



Guaranteed Effortless Control



February 3, 2022

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

Environmental Testing was performed in the following cleanroom areas at
DriveSavers, Inc., on January 21st, 2022.

AREA	CLASSIFICATION	SQ. FOOTAGE	RESULT
Cleanroom A	ISO Class 5	440	Compliant
Cleanroom B	ISO Class 5	630	Compliant

Measurements were made to determine airborne particle concentrations, airflow velocities, and room differential air pressure.

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 Adriana Salvatierra..

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

Sincerely,
ADVANCED CLEANROOM MICROCLEAN CORPORATION.

Saumolia Amisone

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 :*

CLASS	0.1 MICRON	0.2 MICRON	0.3 MICRON	0.5 MICRON	1.0 MICRON	5.0 MICRONS
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:

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

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 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;

Σ 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.

1.4 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.

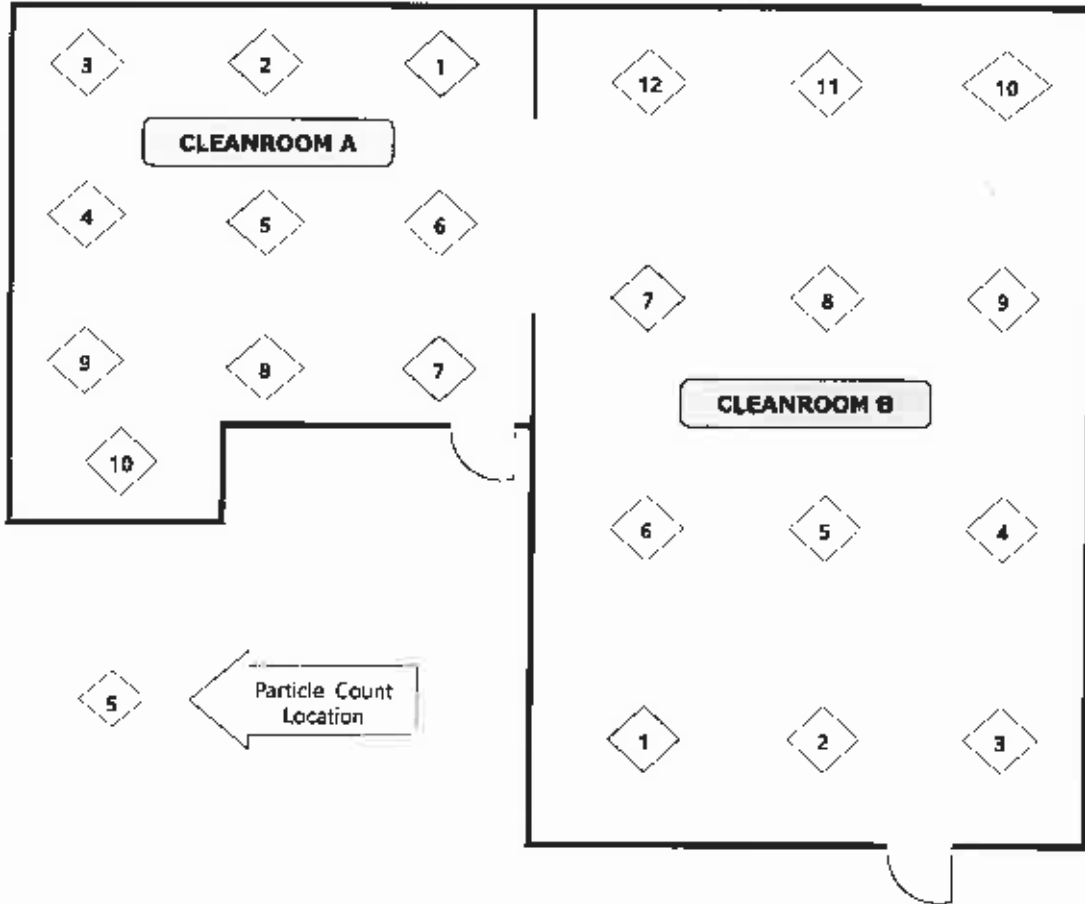
2 Equipment Calibration Summary

Type of Test	Manufacturer	Model	Serial	Cal. Due Date
<i>Non-Viable Particle Counts</i>	Lighthouse	S3100	130404022	03/16/2022
<i>Air Velocity/Volume</i>	Shortridge	ADM-860	M971045	03/04/2022
<i>Room Diff. Pressure</i>	Shortridge	ADM-860	M971045	03/04/2022
<i>Temperature & Humidity</i>	N/A	N/A	N/A	N/A
<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 ML Date 03 Feb 2022

