

AirTrap® Lab Guide



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Section 1 — Scope and Intended Use

This guide is written for laboratories receiving AirTrap® Mini and AirTrap® XL sampling cassettes. It covers receiving and inspecting samples, opening the cassette, slide preparation, stains, microscopic examination, particle-concentration calculations, and counting guidelines. Field sampling procedures are in the AirTrap Mini User Guide and are not repeated here.

The AirTrap is a single-use, slit-impaction air sampling cassette for the collection and quantitative analysis of a wide range of airborne particulates, both biological and non-biological: mold and other fungal spores, fungal fragments, pollen grains, insect parts, dust mites, skin cells, fibers, dander, construction dust, combustion particles, corrosion particles, and more. Each cassette is intended for single use to maintain data integrity.

The AirTrap Mini and AirTrap XL share the same collection chamber, slit geometry, and airflow characteristics as each other and as the industry-standard slit-impaction cassette. They are analyzed identically. The only difference a laboratory will notice is how the cassette body is opened (Section 4).

Section 2 — Principle of Operation

The AirTrap uses inertial impaction. Air is drawn through the cassette at an optimal calibrated flow rate of 15 liters per minute (lpm), accelerated through a tapered inlet and slit impacting onto an enclosed glass slide coated with a clear adhesive collection media. The resulting rectangular deposition trace on the slide is determined by the slit length and width with particle deposition width varying slightly with increasing particle loading.

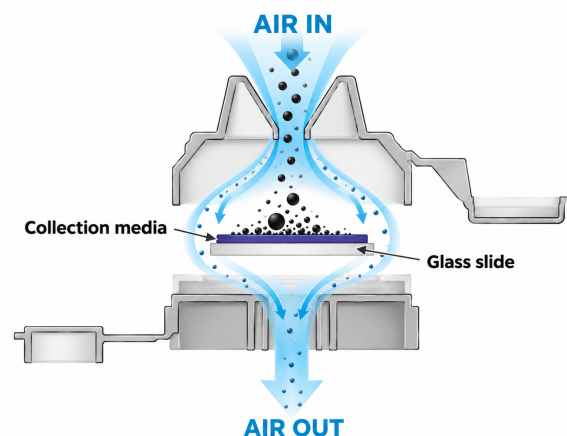


Figure 1. Airflow through the cassette. Particles impact the collection media while the air turns and exits through the base.

At 15 lpm the particle deposition trace is approximately 1.1 mm wide by 14.5 mm long, an area of about 15.95 mm². Because the particle deposition trace width varies with dust loading, the volumetric concentration is most accurately calculated by proportionally using the trace length, the microscopic field diameter, and the number of microscopical perpendicular transects or passes counted across the width of the deposition area.

Section 3 — Receiving and Inspecting Samples

1. Check each cassette against the chain-of-custody form: sample ID, location, date, flow rate, and sampling time. Query the submitter about any missing sampling time or flow rate before analysis, because both are needed for the concentration calculation.
2. Confirm both the inlet and outlet caps are snapped closed. A cassette that arrives with a cap open should be noted on the chain of custody and reported to the submitter.
3. Turn the cassette over and look through the translucent body for two black lines. If both lines are intact, the glass slide is intact. Record any broken or missing line, cracked housing, or expired date; report defects to AirTrap Technical Support with the lot and serial number from the packaging.
4. Check the expiration date printed on the cassette (a month-year date means the last day of that month) and note any expired cassette on the chain of custody.
5. Store cassettes flat at room temperature, 60–82°F (15–28°C) and 40–60% relative humidity, until analysis.

For handling and storage detail, see the AirTrap Product Care Guide (AT-PCG-001).

Section 4 — Opening the Cassette

AirTrap cassettes are opened only in the laboratory. The AirTrap Mini and AirTrap XL open differently.

AirTrap Mini

The AirTrap Mini unscrews. Orientation matters, so follow the steps in order:

1. Turn the AirTrap Mini upside down, so the inlet port faces down and the outlet faces up.
2. Hold the cassette by the inlet port.
3. Unscrew the body of the cassette from the inlet port.
4. Lifting the body away reveals the glass slide, with the adhesive collection media facing down. Handle the slide by its edges only and never touch the media.

Important Note: Always open the Mini upside-down. Opening right-side up risks the slide falling out.

AirTrap Mini Benchtop Prep Jig. We designed a benchtop jig specifically for the AirTrap Mini to make opening cassettes and preparing slides on the bench easier and more consistent. The jig holds the cassette upside down in the correct orientation while you unscrew the body, so the slide is presented ready for staining. Laboratories processing more than a few cassettes a day will find it pays for itself quickly. Product code 3520 (pack of 5); see Section 10.

AirTrap XL

1. Peel off the perimeter sealing band.
2. Lift the body away and carefully remove the glass slide containing the sample trace, handling it by the edges only.

