



Operating Instructions

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SKC PMI Samplers



The patented* SKC single-stage Personal Modular Impactors (PMIs) are designed for the highly efficient collection of PM₁₀, PM_{2.5}, or PM Coarse_(10-2.5). The samplers are easy to use with a removable filter cassette and pre-oiled impaction disc. The 25-mm pre-oiled impaction disc mounts directly on top of the filter cassette and reduces particle bounce for high collection efficiency. A 25-mm filter may be used as an alternate impaction substrate for optional chemical analysis of particles. The PMI Coarse model includes a second filter cassette to allow collection of particles < 10 µm, but larger than 2.5 µm.

Performance Profile

Flow Rate:	3 L/min
50% Cut-point:	2.5 µm or 10 µm (model dependent)
Impaction Substrate:	25-mm pre-oiled disposable porous plastic disc; reduces particle bounce
Alternate Impaction Substrate:	25-mm filter material may be used for optional chemical analysis of larger particles
Final Collection Filter:	37-mm filter, select material based on application
Analysis:	Gravimetric and chemical
Impactor Material:	Inlet: Aluminum Exhaust: PVC Filter Cassette: Delrin® with stainless steel support screen O-rings: <i>Inlet</i> - PTFE <i>Exhaust</i> - BUNA-N
Dimensions:	2 in x 1 in (5.1 x 2.6 cm)
Weight:	2.5 oz (70.9 gm)
Tubing:	1/4-inch ID

* U.S. Patent No. 7,334,453

Principle of Operation

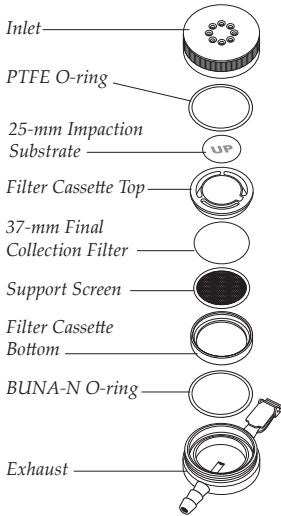


Figure 1. PMI 2.5 exploded

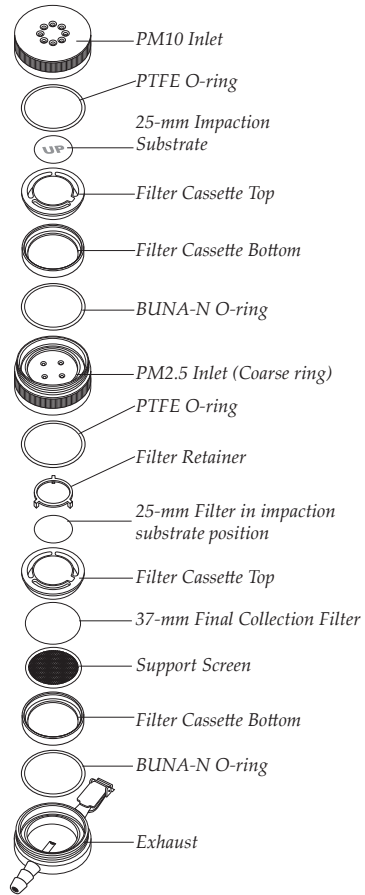


Figure 2. PMI Coarse exploded

Inertial impaction is employed to separate airborne particles according to their aerodynamic diameter. A sample pump draws particle-laden air at a flow rate of 3L/min through an inertial impactor to separate airborne particles according to their aerodynamic diameter. Particles enter the impactor through nozzles on top of the sampler. The nozzles are sized to operate at a 3 L/min flow rate causing airjets to impinge onto the impaction substrate positioned below the inlet nozzles. Particles larger than the sampler cut-point with enough inertia to cross the airstream lines impact on the impaction substrate. The airflow, containing smaller particles, makes a sharp turn, passes through the openings in the top of the filter cassette, and follows through to a 37-mm final collection filter inside a filter cassette where the smaller particles collect.

The top of the filter cassette accommodates the impaction substrate. For optimum impactor performance, a 25-mm oiled porous plastic disc is recommended as disposable impaction substrate. Alternatively, if chemical analysis of the particles is desired, a 25-mm filter may be used. To sample PM Coarse (PM_{10-2.5}), a Coarse Ring accessory can be added to a PMI 10 Sampler or a PMI Coarse Sampler may be selected (see *Ordering Information*). Additional impaction and collection media are required for PM Coarse sampling.

