

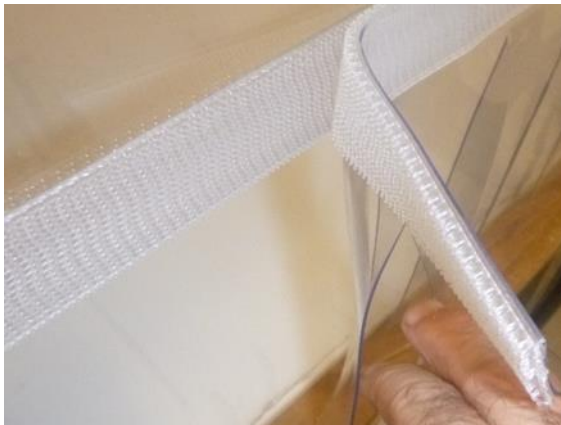
This document will supply a basic understanding of three test methods intended to determine the efficacy of a positive pressure hood. This document contains the testing method recommend by the manufacturer Sentry Air Systems for positive pressure hoods. The material herein is intended to supplement local practices and is not intended to replace training required in order to maintain regulatory compliance.

1. Filter Integrity Testing
2. ISO Class 5 Cleanroom
3. Dynamic Smoke Study

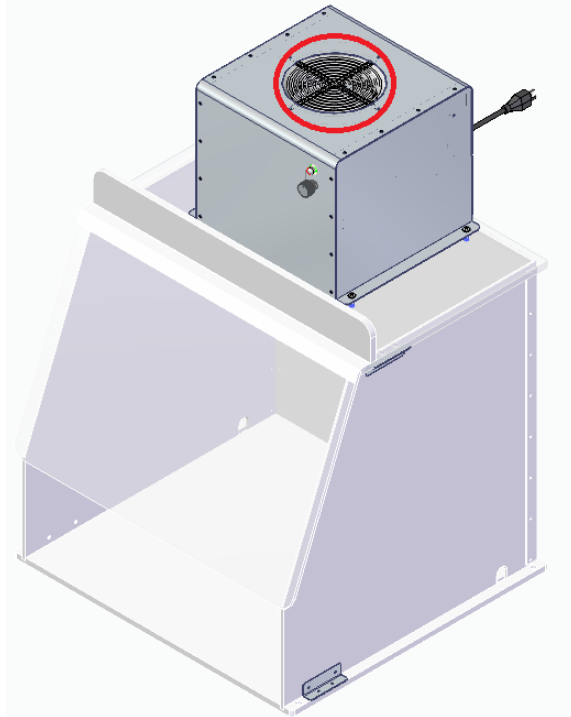
1. Filter Integrity Testing

Filter Integrity Testing is accomplished by determining the percentage of a dispersed material that passes through a filter. Common test particulate aerosol materials include a Dispersed Oil Particulate (DOP) or Poly Alpha Olefin (PAO). During testing a known concentration is injected into the airstream; by testing the total particulate aerosol downstream, the effective percentage of filtration may be determined. Refer to ISO 14664-3, your aerosol generator, and photometer instructions for more specific information.

1. Remove the curtains of the unit in order to test for air volume. Air volume for your unit may vary depending on the hood and how long the filter has been in use.



2. Adjust the filter fan unit to maximum speed prior to beginning testing. Allow the unit to run for a minimum of two minutes at maximum velocity prior to beginning testing. The aerosol producing equipment should be placed at the air intake of the unit.



PAO is the most common aerosol used during filter integrity testing. Properly calibrate PAO aerosol generating equipment such that the upstream concentration presents 10-80 micrograms per liter (or mg/ m³) according to ISO 14644-3 Annex B based on the formula shown below. PAO-4 should be applied with an aerosol reagent nozzle pressure of 23 PSI. Refer to instructions for your aerosol generator to determine the amount of aerosol generated. (Note that in most cases, four “Jet Control” will equal one Laskin nozzle. Refer to your unit’s documentation.)

Determine total upstream concentration using the number of Laskin nozzles in the PAO aerosol generator and the air volume of your filtration unit. The formula below will determine the aerosol concentration in (micrograms per liter) or (mg/m³).

$$\frac{13,500 * (\# \text{ of Laskin Nozzles})}{\text{Total Airflow (CFM)}} = \text{Aerosol Concentration}$$

Example: A PAO aerosol generating equipment with one Laskin Nozzle is attached to an air filtration unit having a total airflow of 220 CFM. Calculate the aerosol concentration as follows:

$$\frac{13,500 * 1}{220} = 61 \text{ (mg/m}^3\text{)}$$

3. Input the upstream PAO aerosol concentration into the photometer (PAO sensing equipment). Pass the probe of the PAO sensing equipment over the area of the filter at a distance of 3 cm from the filter face and at the ISO recommended speed. The ISO recommended speed is 15 divided by the width of test probe (cm) per second. For example, for a test probe width of 5 cm, move the test probe at a rate of 3 cm/sec. If an area shows an increase in PAO, stop and record the maximum concentration that occurs during testing.



