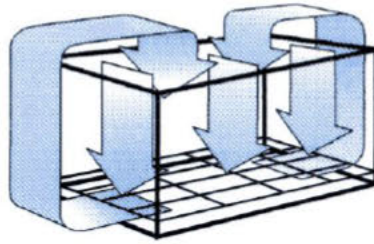


Customer:

Project:

ISO 14644-1:2015(E) Initial Cleanroom Certification



CAS Report No. [REDACTED]

Start Date: [REDACTED]

Completion Date: [REDACTED]



CERTIFIED AIR SOLUTIONS, INC.

PO Box 620
Eagleville, PA 19408
Phone: 610-630-2211
Fax: 610-630-1117
certifiedairsolutions.com



ISO 14644-1:2015(E) Initial Cleanroom Certification

Customer:

[REDACTED]

Project:

[REDACTED]

Contact:

[REDACTED]

Certification**Test Report Number:**

[REDACTED]

Start Date:

[REDACTED]

Completion Date:

[REDACTED]

Scope:

Air volume measurements, calculated air exchange rates, room pressure measurements, HEPA filter integrity testing, temperature measurements, and relative humidity measurements were recorded to establish environmental conditions at the time of ISO 14644-1:2015(E) airborne particle count sampling. Airborne particle counts were taken within all Charles River Laboratories cleanroom areas to verify compliance with the ISO 14644-1:2015(E) definitions of air cleanliness. All tests performed are in accordance with ISO 14644-1:2015(E) and ISO 14644-3:2019(E).

Tests Performed:

- Air Exchange Rate Calculations
- Airborne Particle Counts
- Air Volume Measurements
- HEPA Filter Integrity Testing
- Room Pressurization
- Temperature/Humidity

Status:

The results of testing performed in each cleanroom area comply with their corresponding ISO 14644-1:2015(E) definition of air cleanliness. Although all [REDACTED] cleanroom areas meet the pass/fail criteria for the corresponding ISO class designation in all cleanroom areas, there are areas of that require correction within the cleanroom area.

Upon completion of HEPA filter integrity testing, all filters were found to be free of any penetrations greater than 0.01%. All gasket seals were tight, and no penetrations were found entering the cleanroom area. The media area of all HEPA filters looked intact and had no visible dents or damage from installation.

Upon completion of supply air volume readings, all cleanroom areas were above CleanSpace design criteria. The only area that was below the design criteria was Cleanroom 100. The requirement for this area was 260 ACH, the actual measurement at the time of testing 244 ACH, 6% below design.

Temperature and relative humidity measurements found that most areas were close to the value of 68°F, specifically all areas outside of the Cleanroom 100 area were between 66°F-70°F. The average temperature within Cleanroom 100 was 74.8°F. Relative humidity measurements found that all cleanroom areas other than Cleanroom 100 were above the specification 50%. The cleanroom areas outside of Cleanroom 100 were at 60% or higher.

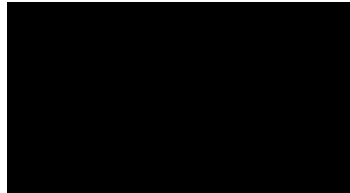
Detailed data pertaining to each cleanroom will be found in the following sections of this certification report.



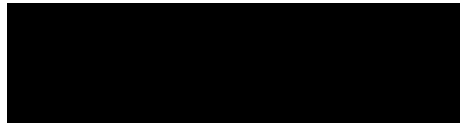
TABLE OF CONTENTS

ROOM DIFFERENTIAL PRESSURE DATA TITLE SHEET	1
ROOM PRESSURE DIFFERENTIAL DATA	2
SUPPLY AIR VOLUME AND HEPA FILTER INTEGRITY DATA TITLE SHEET	3
AIRFLOW AND HEPA FILTER LEAK SPREADSHEET	4-11
AIRBORNE PARTICLE COUNT, TEMPERATURE, AND RELATIVE HUMIDITY TITLE SHEET	12
AIRBORNE PARTICLE COUNT, TEMPERATURE, AND RELATIVE HUMIDITY SAMPLE LOCATION DRAWING	13
AIRBORNE PARTICLE COUNT, TEMPERATURE, AND RELATIVE HUMIDITY SPREADSHEET	14-32
CERTIFICATION EQUIPMENT CALIBRATION REPORTS INDEX.....	33
CALIBRATION REPORTs	33-48

Customer:

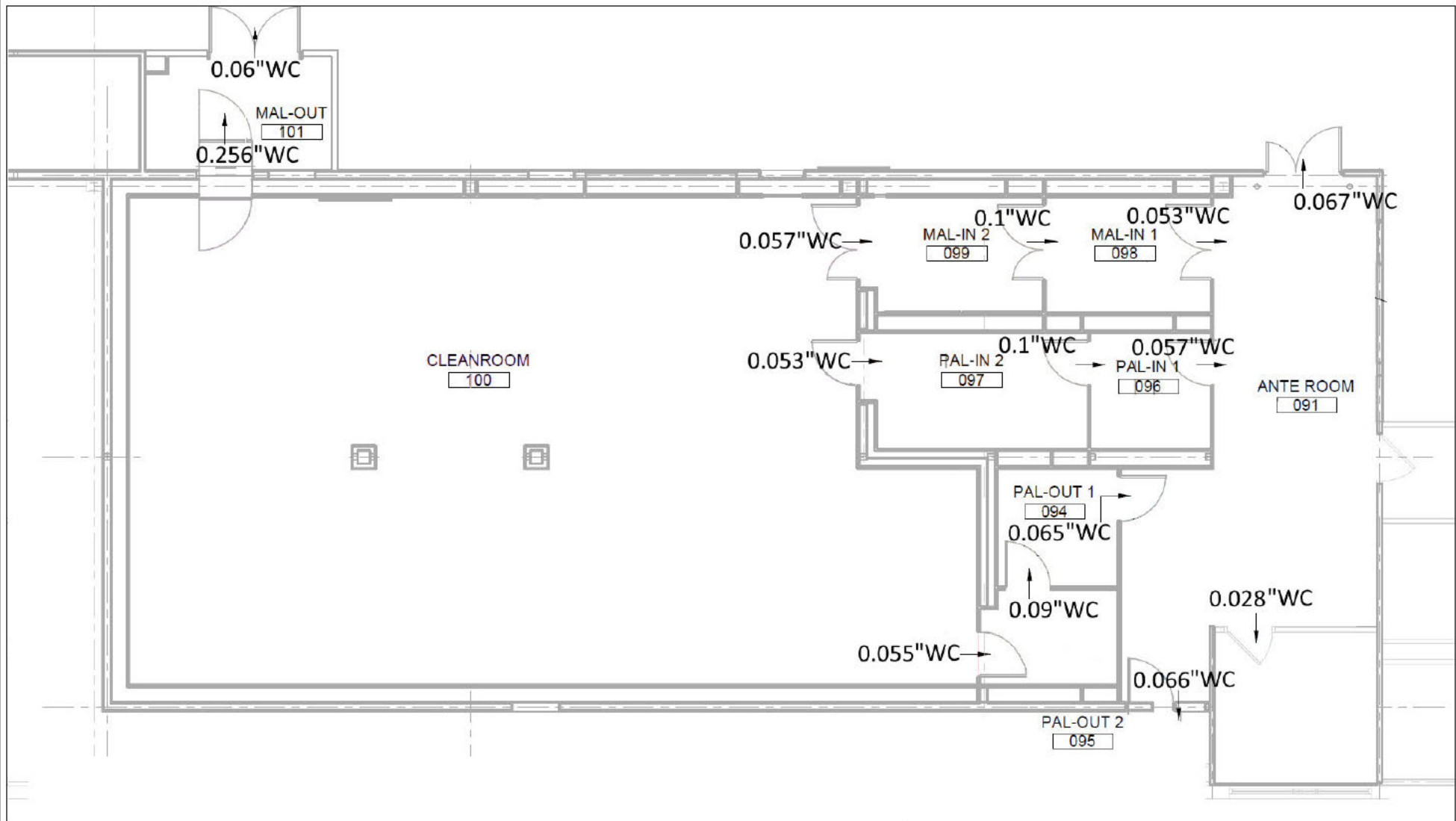


Project:



ISO 14644-1:2015(E) Initial Cleanroom Certification
CAS Report No. 