Media Preparation

Final Collection Filter: Equilibrate and pre-weigh filters in a clean environment according to appropriate procedures. Record the weight as the pre-sample weight.

Impaction Substrate: Ready-to-use pre-oiled disposable plastic impaction discs are available as SKC Cat. Nos. 225-355 (qty. 25) and 225-355A (qty. 50). Using an oiled impaction disc reduces particle bounce.

Alternate Impaction Substrate: 25-mm filters may be used if analysis of larger particles is desired.

Impactor Preparation

Cleaning

For optimum performance, the PMI Sampler should be cleaned after five runs or upon a noticeable buildup of material to remove oil buildup on the top of the filter cassette and other residue built up from frequent sampling. Disassemble the impactor and wash parts in water with a liquid detergent or soap. Rinse and air-dry all parts thoroughly in a clean environment.



Caution: Do not place any mechanical object in the inlet nozzles.

O-ring Care

Visually inspect the condition of BUNA-N O-rings (*see illustrations on page 2 for location of O-rings*). Ensure the O-ring surface is smooth (i.e., without cracks, cuts, or other damage). Ensure the O-ring is fitted properly in its channel. Replace the BUNA-N O-ring if there is apparent damage, stretching, or thinning. The PTFE O-rings are not user-replaceable.

Inserting a Final Collection Filter into the PMI Sampler

The PMI Sampler will arrive already assembled. Disassemble it to insert a final collection filter.



1

Unscrew inlet from exhaust.



2

Remove filter cassette.



3

Use the cassette opener accessory to open filter cassette.



4

Ensure the stainless steel support screen is in place in the bottom of filter cassette.



5

Using the forceps accessory, place a preweighed 37-mm filter on the support screen.



6

Press filter cassette top into filter cassette bottom.



7

Reinsert cassette into impactor.

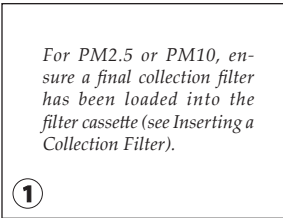
When sampling for PM Coarse using the Coarse Ring accessory or PMI Coarse Sampler, no final collection filter is inserted in the first filter cassette. Insert a 37-mm final collection filter into the second filter cassette. Proceed to Inserting Impaction Substrate into the PMI Sampler.

Technical Tidbit:

- Use the forceps accessory to carefully insert or remove the collection filter. See *Accessories for forceps*.

Inserting Impaction Substrate into the PMI Sampler

For PM_{2.5} or PM₁₀ sampling, insert an impaction substrate only after a final collection filter has been loaded into the filter cassette.



Place impaction disc or filter on top of filter cassette. The rough side of the impaction substrate should face up.



Screw impactor inlet and exhaust together just until tight and then further hand-tighten by 1/4-turn only.

! Keep sampler upright until the inlet is securely screwed onto the exhaust to prevent the impaction substrate from being dislodged.



When sampling for PM Coarse using the Coarse Ring accessory or PMI Coarse Sampler, insert an impaction disc onto the first filter cassette as directed in Step 2. Insert a 25-mm filter in the impaction substrate position on the second filter cassette. Secure with filter retainer (supplied with the Coarse Ring or the PMI Coarse Sampler). Place the filter cassette, Coarse Ring, and second filter cassette assembly on the exhaust and screw impactor inlet and exhaust together just until tight. Further, hand-tighten by 1/4 turn only.

Technical Tidbit:

- SKC recommends using a new impaction substrate for each sample period.

Calibration and Sampling



Note: As the particle load on the final filter increases during sampling, the pressure drop will also increase. Therefore, use a compensating sample pump such as the AirChek® XR5000.

Calibration

Calibrate pump flow rate with the PMI Sampler (loaded with final filter and impaction substrate) in line. *See pump and calibrator operating instructions.*

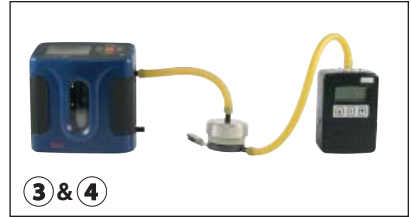
1. Ensure impactor is loaded and fully assembled (see *Inserting a Final Collection Filter into the PMI Sampler and Inserting Impaction Substrate into the PMI Sampler*).



