



**Guaranteed Effortless Control**



March 16, 2023

DriveSavers, Inc  
400 Bel Marin Keys Blvd.  
Novato, CA 94949

Environmental Testing was performed in the following cleanroom areas at  
*DriveSavers, Inc.*, on March 9<sup>th</sup>, 2023.

AREA	CLASSIFICATION	SQ. FOOTAGE	RESULT
Cleanroom A	ISO Class 5	440	<b>Compliant</b>
Cleanroom B	ISO Class 5	630	<b>Compliant</b>

Measurements were made to determine airborne particle concentrations, airflow velocities, integrity of the air supply HEPA filters, room differential air pressure and temperature and humidity.

All measurements are made in accordance with ISO 14644-1 2015, ISO 14644-2: 2015, or ISO 14644-3: 2019 applicable standards, methods, and practices currently in effect. By issuing this report, Advanced Cleanroom Microclean Corporation accepts full responsibility for the accuracy of measurements and reported results at the time the measurements are made. This report and original data on file shall remain proprietary to DriveSavers, Inc

Measurements and data recording are made by Manuel Perezmarcial.

Please feel free to call anytime if you have any questions regarding this report.

Sincerely,  
ADVANCED CLEANROOM MICROCLEAN CORPORATION.

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# 1 ACM Testing Parameters

## 1.1 Airborne Particle Count

**PURPOSE:** To measure the particle levels in the cleanroom in order to maintain compliance of ISO 14644-1:2015 and in accordance to ISO 14644-2:2015

**INSTRUMENTATION:** Particle Counter - Calibration documents on equipment used for certification are attached to the report. DPC must meet ISO 21501-4:2018 calibration requirements per ISO 14644-1:2015

**PROCEDURES:** Divide the Cleanroom work zone into grids of equal proportion and plot the sample locations according to room class and standard used to classify the cleanroom. Place the particle counter probe and take samples perpendicular to the airflow at working height. Record and report data for each considered particle size for the designated classification. The following procedure is listed in ISO 14644-1:2015 Annex A

Install the particle counter intake at the specified sampling location, and set up the flow rate at 1.0 CFM for a duration of one minute per location. Select the particle size threshold(s) in accordance with ISO 14644-1:2015. A sampling probe should be selected to permit close to isokinetic sampling in areas with unidirectional flow. The sample probe velocity should not differ from sampled air velocity by more than 20 %. If this is not possible, set the sampling probe inlet facing into the predominant direction of the airflow; in locations where sampled airflow being sampled is not controlled or predictable (e.g. non-unidirectional airflow) the inlet of the sampling probe shall be directed vertically upward. The transit tube from the sample probe inlet to the particle counter sensor should be as short as possible. For sampling of particles larger than and equal to  $1\mu\text{m}$ , the transit tube length should not exceed the manufacturer's recommended length and diameter.

**ACCEPTANCE:** The particle concentration at each sample location should fall at or below class limit, and the mean of these averages should fall at or below the class limit.

**1.2 Airborne Particulate Cleanliness Classes****ISO - 14644-1***AVERAGE, MEAN, STANDARD DEVIATION, STANDARD ERROR :*

<b>CLASS</b>	<b>0.1 MICRON</b>	<b>0.2 MICRON</b>	<b>0.3 MICRON</b>	<b>0.5 MICRON</b>	<b>1.0 MICRON</b>	<b>5.0 MICRONS</b>
ISO 1	10	2	-	-	-	-
ISO 2	100	24	10	4	-	-
ISO 3	1,000	237	102	35	8	-
ISO 4	10,000	2,370	1,020	352	83	-
ISO 5	100,000	23,700	10,200	3,520	832	-
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 7	-	-	-	352,000	83,200	2,930
ISO 8	-	-	-	3,520,000	832,000	29,300
ISO 9	-	-	-	35,200,000	8,320,000	293,000

FOR ROOMS WHERE NUMBER OF SAMPLING LOCATIONS IS MORE THAN ONE AND LESS THAN NINE.

AVERAGE PARTICLE CONCENTRATION:

$$A = \frac{C_1 + C_2 + \dots + C_N}{N}$$

Where  $C_1, C_2, C_N$  = Individual particle counts  
 $N$  = Number of particle counts taken at each location.*MEAN OF AVERAGES:*

$$M = \frac{A_1 + A_2 + \dots + A_N}{L}$$

Where  $A_1, A_2, \dots, A_N$  = Average particle concentrations at each location.  
 $L$  = Number of locations.*STANDARD DEVIATION:*

$$SD = \sqrt{\frac{(A_1 - M)^2 + (A_2 - M)^2 \dots (A_N - M)^2}{L-1}}$$

Where  $A_1, A_2, \dots, A_N$  = Average particle concentrations at particular locations  
 $M$  = Mean of Averages  
 $L$  = Number of Locations*STANDARD ERROR:*

$$SE = \frac{SD}{\sqrt{L}}$$

Where  $SD$  = Standard Deviation and  $L$  = Number of Locations

### 1.3 HEPA Filter Leak Test with Ambient Air

**PURPOSE:** To verify that all HEPA filters, filter housing and mounting frames located in the Cleanroom are free from leakage when operating at the manufacturers recommended airflow velocities.

**INSTRUMENTATION:** Particle Counter – Calibration documents for equipment used for testing will be attached to the certification report.