CLEANROOM A AIRBORNE PARTICLE COUNT DATA

SAMPLE LOCATION (ISO Class 5)	0.5 MICRONS (Limit 3,520)	5.0 MICRONS (Limit N/A)
1	0	0
2	0	0
3	0	0
4	0	0
5	671	0
6	35	0
7	459	35
8	0	0
9	71	0
10	0	0
AVERAGE COUNT	123.6	3.5
STANDARD DEVIATION	239.0	11.2
STANDARD ERROR	75.6	3.5

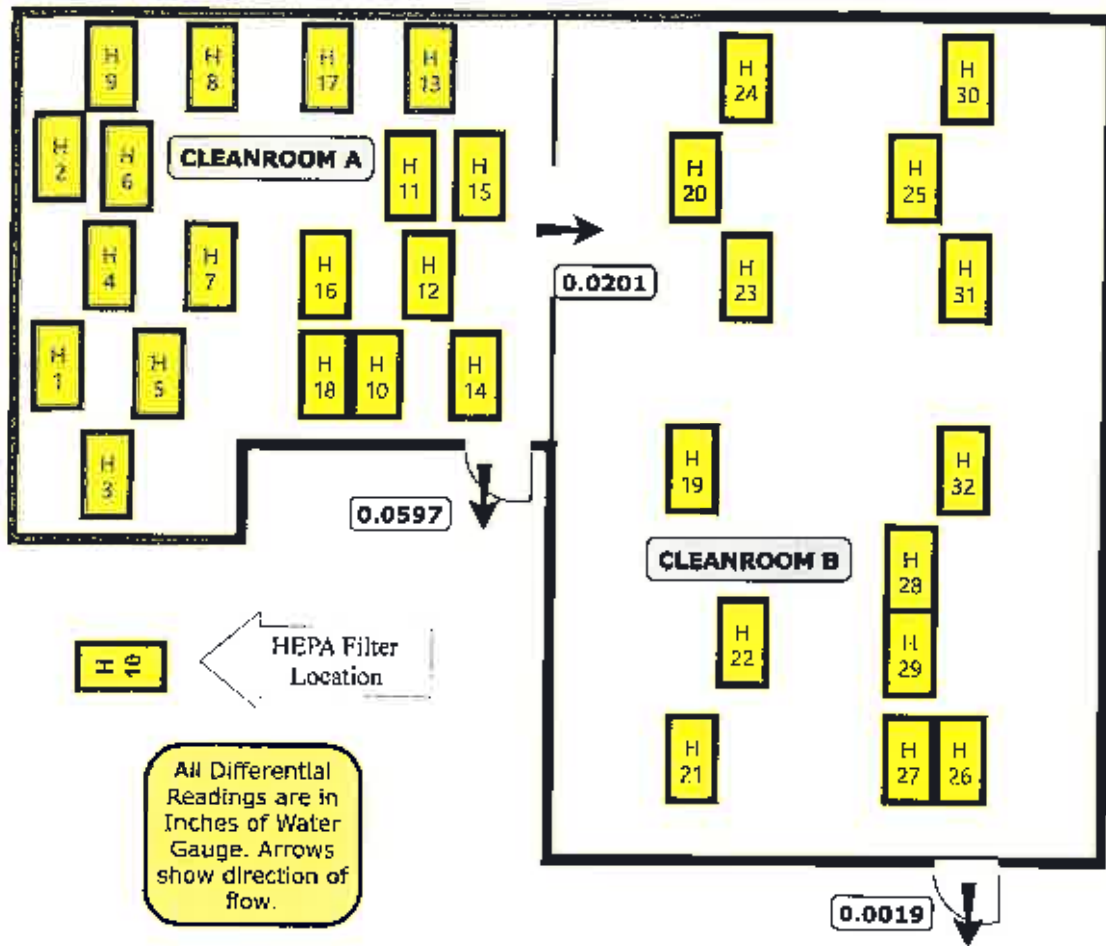
Initials ML Date 03Feb2022

CLEANROOM B AIRBORNE PARTICLE COUNT DATA

SAMPLE LOCATION (ISO Class 5)	0.5 MICRONS (Limit 3,520)	5.0 MICRONS (Limit N/A)
1	0	0
2	282	71
3	0	0
4	1,448	71
5	0	0
6	0	0
7	35	0
8	530	0
9	318	35
10	0	0
11	0	0
12	106	0
AVERAGE COUNT	226.6	14.7
STANDARD DEVIATION	421.4	28.0
STANDARD ERROR	121.7	8.1