Room Differential Pressure Data



TEST INSTRUMENT USED FOR
 DIFFERENTIAL PRESSURE
 MEASUREMENT: EVERGREEN TELEMTRY S-PVF-1
 SERIAL NO.: 2300691D
 DATE OF CALIBRATION: OCTOBER 3, 2023
 CALIBRATION DUE DATE: OCTOBER 3, 2025

DIFFERENTIAL PRESSURE DATA
 START DATE: [REDACTED]
 COMPLETION DATE: [REDACTED]

CAS
 CERTIFIED AIR SOLUTIONS, INC.
 P.O. BOX 620
 EAGLEVILLE, PA 19408-0620
 CERTIFIEDAIRSOLUTIONS.COM

Customer:



Project:



ISO 14644-1:2015(E) Initial Cleanroom Certification
CAS Report No. [REDACTED]

Supply Air Volume and HEPA Filter Integrity Data

HEPA Filter Leak Testing and Airflow Information.

Project: Cleanroom

Test Performed(1): HEPA filter Integrity testing
Test Instrument Used (1): TEC Services Inc., Aerosol Photometer Model PH-5, Serial Number 3737
Date of Calibration: 17-Mar-25
Calibration Due: 17-Mar-26
Test Procedure: ISO 14644-3:2019(E) B.7.2 Procedure for installed filter system leakage scan test with an aerosol photometer
Test Instrument Used (2): Air Techniques, Aerosol Photometer Model TDA-2G, Serial Number 11709
Date of Calibration: 10-Apr-25
Calibration Due: 10-Apr-26
Test Procedure: ISO 14644-3:2019(E) B.7.2 Procedure for installed filter system leakage scan test with an aerosol photometer

Test Performed(2): Supply air volume measurement
Test Instrument Used (1): Evergreen Telemetry 3lb. Hood with Velocity Module S-PVF-1, Serial Number 2300691D
Date of Calibration: 3-Oct-23
Calibration Due: 3-Oct-25
Test Procedure: ISO 14644-3:2019(E) B.2.3.2 Supply air volume flow rate measured using a capture hood

ANTE ROOM 091

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
091.01	FFU	400 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
091.02	FFU	430 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
091.03	FFU	395 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
091.04	FFU	370 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		1,595 ft. ³ /min.	309 ft. ³ /min.	1,600 ft. ³ /min.	3,409 ft. ³	28 ACPH	20 ACH

CHANGING ROOM 092

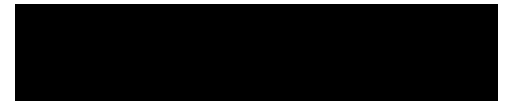
Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
092.01	FFU	399 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		399 ft. ³ /min.	309 ft. ³ /min.	350 ft. ³ /min.	765 ft. ³	31 ACPH	30 ACH

PAL-OUT 1 094

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
094.01	FFU	376 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		376 ft. ³ /min.	238 ft. ³ /min.	450 ft. ³ /min.	536 ft. ³	30 ACPH	30 ACH

PAL-OUT 2 095

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
095.01	FFU	467 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		467 ft. ³ /min.	312 ft. ³ /min.	570 ft. ³ /min.	485 ft. ³	58 ACPH	30 ACH



PAL-IN 1 096

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
096.01	FFU	354 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		354 ft. ³ /min.	242 ft. ³ /min.	450 ft. ³ /min.	521 ft. ³	41 ACPH	30 ACH

PAL-IN 2 097

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
097.01	FFU	413 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
097.02	FFU	427 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		840 ft. ³ /min.	663 ft. ³ /min.	1,100 ft. ³ /min.	968 ft. ³	52 ACPH	30 ACH

MAL-IN 1 098

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
098.01	FFU	378 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		378 ft. ³ /min.	340 ft. ³ /min.	480 ft. ³ /min.	717 ft. ³	32 ACPH	30 ACH

MAL-IN 2 099

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
099.1	FFU	327 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
099.2	FFU	315 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		642 ft. ³ /min.	542 ft. ³ /min.	930 ft. ³ /min.	785 ft. ³	49 ACPH	30 ACH

CLEANROOM 100

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
100.01	FFU	555 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.02	FFU	501 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.03	FFU	603 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.04	FFU	564 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.05	FFU	532 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.06	FFU	475 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.07	FFU	505 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.08	FFU	506 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.09	FFU	527 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.10	FFU	540 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.11	FFU	554 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.12	FFU	527 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.13	FFU	530 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.14	FFU	506 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.15	FFU	554 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.16	FFU	504 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.17	FFU	515 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.18	FFU	540 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.19	FFU	521 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.20	FFU	508 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.21	FFU	510 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.22	FFU	527 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
100.23	FFU	551 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]

CLEANROOM 100

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
100.24	FFU	548 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.25	FFU	481 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.26	FFU	515 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.27	FFU	547 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.28	FFU	582 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.29	FFU	528 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.30	FFU	523 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.31	FFU	550 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.32	FFU	504 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.33	FFU	510 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.34	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.35	FFU	535 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.36	FFU	515 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.37	FFU	500 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.38	FFU	557 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.39	FFU	490 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.40	FFU	510 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.41	FFU	520 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.42	FFU	565 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.43	FFU	550 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.44	FFU	524 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.45	FFU	527 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.46	FFU	380 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.47	FFU	501 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.48	FFU	540 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.49	FFU	485 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.50	FFU	585 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.51	FFU	518 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.52	FFU	505 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.53	FFU	495 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.54	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.55	FFU	542 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.56	FFU	530 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.57	FFU	489 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	

CLEANROOM 100

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
100.58	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.59	FFU	555 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.60	FFU	525 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.61	FFU	515 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.62	FFU	535 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.63	FFU	573 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.64	FFU	480 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.65	FFU	502 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.66	FFU	535 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.67	FFU	493 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.68	FFU	562 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.69	FFU	500 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.70	FFU	473 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.71	FFU	572 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.72	FFU	500 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.73	FFU	537 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.74	FFU	560 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.75	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.76	FFU	488 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.77	FFU	566 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.78	FFU	535 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.79	FFU	536 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.80	FFU	571 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.81	FFU	526 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.82	FFU	469 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.83	FFU	587 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.84	FFU	565 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.85	FFU	525 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.86	FFU	562 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.87	FFU	575 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.88	FFU	540 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.89	FFU	552 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.90	FFU	570 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.91	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	

CLEANROOM 100

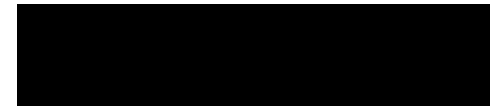
Filter Identification	HEPA Type	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test	
100.92	FFU	566 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	
100.93	FFU	534 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.94	FFU	521 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.95	FFU	501 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.96	FFU	498 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.97	FFU	511 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.98	FFU	540 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.99	FFU	585 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.100	FFU	545 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.101	FFU	553 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.102	FFU	492 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.103	FFU	518 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.104	FFU	477 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.105	FFU	450 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.106	FFU	479 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.107	FFU	533 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.108	FFU	501 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.109	FFU	485 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
100.110	FFU	533 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%		
		Total Supply Air Volume	Required Minimum Supply Air Volume	██████████ Design Criteria for Supply Air Volume	Volume of Room		Air Changes Per Hour
		57,937 ft. ³ /min.	60,223 ft. ³ /min.	62,350 ft. ³ /min.	14,259 ft. ³	244 ACPH	260 ACH