**PROCEDURES:** The two-stage approach of this in situ filter leak test method provides accuracy and speed:

- 1) The clean side of the filter should be scanned for a potential leak. During scanning with a DPC, detection of more than the observed acceptable counts  $N_a$ , in sample acquisition time  $T_s$  indicates the potential presence of a leak. In this case, the second stage should be performed. If there are no indications of potential leaks, further investigations are not necessary. The determinations of  $N_a$  and  $T_s$  are described in ISO 14644-3:2019 Section B.7.3.1
- 2) The probe should be returned to the place of maximum particle count under each potential leak and a stationary re-measurement should be performed. During the stationary re-measurement with the DPC, detection of more than the observed acceptable counts ( $N_a$ ) in sustained residence time  $T_r$  indicates the presence of a leak. The determinations of  $N_a$  and  $T_r$  are described in ISO 14644-3:2019 Section B.7.3.9.

**ACCEPTANCE:** Ambient air should not exceed 0.01 percent of the upstream concentration at any point, however, upstream ambient air may be too clean to leak test within a reasonable amount of time. Filter integrity requirements are no leaks or repairs are acceptable.

## 1.4 HEPA Filter Air Flow Velocity

**PURPOSE:** To determine the volume of air delivered through each HEPA filter and to calculate the average airflow, uniformity range and room air exchange rate, within the Cleanroom.

**INSTRUMENTATION:** Calibration documents for equipment used for testing will be included in the certification reports.

### **PROCEDURES:**

1. ISO 14644-3:2019 section B-2.3.3

Supply airflow rate calculated from filter face velocity

Evaluation of the supply airflow rate without a flowhood may be done with an anemometer downstream of each final filter. The supply airflow rate is determined from the airflow velocity multiplied by the area of exit. A curtain may be used to exclude disturbances to the unidirectional airflow.

For the number of measuring points and the calculation of supply airflow rate, refer to B.2.2.2 and B.2.2.4, respectively.

If it is impossible to divide the plane into grid cells of equal areas, the average air velocity weighted by area may be substituted.

2. ISO 14644-3:2019 section B.2.2.2

Supply airflow velocity

The airflow velocity should be measured at approximately 150 mm to 300 mm from the filter face. The number of measuring points should be sufficient to determine the supply airflow rate in cleanrooms and clean zones, and should be the square root of 10 times of area in square meters but no less than 4. At least one point should be measured for each filter outlet or fan-filter unit. A curtain may be used to exclude disturbances to the unidirectional airflow.

The measuring time at each position should be also sufficient to ensure a repeatable reading. Time-averaged values of measured velocities should be recorded for multiple locations.

### 3. ISO 14644-3:2019 B.4.2.4

Supply airflow rate measured by filter face velocity

The results of the airflow velocity test carried out in accordance with B.2.2.2 can be used to calculate the total supply airflow rate as follows:

$$Q = \sum (V_n \times A_c)$$

$Q$  is the total airflow rate;

$V_n$  is the airflow velocity at each cell centre;

$A_c$  is the cell area which is defined as the installation area divided by the number of measuring points;

$\sum$  is the summation for all cells.

**ACCEPTANCE:** The average airflow velocity or the average or total airflow volume for the cleanroom or clean zone should be within the value specified for the cleanroom or clean zone, or within other tolerance limits agreed upon by the buyer and seller.

## 1.5 Temperature

**PURPOSE:** To verify the capability of the Cleanroom air handling equipment to maintain temperature within design specification.

**INSTRUMENTATION:** Calibration documents for equipment used in testing are included in the certification report.

1. **PROCEDURES:** This test is recommended for areas where temperature and moisture levels are primarily controlled for purposes of worker comfort rather than process or equipment requirements. When processes require strict temperature control, a more comprehensive test is performed.
2. Allow room to operate for 24 hours before testing.
3. ISO 14644-3:2019 Section B.5 Comprehensive temperature test  
This test is recommended for areas having strict environmental control specifications. This test should be performed at least 1 hour after the air-conditioning system has been operated and the conditions have been stabilized. The work zone should be divided into a grid of equal areas. Individual testing areas should be selected by agreement between the customer and supplier. The number of measuring locations should be at least two-The temperature probe should be positioned at work-level height and at a distance of no less than 300 mm from the ceiling, walls, or floor of the installation. The probe position should be selected with due consideration of the presence of heat sources. Measurements should be performed as appropriate for the purpose of application and the measurement time should be at least 5 min with one value recorded at least every minute.

**ACCEPTANCE:** Temperature and uniformity measurements are for reference only.



## 1.6 Humidity

**PURPOSE:** To verify that the system humidity control of the Cleanroom is working at the acceptance level. Humidity control is necessary to:

1. Prevent corrosion and/or oxidation.
2. Prevent condensation on work surfaces.
3. Reduce static electricity.
4. Provide personnel comfort.
5. Prevent product contamination.
6. Compensate for hygroscopic materials.
7. Control microbial growth.

**INSTRUMENTATION:** Calibration documents for equipment used for testing are included in the certification report.

**PROCEDURES:** ISO 14644-3:2019 Section B.6 Procedure for humidity test  
The test is performed following completion of the airflow uniformity tests and the adjustment of air-conditioning system controls. This test should be performed with the air-conditioning system fully operational and when stable conditions have been achieved. The humidity sensor should be located at least at one location for each humidity control zone, and sufficient time should be allowed for the sensor to stabilize. Measurements should be performed as appropriate for the purpose of application after the sensor has stabilized, and the measurement time should be at least 5 min. The measurement points, frequency, intervals and period for data recording should be agreed between the customer and the supplier. The humidity test should be performed in conjunction with the temperature test.