Initials ML Date 03Feb2022

CLEANROOM A & B HEPA FILTER LOCATION DIAGRAM



Initials ML Date 03 Feb 2022

CLEANROOM A VELOCITY COUNT DATA

HEPA FILTER #	VELOCITY #1	VELOCITY #2	AVERAGE VELOCITY
1	85	81	83
2	126	123	125
3	136	117	127
4	128	135	132
5	127	122	125
6	129	118	124
7	135	130	133
8	134	130	132
9	82	87	85
10	148	114	131
11	125	134	130
12	149	138	144
13	126	125	126
14	115	108	112
15	138	147	143
16	108	123	116
17	82	87	85
18	118	111	115
AVERAGE AIRFLOW VELOCITY (fpm)			120.0
STANDARD DEVIATION			18.5
TOTAL AIR SUPPLIED (cfm)			14,907.5
APPROXIMATE ROOM VOLUME			3,740
THEORETICAL AIR CHANGES PER HOUR			239.2

Initials ML Date 03Feb2022

CLEANROOM A CERTIFICATE OF COMPLIANCE

Test Mode: Operational
Airflow Type: Non-Unidirectional
Test Date: 01/21/2022
Next Test Date: 01/2023

Class:
ISO 14644-1: 5 Limit at 0.5 μm = 3,520

CLEANROOM A Meets the Requirements Per ISO 14644-1 Class 5, at 0.5 μm
Particle Size.

Initials ML Date 03 Feb 2022

CLEANROOM B VELOCITY COUNT DATA

HEPA FILTER #	VELOCITY #1	VELOCITY #2	AVERAGE VELOCITY
19	120	140	130
20	163	112	138
21	115	130	123
22	130	101	116
23	128	169	149
24	117	136	127
25	127	97	112
26	110	130	120
27	100	120	110
28	95	120	108
29	125	130	128
30	95	179	137
31	100	120	110
32	110	125	118
AVERAGE AIRFLOW VELOCITY (fpm)			123.0
STANDARD DEVIATION			12.2
TOTAL AIR SUPPLIED (cfm)			11,881.8
APPROXIMATE ROOM VOLUME			5,355
THEORETICAL AIR CHANGES PER HOUR			133.1

CLEANROOM B CERTIFICATE OF COMPLIANCE

Test Mode: Operational

Airflow Type: Non-Unidirectional

Test Date: 01/21/2022

Next Test Date: 01/2023

Class:

ISO 14644-1: 5 Limit at 0.5 μm = 3,520

CLEANROOM B Meet the Requirements Per ISO 14644-1 Class 5,
at 0.5 μm Particle Size.

Initials ML Date 03 Feb 2022

CALIBRATION CERTIFICATE

Certificate Number

44Z71130404022

Model: S3100 **Customer:** Advanced Cleanroom Microclean
Serial Number: 130404022 **RMAS:** US-4823
Sensor ID: 130404-022
Calibration Location: 1221 Disk Drive, Medford, OR 97501
Date of Calibration: March 16, 2021

Next calibration on this instrument is due: March 16, 2022

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 714252600-1. 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 29.0 %

Test Equipment

Standards	Model	Mfg	Serial#	Cal Date	Cal Due
Flow meter	4045	TSI	40451732004	2/10/2021	6/10/2021
DMM	Fluke 179	Fluke	87728256	5/20/2020	5/20/2021
MCA	6000D	Amptek	554	2/9/2021	2/9/2022
Test Standard	Solid	LWS	140898001	2/3/2021	5/3/2021

Particle Size Standards

Nominal Size	Particle Size	Tolerance (nm)	Lot No.	Manufacturer	Expiration Date
0.30µm	0.303µm	+/-3	231958	Thermo Scientific	10/1/2023
0.40µm	0.401µm	+/-3	211088	Thermo Scientific	4/30/2022
0.50µm	0.510µm	+/-3.5	229580	Thermo Scientific	8/1/2023
1.00µm	1.038µm	+/-4	219284	Thermo Scientific	11/1/2022
3.00µm	2.960µm	+/-15	233440	Thermo Scientific	10/1/2023
5.00µm	5.020µm	+/-20	230778	Thermo Scientific	9/1/2023
10.00µm	9.990µm	+/-50	231879	Thermo Scientific	10/31/2021