2. Align calibration adapter with PMI inlet and press down until a firm seal is established.



3. Ensure pump has run for five minutes before calibrating. Using flexible tubing, connect the calibrator outlet (suction port) to the PMI calibration adapter inlet.



4. Using a second length of tubing, connect the PMI exhaust to the inlet of a sample pump.

5. Calibrate the sample pump to the specified flow rate. *See sample pump and calibrator operating instructions.*

6. When calibration is completed, remove the calibrator, tubing, and calibration adapter.

Sampling

1. If required, replace representative sample media used for calibration with new, pre-weighed media (*see Media Preparation*).
2. Use a length of Tygon® tubing to connect the PMI exhaust to the pump inlet.
3. Use the clip to attach the PMI Sampler to a worker's collar in the breathing zone.
4. Turn on pump and record sample start time and other pertinent data.
5. After the desired sample time has elapsed, turn off the pump and record sample stop time and other pertinent data.
6. Reinstall calibration train and verify flow rate (*see Calibration*).
7. Remove pump and tubing from the impactor.



Sample Removal, Shipping, and Analysis

Removing the Final Collection Filter and Impaction Substrate



1 Unscrew impactor inlet from exhaust.



2 Locate recessed area on filter cassette top and remove impaction substrate. If chemical analysis of larger particles is desired, place in appropriate container for shipping to a laboratory for analysis (see Accessories for Filter-Keeper).



3 Gently lift filter cassette from exhaust.



4 Use the cassette opener accessory to separate the two halves.



5 Use the forceps accessory to remove the final collection filter and place it in an appropriate container for shipping to a laboratory.

When sampling for PM Coarse using the Coarse Ring accessory or PMI Coarse Sampler, follow the instructions in Steps 1 through 5 for the second filter cassette only. Remove the two filters (one 25-mm filter for PM₁₀ and one 37-mm final filter for PM_{2.5}) from the second filter cassette, insert in separate containers, and ship to a laboratory for analysis. The impaction disc from the first filter cassette may be shipped to a laboratory for analysis if desired.

Shipping Samples

Package and transport samples and blanks in a manner that will prevent sample loss and contamination. See *Accessories for the Filter-Keeper for transporting samples*.

Analysis

Gravimetric and/or chemical by an accredited laboratory

Ordering Information

Description	Cat. No.
Personal Modular Impactor (PMI) includes impactor and filter cassette with support screen, <i>requires impaction substrate and collection media sold separately; see below</i>	
PM2.5 (gold)	225-352
PM10 (silver)	225-350
PM Coarse includes 2 filter cassettes and a filter retainer	225-351

Recommended Collection Filters	
Quartz Filters , 37 mm, Tissuquartz™, 432 µm thick, pk/25	225-1822
PTFE Filters , [†] 37 mm, 2.0-µm pore size, PTFE with PMP support ring, pk/50	225-1709
PTFE Filters , [†] 37 mm, 1.0-µm pore size, PTFE with laminated PTFE support, pk/50	225-2705

Recommended Impaction Substrate, <i>required for sampling. Limited shelf-life</i>		
Pre-oiled Porous Plastic Impaction Discs , [‡] 25 mm, ready to use,	pk/25	225-355
disposable	pk/50	225-355A

Accessories		
PM Coarse Ring includes filter cassette and filter retainer, adapts a PMI 10 to a PMI Coarse		225-3512
PMI Cassette Opener		225-357
Filter-Keepers , 37 mm, for filter transport	pk/100	225-8303
	pk/10	225-8303A
PMI Calibration Adapter		225-358
Forceps , stainless steel, non-serrated flat tips, for delicate membranes		225-8371
Filter Retainer , secures filter in impaction substrate position on top of cassette		225-354

Replacement Parts	
Replacement Filter Cassette	225-356
Replacement Exhaust O-ring, BUNA-N	P32001

[†] Back pressure on PTFE filters can vary within the same lot.

[‡] A 25-mm filter may be used as an alternative impaction substrate for optional chemical analysis.

References

Haynes, E.N., et al., "Assessment of personal exposure to manganese in children living near a ferromanganese refinery," *Science of the Total Environment*, Vol. 427-428, 2012, pp. 19-25

Wang, Z., et al., "Evaluation of Real-time Instruments Used to Monitor PM in a Green Building," *American Association for Aerosol Research (AAAR) Annual Conference Abstracts, Session 3AE.3*, 2012

SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to <http://www.skcinc.com/warranty.asp>.

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