

CALIBRATION CERTIFICATE

Certificate Number 458812508141393

Model Apex Z3
Serial Number 2508141393

Sensor ID 2508141-019
Date of Calibration August 12, 2025
Next Calibration Due August 12, 2026
Calibration Location 300 W Antelope Road, White City, OR 97503

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 72.0 F **Relative Humidity** 48.0%

Test Equipment

Standards	Model	Manufacturer	Serial Number	Calibration Date	Calibration Due
DMM	Fluke 179	Fluke	17370023	AUG-22-2024	AUG-22-2025
MCA	8000D	Amptek	979	OCT-03-2024	OCT-03-2025
Flow Meter	4045	TSI	40451709001	MAY-12-2025	NOV-12-2025
Test Standard	Transfer Standard	LWS	190299004	OCT-11-2024	OCT-11-2025

Particle Size Standards

Nominal Size	Particle Size	Tolerance	Lot No.	Manufacturer	Expiration Date
0.30 μm	0.30 μm	$\pm 2.5\text{nm}$	292710	Thermo Scientific	JUN-01-2028
0.40 μm	0.40 μm	$\pm 3\text{nm}$	283679	Thermo Scientific	AUG-01-2027
0.50 μm	0.51 μm	$\pm 3.5\text{nm}$	285407	Thermo Scientific	OCT-01-2027
1.00 μm	1.03 μm	$\pm 9\text{nm}$	292713	Thermo Scientific	JUN-01-2028
3.00 μm	3.02 μm	$\pm 30\text{nm}$	287254	Thermo Scientific	DEC-01-2027
5.00 μm	4.97 μm	$\pm 30\text{nm}$	283472	Thermo Scientific	AUG-01-2027
10.00 μm	9.92 μm	$\pm 30\text{nm}$	287466	Thermo Scientific	DEC-01-2027

Counting Efficiency Particle Size Standards

Nominal Size	Particle Size	Tolerance	Lot No.	Manufacturer	Expiration Date
0.30 μm	0.30 μm	$\pm 2.5\text{nm}$	292710	Thermo Scientific	JUN-01-2028
0.50 μm	0.51 μm	$\pm 3.5\text{nm}$	285407	Thermo Scientific	OCT-01-2027

CALIBRATION RESULTS AS LEFT

Certificate Number

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Size Calibrations as Left

Channel	Channel Size	Threshold	U(k=2)	Size Error	Result
1	0.30 µm	44 mV	0.0090 µm	0.3%	Pass
2	0.50 µm	426 mV	0.010 µm	0.1%	Pass
3	1.00 µm	1206 mV	0.019 µm	0.2%	Pass
4	3.00 µm	2835 mV	0.061 µm	0.0%	Pass
5	5.00 µm	4679 mV	0.062 µm	-0.1%	Pass
6	10.00 µm	6390 mV	0.065 µm	0.0%	Pass

Measurements as Left

Nominal Flow Rate	Measured Flow	Criteria	U(k=2)	Result	
28.3 LPM	28.31 LPM	(limit ± 5% of nominal)	0.82 L/min	Pass	
False Count Rate	Observed Counts	Criteria	UCL	Result	
JIS B 9921	0	(≤ 1 ct max / 5 min.)	2 Particles/m³	Pass	
ISO21501-4	0	(≤ 1 ct max / 5 min.)*	2 Particles/m³	Pass	
Counting Efficiency	Size	Measured	Criteria	U(k=2)	Result
50%	0.300 µm	53.6%	(limit 30% - 70%)	3.4%	Pass
100%	0.510 µm	108.0%	(limit 90% - 110%)	5.2%	Pass
Size Resolution	Size	Measured	Criteria	U(k=2)	Result
	0.401 µm	7.15%	(limit 15%)	1.6%	Pass

CALIBRATION RESULTS AS FOUND
Size Calibrations as Found

Channel	Size	Threshold	As Rec'd Size	Size Error	Tolerance	U(k=2)	Result
1	0.30	44 mV	0.301	0.3%	± 10%	0.0090 µm	Pass
2	0.50	426 mV	0.500	0.1%	± 10%	0.010 µm	Pass
3	1.00	1206 mV	1.002	0.2%	± 10%	0.019 µm	Pass
4	3.00	2835 mV	3.000	0.0%	± 10%	0.061 µm	Pass
5	5.00	4679 mV	4.994	-0.1%	± 10%	0.062 µm	Pass
6	10.00	6390 mV	10.001	0.0%	± 10%	0.065 µm	Pass

Measurements as Found

Nominal Flow Rate	Measured Flow	Criteria	U(k=2)	Result	
28.3 LPM	28.31 LPM	(limit ± 5% of nominal)	0.82 L/min	Pass	
False Count Rate	Observed Counts	Criteria	UCL	Result	
JIS B 9921	0	(≤ 1 ct max / 5 min.)	2 Particles/m³	Pass	
ISO21501-4	0	(≤ 1 ct max / 5 min.)*	2 Particles/m³	Pass	
Counting Efficiency	Size	Measured	Criteria	U(k=2)	Result
50%	0.300 µm	53.6%	(limit 30% - 70%)	3.4%	Pass
100%	0.510 µm	108.0%	(limit 90% - 110%)	5.2%	Pass
Size Resolution	Size	Measured	Criteria	U(k=2)	Result
	0.401 µm	7.15%	(limit 15%)	1.6%	Pass

 Signature
 Metrology Manager


 David Voeller

 Signature
 Calibration Technician


 Dalton Sells

Metrology Manager acknowledges that the calibration has been carried out in accordance with Lighthouse Worldwide Solutions Quality Management System to comply with ISO 21501-4 calibration requirements and ISO 17025 General Requirements for Competence and Testing of Calibration Laboratories.

* LWS Internal Specification