Counting Efficiency Particle Size Standards

Nominal Size	Particle Size	Tolerance (nm)	Lot No.	Manufacturer	Expiration Date
0.30µm	0.303µm	+/-3	231958	Thermo Scientific	10/1/2023
0.50µm	0.510µm	+/-3.5	229580	Thermo Scientific	8/1/2023



CALIBRATION RESULTS AS LEFT

Certificate Number

44271130404022

Size Calibrations as Left

Channel	Chnl Size	Threshold	Particle Size	Particle Size Voltage	Expanded Uncertainty	As Left Size Error
1	0.30µm	58mV	0.303µm	57.0mV	0.009 µm	0%
2	0.50µm	576mV	0.510µm	505.0mV	0.01 µm	0%
3	1.00µm	1459mV	1.036µm	1605.0mV	0.014 µm	0%
4	3.00µm	3298mV	2.960µm	3289.0mV	0.035 µm	0%
5	5.00µm	3773mV	5.020µm	3778.0mV	0.04 µm	0%
6	10.00µm	4517mV	9.990µm	4517.0mV	0.118 µm	0%

Measurements as Left

Nominal Flow Rate:	Measured Flow:	(limit ±5% of nominal)	Expanded Uncertainty	Result
28.30 LPM	28.01 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	21 Particles/m3

Counting Efficiency 50%:	Size	Counting Efficiency	(limit 30% - 70%)	Expanded Uncertainty	Result
	0.303 µm	52.5%		3.4 %	Pass

Counting Efficiency 100%:	Size	Counting Efficiency	(limit 90% - 110%)	Expanded Uncertainty	Result
	0.51 µm	104.0%		5.4 %	Pass

Size Resolution:	Size	Resolution	(limit 15%)	Expanded Uncertainty	Result
	0.401 µm	9.87%		1.8 %	Pass

CALIBRATION RESULTS AS FOUND

Certificate Number

44271130404022

Size Calibrations as Found

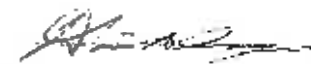
Channel	Standard	As Rec'd Threshold Settings mV	As measured Threshold Settings mV	As Rec'd size (um)	Percent size error (%)	Percent size error tolerance	Expanded Uncertainty	Pass/Fail
1	0.3	63	56	0.305	1.8%	+/- 10%	0.009 µm	Pass
2	0.5	615	576	0.514	2.8%	+/- 10%	0.01 µm	Pass
3	1	1480	1459	1.010	1.0%	+/-10%	0.014 µm	Pass
4	3	3347	3299	3.111	3.7%	+/-10%	0.035 µm	Pass
5	5	3785	3773	4.831	-1.4%	+/-10%	0.04 µm	Pass
6	10	4524	4517	9.989	-0.1%	+/-10%	0.116 µm	Pass

Measurements as Found

Nominal Flow Rate:	Measured Flow:	(limit ±5% of nominal)	Expanded Uncertainty	Result
29.30 LPM	28.01 LPM		0.8L/min	Pass

False Count Rate:	Observed Cts:	Upper confidence level	Result
JIS B 9921 Zero Count	0	(≤ 1 ct max / 5 min.)	Pass
ISO21501-4 False Count Rate	0	21 Particles/m3	

Size Resolution:	Size	0.401 µm	5.87% (limit 15%)	1.6 %	Pass

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: D. Jackson

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

Customer ID: 013186 S/N: M971045
 Customer: ADVANCED CLEANROOM MICROCLEAN CORP. City: SANTA ANA State: CA
 As-Received Model #: ADM-860 Converted to Model #: NA Order #: R210520
 PO #: NA Customer Eqpt ID#: NA Calibration Due Date: NA

This instrument has been calibrated using Calibration Standards which are traceable to NIST (National Institute of Standards and Technology). Test accuracy ratio is 4:1 for pressures and temperature. Quality Assurance Program and calibration procedures meet the requirements for ANSINCSSL Z540-1, ISO 17025, MIL-STD 45862A and manufacturer's specifications. Calibration accuracy is certified when meters are used with properly functioning accessories only. All Uncertainties are expressed in expanded terms (twice the calculated uncertainty). This report shall not be reproduced, except in full, without the written approval of Shortridge Instruments Inc. Results relate only to the item calibrated. For limitations on use, see Shortridge Instruments, Inc. Instruction Manual for the use of AirData Multimeters. Procedure used: Procedure for Differential Pressure, Absolute Pressure and Temperature Recalibration of AirData Multimeters SIP-CP02 Revision: 30 Dated: 04/04/16