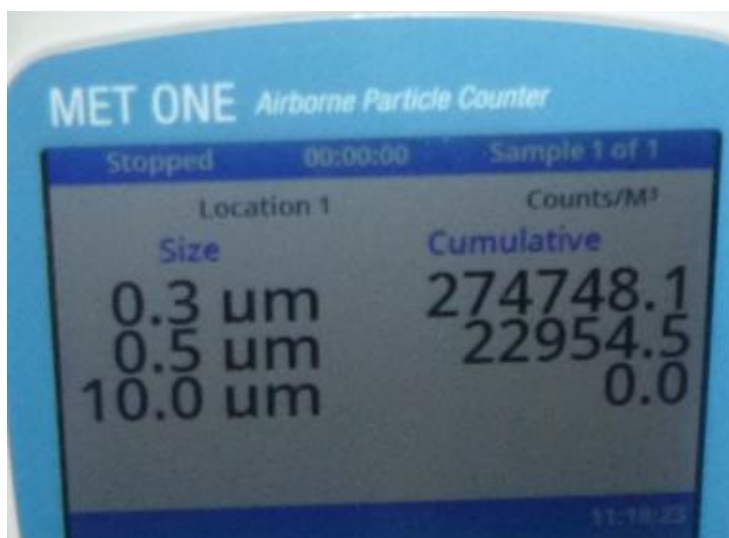
In general, PAO sensing equipment will display the percentage of material that has passed through the filtration equipment. Subtract the maximum concentration from 100 in order to determine the effective percentage of the filtration system. For example, a PAO sensor displaying “.03” would demonstrate a filtration system being 99.97% effective.

2. ISO Class 5 Cleanroom

ISO 14644 is the international standard used to determine proper operation of a clean room environment. A minimum standard of air quality must be maintained in order to meet a specific ISO classification. For example, in order for a hood to meet an ISO Class 5 according to ISO 14644, the hood must maintain less than 3,520 particles larger than 0.5 microns per cubic meter.

Selected airborne particulate cleanliness classes						
ISO 14644-1:2015 Classification Number (N)	Maximum concentration limits (particles/m ³)					
	0.1 μm	0.2 μm	0.3 μm	0.5 μm	1.0 μm	5.0 μm
ISO Class 1	10					
ISO Class 2	100	24	10			
ISO Class 3	1 000	237	102	35		
ISO Class 4	10 000	2 370	1 020	352	83	
ISO Class 5	100 000	23 700	10 200	3 520	832	
ISO Class 6	1 000 000	237 000	102 000	35 200	8 320	298
ISO Class 7				352 000	83 200	2 930
ISO Class 8				3 520 000	832 000	29 300
ISO Class 9				35 200 000	8 320 000	293 000

An example is shown below of a measuring device measuring 22954 particles per m³ at a size of .5 microns. This would exceed the limit of 3520 particles per m³ of an ISO Class 5 and would not qualify as an ISO Class 5 cleanroom according to ISO 14644.



ISO 14644 requires a single test for an area less than 2 m² such as positive pressure hoods supplied by SAS. Testing in at least the four corners will help to determine if there are any areas of concern and is recommended by SAS.

3. Dynamic Smoke Study

Dynamic Smoke Study (DSS)(also known as flow visualization) is used demonstrate laminar outward flow with no refluxing or dead spot in the behavior of the airflow exiting a positive pressure hood. A smoke test may help to determine the reason that a hood is failing to meet a specific ISO Classification. Non-laminar flow may cause eddy currents in turbulent airflow which will result in ambient air entering a cleanroom environment.

1. Turn on the filtration unit to its highest speed. Leave anything that will be used during normal operation (such as beakers or test equipment) inside the hood at its current location.
2. Remove a single set of curtains (a set of curtains will consist of 5 curtain flaps) or pull up a set of curtains out of the way.



3. Use a glycol-base smoke generator or chemical smoke tube that is neutrally buoyant to create smoke parallel to the open face of the hood. Move the smoke generating equipment over the exposed area slowly, noting the direction as smoke exits the hood.



4. Replace the curtains that were removed and repeat steps two and three for the entire hood.

In all cases, smoke should be leaving the hood in a unified single direction. If smoke is billowing or is “curling back towards” the hood, consider moving objects inside the hood that may be interrupting a distinct unidirectional laminar flow out of the hood; this may be especially applicable to large objects placed near the front edge of the hood.