**ACCEPTANCE:** Humidity and uniformity measurements are for reference only.

## 1.7 Room Pressurization

**PURPOSE:** To verify that a differential pressure should be maintained between the rooms sufficient to assure airflow outward progressively from the cleanest spaces to the least clean during normal operation and during periods of temporary upsets in air balance, as when a door connecting two (2) rooms is suddenly opened.

**INSTRUMENTATION:** Calibration documents for equipment used in testing are included in certification report.

**PROCEDURES:** ISO 14644-3:2019 Section B.1.2 Procedure for air pressure difference test. It is advisable to confirm that the supply air volume and installation balancing are within specifications before commencing the measurement of differential pressure between rooms or between rooms and outside areas. With all doors closed, the pressure difference between the cleanroom and any surrounding environment should be measured and recorded. If the installation is subdivided into more than one cleanroom, the pressure differences between the innermost room and the next adjacent room should be measured. The measurement should be continued until the pressure difference between the last enclosure and surrounding ancillary environment and against the external environment is measured. The pressures being measured are very small and incorrect measurement techniques can easily give erroneous readings. The following should be considered:

- a) installation of permanent measuring points is recommended;
- b) take measurements near to the middle of the cleanroom and away from any supply air inlets or return air outlet devices which may influence the local pressure at the measuring point.

**ACCEPTANCE:** Pressurization and uniformity requirements are a matter for agreement between the buyer and the seller. Units of measurement are in inches of water gauge.

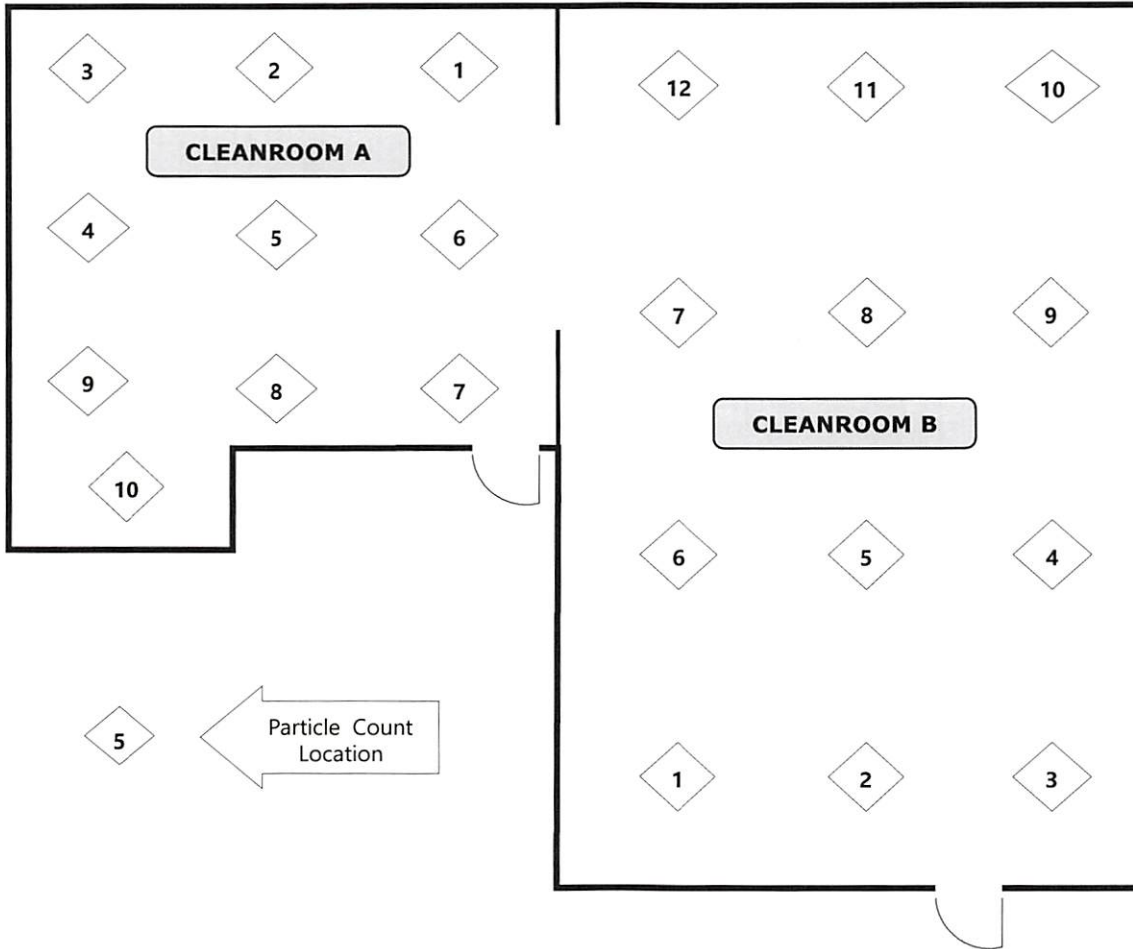
## 2 Equipment Calibration Summary

Type of Test	Manufacturer	Model	Serial	Cal. Due Date
<i>Non-Viable Particle Counts</i>	Lighthouse	S3100	120404008	06/13/2023
<i>Air Velocity/Volume</i>	TSI Alnor	EBT731	EBT731644029	09/01/2023
<i>Room Diff. Pressure</i>	TSI Alnor	EBT731	EBT731644029	09/01/2023
<i>Temperature &amp; Humidity</i>	Lighthouse	LWS TRH Probe	330677-12002552	08/16/2023
<i>Viable Air Sampling</i>	N/A	N/A	N/A	N/A

### **3 Report Content**

Pages are organized by area. Each section may include a sketch of the Cleanroom showing particle count locations, particle count data, temperature, humidity, room air pressure and airflow data. The report sections conclude with summary data and statement of certification, followed by certificates of compliance.

