Mini-environment Certification
&
Test Procedure

Airtek Environmental Solutions, Inc.
21701 Stevens Creek Blvd.
Number 1105
Cupertino, CA 95015

Email: info@airtekenvironmentalsolutions.com

1 Objective

This document describes the specification and qualification procedure for Mini-environments. The procedure is intended to qualify the performance of Mini-environments in terms of contamination control. Test procedures for airflow inside the mini-environment, pressure differential between the mini-environment and the ambient cleanroom, airborne particle count, and flow visualization are described.

2 General recommended Specification

The following mini-environment specifications are recommended by Airtek for most process tools. However, for some process tools, those specifications are not applicable. Therefore, it is recommended to understand the process and it's exhaust to determine the optimal operating conditions of the mini-environment. The mini-environment specifications are based on safety, wafer contamination, cross contamination, total isolation, and fab contamination.

3 Measurement Equipment and Responsibilities

Airtek, Inc. prefers to utilize the calibrated measurement equipment provided by the customer such as airborne particle counters, airflow velocity and static pressure measurement instrumentation. If the customer can not provide the calibrated measurement equipment, Airtek, Inc. will be responsible to provide the necessary measurement equipment.
All tests shall be performed jointly by Airtek engineers and a customer representative assigned from the installation site.
Velocity, static pressure and airborne particle measurements will be performed by Airtek on individual tools after installation of the complete System.
Upon successful completion of all the tests, the customer will sign off the system
Certification is done to Airtek, Inc. mini-environment design and specification unless customer requests otherwise.

4 Visual Inspection

A visual inspection of the enclosure and air systems will be conducted to evaluate system quality and to ensure that the enclosure and supply air systems meet all design parameters outlined in the applicable Mini-environment enclosure specification.

The following checklist will be used as a guide for inspection, but is not necessarily all-inclusive. The system must meet all design parameters and specifications.
Check frame and panel for finish integrity, smoothness, scratches and defects.
Verify that materials used are as specified.
Check component joints, connections and corners for strength, integrity, tightness and smoothness.
Check smoothness of operation and seals on doors, hinges, latches and removable panels.

Verify the ability to, and ease of adjustment of relief grilles to control enclosure air balance and pressurization.
Verify maintenance accessibility, fan-motor change time, and any building or tool interferences.
Verify all system dimensions with submittal drawings and verify all required building clearances.
Check any structural connections to building.
Verify facility service connections and their clearances with the enclosure, including makeup air supply.
Verify that all of the electrical wiring and connects are shown in approved shop drawings, and meet all applicable building standards and safety requirements.
Check all seals and leak potential around the filter and duct connections.
Verify that all filters have been bench-checked prior to installation.
Verify enclosure lighting meets requirements and is operational.

5 Air Velocity Test:

5.1 Equipment:

The velocity of air movement in the enclosure will be measured using a Shortridge ADM 870, Solomat MPM4000 or customer approved equivalent.

5.2 Testing Procedure:

The enclosure will be divided into the grids not more than 2ft square. At the center of each grid the velocity of the airflow will be measured 6" below the filter for a minimum of 5 seconds with the average reading recorded.
Measurements done with a hot wire or anemometer shall be done using a suitable stand so that the probe is supported perpendicular to the airflow.

5.3 Reporting:

All readings will be recorded on a plan of the enclosure with the grids identified on it.
Compute the average of all velocity readings taken within the enclosure or within sections of the enclosure when more than one enclosure velocity is specified.
Calculate the relative standard deviation for the velocities. This is done by dividing the standard deviation of the samples taken in the enclosure or specific section of the enclosure by the average velocity for that area.

5.4 Acceptance:

All values measured must be within ± 5 % of any set point condition (FPM)
Specified in applicable Mini-environment enclosure specification or as indicated on Customer- approved design submittals.

The relative standard deviation of the velocity measurements shall not exceed 15%, or that value specified in applicable Mini-environment enclosure specification.

6 Static Pressure Test:

6.1 Equipment:

Enclosure pressure conditions will be measured using a Shortridge ADM 870, Solomat MPM 4000, a 4-20μA pressure transducer with time based recorder, or customer approved equivalent static pressure device.

6.2 Testing procedure:

The enclosure will be divided into a minimum of four different regions. Each region will be measured to determine overpressure.
The high pressure indicator tube from the static pressure device will be placed in each region. The corresponding low pressure indicator tube from that device will be placed outside the enclosure. Readings will be taken and recorded for each region with all enclosure doors closed.
An access door for the enclosure will be opened, and the high pressure indicator tube from the static pressure device will be placed in one of the regions determined in section 5. The corresponding low pressure indicator tube from that device will be placed outside the enclosure and measurements will be recorded. Similarly, testing will be repeated, and data will be recorded for access doors in each region, and for every combination of doors (two or more) that are required to be opened for normal system operation, maintenance or operator assistance.