Section 5 — Slide Preparation

Materials

- Clean, pre-labeled microscope slide, 75 mm × 25 mm
- Cover slip
- Staining or mounting media (AirTrap Stain, product code 3530, or lactophenol cotton blue; see Section 6)
- Tissue wipes or cotton swabs

Procedure

1. Place 1–2 drops of staining solution in the center of the clean, pre-labeled microscope slide.
2. Open the cassette (Section 4) and remove the AirTrap glass slide, media side down.
3. Slowly lower the AirTrap slide at an angle, media side down, onto the staining solution so the stain wets the trace without trapping air.
4. Do not press down on the slide during or after staining.
5. Wait 10 minutes.
6. Remove excess staining solution from around the edges with a tissue wipe or cotton swab to ensure even staining.

Note: The AirTrap Mini slide can also be mounted media side up: secure it to the microscope slide with a drop of clear nail polish (or water if immediate analysis is performed), place a couple of drops of stain on the media, and place a 22 x22mm cover slip onto the preparation.

Section 6 — About Stains

Various stains and coupling agents can be used, including AirTrap Stain and lactophenol cotton blue (LPCB). Important: Most commercially available mold stains (primarily lactophenol cotton blue and Calberla's stains) are concentrated with alcohol, phenol, and lactic acid to produce rapid uptake and staining and prevent growth in direct bulk mold sample analysis. Without dilution, these stains can produce clouding of the impaction media, and/or generation of air bubbles when examining environmental samples containing carbonates or drywall dust.

The cotton blue stains can typically be diluted 10-fold with additional water and glycerin to make them suitable for analysis.

AirTrap Stain (product code 3530) is lactophenol cotton blue diluted with additional glycerin to enhance the clarity and observable time window of prepared slides.

NOTE: Calberla's stain does not work with the AirTrap collection media and should not be used.

Section 7 — Microscopic Examination

AirTrap samples are intended to be analyzed in accordance with ASTM D7391, Standard Test Method for Categorization and Quantification of Airborne Fungal Structures in an Inertial Impaction Sample by Optical Microscopy, as well as any applicable laboratory accreditation requirements and industry guidance. Analysis should be performed by an experienced microbiologist, aerobiologist, mycologist, or environmental microscopist.

Counting and quantification are performed on calibrated cross-sections (traverses) of the deposition trace. The number and type of particles per cubic meter of air are calculated from the length of the deposition trace, the portion of the trace examined, the volume of air sampled, and the number of particles counted.

One traverse is one complete cross-sectional pass across the full width of the deposition trace, and its length is defined by the calibrated diameter of the microscope field of view. Always examine the entire width of the trace on each traverse: particle density differs from the center of the trace to the outer edges, and the visible width varies with loading, so partial traverses bias the count.

Illustration of Counting Method

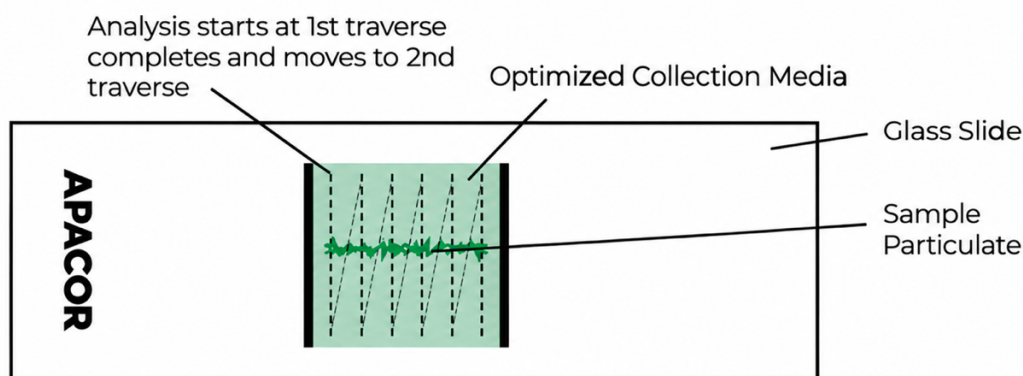


Figure 2. Counting method: traverses across the deposition trace.

Calibrating the Field of View

1. Measure the diameter of the microscope field of view with a stage micrometer at each magnification used for counting.
2. Calibrate each ocular and objective combination individually. Stated magnifications are often imprecise, and each microscope differs.
3. Record the field diameter in millimeters; it is used in Equation 2.

Section 8 — Calculating Particle Concentration

Particle concentration per cubic meter of air is calculated in three steps.

Step 1. Air volume sampled.

Equation 1 Air volume (m^3) = (flow rate in lpm $\div$ 1000) $\times$ sampling time in minutes

Step 2. Length of trace examined. Record the number of complete traverses counted. The calculation is always based on the fraction of the trace length examined, never on trace area or width, because the visible width of the trace changes with particle loading.