Calibration Technician(s): J. LaBail J. Harrison Calibration Date: 03/04/2021
 Calibration Approved by: W. P. Kovic Title: Asst. Cal. Supervisor Date: 03/04/2021

AS-Received By <u>J. LaBail</u> Date <u>03/01/2021</u> Rh <u>18</u> % Ambient Temperature <u>73</u> °F Barometric Pressure <u>28.78</u> in Hg All within spec <u>YES</u> NO NA	Final Test By <u>J. Harrison</u> Date <u>03/04/2021</u> Rh <u>38</u> % Ambient Temperature <u>74</u> °F Barometric Pressure <u>28.68</u> in Hg All within spec <u>YES</u> NO	Test By _____ Date <u>1/28</u> Rh _____ % Ambient Temperature _____ °F Barometric Pressure _____ in Hg All within spec YES NO
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ABSOLUTE PRESSURE TEST (in Hg)

TEST METER TOLERANCE = ± 2.0 % ± .1 in Hg AS-RECEIVED TEST WITHIN SPEC YES NO N/A See Notes

Pressure Standard: Heise #02-R S/N: 41741/42451 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #12A-R S/N: 45605/48481 <u>As-Rcvd</u> Test 2 Test 3
Pressure Standard: Heise #04-R S/N: 41743/42453 As-Rcvd <u>Test 2</u> Test 3	Pressure Standard: Heise #14-R S/N: 43412/45043-2 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #06-R S/N: 41742/42452-1 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #16-R S/N: 43413/45044 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #08-R S/N: 42188/43328 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #18-R S/N: 44561/46845 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #10-R S/N: 42203/43352 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #20-R S/N: 44562/46847 As-Rcvd Test 2 Test 3

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
14.0	14.15	14.1	-0.35	14.43	14.4	-0.21			
28.4	28.78	28.8	.07	28.68	28.6	-0.28	NA		
40.0	40.19	40.1	-0.22	40.76	40.7	-0.15			

DIFFERENTIAL PRESSURE TEST (in wc)

TEST METER TOLERANCE = ± 2.0 % ± 0.001 in wc AS-RECEIVED TEST WITHIN SPEC YES NO N/A See Notes

Pressure Standard: Heise #01-L S/N: 41739/42440 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #11-L S/N: 43165/44551-1 <u>As-Rcvd</u> Test 2 Test 3
Pressure Standard: Heise #01-R S/N: 41739/42446 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #11-R S/N: 43185/44730 <u>As-Rcvd</u> Test 2 Test 3
Pressure Standard: Heise #02-L S/N: 41741/42454 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #12A-L S/N: 45605/48490-1 <u>As-Rcvd</u> Test 2 Test 3
Pressure Standard: Heise #03A-L S/N: 45570/48481 As-Rcvd <u>Test 2</u> Test 3	Pressure Standard: Heise #13-L S/N: 43415/45041 <u>As-Rcvd</u> Test 2 Test 3
Pressure Standard: Heise #03A-R S/N: 45570/48480 As-Rcvd <u>Test 2</u> Test 3	Pressure Standard: Heise #13-R S/N: 43415/45039 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #04-L S/N: 41743/42456 As-Rcvd <u>Test 2</u> Test 3	Pressure Standard: Heise #14-L S/N: 43412/45045 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #05-L S/N: 41740/42450 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #15-L S/N: 43416/45042 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #05-R S/N: 41740/42447 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #16-R S/N: 43416/45040 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #06-L S/N: 41742/42455 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #16-L S/N: 43413/45046 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #07-L S/N: 42185/42188 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #17-L S/N: 44579/46842 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #07-R S/N: 42185/43328 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #17-R S/N: 44579/46841 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #06-L S/N: 42188/43328 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #18-L S/N: 44561/46846 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #08-L S/N: 42202/43351 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #19-L S/N: 44560/46844 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #08-R S/N: 42202/43350 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #19-R S/N: 44560/46843 As-Rcvd Test 2 Test 3
Pressure Standard: Heise #10-L S/N: 42203/43353 As-Rcvd Test 2 Test 3	Pressure Standard: Heise #20-L S/N: 44562/46848 As-Rcvd Test 2 Test 3