6.3 Reporting:

The average reading will be recorded for the pressure differential between each enclosure region and the surrounding area. For testing with the enclosure door(s) open, the average pressure differential and the specific door (or combination of doors) open during the test will be recorded.

6.4 Acceptance:

The overpressure conditions of the enclosure relative to the surrounding area shall be within the range specified in the applicable Mini-environment enclosure specification or as approved in advance by Customer.
The overpressure conditions of the enclosure relative to the surrounding area with a door (or combination of doors) open shall be with the range specified in the applicable Mini-environment enclosure specification or as approved in advance by Customer.

7 Installed Filter Test

7.1 Equipment:

Performance of installed filters in the Mini-environment system shall be verified using an upstream challenge of a 0.18μm PSL (polystyrene latex spheres).
Aerosol measurements shall be made using a laser particle counter having a sensitivity of at least 0.2μm and drawing 1cfm of air.

7.2 Testing Procedure:

All testing will be conducted after the filter has been balanced and certified for flow uniformity by the enclosure supplier.
The test will begin by establishing the particle count in the plenum upstream of the filters. This testing should be done in a manner, which prevents damage to the laser particle counter (i.e. reduced time and/or reduced flow counter).
The filter will be tested at the design velocity for that area of the enclosure. Testing will be done by scanning with a particle counting probe passed over the entire face of the filter in overlapping strokes. Separate passes shall also be made around the periphery of the filter and along the seal between the filter and the holding frame.
The probe shall be held 1" from the face of the area being tested and traversed at no more than 10 FPM.
If any penetrations on the discharge side of the filter, around the ceiling grid, or in any part of the enclosure from the supply air side of the plenum are greater than 0.001% of that in the plenum it constitutes a leak.
All filters, ceiling grids or areas found to have leaks shall be corrected, replaced and re-tested at no cost to customer.
Patching or sealing filters is not an acceptable means for correcting leakage.

7.3 Reporting:

All filters shall be identified and labeled on a plan view of the enclosure.
All failures or indication of high counts shall be recorded and identified by appropriate filter label or grid location. All corrective action done to the filter or framework shall be recorded.

7.4 Acceptance:

All filters and framework serving the enclosure shall meet by-pass requirements before the system can be accepted.

8 Airborne Particle Count Test:

8.1 Equipment:

Aerosol measurements shall be made using a laser particle counter having a counting efficiency of at least 90% at a sensitivity of 0.1μm (or smaller), and drawing 1cfm of air. During testing, the particle counter sampling cone shall be mounted on an appropriate stand inside the enclosure.

8.2 Testing Procedure:

The contamination control performance of the complete Mini-environment system will be tested by measuring internal airborne particle counts with the tool and any automated equipment
I/O in a static (non operating) mode.
Sampling locations shall be as specified in appropriate Mini-environment enclosure specification or as indicated in Customer – approved design submittals.
Readings shall be used to calculate the average particles per cubic foot of air measured (This is based on the sensor flow rate) at each location specified.

8.3 Reporting:

On a plan view of the enclosure, identify each location sampled. Locations shall be identified by the distance from a fixed reference point on the tool or enclosure, and by the distance above the work surface directly below the counter.
The following information shall be recorded for each sample location: particle size measured, equipment used (including sensor flow rate), test time, average particle per cubic foot of air measured, and any comments or special information regarding the test.
The following information shall be calculated and recorded for the enclosure (or region of the enclosure for those systems having divided areas): particle size measured, mean value for the sample locations, standard deviation of the sample locations, 95% confidence interval for the sample mean of the test locations.

8.4 Acceptance:

All individual sample locations shall have particle counts less than or equal to those specified in applicable Customer Mini-environment enclosure specifications, or as indicated in LSI – approved design submittals.
The mean of all the sample locations shall be less than that specified for the enclosure (or area of the enclosure) in applicable LSI Mini-environment enclosure specification with a 95% confidence limit.
All corrections required to bring the system into specification shall be completed and the system re-tested before the enclosure can be accepted.

9 Noise level Test

9.1 Equipment:

Measurements will be made with a GenRad, or equivalent, sound level meter.
The purpose of this test is to establish airborne sound pressure levels produced by the operating Mini-environment enclosure and air systems.
Measurements shall be taken in at least five (5) locations surrounding the enclosure at a height between 4 and 6 ft. off the floor. One of these locations shall be in a condition where the measurements are taken in front of an open enclosure door.
The sound pressure level shall be measured at each location for the following
Bands (in Hertz): 63, 125, 250, 500, 1000, 2000, 4000, 8000.
During the testing, an attempt should be made to minimize noise interference from surrounding equipment.
Record of all measurements taken at each grid location. Plot the readings for each band on a noise criteria (NC) curve and determine the minimum NC measurement from the maximum readings for all octave bands.

9.2 Acceptance:

All noise level readings shall be equal to or below NC55 (in absence of background noises) unless otherwise specified in applicable Customer Mini-environment enclosure specification.