Equation 2 Trace length counted (mm) = field diameter (mm) $\times$ number of traverses

Step 3. Concentration.

Equation 3 Counts/ m^3 = [trace length (14.5 mm) $\div$ trace length counted (mm)] $\times$ [1 $\div$ air volume (m^3)] $\times$ particles counted

Equations 2 and 3 may be combined into a single expression if preferred; the result is identical.

Worked Example 1 — Mold Spores

Field diameter at 900x = 0.240 mm
 Traverses counted = 10
 Sample: 15 lpm for 10 minutes $\rightarrow$ air volume = (15 $\div$ 1000) $\times$ 10 = 0.150 m^3
 Mold spores counted = 50
 Trace length counted = 0.240 $\times$ 10 = 2.40 mm
 Concentration = (14.5 $\div$ 2.40) $\times$ (1 $\div$ 0.150) $\times$ 50 = 6.04 $\times$ 6.67 $\times$ 50 $\approx$ 2,000 spores/ m^3

Worked Example 2 — Pollen Grains

Field diameter at 200x = 1.11 mm
 Traverses counted = 10
 Sample: 15 lpm for 10 minutes $\rightarrow$ air volume = (15 $\div$ 1000) $\times$ 10 = 0.150 m^3
 Pollen grains counted = 25
 Trace length counted = 1.11 $\times$ 10 = 11.1 mm
 Concentration = (14.5 $\div$ 11.1) $\times$ (1 $\div$ 0.150) $\times$ 25 = 1.31 $\times$ 6.67 $\times$ 25 $\approx$ 218 grains/ m^3

Section 9 — Recommended Counting Guidelines

- **Pollen:** Examine the entire trace or up to 100 grains, whichever comes first, at a minimum magnification of 200x. Identify at 400x or higher.
- **Mold spores:** Examine at least 20% of the trace or 100 spores, whichever comes first. Identify at a minimum of 400x.
- **Fibers:** Examine the entire trace or up to 100 fibers, whichever comes first, at a minimum of 200x.
- **Other aerosols:** For skin cell fragments, combustion particles, insect parts, and similar, examine at least 10% of the trace or count a minimum of 100 particles, whichever comes first. At least 20% of the trace should be examined for mold spores when the 100-spore stopping rule described above has not been reached (or refer to ASTM D7391).

Overloading check: in an appropriately loaded sample, particle overlap should be minimal at 400x, with no more than about 50% of the center of the deposition trace occupied by particles. If a sample is overloaded, report it as such; a shorter-duration resample is the remedy.

Section 10 — Storage, Ordering, and Related Documents

Storage and Operating Conditions

- **Storage temperature and humidity:** Store at room temperature, between 60–82°F (15–28°C), and 40–60% relative humidity, flat, in a cool, dry place.
- **Shelf life:** Use by the expiration date printed on the cassette. A month-year date means the last day of that month.
- **Usage:** AirTrap cassettes are designed for one-time use only and are not reusable. The housing is #5 polypropylene and recyclable, so please recycle. Keep samples and stains out of reach of children and pets; avoid direct exposure to collected particulates.

Ordering Information

Product	Product code
AirTrap Mini (pk. 48)	350048
AirTrap Mini (pk. 10)	350048-10PK
AirTrap XL (pk. 24)	350024
AirTrap Mini Benchtop Prep Jig (pk. 5)	3520
AirTrap In-Wall Adapter (pk. 10)	3516
AirTrap In-Wall Adapter Starter Kit (Push Rod + pk. 10)	3516-ST
AirTrap Inlet Adapter (pk. 10)	3511
AirTrap Swabs (pk. 10)	3561

Product	Product code
AirTrap Flow Meter (Coming Soon)	350100
AirTrap Stain (pk. 5)	3530

Related Documents

- **AirTrap Mini User Guide (AT-UG-001):** Field sampling procedures, sampling times, and pump calibration. <http://airtrap.us/doc/mini-user-guide.pdf>
- **AirTrap Product Care Guide (AT-PCG-001):** Storage, handling, inspection, and shipping. <http://airtrap.us/docs/product-care-guide.pdf>
- **Engineering Position Statement (AT-EPS-001):** Why AirTrap requires no change to pump or calibration method. <http://airtrap.us/docs/engineering-statement.pdf>
- **Field Calibration Guide (AT-FCG-001):** Step-by-step pump calibration for common pump and calibrator combinations. <http://airtrap.us/docs/calibration-guide.pdf>
- **ASTM D7391:** Standard Test Method for Categorization and Quantification of Airborne Fungal Structures in an Inertial Impaction Sample by Optical Microscopy.

AirTrap.us Technical Support

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Got questions? Let us know. We're here to help.

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