### CLEANROOM A & B PARTICLE COUNT SAMPLING LOCATION DIAGRAM



Initials MP Date 16 Mar 23

**CLEANROOM A AIRBORNE PARTICLE COUNT DATA**

<b>SAMPLE LOCATION (ISO Class 5)</b>	<b>0.5 MICRONS (Limit 3,520)</b>	<b>5.0 MICRONS (Limit N/A)</b>
1	0	0
2	0	0
3	0	0
4	0	0
5	177	106
6	0	0
7	0	0
8	0	0
9	71	0
10	0	0
<b>AVERAGE COUNT</b>	<b>24.8</b>	<b>10.6</b>
<b>STANDARD DEVIATION</b>	<b>57.8</b>	<b>33.5</b>
<b>STANDARD ERROR</b>	<b>18.3</b>	<b>10.6</b>

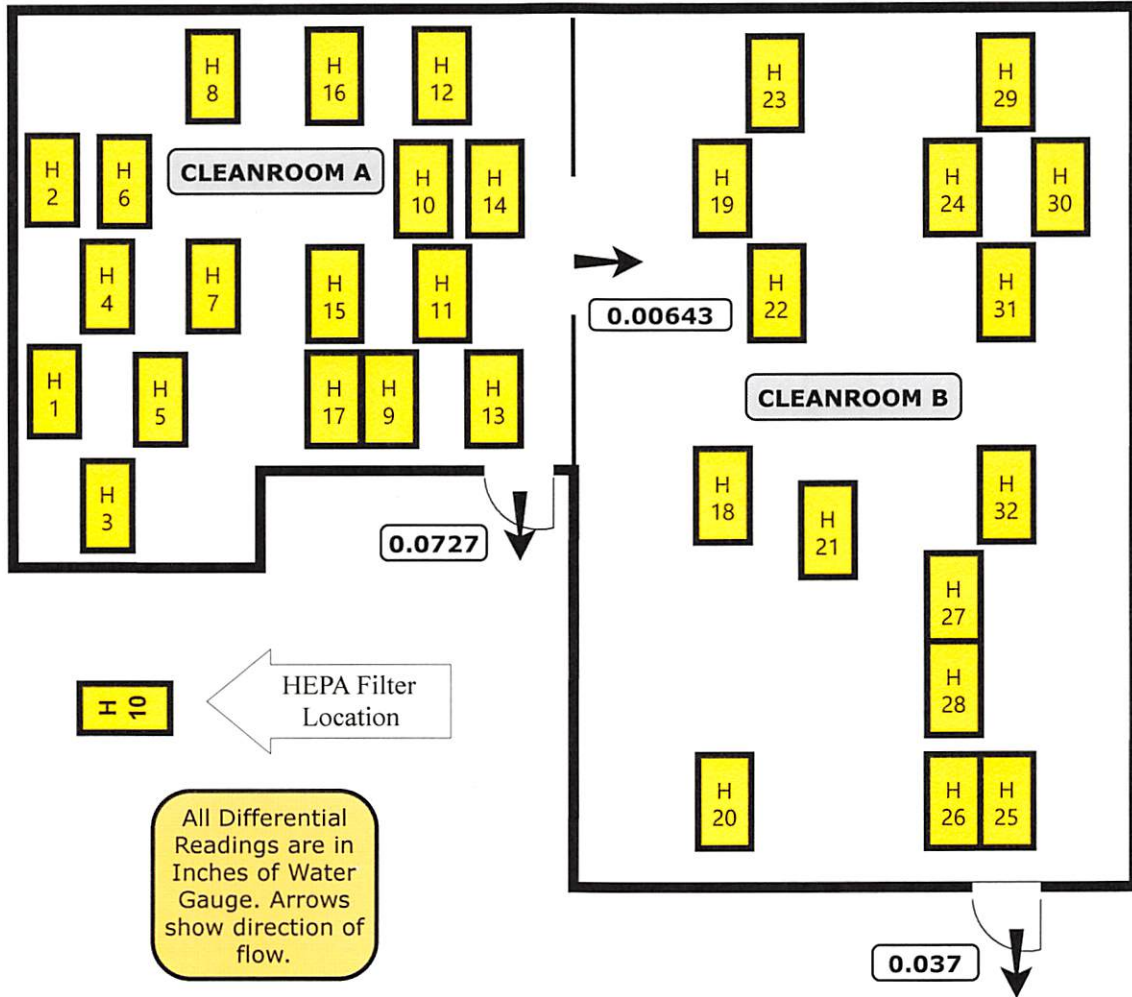
Initials mp Date 16 Mar 23

**CLEANROOM B AIRBORNE PARTICLE COUNT DATA**

<b>SAMPLE LOCATION (ISO Class 5)</b>	<b>0.5 MICRONS (Limit 3,520)</b>	<b>5.0 MICRONS (Limit N/A)</b>
1	0	0
2	0	0
3	0	0
4	35	35
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	35	35
<b>AVERAGE COUNT</b>	<b>5.8</b>	<b>5.8</b>
<b>STANDARD DEVIATION</b>	<b>13.6</b>	<b>13.6</b>
<b>STANDARD ERROR</b>	<b>3.9</b>	<b>3.9</b>

