

**CALIBRATION CERTIFICATE**

Certificate Number 44007200605027

**Model:** S1100  
**Serial Number:** 200605027  
**Sensor ID:** 200605-022  
**Calibration Location:** 1221 Disk Drive, Medford, OR 97501  
**Date of Calibration** June 25, 2020

**Next calibration on this instrument is due:** June 25, 2021

**Calibration Method** Calibration of this instrument has been accomplished as defined in ISO 21501-4 2018: Light scattering airborne particle counter for clean spaces. All work performed is in accordance with Lighthouse Worldwide Solutions. Quality Manual P/N 714252800-1. 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** Ambient temperature 73.0 °F Relative humidity 40.0 %

**Test Equipment**

<u>Standards</u>	<u>Model</u>	<u>Mfg</u>	<u>Serial#</u>	<u>Cal Date</u>	<u>Cal Due</u>
Flow meter	4043	TSI	1705011	12/30/2019	9/30/2020
DMM	Fluke 179	Fluke	19850108	8/27/2019	8/27/2020
MCA	8000D	Amptek	979	5/15/2020	5/15/2021
Test Standard	3750	TSI	3750182301	1/10/2020	1/10/2021

**Particle Size Standards**

<u>Nominal Size</u>	<u>Particle Size</u>	<u>Tolerance (nm)</u>	<u>Lot No.</u>	<u>Manufacturer</u>	<u>Expiration Date</u>
0.10µm	0.104µm	+/-1.5	PS3338B-0319	Magsphere Inc.	3/5/2022
0.15µm	0.152µm	+/-2.5	209772	Thermo Scientific	4/31/22
0.20µm	0.203µm	+/-2.5	205131	Thermo Scientific	11/30/2021
0.25µm	0.240µm	+/-2.5	218940	Thermo Scientific	11/30/2021
0.30µm	0.303µm	+/-3	219211	Thermo Scientific	11/30/2022
0.50µm	0.510µm	+/-3.5	218477	Thermo Scientific	10/1/2022
1.00µm	1.036µm	+/-6	215612	Thermo Scientific	8/31/2022
5.00µm	5.020µm	+/-20	214744	Thermo Scientific	7/1/2022

**Counting Efficiency Particle Size Standards**

<u>Nominal Size</u>	<u>Particle Size</u>	<u>Tolerance (nm)</u>	<u>Lot No.</u>	<u>Manufacturer</u>	<u>Expiration Date</u>
0.10µm	0.104µm	+/-1.5	PS3338B-0319	Magsphere Inc.	3/5/2022
0.20µm	0.203µm	+/-2.5	205131	Thermo Scientific	11/30/2021

**CALIBRATION RESULTS AS LEFT**

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**Size Calibrations as Left**

Channel	Chnl Size	Threshold	Particle Size	Particle Size Voltage	Expanded Uncertainty	As Left Size Error
1	0.10µm	24mV	0.104µm	24.0mV	0.003 µm	0%
2	0.15µm	1184mV	0.152µm	1184.0mV	0.005 µm	0%
3	0.20µm	2764mV	0.203µm	2764.0mV	0.008 µm	0%
4	0.25µm	3768mV	0.240µm	3604.0mV	0.006 µm	0%
5	0.30µm	4461mV	0.303µm	4497.0mV	0.009 µm	0%
6	0.50µm	5468mV	0.510µm	5491.0mV	0.01 µm	0%
7	1.00µm	6127mV	1.036µm	6147.0mV	0.02 µm	0%
8	5.00µm	7322mV	5.020µm	7327.0mV	0.048 µm	0%

**Measurements as Left**

Nominal Flow Rate:	Measured Flow:	(limit $\pm 5\%$ of nominal)	Expanded Uncertainty	Result
28.30 LPM	28.15 LPM		0.8L/min	Pass

**False Count Rate:**

JIS B 9921 Zero Count	Observed Cts:	0	( $\leq 1$ ct max / 5 min.)	Pass
ISO21501-4 False Count Rate	Observed Cts:	0	Upper confidence level	2 Particles/m3

Counting Efficiency 50%:	Size	0.104 µm	50.1% (limit 30% - 70%)	Expanded Uncertainty	3.5 %	Result
						Pass

Counting Efficiency 100%:	Size	0.203 µm	102.3% (limit 90% - 110%)	Expanded Uncertainty	7.3 %	Result
						Pass

Size Resolution:	Size	0.240 µm	8.22% (limit 15%)	Expanded Uncertainty	2.2 %	Result
						Pass

**CALIBRATION RESULTS AS FOUND**

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**Size Calibrations as Found**

Channel	Size(μm)	As Rec'd Threshold Settings mV	As measured Threshold Settings mV	As Rec'd size (μm)	Percent size error (%)	Percent size error tolerance	Expanded Uncertainty	Pass/Fail
1	0.1	24	24	0.107	2.9%	+/- 10%	0.003 μm	Pass
2	0.15	1184	1184	0.152	1.2%	+/- 10%	0.005 μm	Pass
3	0.2	2764	2764	0.202	1.1%	+/-10%	0.008 μm	Pass
4	0.25	3768	3768	0.249	-0.2%	+/-10%	0.006 μm	Pass
5	0.3	4461	4461	0.298	-0.5%	+/-10%	0.009 μm	Pass
6	0.5	5468	5468	0.499	-0.2%	+/-10%	0.01 μm	Pass
7	1	6127	6127	0.999	-0.1%	+/-10%	0.02 μm	Pass
8	5	7322	7322	4.995	-0.1%	+/-10%	0.048 μm	Pass

**Measurements as Found**

Nominal Flow Rate:	Measured Flow:	(limit ±5% of nominal)	Expanded Uncertainty	Result
28.30 LPM	28.15 LPM		0.8L/min	Pass

**False Count Rate:**

JIS B 9921 Zero Count	Observed Cts:	0	(≤ 1 ct max / 5 min.)	Pass
ISO21501-4 False Count Rate	Observed Cts:	0	Upper confidence level	2 Particles/m3

**Size Resolution:**

Size	0.240 μm	8.22% (limit 15%)	2.2 %	Pass
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Signature:

Head of Calibration:

D. Spranger

Head of calibration acknowledges that the calibration has been carried out in accordance with Lighthouse Worldwide Solutions ISO 17025 Quality Management system to comply to ISO 21501-4:2018 calibration requirements.

Signature:

Calibration Tech/Engineer:

B. PARMER