CLEANROOM 100 PASS THRU

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
100PT.01	FFU	301 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Volume of Room	Air Changes Per Hour			
		301 ft. ³ /min.	64 ft. ³	282 ACPH			

MAL-OUT 101

Filter Identification	HEPA Type	Supply Air Volume Measurement	Size	Upstream Challenge Concentration	Downstream Measurement	Pass/Fail	Date of Test
101.01	FFU	439 ft. ³ /min.	24" X 48"	10 µg/L < 20 µg/L	≤0.01%	Pass	[REDACTED]
		Total Supply Air Volume	Required Minimum Supply Air Volume	[REDACTED] Design Criteria for Supply Air Volume	Volume of Room	Air Changes Per Hour	Minimum Design Criteria for Air Changes Per Hour
		439 ft. ³ /min.	347 ft. ³ /min.	400 ft. ³ /min.	799 ft. ³	33 ACPH	25 ACH



Customer:

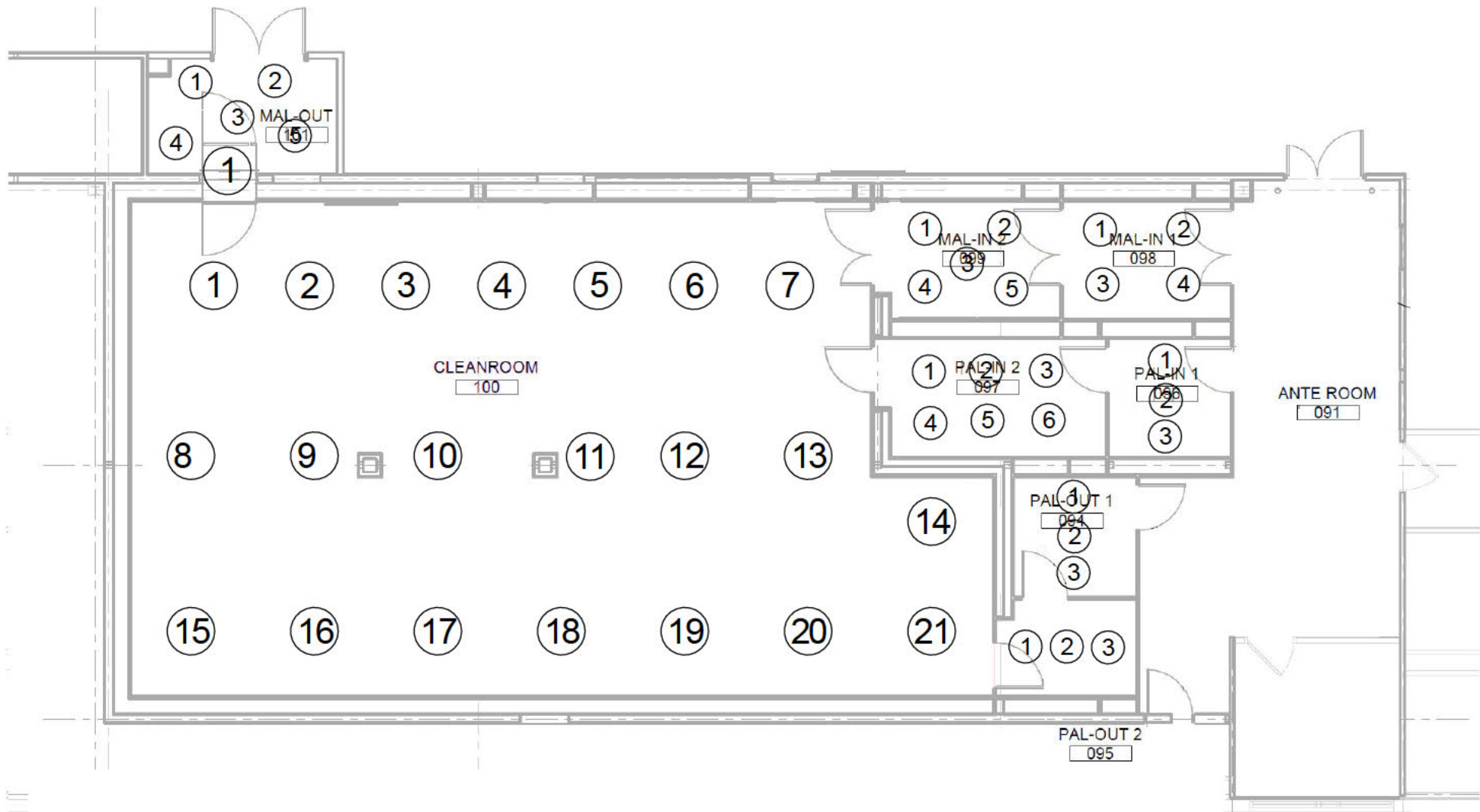


Project:



ISO 14644-1:2015(E) Initial Cleanroom Certification
CAS Report No. 

Airborne Particle Count, Temperature, and Relative Humidity Data



AIRBORNE PARTICLE COUNT,
TEMPERATURE AND RELATIVE
HUMIDITY SAMPLE LOCATIONS
START DATE: [REDACTED]
COMPLETION DATE: [REDACTED]

CAS 
CERTIFIED AIR SOLUTIONS, INC.
P.O. BOX 620
EAGLEVILLE, PA 19408-0620
CERTIFIEDAIRSOLUTIONS.COM

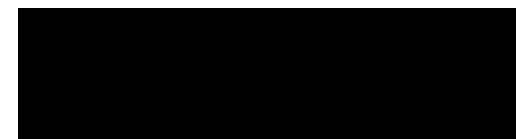
Airborne Particle Count, Temperature and Relative Humidity Data

Project: Cleanroom

Test Performed(1): Airborne particle count
Test Instrument Used (1): Beckman Coulter 3445, Serial Number 1608538042
Date of Calibration: 7-Oct-24
Calibration Due: 7-Oct-25
Test Instrument Used (2): Beckman Coulter 3445+, Serial Number C38687-2023350319
Test Procedure: ISO 14644-1:2015(E) Annex A
Date of Calibration: 4-Sep-24
Calibration Due: 4-Sep-25

Test Performed(2): Temperature and relative humidity measurement
Test Instrument Used (1): Vailala HMP110, Serial Number M2910217
Date of Calibration: 8-Oct-24
Calibration Due: 8-Oct-25
Test Instrument Used (2): Vailala HMP110, Serial Number V0910854
Date of Calibration: 4-Sep-24
Calibration Due: 4-Sep-25
Test Procedure: ISO 14644-3:2019(E) B.5 and B.6 Temperature and Humidity
Test Date: 29-May-25

Sample Location							
PAL-OUT 1 094 ISO 8, Area of Room 6 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	2,752	99.6 Liters	27,630	3,520,000	Pass	70.6°F	56.1%
2	4,112	99.6 Liters	41,288	3,520,000	Pass	69.2°F	59.8%
3	1,934	99.6 Liters	19,420	3,520,000	Pass	68.7°F	61.8%
Average Particle Concentration Per m ³ and/or 1,000 Liters			29,446	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average			11,047				
Confidence Interval			12,500				
95% Upper Confidence Limit			41,946				



Sample Location							
PAL-OUT 1 094 ISO 8, Area of Room 6 m ²	Sample 1 x, ≥ 5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	552	99.6 Liters	5,542	29,300	Pass	70.6°F	56.1%
2	508	99.6 Liters	5,101	29,300	Pass	69.2°F	59.8%
3	341	99.6 Liters	3,424	29,300	Pass	68.7°F	61.8%
Average Particle Concentration Per m ³ and/or 1,000 Liters			4,689	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average			1,117				
Confidence Interval			1,264				
95% Upper Confidence Limit			5,953				