Initials mp Date 16 Mar 23

### CLEANROOM A & B HEPA FILTER LOCATION DIAGRAM



Initials MP Date 16 Mar 23



**CLEANROOM A VELOCITY COUNT DATA**

HEPA FILTER #	VELOCITY #1	VELOCITY #2	AVERAGE VELOCITY
1	95	99	97
2	101	98	100
3	149	127	138
4	99	113	106
*5	90	98	94
6	130	121	126
*7	99	105	102
8	130	131	131
*9	122	128	125
10	105	107	106
*11	133	127	130
12	102	110	106
*13	126	117	122
14	99	100	100
*15	99	97	98
16	101	115	108
*17	124	120	122
<b>AVERAGE AIRFLOW VELOCITY (fpm)</b>			<b>112.3</b>
<b>STANDARD DEVIATION</b>			<b>14.1</b>
<b>TOTAL AIR SUPPLIED (cfm)</b>			<b>13,168.7</b>
<b>APPROXIMATE ROOM VOLUME</b>			<b>3,740</b>
<b>THEORETICAL AIR CHANGES PER HOUR</b>			<b>211.3</b>

\* HEPA Filter Leak Test:  
Performed – No Leaks Detected

Initials mp Date 16 Mar 23

**Room Temperature and Humidity Test**

\* Average Room Temperature = 73.0°F  
\* Average Room Humidity = 31.1%

<b>CLEANROOM A CERTIFICATE OF COMPLIANCE</b>	
<b>Test Mode:</b>	At-Rest
<b>Airflow Type:</b>	Non-Unidirectional
<b>Test Date:</b>	03/09/2023
<b>Next Test Date:</b>	03/2024
<b>Class:</b>	
ISO 14644-1: 5	Limit at 0.5 µm = 3,520
CLEANROOM A <b>Meets</b> the Requirements Per ISO 14644-1 Class 5, at 0.5 µm Particle Size.	

Initials MP Date 16 Mar 23

**CLEANROOM B VELOCITY COUNT DATA**

HEPA FILTER #	VELOCITY #1	VELOCITY #2	AVERAGE VELOCITY
18	126	118	122
19	110	108	109
20	127	120	124
21	99	108	104
22	133	130	132
23	121	110	116
24	99	97	98
25	99	105	102
26	98	109	104
27	122	117	120
28	131	126	129
29	118	104	111
30	98	95	97
31	100	103	102
32	100	107	104
<b>AVERAGE AIRFLOW VELOCITY (fpm)</b>			<b>110.5</b>
<b>STANDARD DEVIATION</b>			<b>11.4</b>
<b>TOTAL AIR SUPPLIED (cfm)</b>			<b>10,674.3</b>
<b>APPROXIMATE ROOM VOLUME</b>			<b>5,355</b>
<b>THEORETICAL AIR CHANGES PER HOUR</b>			<b>119.6</b>

Initials MP Date 16 Mar 23

**Room Temperature and Humidity Test**

\* Average Room Temperature = 73.0°F  
\* Average Room Humidity = 31.5%

<b>CLEANROOM B CERTIFICATE OF COMPLIANCE</b>	
<b>Test Mode:</b>	At-Rest
<b>Airflow Type:</b>	Non-Unidirectional
<b>Test Date:</b>	03/09/2023
<b>Next Test Date:</b>	03/2024
<b>Class:</b>	
ISO 14644-1: 5	Limit at 0.5 µm = 3,520
CLEANROOM B <b>Meet</b> the Requirements Per ISO 14644-1 Class 5, at 0.5 µm Particle Size.	

Initials mp Date 16 Mar 23



**CALIBRATION CERTIFICATE**

Certificate Number 44725120404008

Model: S3100 Customer: Bio-Techne  
 Serial Number: 120404008 RMA#: US-62517  
 Sensor ID: 120404-006  
 Calibration Location: 1221 Disk Drive, Medford, OR 97501  
 Date of Calibration June 13, 2022

Next calibration on this instrument is due: June 13, 2023

**Calibration Method** Calibration of this instrument has been accomplished by the applicable parameters defined in ISO 21501-4 2018: Light scattering airborne particle counter for clean spaces section. 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 70.0 °F Relative humidity 38.0 %

**Test Equipment**

Standards	Model	Mfg	Serial#	Cal Date	Cal Due
Flow meter	4043	TSI	40431810027	5/9/2022	11/9/2022
DMM	Fluke 179	Fluke	18030613	4/29/2022	4/29/2023
MCA	8000D	Amptek	836	2/9/2022	2/9/2023

**Particle Size Standards**

Nominal Size	Particle Size	Tolerance (nm)	Lot No.	Manufacturer	Expiration Date
0.30µm	0.30µm	+/- 3	231958	Thermo Scientific	10/1/2023
0.40µm	0.40µm	+/- 3	239874	Thermo Scientific	4/1/2024
0.50µm	0.51µm	+/- 3.5	242804	Thermo Scientific	7/1/2024
1.00µm	1.04µm	+/- 6	241634	Thermo Scientific	7/1/2024
3.00µm	3.01µm	+/- 20	244037	Thermo Scientific	8/1/2024
5.00µm	5.08µm	+/-30	245084	Thermo Scientific	9/1/2024
10.00µm	10.10µm	+/-80	248925	Thermo Scientific	1/1/2025

