | Range | Max |
|----------------|---------------|-----------|-------|-----|
| 21.14          | 20.94         | 20.14     | 22.14 |     |

### (h) Pressure

Tolerance:  $\pm 0.110$  psia

| Reference (psia) | Measured (psia) | Allowable | Range | Max |
|------------------|-----------------|-----------|-------|-----|
| 4.44             | 4.44            | 4.33      | 4.55  |     |

| Internal Calibration Reference(s) (g) |                 |
|---------------------------------------|-----------------|
| Measurement Type                      | Reference (FC1) |
| Flow                                  | E005063         |
| Pressure                              | E005064         |
| Temperature                           | E005065         |

Verified by: \_\_\_\_\_

TSI Inc.  
 500 Cardigan Rd  
 55126 Shoreview USA

\*Tolerance specified: whichever is greater

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TSI does hereby certify that this flowmeter has been calibrated using TSI procedure 10000021269. The calibration of the reference standards maintain national laboratory traceability to National Institute of Standards & Technology (NIST).



- (a) Model**  
The model number of the unit under test.
- (b) Serial Number**  
The serial number of the unit under test.
- (c) Revision**  
The hardware revision level of the unit under test.
- (d) Verification Date**  
The date the verification data printed on the Calibration Certificate was taken.
- (e) Summary Status**  
The results of the test data shown on the Calibration Certificate.
  - a. As-Found vs. As-Left**  
Indicates what stage of the calibration process the data on the Calibration Certificate references to.
  - b. In Tolerance vs. Out of Tolerance**  
Indicates if the unit under test was found to be In Tolerance or Pass the calibration test process or Out of Tolerance or Fail the calibration test process.
- (f) Environmental Conditions**  
The recorded environmental conditions from the calibrator at the time of the test.
- (g) Gas**  
The gas used while collecting the verification data for the table listed below.
- (h) Tolerance**  
The allowable variability between the Actual and Measured data that results in a passing test.
- (i) Reference**  
This column is the actual flow rate indicated by the flow reference in SLPM.
- (j) Measured**  
This column is the flow rate measured by the unit under test in SLPM.
- (k) Allowable Range**  
This column shows the Min and Max values that the measured flow can fall between in order to achieve a passing test.
  - a. Min**  
The minimum measured flow value that results in a passing test.
  - b. Max**  
The maximum measured flow value that results in a passing test.
- (l) Pass or Fail**  
Shows if the result of the calibration test for the gas designated at the top of that column was a Pass or Fail.
- (m) Temperature**  
This column is the temperature received from the thermistor located within the unit under test.
- (n) Pressure**  
This column is the absolute pressure received from the absolute pressure sensor located within the unit under test.
- (o) Internal Calibration References**  
Displays the calibration references that TSI used during the verification testing of the unit under test.
  - a. Measurement Type**  
Refers to the parameter being tested by the internal calibration reference.
  - b. Reference**  
Refers to the TSI internal calibration reference.
  - c. Due for Calibration**  
Shows the date that the TSI internal calibration reference is due for calibration.
- (p) Shipping Address**  
The TSI Inc. shipping address.
- (q) Print Date**  
The date the certificate was printed.

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