Approx Set Pt	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff	Standard	Test Meter	% Diff
.0500	.0504	.0507	.20	.0520	.0521	.19			
.1250	.1252	.1253	.08	.1250	.1251	.08			
.2250	.2257	.2254	-.13	.2251	.2249	-.09			
1.000	1.024	1.028	.19	1.005	1.009	.39	NA		
2.000	2.009	2.016	.35	2.015	2.020	.25			
3.600	3.629	3.651	.61	3.654	3.656	-.05			
4.400	4.432	4.443	.25	4.412	4.420	.18			
27.00	27.05	27.08	.11	27.11	27.23	.44			
50.00	50.38	50.19	-.38	50.01	49.96	-.10			
Overage	NA	✓	NA	NA	✓	NA	NA		NA

Shortridge Instruments, Inc.
 7855 East Radfield Road Scottsdale, Arizona 85260
 (480) 991-8744 • Fax (480) 443-1267 • www.shortridge.com

AIRDATA MULTIMETER CERTIFICATE OF RECALIBRATION

S/N: M971045

Order #: R210520

LOW VELOCITY CONFIRMATION (FPM)

TEST METER TOLERANCE = $\pm 3.0\% \pm 7$ FPM AS-RECEIVED TEST WITHIN SPEC YES NO N/A See Notes

Vel Eqv Trans Std: S/N: M02009	As-Rcvd	<u>Test 2</u>	Test 3	Vel Eqv Trans Std: S/N: M10897	As-Rcvd	Test 2	Test 3
Vel Eqv Trans Std: S/N: M02903	As-Rcvd	<u>Test 2</u>	Test 3	Vel Eqv Trans Std: S/N: M10901	As-Rcvd	Test 2	Test 3
Vel Eqv Trans Std: S/N: M10839	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M13492	As-Rcvd	Test 2	Test 3
Vel Eqv Trans Std: S/N: M10840	As-Rcvd	Test 2	Test 3	Vel Eqv Trans Std: S/N: M19325	As-Rcvd	Test 2	Test 3

Approx Set Point	Standard	Test Meter	Diff	Standard	Test Meter	Diff	Standard	Test Meter	Diff
100	109	110	1	107.7	108	.3			
500	510	511	1	525.5	524	.5			

ADM-880C, ADM-870/870C and ADM-860/860C models are read in AirFoil Mode. ADM-850/850L models are read in Pitot Tube Mode.

TEMPERATURE TEST - AIRDATA MULTIMETER (°F)

TEST METER TOLERANCE = ± 0.2 °F AS-RECEIVED TEST WITHIN SPEC YES NO N/A See Notes

RTD Simulator: S/N 249	As-Rcvd	<u>Test 2</u>	Test 3	Set Point: <u>35.6</u> °F	95° F	154.4° F
RTD Simulator: S/N 250	As-Rcvd	<u>Test 2</u>	Test 3	Set Point: 35.8° F	<u>95</u> ° F	154.4° F
RTD Simulator: S/N 253	As-Rcvd	<u>Test 2</u>	Test 3	Set Point: 35.8° F	95° F	<u>154.4</u> ° F
RTD Simulator: S/N 254	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 266	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 267	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 292	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 293	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 294	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 313	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 314	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 315	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 316	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 317	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F
RTD Simulator: S/N 318	As-Rcvd	Test 2	Test 3	Set Point: 35.8° F	95° F	154.4° F

RTD Simulator Temperature Equivalent Set Point	Test Meter	Difference	Test Meter	Difference	Test Meter	Difference
35.60	35.6	.0	35.6	.0		
95.00	95.0	.0	95.0	.0		
154.40	154.4	.0	154.4	.0		

NOTES: NA

The enclosed ADM Calibration Standards for Pressure and Temperature form(s) is/are an integral part of this calibration and must remain with this Certificate of Calibration. Note: There may be more than one such form included that pertains to this calibration.