**CALIBRATION RESULTS AS LEFT**

Certificate Number

44725120404008

**Size Calibrations as Left**

Channel	Chnl Size	Threshold	Expanded Uncertainty	Size Error	Result
1	0.30µm	58mV	0.009 µm	0%	Pass
2	0.50µm	521mV	0.01 µm	0%	Pass
3	1.00µm	1215mV	0.014 µm	0%	Pass
4	3.00µm	3538mV	0.041 µm	0%	Pass
5	5.00µm	4623mV	0.06 µm	0%	Pass
6	10.00µm	7759mV	0.16 µm	0%	Pass

**Measurements as Left**

Nominal Flow Rate:	Measured	Tolerance	Expanded Uncertainty	Result
28.30 LPM	28.41 LPM	+5% of nominal	0.82 L/min	Pass
<b>False Count Rate:</b>				
JIS B 9921 Zero Count Observed Cts	0	≤ 1 ct max / 5 min.	21 Particles/m3	Pass
ISO21501-4 False Count Rate	0	Upper confidence level		

**CALIBRATION RESULTS AS FOUND**
**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	62mV	0.32µm	6.2%	+/- 10%	0.009 µm	Pass
2	0.50µm	512mV	0.69µm	38.6%	+/- 10%	0.01 µm	FAIL
3	1.00µm	1203mV	1.40µm	40.4%	+/-10%	0.014 µm	FAIL
4	3.00µm	3556mV	3.86µm	28.6%	+/-10%	0.041 µm	FAIL
5	5.00µm	4638mV	6.19µm	23.8%	+/-10%	0.06 µm	FAIL
6	10.00µm	7670mV	12.77µm	27.7%	+/-10%	0.16 µm	FAIL

**Measurements as Found**

Nominal Flow Rate:	Measured Flow:	Tolerance	Expanded Uncertainty	Result
28.30 L/min	34.50 L/min	+5% of nominal	0.82 L/min	Fail
<b>False Count Rate:</b>				
JIS B 9921 Zero Count Observed Cts	0	≤ 1 ct max / 5 min.	21 Particles/m3	Pass
ISO21501-4 False Count Rate	0	Upper confidence level		

 Signature:  
 Head of Calibration:

  
 Kyle Perry

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

 Signature:  
 Calibration Tech/Engineer:

  
 Caleb Lange



# Manufacturer Calibration Certificate

## CALIBRATION CERTIFICATE

Certificate Number 4478912002552

Model:	LWS TRH Probe	RMA #	US-63094
Paired Unit	Wand	Customer	Advanced Cleanroom Microclean
Wand SN:	330677		
TRH Sensor S/N:	12002552		
Temp Range:	0-150°F		

Calibration Location 47509 Seabridge Drive  
Fremont CA 94538

Calibration Date: August 16, 2022

Calibration Due: August 16, 2023

**Calibration Method** 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.

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

**Environmental Conditions** Ambient Temperature 75.01 °F Relative Humidity 50.55%

As Received					
Relative Humidity, %RH					
Reference	Unit Under Test		Error	Tolerance %	Result
50.17%	48.95%		-1.22%	+/- 3.0%	Pass
Temperature, °F/[°C]					
Reference *	Unit Under Test *		Error	Tolerance *	Result
74.62°F 23.68°C	76°F 24.44°C		1.38°F 0.77°C	+/- 2.3%	Pass

As Calibrated					
Relative Humidity, %RH					
Reference	Unit Under Test		Error	Tolerance %	Result
50.17%	48.95%		-1.22%	+/- 3.0%	Pass
Temperature, °F/[°C]					
Reference *	Unit Under Test *		Error	Tolerance *	Result
74.62°F 23.68°C	76°F 24.44°C		1.38°F 0.77°C	+/- 2.3%	Pass

Instrument & Model	Manufacturer	Serial No.	Cal Date	Cal Due	Uncertainty
TRH Indicator	Vaisala	N0810674	04/11/2022	04/11/2023	1.00%

\* Tolerance ±1.8 °F at 77 °F (2.3%)  
\* Refer to model specific spec sheet for temperature ranges

Signature: Kyle Perry  
 Metrology Manager  
 The Metrology Manager acknowledges that the calibration has been carried out in accordance with Lighthouse Worldwide Solutions Quality Management system to comply with the applicable calibration parameters.

Signature: Aaron Chatoff  
 Calibration Tech/Engineer:



# CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA  
TEL: 1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	73.3	° F
RELATIVE HUMIDITY	49.0	% RH
BAROMETRIC PRESSURE	28.89	inHg

MODEL	EBT™ Micromanometer EBT731
SERIAL NO.	EBT731644029

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

<input type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input checked="" type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

## CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN in.Hg			DIFFERENTIAL PRESSURE MEASURED IN in.H <sub>2</sub> O		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	20.23	20.21	19.83 ~ 20.63	0.0879	0.0878	0.0860 ~ 0.0898
2	28.85	28.86	28.28 ~ 29.42	0.494	0.495	0.484 ~ 0.504
3	34.21	34.21	33.53 ~ 34.89	3.01	3.02	2.95 ~ 3.07
4	-	-	-	11.6	11.6	11.4 ~ 11.8
5	-	-	-	14.5	14.5	14.2 ~ 14.8

TESTING POINTS	TEMPERATURE MEASURED IN °F <sup>1</sup>		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	5.0	5.0	4.5 ~ 5.5
2	77.0	77.0	76.5 ~ 77.5
3	158.0	157.9	157.5 ~ 158.5

