

**CALIBRATION CERTIFICATE**

Certificate Number

45666140744004

**Model:** HH3016-IAQ

**Customer:** INNOVATEC Industrial Solutions

**Serial Number:** 140744004

**RMA#:** US-73128

**Sensor ID:** 140702-017

**Calibration Location:** 300 W. Antelope Rd. White City, OR 97503

**Date of Calibration:** January 9, 2025

**Calibration Due Date:** January 9, 2026

**Calibration Method** Calibration of this instrument has been accomplished as defined in ISO 21501-4: Light scattering airborne particle counter for clean spaces. All work performed is in accordance with Lighthouse Worldwide Solutions Quality Manual P/N 714252800-1 and 17025 SOP 0.1.1. Reproduction of this certificate and accompanying documentation is prohibited without the expressed written permission of Lighthouse Worldwide Solutions. All records of work performed are maintained by Lighthouse Worldwide Solutions.

**Traceability** The Standards of the Compliant Calibration Laboratory are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported by this laboratory. The unique laboratory calibration number identified above shall be used in referencing metrological traceability for artifacts identified only in this certificate.

**Uncertainty** The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of  $k = 2$ , which provides a confidence level of approximately 95%. The values and test criteria are applied using Simple Acceptance; Shared Risk approach.

**Results** This certifies the above named instrument conforms to the original specifications in effect at date of manufacture and test.

**Environmental Conditions** All reported values are established with room air at these conditions unless otherwise indicated.

Ambient temperature 75.0 °F Relative humidity 35.0 %

**Test Equipment**

Standards	Model	Manufacturer	Serial Number	Cal Date	Cal Due
Flow meter	4143	TSI	41432126006	7/11/2024	1/11/2025
DMM	Fluke 179	Fluke	28150637	5/14/2024	5/14/2025
MCA	8000D	Amptek	1937	11/4/2024	11/4/2025
Test Standard	Solair	LWS	231199001	12/4/2024	6/4/2025

**Particle Size Standards**

Nominal Size	Particle Size	Tolerance (nm)	Lot No.	Manufacturer	Expiration Date
0.30µm	0.30µm	+/- 2.5	281235	Thermo Scientific	6/1/2027
0.40µm	0.40µm	+/- 3	283679	Thermo Scientific	8/1/2027
0.50µm	0.51µm	+/- 3.5	279810	Thermo Scientific	5/1/2027
1.00µm	1.03µm	+/- 9	280490	Thermo Scientific	5/1/2027
2.50µm	2.51µm	+/- 13.5	280474	Thermo Scientific	5/1/2027
5.00µm	5.02µm	+/- 30	280996	Thermo Scientific	6/1/2027
10.00µm	9.69µm	+/- 60	280503	Thermo Scientific	5/1/2027

**Counting Efficiency Particle Size Standards**

Nominal Size	Particle Size	Tolerance (nm)	Lot No.	Manufacturer	Expiration Date
0.30µm	0.30µm	+/- 2.5	281235	Thermo Scientific	6/1/2027
0.50µm	0.51µm	+/- 3.5	279810	Thermo Scientific	5/1/2027

**CALIBRATION RESULTS AS LEFT**

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**Size Calibrations as Left**

<u>Channel</u>	<u>Channel Size</u>	<u>Threshold</u>	<u>Size Error</u>	<u>Expanded Uncertainty</u>	<u>Result</u>
1	0.30µm	65mV	0%	0.009 µm	Pass
2	0.50µm	637mV	0%	0.010 µm	Pass
3	1.00µm	1165mV	0%	0.022 µm	Pass
4	2.50µm	2033mV	0%	0.029 µm	Pass
5	5.00µm	3793mV	0%	0.060 µm	Pass
6	10.00µm	4420mV	0%	0.160 µm	Pass

**Measurements as Left**

<b>Nominal Flow Rate:</b> 2.83 L/min	<b>Measured</b> 2.83 L/min	<b>Tolerance</b> ± 5% of nominal	<b>Expanded Uncertainty</b> 0.1 L/min	<b>Result</b> Pass
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**False Count Rate:**

JIS B 9921 Observed Counts:	0	≤ 1 ct max / 5 min.	212 particles/m³	Pass
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ISO21501-4 False Count Rate:	0	Upper confidence level	212 particles/m³	Pass
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**Counting Efficiency 50%:**

Size 0.300 µm	56.3%	30% - 70%	3.4%	Pass
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**Counting Efficiency 100%:**

Size 0.51 µm	100.3%	90% - 110%	5.6%	Pass
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**Size Resolution:**

Size 0.401 µm	14.61%	15%	1.5%	Pass
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**CALIBRATION RESULTS AS FOUND**

Certificate Number

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**Size Calibrations as Found**

Channel	Channel Size	Threshold Settings	As Received Size	Percent Size Error	Size Error Tolerance	Expanded Uncertainty	Pass/Fail
1	0.30µm	66mV	0.30µm	0.0%	+/-10%	0.009 µm	Pass
2	0.50µm	553mV	0.51µm	2.2%	+/-10%	0.010 µm	Pass
3	1.00µm	893mV	0.73µm	-26.9%	+/-10%	0.022 µm	FAIL
4	2.50µm	2491mV	3.51µm	40.3%	+/-10%	0.029 µm	FAIL
5	5.00µm	3761mV	5.08µm	1.6%	+/-10%	0.060 µm	Pass
6	10.00µm	4547mV	8.20µm	-18.0%	+/-10%	0.180 µm	FAIL

**Measurements as Found**

Nominal Flow Rate: 2.83 L/min	Measured 2.90 L/min	Tolerance ± 5% of nominal	Expanded Uncertainty 0.1 L/min	Result Pass
False Count Rate:				
JIS B 9921 Observed Counts:	0	≤ 1 count / 5 min.	212 particles/m³	Pass
ISO21501-4 False Count Rate:	0	Upper confidence level	212 particles/m³	Pass
Counting Efficiency 50%:				
Size 0.300 µm	47.3%	30% - 70%	3.4%	Pass
Counting Efficiency 100%:				
Size 0.51 µm	104.7%	90% - 110%	6.0%	Pass
Size Resolution:				
Size 0.401 µm	13.58%	15%	1.5%	Pass

 Signature:  
 Metrology Manager

  
 David Voeller

Metrology Manager acknowledges that the calibration methodology employed is in accordance with ISO 17025 and Lighthouse Worldwide Solutions Quality Management System to comply to ISO 21501-4 calibration requirements.

 Signature:  
 Calibration Tech/Engineer:

  
 Bryce Fry