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Order Number: R210520 Serial Number: M971045 Test Type: Initial As-Received Final

ABSOLUTE PRESSURE STANDARDS

ADM #02-R	S/N: 41741/42451	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 04/27/20	Due Date: 04/2021
ADM #04-R	S/N: 41743/42453	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/08/20	Due Date: 11/2021
ADM #05-R	S/N: 41742/42452-1	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/24/20	Due Date: 08/2021
ADM #08-R	S/N: 42188/43328	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/13/20	Due Date: 03/2021
ADM #10-R	S/N: 42203/43352	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/27/21	Due Date: 01/2022
ADM #12A-R	S/N: 45605/48491	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/28/20	Due Date: 07/2021
ADM #14-R	S/N: 43412/45043-2	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/13/20	Due Date: 09/2021
ADM #16-R	S/N: 43413/45044	Heise Model: PPM-2	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 02/27/20	Due Date: 02/2021
ADM #18-R	S/N: 44581/48846	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 01/23/21	Due Date: 08/2021
ADM #20-R	S/N: 44582/48847	Heise Model: PPM-2	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 07/09/20	Due Date: 06/2021
#02-R, 04-R, 05-R, 08-R, 10-R, 12A-R, 14-R, 16-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-30 psia		Resolution: 0.01	Uncertainty: < 0.0358
#18-R, 20-R	Rated Accuracy: 0.05% fs (0.0305 in Hg)		Range: 0-50 in Hg		Resolution: 0.001	Uncertainty: < 0.0358

DIFFERENTIAL PRESSURE STANDARDS

ADM #01-L	S/N: 41738/42449	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/05/20	Due Date: 04/2021
ADM #01-R	S/N: 41738/42446	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/05/20	Due Date: 04/2021
ADM #02-L	S/N: 41741/42454	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 05/04/20	Due Date: 04/2021
ADM #03A-L	S/N: 45570/48461	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/11/20	Due Date: 11/2021
ADM #03A-R	S/N: 45570/48460	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/11/20	Due Date: 11/2021
ADM #04-L	S/N: 41743/42456	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 11/09/20	Due Date: 11/2021
ADM #05-L	S/N: 41740/42450	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/03/20	Due Date: 08/2021
ADM #05-R	S/N: 41740/42447	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/03/20	Due Date: 08/2021
ADM #06-L	S/N: 41742/42455	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 09/03/20	Due Date: 08/2021
ADM #07-L	S/N: 42185/43328	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/13/20	Due Date: 03/2021
ADM #07-R	S/N: 42185/43328	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/13/20	Due Date: 03/2021
ADM #08-L	S/N: 42188/43329	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/13/20	Due Date: 03/2021
ADM #09-L	S/N: 42202/43361	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/28/21	Due Date: 01/2022
ADM #09-R	S/N: 42202/43350	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/28/21	Due Date: 01/2022
ADM #10-L	S/N: 42203/43353	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 01/28/21	Due Date: 01/2022
ADM #11-L	S/N: 43185/44551-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/20	Due Date: 07/2021
ADM #11-R	S/N: 43185/44730	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 07/30/20	Due Date: 07/2021
ADM #12A-L	S/N: 45605/48480-1	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 08/11/20	Due Date: 07/2021
ADM #13-L	S/N: 43415/45041	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/21/20	Due Date: 09/2021
ADM #13-R	S/N: 43415/45039	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/21/20	Due Date: 09/2021
ADM #14-L	S/N: 43412/45045	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 10/21/20	Due Date: 09/2021
ADM #15-L	S/N: 43418/45042	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/03/20	Due Date: 02/2021
ADM #15-R	S/N: 43418/45040	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/03/20	Due Date: 02/2021
ADM #16-L	S/N: 43413/45048	Heise Model: PPM-1	Mfgd by Dresser Industries	Calibrated by Ashcroft	Calibration Date: 03/03/20	Due Date: 02/2021
ADM #17-L	S/N: 44578/48842	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 01/28/21	Due Date: 10/2021
ADM #17-R	S/N: 44578/48841	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 01/28/21	Due Date: 10/2021
ADM #18-L	S/N: 44581/48848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 01/28/21	Due Date: 10/2021
ADM #19-L	S/N: 44580/48844	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/20	Due Date: 06/2021
ADM #19-R	S/N: 44580/48843	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/23/20	Due Date: 06/2021
ADM #20-L	S/N: 44582/48848	Heise Model: PPM-1	Mfgd & Calibrated by Ashcroft, Inc.		Calibration Date: 06/18/20	Due Date: 06/2021
#01-L, 03A-L, 05-L, 07-L, 09-L, 11-L, 13-L, 15-L, 17-L, 19-L	Rated Accuracy: > 0.07% fs (0.000175 in wc)		Range: 0.0-0.25 in wc		Res.: 0.00001	Uncertainty: < 0.00035
#01-R, 03A-R, 05-R, 07-R, 09-R, 11-R, 13-R, 15-R, 17-R, 19-R	Rated Accuracy: > 0.08% fs (0.0003 in wc)		Range: 0.0-5.0 in wc		Res.: 0.0001	Uncertainty: < 0.00348
#02-L, 04-L, 06-L, 08-L, 10-L, 12A-L, 14-L, 16-L, 18-L, 20-L	Rated Accuracy: > 0.08% fs (0.03 in wc)		Range: 0.0-50.0 in wc		Res.: 0.001	Uncertainty: < 0.0348