Sample Location							
PAL-OUT 2 095 ISO 7, Area of Room 6 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
	1	1,428	99.5 Liters	14,346	352,000	Pass	68.2°F 64.1%
	2	803	99.5 Liters	8,067	352,000	Pass	68.2°F 64.4%
	3	501	99.5 Liters	5,033	352,000	Pass	68.1°F 64.6%
	Average Particle Concentration Per m ³ and/or 1,000 Liters		9,148	% of samples that meet ISO class cleanliness by particle concentration		100%	Avg. Temp. Avg. RH
	Standard Deviation of Average		4,750			68.2°F	64.4%
	Confidence Interval		5,375				
	95% Upper Confidence Limit		14,523				



Sample Location							
PAL-OUT 2 095 ISO 7, Area of Room 6 m ²		Sample 1 x, ≥ 5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 5 μm particle size	Pass/fail	Temperature
							Relative Humidity
	1	187	99.5 Liters	1,879	2,930	Pass	68.2°F
	2	100	99.5 Liters	1,005	2,930	Pass	68.2°F
	3	52	99.5 Liters	522	2,930	Pass	68.1°F
			Average Particle Concentration Per m ³ and/or 1,000 Liters	1,135	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.
			Standard Deviation of Average	687			68.2°F
			Confidence Interval	778			
			95% Upper Confidence Limit	1,913			
							Avg. RH
							64.4%

Sample Location								
PAL-IN 1 096 ISO 8, Area of Room 6 m ²	Sample 1 x _i ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity	
1	947	99.5 Liters	9,518	3,520,000	Pass	67.4°F	67.5%	
2	715	99.5 Liters	7,183	3,520,000	Pass	67.5°F	67.4%	
3	402	99.6 Liters	4,038	3,520,000	Pass	67.4°F	67.3%	
Average Particle Concentration Per m ³ and/or 1,000 Liters			6,913	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH	
Standard Deviation of Average			2,750					
Confidence Interval			3,112					
95% Upper Confidence Limit			10,025					
						67.4°F	67.4%	



Sample Location								
PAL-IN 1 096 ISO 8, Area of Room 6 m ²	Sample 1 x _i ≥ 5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 5 μm particle size	Pass/fail	Temperature	Relative Humidity	
1	133	99.5 Liters	1,337	29,300	Pass	67.4°F	67.5%	
2	68	99.5 Liters	683	29,300	Pass	67.5°F	67.4%	
3	35	99.6 Liters	352	29,300	Pass	67.4°F	67.3%	
Average Particle Concentration Per m ³ and/or 1,000 Liters			790	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH	
Standard Deviation of Average			501					
Confidence Interval			567					
95% Upper Confidence Limit			1,358					
						67.4°F	67.4%	



Sample Location								
PAL-IN 2 097 ISO 7, Area of Room 11 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity	
1	1,383	99.5 Liters	13,893	352,000	Pass	67.8°F	64.5%	
2	2,122	99.5 Liters	21,328	352,000	Pass	68.0°F	64.2%	
3	1,722	99.6 Liters	17,291	352,000	Pass	68.0°F	64%	
4	604	99.6 Liters	6,064	352,000	Pass	67.9°F	64.2%	
5	210	99.6 Liters	2,109	352,000	Pass	67.5°F	65.1%	
6	84	99.6 Liters	844	352,000	Pass	67.1°F	66.2%	
Average Particle Concentration Per m ³ and/or 1,000 Liters			10,255	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH	
Standard Deviation of Average			8,460					
Confidence Interval			6,769					
95% Upper Confidence Limit			17,024					
						67.7°F	64.7%	



Sample Location								
PAL-IN 2 097 ISO 7, Area of Room 11 m²	Sample 1 $x_i \geq$ 5 μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 5 μ m particle size	Pass/fail	Temperature	Relative Humidity	
1	258	99.5 Liters	2,592	2,930	Pass	67.8°F	64.5%	
2	271	99.5 Liters	2,724	2,930		68.0°F	64.2%	
3	222	99.6 Liters	2,229	2,930		68.0°F	64%	
4	65	99.6 Liters	653	2,930		67.9°F	64.2%	
5	22	99.6 Liters	221	2,930		67.5°F	65.1%	
6	4	99.6 Liters	40	2,930		67.1°F	66.2%	
Average Particle Concentration Per m³ and/or 1,000 Liters			1,410	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH	
Standard Deviation of Average			1,238					
Confidence Interval			990					
95% Upper Confidence Limit			2,400					



Sample Location							
MAL-IN 1 098 ISO 8, Area of Room 8 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	5,123	99.6 Liters	51,434	3,520,000	Pass	66.7°F	67.2%
2	2,221	99.5 Liters	22,320	3,520,000	Pass	66.5°F	67.7%
3	981	99.5 Liters	9,856	3,520,000	Pass	66.3°F	67.9%
4	1,041	99.6 Liters	10,454	3,520,000	Pass	66.3°F	68%
		Average Particle Concentration Per m ³ and/or 1,000 Liters	23,516	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
		Standard Deviation of Average	19,477			66.5°F	67.7%
		Confidence Interval	19,087				
		95% Upper Confidence Limit	42,603				



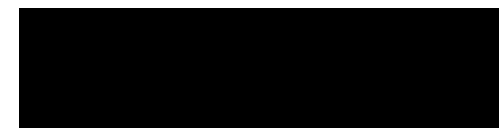
Sample Location							
MAL-IN 1 098 ISO 8, Area of Room 8 m ²	Sample 1 x _i ≥ 5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	817	99.6 Liters	8,203	29,300	Pass	66.7°F	67.2%
2	229	99.5 Liters	2,301	29,300	Pass	66.5°F	67.7%
3	112	99.5 Liters	1,125	29,300	Pass	66.3°F	67.9%
4	132	99.6 Liters	1,326	29,300	Pass	66.3°F	68%
Average Particle Concentration Per m ³ and/or 1,000 Liters			3,239	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average			3,349				
Confidence Interval			3,282				
95% Upper Confidence Limit			6,521				



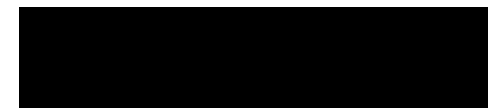
Sample Location							
MAL-IN 2 099 ISO 7, Area of Room 9 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	708	99.6 Liters	7,110	352,000	Pass	66.4°F	68.1%
2	107	99.6 Liters	1,075	352,000	Pass	66.4°F	67.7%
3	41	99.5 Liters	412	352,000	Pass	66.7°F	67.3%
4	69	99.6 Liters	693	352,000	Pass	66.7°F	66.9%
5	37	99.6 Liters	372	352,000	Pass	66.8°F	66.9%
		Average Particle Concentration Per m ³ and/or 1,000 Liters	1,932	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
		Standard Deviation of Average	2,908			66.6°F	67.4%
		Confidence Interval	2,549				
		95% Upper Confidence Limit	4,481				



Sample Location							
MAL-IN 2 099 ISO 7, Area of Room 9 m ²	Sample 1 x, $\geq$ 5 μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 5 μ m particle size	Pass/fail	Temperature	Relative Humidity
1	107	99.6 Liters	1,075	2,930	Pass	66.4°F	68.1%
2	21	99.6 Liters	211	2,930	Pass	66.4°F	67.7%
3	2	99.5 Liters	20	2,930	Pass	66.7°F	67.3%
4	8	99.6 Liters	80	2,930	Pass	66.7°F	66.9%
5	9	99.6 Liters	90	2,930	Pass	66.8°F	66.9%
		Average Particle Concentration Per m ³ and/or 1,000 Liters	295	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
		Standard Deviation of Average	441			66.6°F	67.4%
		Confidence Interval	387				
		95% Upper Confidence Limit	682				