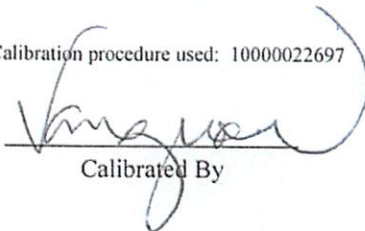
\* Indicates out of tolerance condition

<sup>1</sup>Circuit portion of temperature measurement only, not including probe

TSI Incorporated does hereby certify that the above described instrument conforms to the original manufacturer's specifications (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology within the limitations of NIST's calibration services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self calibration techniques. The following ratios express the expanded uncertainty at a confidence level of 95% (i.e. with a coverage factor k=2) of the calibration facilities with respect to the instrument being calibrated: for barometric pressure ≥ 6.7:1; for differential pressure ≥ 3:1; for temperature ≥ 1.16:1. TSI is registered to ISO-9001:2015, Quality Assurance Requirements. This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	08-23-22	02-29-24
DC Voltage	E002797	08-23-22	02-29-24
Pressure	E002124	09-17-21	09-30-22
Pressure	E002447	06-29-22	06-30-23

Calibration procedure used: 10000022697

  
Calibrated By

Sep. 1, 2022

Calibration Date

1083501A





# CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA  
TEL:1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	22.9	°C
RELATIVE HUMIDITY	49.0	% RH
BAROMETRIC PRESSURE	978	hPa

MODEL	EBT™ Micromanometer EBT731
SERIAL NO.	EBT731644029

CALIBRATION STANDARDS USED
Manometer Calibration Bench 1

<input type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input checked="" type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

## CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN hPa			DIFFERENTIAL PRESSURE MEASURED IN Pa		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	685	684	671 ~ 699	21.89	21.87	21.43 ~ 22.35
2	977	977	957 ~ 997	123	123	121 ~ 125
3	1158	1158	1135 ~ 1181	750	752	735 ~ 765
4	-	-	-	2889	2889	2831 ~ 2947
5	-	-	-	3612	3612	3540 ~ 3684

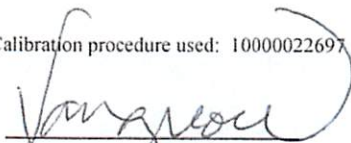
TESTING POINTS	TEMPERATURE MEASURED IN °C <sup>1</sup>		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-15.0	-15.0	-14.7 ~ -15.3
2	25.0	25.0	24.7 ~ 25.3
3	70.0	69.9	69.7 ~ 70.3

\* Indicates out of tolerance condition

<sup>1</sup>Circuit portion of temperature measurement only, not including probe  
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Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	08-23-22	02-29-24
DC Voltage	E002797	08-23-22	02-29-24
Pressure	E002124	09-17-21	09-30-22
Pressure	E002447	06-29-22	06-30-23

Calibration procedure used: 10000022697

  
 Calibrated By

Sep. 1, 2022

Calibration Date

1083501A

Calibrated By

*[Signature]*

Calibration procedure used: 10000022697

Calibration Date

Sep. 1, 2022

Measurement Variable	System ID Number	Date Last Calibrated	Calibration Due Date
DC Voltage	E002798	08-23-22	02-29-24
DC Voltage	E002797	08-23-22	02-29-24
Pressure	E002124	09-17-21	09-30-22
Pressure	E002447	06-29-22	06-30-23

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\* Indicates out of tolerance condition

TESTING POINTS	TEMPERATURE MEASURED IN °F		
	ALLOWABLE RANGE	INSTRUMENT OUTPUT	STANDARD
1	4.5 ~ 5.5	5.0	5.0
2	76.5 ~ 77.5	77.0	77.0
3	157.5 ~ 158.5	157.9	158.0

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN in.Hg			DIFFERENTIAL PRESSURE MEASURED IN in.H <sub>2</sub> O		
	ALLOWABLE RANGE	INSTRUMENT OUTPUT	STANDARD	ALLOWABLE RANGE	INSTRUMENT OUTPUT	STANDARD
1	20.22	19.84 ~ 20.64	0.0864	0.0878	0.0846 ~ 0.0882	0.495
2	28.83	28.26 ~ 29.40	0.495	0.495	0.485 ~ 0.505	3.01
3	34.20	34.19	33.52 ~ 34.88	3.01	2.95 ~ 3.07	11.5
4	-	-	-	11.5	11.3 ~ 11.7	14.5
5	-	-	-	14.5	14.2 ~ 14.8	

<input checked="" type="checkbox"/> AS LEFT <input type="checkbox"/> AS FOUND <input type="checkbox"/> OUT OF TOLERANCE <input type="checkbox"/> IN TOLERANCE		Manometer Calibration Bench 1 CALIBRATION STANDARDS USED	
MODEL EBT™ Micromanometer EBT731	SERIAL NO. EBT731644029	ENVIRONMENT CONDITION TEMPERATURE °F 73.3	RELATIVE HUMIDITY % RH 49.0
		BAROMETRIC PRESSURE in.Hg 28.89	

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA  
 TEL: 1-800-874-2811 FAX: 1-651-490-3824 WWW: alnor.com

**CERTIFICATE OF CALIBRATION**





# CERTIFICATE OF CALIBRATION

TSI Incorporated, Alnor Products, 500 Cardigan Road, Shoreview, MN 55126 USA  
TEL: 1-800-874-2811 1-651-490-2811 FAX: 1-651-490-3824 www.alnor.com