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Shortridge Instruments, Inc. AirData Multimeter Calibration Equipment

Customer Order Number, Meter Serial Number, and Test Type are referenced on page 1

LOW VELOCITY EQUIVALENT CONFIRMATION STANDARDS

Vel Eqv Transfer Standard S/N: M02008	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M02903	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M10639	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M10840	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M10897	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 01/26/21	Due Date: 01/2022
Vel Eqv Transfer Standard S/N: M10901	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 12/16/20	Due Date: 12/2021
Vel Eqv Transfer Standard S/N: M13492	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 08/16/20	Due Date: 08/2021
Vel Eqv Transfer Standard S/N: M18325	Model ADM-870C	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 06/25/20	Due Date: 06/2021
Rated Accuracy: Velocity $\pm 1.5\% \pm 3.5$ fpm		Range: 100-5000 fpm Resolution: 0.1	Uncertainty: <5.00 fpm at 100 fpm; <7.50 fpm at 500 fpm	

TEMPERATURE STANDARDS

RTD Simulator S/N: 249	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 250	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 253	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/02/20	Due Date: 03/2024
RTD Simulator S/N: 254	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 256	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 257	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 05/04/20	Due Date: 04/2024
RTD Simulator S/N: 282	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 293	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 294	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 313	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 01/03/20	Due Date: 01/2024
RTD Simulator S/N: 314	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 315	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 03/16/18	Due Date: 03/2022
RTD Simulator S/N: 316	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 317	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
RTD Simulator S/N: 318	Model RTD-1000/500	Mfg'd by General Resistance	Calibrated by IET Labs	Calibration Date: 04/16/18	Due Date: 04/2022
Rated Accuracy: 0.025% of setting		Range: 100.00 Ω to 11111.10 Ω	Resolution: 0.01 Ω	Uncertainty: ± 32 ppm	

Thermometer #1 S/N B4089/Thermistor S/N A410880	Model 1504/5810	Mfg'd by Hart Scientific	Calibrated by Fluke	Calibration Date: 06/27/19	Due Date: 06/2021
Thermometer #2 S/N B8104/Thermistor S/N B71607	Model 1504/5810	Mfg'd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #5 S/N B11780/Thermistor S/N B10505	Model 1504/5810	Mfg'd by Hart Scientific	Calibrated by Fluke	Calibration Date: 11/04/20	Due Date: 11/2022
Thermometer #6 S/N B11782/Thermistor S/N B10508	Model 1504/5810	Mfg'd by Hart Scientific	Calibrated by Fluke	Calibration Date: 02/24/20	Due Date: 02/2022
Thermometer #7 S/N B48938/Thermistor S/N B482202	Model 1504/5810	Mfg'd and Calibrated by Fluke		Calibration Date: 06/26/19	Due Date: 06/2021
Rated Accuracy(combined): 0.0324° F		Range: 32° F to 176° F	Resolution: 0.001° F	Combined Uncertainty with Baths: $\pm 0.040^\circ$ F	

Temp Transfer Standard S/N M00138	Model ADM-870	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 10/20/20	Due Date: 10/2021
Temp Transfer Standard S/N M98100	Model ADM-870	Mfg'd & Calibrated by Shortridge Instruments, Inc.	Calibration Date: 03/09/20	Due Date: 03/2021
Rated Accuracy: 0.03° F		Range: 33° F to 158° F	Resolution: 0.01° F	Uncertainty: $< 0.023^\circ$ F
Total combined Uncertainty for MultiTemp and TemProbe testing : $\pm 0.046^\circ$ F				

This form must remain with the Certificate of Calibration corresponding to the Customer Order Number and Meter Serial Number referenced on page 1.

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