Sample Location		Sample 1 $x_i \geq$ 0.5 μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m³ = location sample x 1,000/sample volume)	ISO Class 5 limit for 0.5 μ m particle size	Pass/fail	Temperature	Relative Humidity
CLEANROOM 100 ISO 5, Area of Room 157 m²								
1		495	729.4 Liters	679	3,520	Pass	74.3°F	51%
2		204	729.5 Liters	280	3,520	Pass	73.7°F	52.2%
3		160	729.5 Liters	219	3,520	Pass	73.5°F	52.4%
4		275	729.2 Liters	377	3,520	Pass	72.8°F	53.1%
5		41	729.2 Liters	56	3,520	Pass	71.2°F	56.3%
6		20	729.4 Liters	27	3,520	Pass	72.4°F	53.9%
7		484	729.7 Liters	663	3,520	Pass	73.6°F	51.6%
8		722	729.3 Liters	990	3,520	Pass	73.9°F	50.6%
9		43	729.6 Liters	59	3,520	Pass	74.3°F	50.5%
10		26	729.9 Liters	36	3,520	Pass	76.6°F	45.7%
11		122	729.6 Liters	167	3,520	Pass	76.5°F	46.8%
12		67	729.6 Liters	92	3,520	Pass	76.3°F	47.9%
13		26	729.5 Liters	36	3,520	Pass	76.3°F	47.5%
14		29	729.7 Liters	40	3,520	Pass	75.4°F	48.2%
15		21	729.7 Liters	29	3,520	Pass	75.4°F	48.3%
16		102	729.8 Liters	140	3,520	Pass	75.4°F	48.5%
17		187	729.7 Liters	256	3,520	Pass	75.2°F	49%
18		3	729.8 Liters	4	3,520	Pass	75.2°F	48.9%
19		84	729.5 Liters	115	3,520	Pass	76.1°F	47.8%
20		30	729.5 Liters	41	3,520	Pass	76.5°F	47%
21		30	729.8 Liters	41	3,520	Pass	75.4°F	49%
Average Particle Concentration Per m³ and/or 1,000 Liters				207	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average				265				
Confidence Interval				113				
95% Upper Confidence Limit				320				

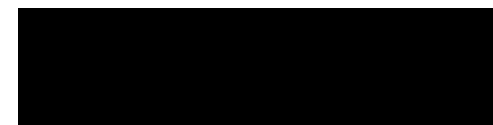


Sample Location								
CLEANROOM 100 ISO 5, Area of Room 157 m²	Sample 1 $x_i \geq 5\mu$ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m³ = location sample x 1,000/sample volume)	ISO Class 5 limit for 5 μ m particle size	Pass/fail	Temperature	Relative Humidity	
1	16	729.4 Liters	22	29	Pass	74.3°F	51%	
2	16	729.5 Liters	22	29	Pass	73.7°F	52.2%	
3	14	729.5 Liters	19	29	Pass	73.5°F	52.4%	
4	15	729.2 Liters	21	29	Pass	72.8°F	53.1%	
5	7	729.2 Liters	10	29	Pass	71.2°F	56.3%	
6	3	729.4 Liters	4	29	Pass	72.4°F	53.9%	
7	16	729.7 Liters	22	29	Pass	73.6°F	51.6%	
8	19	729.3 Liters	26	29	Pass	73.9°F	50.6%	
9	2	729.6 Liters	3	29	Pass	74.3°F	50.5%	
10	3	729.9 Liters	4	29	Pass	76.6°F	45.7%	
11	13	729.6 Liters	18	29	Pass	76.5°F	46.8%	
12	6	729.6 Liters	8	29	Pass	76.3°F	47.9%	
13	7	729.5 Liters	10	29	Pass	76.3°F	47.5%	
14	10	729.7 Liters	14	29	Pass	75.4°F	48.2%	
15	9	723.9 Liters	12	29	Pass	75.4°F	48.3%	
16	6	729.8 Liters	8	29	Pass	75.4°F	48.5%	
17	10	729.7 Liters	14	29	Pass	75.2°F	49%	
18	1	729.8 Liters	1	29	Pass	75.2°F	48.9%	
19	4	729.5 Liters	5	29	Pass	76.1°F	47.8%	
20	1	729.5 Liters	1	29	Pass	76.5°F	47%	
21	3	729.8 Liters	4	29	Pass	75.4°F	49%	
Average Particle Concentration Per m³ and/or 1,000 Liters			12	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH	
Standard Deviation of Average			8			74.8°F	49.8%	
Confidence Interval			3					
95% Upper Confidence Limit			15					

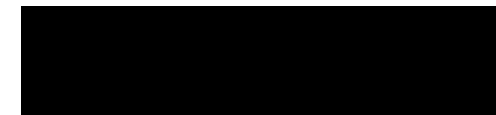
Sample Location							
CLEANROOM 100 PASS THRU, Area of Room 2 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	3	100.5 Liters	30	352,000	Pass	76.0°F	48.9%
		Average Particle Concentration Per m ³ and/or 1,000 Liters	30	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
		Standard Deviation of Average	N/A			76.0°F	48.9%
		Confidence Interval	N/A				
		95% Upper Confidence Limit	N/A				



Sample Location							
CLEANROOM 100 PASS THRU, Area of Room 2 m ²	Sample 1 x, ≥ 5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 7 limit for 5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	0	100.5 Liters	0	2,930	Pass	76.0°F	48.9%
		Average Particle Concentration Per m ³ and/or 1,000 Liters	0	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
		Standard Deviation of Average	N/A			76.0°F	48.9%
		Confidence Interval	N/A				
		95% Upper Confidence Limit	N/A				



Sample Location							
MAL-OUT 101 ISO 8, Area of Room 9 m ²	Sample 1 x, ≥ 0.5μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 0.5 μm particle size	Pass/fail	Temperature	Relative Humidity
1	6,351	103.6 Liters	61,297	3,520,000	Pass	76.7°F	46.9%
2	9,620	103.6 Liters	92,821	3,520,000	Pass	76.9°F	47.5%
3	8,375	103.6 Liters	80,858	3,520,000	Pass	76.8°F	47.7%
4	5,493	103.6 Liters	53,012	3,520,000	Pass	76.8°F	48.2%
5	13,272	103.5 Liters	128,181	3,520,000	Pass	75.5°F	48%
Average Particle Concentration Per m ³ and/or 1,000 Liters			83,234	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average			29,633				
Confidence Interval			25,974				
95% Upper Confidence Limit			109,208				



Sample Location							
MAL-OUT 101 ISO 8, Area of Room 9 m ²	Sample 1 x, $\geq$ 5 μ (counts per 100 l)	Location Sample Volume	Location concentration average (counts per m ³ = location sample x 1,000/sample volume)	ISO Class 8 limit for 5 μ m particle size	Pass/fail	Temperature	Relative Humidity
1	513	103.6 Liters	4,951	29,300	Pass	76.7°F	46.9%
2	781	103.6 Liters	7,536	29,300	Pass	76.9°F	47.5%
3	758	103.6 Liters	7,318	29,300	Pass	76.8°F	47.7%
4	363	103.6 Liters	3,503	29,300	Pass	76.8°F	48.2%
5	1,187	103.5 Liters	11,464	29,300	Pass	75.5°F	48%
Average Particle Concentration Per m ³ and/or 1,000 Liters			6,954	% of samples that meet ISO class cleanliness by particle concentration	100%	Avg. Temp.	Avg. RH
Standard Deviation of Average			3,030			76.5°F	47.7%
Confidence Interval			2,656				
95% Upper Confidence Limit			9,611				