ENVIRONMENT CONDITION		
TEMPERATURE	22.9	°C
RELATIVE HUMIDITY	49.0	% RH
BAROMETRIC PRESSURE	978	hPa

MODEL	EBT™ Micromanometer EBT731
SERIAL NO.	EBT731644029

CALIBRATION STANDARDS USED
Manometer Calibration Bench I

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

## CALIBRATION DATA

TESTING POINTS	BAROMETRIC PRESSURE MEASURED IN hPa			DIFFERENTIAL PRESSURE MEASURED IN Pa		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	685	685	671 ~ 699	21.52	21.87	21.06 ~ 21.98
2	976	976	956 ~ 996	123	123	121 ~ 125
3	1158	1158	1135 ~ 1181	750	750	735 ~ 765
4	-	-	-	2865	2865	2808 ~ 2922
5	-	-	-	3612	3612	3540 ~ 3684

TESTING POINTS	TEMPERATURE MEASURED IN °C <sup>1</sup>		
	CALIBRATION STANDARD	INSTRUMENT OUTPUT	ALLOWABLE RANGE
1	-15.0	-15.0	-14.7 ~ -15.3
2	25.0	25.0	24.7 ~ 25.3
3	70.0	69.9	69.7 ~ 70.3

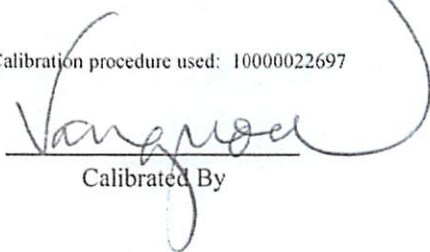
\* Indicates out of tolerance condition

<sup>1</sup>Circuit portion of temperature measurement only, not including probe

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DC Voltage	E002798	08-23-22	02-29-24
DC Voltage	E002797	08-23-22	02-29-24
Pressure	E002124	09-17-21	09-30-22
Pressure	E002447	06-29-22	06-30-23

Calibration procedure used: 10000022697

  
Calibrated By

Sep. 1, 2022

Calibration Date

1083501A

Job Date/s:

3/9/23



Work Order Number :

JOB SITE

Co. Name: Drive Savers  
City, State, Zip: \_\_\_\_\_

SCOPE OF WORK:

- [A] Particle Counts
- [B] Velocity
- [C] Air Differential
- [D] Temperature
- [E] Humidity
- [F] Air Flow Patterns
- [G] Filter Scan (Ambient)
- [H] Filter Scan (PAO)
- [I] Filter Scan (PSL)
- [J] Microbial (Surface)
- [K] Microbial (Air)
- [L] Other: \_\_\_\_\_

Check equipment for errors prior to start of job

- Equipment Calibration Current?  Yes  No
- Any New Equipment used on this job that was not reported to customer?  No  Yes (report immediately prior to testing)
- Any Equipment failure/errors during or before testing?  No  Yes (report immediately prior to testing)

Equipment Used:

Lighthouse Solair 3100 Particle Counter S/N 120304001	<input type="checkbox"/>	Shortridge ADM-860 S/N M971045	<input type="checkbox"/>
Lighthouse Solair 3100 Particle Counter S/N 120304008	<input checked="" type="checkbox"/>	Shortridge ADM-860 S/N M02169	<input type="checkbox"/>
Lighthouse Solair 3100 Particle Counter S/N 130404022	<input type="checkbox"/>	Shortridge ADM-860 S/N M9988485	<input type="checkbox"/>
Lighthouse Temp/Humidity Sensor S/N 330475.125610	<input type="checkbox"/>	AP Buck Air Sampler S/N C101726	<input type="checkbox"/>
Lighthouse Temp/Humidity S/N 330677.126618	<input checked="" type="checkbox"/>	AP Buck Air Sampler S/N C101748	<input type="checkbox"/>
Lighthouse Temp/Humidity S/N 330474.125621	<input type="checkbox"/>	Thermal Anemometer "HotStick" TSI 9565	<input type="checkbox"/>
TSI Aerotrak Particle Counter S/N 93101645002	<input type="checkbox"/>	TSI Temperature/Humidity Sensor 700084	<input type="checkbox"/>
Bioscience International SAS-180 Air Sampler S/N 15-D-09890	<input type="checkbox"/>	TSI Temperature/Humidity Probe 966	<input type="checkbox"/>
TSI Alnor Micromanometer EBT 730 S/N EBT731615019	<input type="checkbox"/>	Extech Temperature Pen S/N 1023928	<input type="checkbox"/>
TSI Alnor Micromanometer EBT 730 S/N EBT731644029	<input checked="" type="checkbox"/>	Other:	<input type="checkbox"/>

Document Control Workflow

Comments:

CERTIFICATION	Tech Initial ( tasks that were performed)		
Room Name / No			
Filter Scan			
Temp & Hum	<i>MP</i>		
Particle Counts	<i>MP</i>		
Air Differential	<i>MP</i>		
Velocities	<i>MP</i>		
Uniformity			
Data Input			
MICROBIAL	Air Lot#		
	Plate Lot#		
Air Bio Counts			
Surface Bio Counts			
Compressed Air			
Incubation In			
Incubation Out			
<b>REPORT (Office Use Only)</b>			
Review Report	<i>SA</i>	Date:	3/14/2023
Quality Audit of Report	<i>MP</i>	Date:	
Corrections to Report		Date:	
Quality Audit of Report		Date:	

Room Occupany State

- " As-Built "
- " At-Rest "
- " Operational "

ACM TECHNICIAN:

*[Signature]*