[REDACTED]
[REDACTED]

Instrument / Serial Number	Application	Date of Use	Calibration Date	Frequency of Calibration	Calibration Due Date
Evergreen Telemetry 3lb. Hood with Velocity Module S-PVF-1 / 2300691D	Air Volume Measurement	28-May-25	3-Oct-23	Biannual	3-Oct-25
TEC Services Aerosol Phtometer Model PH-5 / 3737	HEP Filter Integrity Testing	28-May-25	17-Mar-25	Annual	17-Mar-26
Air Techniques Aerosol Photometer TDA-2G / 11709	HEPA Filter Leak Testing	28-May-25	10-Apr-25	Annual	10-Apr-26
Beckman Coulter 3445 / 1608538042	Particle Count Sampling	29-May-25	7-Oct-24	Annual	7-Oct-25
Vailala HMP110 / M2910217	Temperature and Humidity Samples	29-May-25	8-Oct-24	Annual	8-Oct-25
Beckman Coulter 3445+ / C38687-2023350319	Particle Count Sampling	29-May-25	4-Sep-24	Annual	4-Sep-25
Vailala HMP110 / M2910217	Temperature and Humidity Samples	29-May-25	4-Sep-24	Annual	4-Sep-25

[REDACTED]

**Evergreen Telemetry
31b. Hood with Velocity
Module S-PVF-1, Serial
Number 2300691D
Calibration Report**

Certificate of Calibration

Certified Air Solutions

Manufacturer	Evergreen Telemetry	Calibration Environment		
Product	Pressure / Velocity Module	Temperature	74	°F
Model	S-PVF-1	Rel. Humidity	31	%
SN	2300691D	Bar. Pressure	28.6	in Hg

☐ As Found ☒ As Left ☒ In Tolerance ☐ Out of Tolerance

Calibration Data

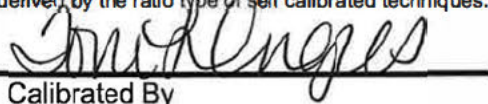
Measurement Variable	Test Point	Cal Standard	Allowable Range		Test Instrument	
			Min	Max		
Barometric Pressure (in Hg)	Spec		-2% - 0.1	+ 2% + 0.1		
	1	20.0			20.1	
	2	28.6			28.6	
	3	33.0			33.1	
Differential Pressure (in wc)	Spec		-2%-.001	+2%+.001		
	1	10.00			9.964	
	2	2.000			1.991	
	3	0.5000			0.4957	
	4	0.0500			0.0496	
	5	-10.00			-9.991	
Via Pitot >> Velocity Pressure >> (inW.C. / FPM) -3% -7	6	-0.0500			-0.0494	
			-3% - 7	+3% + 7		
	7	.00067 / 103			103	
	8	.0161 / 508			506	

Indicates out of tolerance condition ----- ↑

NIST-Traceable Lab Calibration Standards

Variable	System ID	Calibration Last	Calibration Due
Pressure	7481227	8-Mar-23	8-Mar-25
Pressure	7568470	8-Mar-23	8-Mar-25
Pressure	7871917	12-Sep-23	12-Sep-25
Pressure	7870754	12-Sep-23	12-Sep-25
Pressure	2205000006	13-Sep-23	13-Sep-25
Pressure	1208000080	13-Feb-23	13-Feb-25
Pressure	41001F6C	27-Apr-23	27-Apr-25
Velocity	2100191A	24-Feb-23	24-Feb-25
Velocity	2100190A	1-May-23	1-May-25

This instrument has been checked for accuracy, calibrated to manufacturer's specifications, and found to be within the specified tolerance unless otherwise stated. It has been calibrated using measurement standards traceable to the National Institute of Standards and Technology, or accepted intrinsic standards of measurement, or derived by the ratio type or self calibrated techniques.


Calibrated By

3-Oct-2023 3-Oct-2025
Calibration Date Date Due



Certificate of Calibration

Certified Air Solutions

Manufacturer	Evergreen Telemetry	Calibration Environment		
Product	Capture Hood	Temperature	74	°F
Model	Three Pounder	Rel. Humidity	19	%
SN	2300338B	Bar. Pressure	28.7	in Hg

☐ As Found ☒ As Left ☒ In Tolerance ☐ Out of Tolerance

Calibration Data

Measurement Variable	Test Point	Cal Standard	Allowable Range		Test Instrument	
			Min	Max		
Airflow (CFM)	No Plate		-3% - 7	+3%-7		
	1	202			202	
	2	1002			985	
	3	2001			1969	
	4	-1505			-1487	
	Plate 1.1					
	1	80			79	
	2	402			398	
	3	802			798	
	4	-605			-594	
	Plate 0.3					
	1	30			29	
	2	150			148	
	3	-80			-80	

Indicates out of tolerance condition -----↑

NIST-Traceable Calibration Lab Standards

Variable	System ID	Calibration Last	Calibration Due
Pressure	7481227	8-Mar-23	8-Mar-25
Pressure	7568470	8-Mar-23	8-Mar-25
Pressure	7871917	16-Nov-21	16-Nov-23
Pressure	7870754	16-Nov-21	16-Nov-23
Pressure	2205000006	27-Jan-22	27-Jan-24
Pressure	1208000080	13-Feb-23	13-Feb-25
Pressure	41001F6C	27-Apr-23	27-Apr-25
Velocity	2100191A	24-Feb-23	24-Feb-25
Velocity	2100190A	1-May-23	1-May-25

This instrument has been checked for accuracy, calibrated to manufacturer's specifications, and found to be within the specified tolerance unless otherwise stated. It has been calibrated using measurement standards traceable to the National Institute of Standards and Technology, or accepted intrinsic standards of measurement, or derived by the ratio type of self calibrated techniques.


Calibrated By

September 27, 2023

Calibration Date

TEC Services Inc., Aerosol Photometer Model

PH-5

Serial Number 3737

Calibration Report



TEC Services, Inc.

25 Little Avenue
New Oxford, PA 17350
Phone: 717-624-3191
Fax: 717-624-3549
www.tecservicesinc.com

Controlled Environment Products
Calibration & Services

EQUIPMENT CALIBRATION REPORT

Date Received: 3/14/25 Date Shipped: 3/17/25
Customer: Certified Air Solutions, Inc. Contact: Jim Flannery
Address: 234 Egypt Road Phone #: 610-630-2211
Norristown, PA 19403 Customer PO #: 371
Manufacturer: TEC Services Model #: PH-5
Instrument Type: Aerosol Photometer Serial #: 3737 Customer ID#: N/A

NIST Traceable calibration performed to the above instrument per IEST-RP-CC013 and TEC Services' SOP's.

INSTRUMENT DATA

		As Found	Final	Mfg. Tolerances
Straylight	(N/A)	2.176%	.191%	Not Applicable
Sample Flow	(1)	28.0	29.0	28.3 ± 2.8 SLPM
V1	(1)	5.15	5.15	5.15V ± .05V
V2	(1)	11.43	11.43	12.0V ± 1V
V3	(1)	-12.07	-12.08	-12.0V ± .5V
V4	(1)	24.07	24.06	24.0V ± .5V
U5	(1)	5.002	5.002	5.000 ± .010V

(1) In Tolerance (2) Out of Tolerance (3) No effect on instrument operation (N/A) Not Applicable
Received in Tolerance: ☒ Yes ☐ No ☐ Not Operable
☐ Not Applicable - NEW INSTRUMENT

Calibrated for: ☒ PAO

Temperature: 20.7 °C

Relative Humidity: 42.0 %

MAINTENANCE PERFORMED

☒ Clean / Rebuild Chamber ☒ Realign Optics ☒ Flush Hoses
☒ Check Wiring & Hardware ☐ Replace Gaskets ☒ Update Software Version 1.535
☐ Not Applicable - NEW INSTRUMENT

Notes: _____

FINAL VERIFICATION PERFORMED

☒ Leak Test Sampling System ☒ Test Scanning Probe ☒ Perform Voltage Check
☒ Verify Max Gain Stability ☒ Performance Test

NIST TRACEABLE EQUIPMENT USED

Description	Model	Serial #	Certificate #	Cal Date	Due Date
Digital Multimeter	Fluke 87-V	64740006	U476015-00-01	04 APR 24	04 APR 25
Thermohygrometer	Extech 445715	CP244467	1756326	17 MAY 24	17 MAY 25
Flowmeter	TSI 4043	40431911011	N/A	03 OCT 24	03 OCT 25

Calibrated per Procedure: ☒ TEC001 ☐ TEC002 ☒ TEC003 ☐ TEC004 ☒ TEC005
☐ TEC006 ☒ TEC007 ☒ TEC008 ☒ TEC009 ☐ TEC010

CALIBRATION BY:

George Bob

DATE: 3/17/25

DUE DATE: 3/17/26

Air Techniques Aerosol Photometer TDA-2G
Serial Number 11709
Calibration Report



TEC Services, Inc.

25 Little Avenue
New Oxford, PA 17350
Phone: 717-624-3191
Fax: 717-624-3549
www.tecservicesinc.com

Controlled Environment Products
Calibration & Services

EQUIPMENT CALIBRATION REPORT

Date Received: 3/14/25 Date Returned: 4/10/25
Customer: Certified Air Solution Contact: Jon Flannery
Address: 1472 Laura lane Phone #: 610-324-2211
Pottsgrove, PA 19464 Customer PO #: 371
Manufacturer: Air Techniques Model #: TDA-2G
Instrument Type: Aerosol Photometer Serial #: 11709

NIST Traceable calibration performed to the above instrument per IEST-RP-CC013 and TEC Services' SOP's.

INSTRUMENT DATA

		As Found	Final	Mfg. Tolerances		As Found	Final	Mfg. Tolerances
Straylight	(3)	.0011%	.0008%	Not Applicable	U4-3	(1)	-12.01	-12.01
Sample Flow	(1)	27.1	27.3	28.3 ± 2.8 SLPM	U8-1	(1)	12.11	12.11
0.001%	(1)	.80 x 10 ⁻¹⁰	.80 x 10 ⁻¹⁰	.80 ± .04 x 10 ⁻¹⁰ *	U12-6	(1)	5.00	5.00
0.01%	(1)	.80 x 10 ⁻⁹	.80 x 10 ⁻⁹	.80 ± .04 x 10 ⁻⁹ *	U13-1	(1)	9.85	9.85
0.1%	(1)	.80 x 10 ⁻⁸	.80 x 10 ⁻⁸	.80 ± .04 x 10 ⁻⁸ *	J6-Wh	(1)	296	296
1.0%	(1)	.80 x 10 ⁻⁷	.80 x 10 ⁻⁷	.80 ± .04 x 10 ⁻⁷ *	J9-1	(1)	5.07	5.07
10%	(1)	.80 x 10 ⁻⁶	.80 x 10 ⁻⁶	.80 ± .04 x 10 ⁻⁶ *	J9-5	(1)	14.98	14.98
100%	(1)	.80 x 10 ⁻⁵	.80 x 10 ⁻⁵	.80 ± .04 x 10 ⁻⁵ *	J9-6	(1)	-14.99	-14.99

(1) In Tolerance (2) Out of Tolerance (3) No effect on instrument operation (N/A) Not Applicable * Amperes

Received in Tolerance: ☒ Yes ☐ No ☐ Not Operable ☐ Tolerance Not Applicable

Calibrated for: ☒ PAO ☒ DOP

Temperature: 21.4 °C Relative Humidity: 37.0 %

MAINTENANCE PERFORMED

☒ Clean / Rebuild Chamber
☒ Check Wiring & Hardware

☒ Realign Optics
☐ Replace Gaskets

☒ Flush Hoses
☐ Replace Cell Lamp

Notes:

FINAL VERIFICATION PERFORMED

☒ Leak Test Sampling System
☒ Verify Max Gain Stability

☒ Test Scanning Probe
☒ Performance Test

☒ Perform Voltage Check

NIST TRACEABLE EQUIPMENT USED

Description	Model	Serial #	Certificate #	Cal Date	Due Date
Picoampere Source	Keithley 6220	1272482	2409265-1	24 MAR 25	24 MAR 26
Digital Multimeter	Fluke 87-V	67030001	U540637-00-01	14 MAR 25	14 MAR 26
Thermohygrometer	Extech 445715	CP244467	1756326	17 MAY 24	17 MAY 25
Flowmeter	TSI 4043	40431911011	N/A	03 OCT 24	03 OCT 25

Calibrated per Procedure:

☒ TEC001 ☒ TEC002 ☐ TEC003 ☐ TEC004 ☒ TEC005
☒ TEC006 ☒ TEC007 ☒ TEC008 ☒ TEC009 ☐ TEC010

CALIBRATION BY:

Philip Bon

DATE: 4/10/25

DUE DATE: 4/10/26

Beckman Coulter 3445
Serial Number 1608538042
Calibration Report



CERTIFICATE OF CALIBRATION

Beckman Coulter certifies that the calibration performed complies with the requirements of ISO 21501 in whole or in part, as requested by the customer. This certifies that the reported sizes in the calibration information section are accurate to +/- 10%.

The accuracy of the standards & equipment used for the calibration are traceable to the US National Institute of Standards and Technology (NIST). A record of all work performed by Beckman Coulter is compliant with ISO 9001. This certificate may not be reproduced other than in full. Calibration certificates without a watermark & an authorized signature are not valid.

General Information

Calibration Lab

Beckman Coulter
4510 Byrd Drive
Loveland, CO 80538

Customer Name

CERTIFIED AIR SOLUTIONS
234 EGYPT RD
NORRISTOWN, PA, 19403

JAMES FLANNERY

Instrument Information

Counter Model 3445
Part Number 2088900-32
Counter Serial 1608538042
Sensor Model AIR
Sensor Serial 081516A104
Procedure WI-2170

Station ID 01 Svc Air 2
Calibration Date 2024-Oct-07
Calibration Due 2025-Oct-07
RA Number CA-07093993

Temperature 23.0 °C
Relative Humidity 28.0 %
Pressure 84.6 kPa
Nominal Flow 100.0 LPM
Laser Current 57.4 mA
(Reference Only)

Performance Information

Test Name	Test Result	Criteria	Pass/Fail
ISO-21501 Flow	100 LPM	±5%	Pass
Noise	32.5 mV	Reference Only	N/A
Peak to Valley	2:1	N/A	N/A
False Count Rate	0.0 particles in 1 m ³	2.0 particles in 1 m ³	Pass

Calibration Equipment

Type	Model	Serial	Cal Due Date
PHA	Core Counter PHA	1612418003	2025-Feb-28
Thermometer	Vaisala HMP75	F2610016	2024-Oct-31
Pressure	4043	40432247013	2024-Oct-23
DMM	FLUKE 8808A	9597099	2025-Mar-18
Flow Meter	TSI 4045	40451639002	2025-Jun-21

Calibration Information

Channel	Size (µm)	Calibrated (mV)	Threshold (mV)	Particle Size (µm)	Mfg	Lot Number	Expiration Date
1	0.5	228.0	226.46	0.51	THERMO	274149	2026-Nov-30
2	1.0	307.8	309.1	0.994	Thermo	258865	2025-Sep-30
3	2.0	549.31	545.43	2.02	Thermo	256960	2025-Aug-31
4	3.0	715.33	715.69	2.998	Thermo	264186	2026-Feb-26
5	5.0	1141.35	1149.82	4.973	Thermo	265485	2026-May-31
6	10.0	3632.8	3632.8	10.0	Thermo	268321	2026-Jun-30

Standard Calibration
1608538042.10.07.2024

Reproduction of this Certificate except in full is strictly forbidden without the written approval of Beckman Coulter

Service Center Engineer : Paul Noyes

Vailala HMP110
Serial Number M2910217
Calibration Report



Certificate of Calibration

SR No: CA-07093990
Model: HMP110 (2088928)
Serial No: SN-M2910217

Calibration Date: 10/8/24
In-Service Date: _____
Next Cal (12 mo): 10/8/25

Rm Temp: 22.0
Rm % RH: 30.0%

Calibration has been accomplished using fixed humidity points & temperature comparison with a standard. Uncertainty for the RH calibration is approximately 0.7% & uncertainty for the temperature calibration is approximately 0.2 deg F. The accuracy of the standards used are traceable to NIST, or derived from natural physical constants. A record of all work performed is maintained by Beckman Coulter. This calibration is compliant to ANSI/ISO/ASQ Q9001:2008. Under normal operating conditions, this instrument can be expected to remain within specification for a period of at least 12 months. Beckman Coulter is ISO 9001:2008 compliant.

Specifications:

Relative Humidity (RH): 0% to 90%, $\pm 2.0\%$
90% to 100%, $\pm 2.5\%$

Temperature: 0° C to 40° C, $\pm 0.2^\circ$ C

As Received: Within Specifications

Relative Humidity Calibration:

Bath		UUT					
Type	Standard	As Rcvd	Tolerance	Pass/Fail	Adjusted	Tolerance	Pass/Fail
LiCl	11.3	11.1	2.0	Pass	11.3	0.2	Pass
NaCl	75.0	75.6	2.0	Pass	75.3	1.5	Pass
MgCl ₂	33.0	Reference - Measured Value			33.3	0.7	Pass

Temperature Verification:

As Received:

Standard (deg C)	UUT (deg C)	Tolerance (deg C)	Pass/Fail
22.0	22.0	0.2	Pass

As Adjusted:

Standard (deg C)	UUT (deg C)	Tolerance (deg C)	Pass/Fail
22.0	22	0.2	Pass

Calibration Procedure: WI-2179 Vaisala HMP60/110 Calibration Procedure

LiCl Bath: LiCl V371
NaCl Bath: NaCl V304
MgCl₂ Bath: MgCl₂ V303
Standard Temp Probe: F2610016

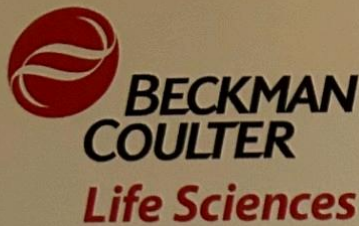
Due: 10/26/24
Due: 10/26/24
Due: 10/26/24
Due: 10/31/24

Signature: 

Date: 10/8/24

Reproduction of this Certificate, except in full, is strictly forbidden without written permission from Beckman Coulter.

**Beckman Coulter 3445+ Serial
Number C38687-2023350319
Calibration Report**



Certificate of Calibration

Beckman Coulter certifies that the calibration performed complies with the requirements of ISO 21501-4:2018(E) standard, as requested by the customer. The reported As-Calibrated uncertainties with a confidence level of 95% are $\pm 5.8\%$ related to size accuracy, $\pm 2.4\%$ related to flow rate, $\pm 2.8\%$ related to size resolution, $\pm 7.4\%$ related to 50% counting efficiency and $\pm 5.8\%$ related to 100% counting efficiency, respectively.

The accuracy of the standards and equipment used for calibration are traceable to the US National Institute of Standards and Technology (NIST). A record of all work performed is maintained by Beckman Coulter, as ISO 9001 certified company. This certificate may not be reproduced other than in full. Calibration certificates without a watermark and an authorized signature are not valid.

General Information

Manufacturer

Beckman Coulter
Building 4
No. 218 Sangtian Street, Suzhou Industrial Park
China

Lab Contact Information

Sarah Earl
Service Center Engineer

Beckman Coulter Life Sciences
4510 Byrd Drive
Loveland, CO 80538
USA

Customer Contact Information

JAMES FLANNERY

CERTIFIED AIR SOLUTIONS
234 EGYPT RD
NORRISTOWN, PA 19403
USA

Instrument Information

Counter Model 3445+
Part Number C36096
Counter Serial C38687-2023350319
Sensor Serial 08232023V0718
Procedure DMR-00106

Calibration Date 2024-09-04
Calibration Due 2025-09-04
RA Number CA-07094001

Temperature 23.5°C
Relative Humidity 35.0%
Pressure 84.9kPa
Nominal Flow 100.0L/min
Initial Laser Current 69.0mA @ 23.0°C
Laser Current (Reference Only) 69.0mA

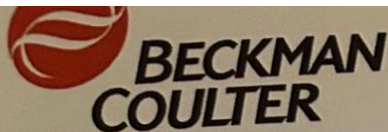
ISO-21501-4:2018(E) Calibration
C38687-2023350319.09.04.2024

Reproduction of this Certificate except in full is strictly forbidden without the written approval of Beckman Coulter

Authorizing Signature

Service Center Engineer: Sarah Earl

Vailala HMP110
Serial Number V0910854
Calibration Report



Certificate of Calibration

SR No: 07094003
 Model: HMP110 (2088928)
 Serial No: V0910854

Calibration Date: 9/4/24
 In-Service Date: N/A
 Next Cal (12 mo): 9/4/25

Rm Temp: 23.5
 Rm % RH: 34.0%

Calibration has been accomplished using fixed humidity points & temperature comparison with a standard. Uncertainty for the RH calibration is approximately 0.7% & uncertainty for the temperature calibration is approximately 0.2 deg F. The accuracy of the standards used are traceable to NIST, or derived from natural physical constants. A record of all work performed is maintained by Beckman Coulter. This calibration is compliant to ANSI/ISO/ASQ Q9001:2008. Under normal operating conditions, this instrument can be expected to remain within specification for a period of at least 12 months. Beckman Coulter is ISO 9001:2008 compliant.

Specifications:

Relative Humidity (RH): 0% to 90%, $\pm 2.0\%$
 90% to 100%, $\pm 2.5\%$

Temperature: 0° C to 40° C, $\pm 0.2^\circ$ C

As Received: Within Specifications

Relative Humidity Calibration:

Bath		UUT					
Type	Standard (% RH)	As Rcvd (% RH)	Tolerance (+/-)	Pass/Fail	Adjusted (% RH)	Tolerance (+/-)	Pass/Fail
LiCl	11.3	11.2	0.2	Pass	11.3	0.2	Pass
NaCl	75.3	74.4	1.5	Pass	75.3	1.5	Pass
MgCl ₂	33.0	Reference - Measured Value			33.4	0.7	Pass

Temperature Verification:

As Received:

Standard (deg C)	UUT (deg C)	Tolerance (deg C)	Pass/Fail
23.5	23.6	0.2	Pass

As Adjusted:

Standard (deg C)	UUT (deg C)	Tolerance (deg C)	Pass/Fail
23.5	23.5	0.2	Pass

Calibration Procedure:

WI-2179 Vaisala HMP60/110 Calibration Procedure

LiCl Bath: LiCl V371
 NaCl Bath: NaCl V304
 MgCl₂ Bath: MgCl₂ V303
 Standard Temp Probe: F2610016

Due: 10/26/24
 Due: 10/26/24
 Due: 10/26/24
 Due: 10/31/24

Signature: 

Date: 9/4/24

Reproduction of this Certificate, except in full, is strictly forbidden without written permission from Beckman Coulter.

Form: # Bec123