ANALYT MESSTECHNIK



OPERATING MANUAL

SKC Personal Environmental Monitor (PEM)

Preparing, loading, flow rate verification and sampling with the PEM impactor for PM2.5 or PM10 at 2, 4 or 10 L/min, with specifications, pressure drops and ordering information.

AMTC-MN-0031

Rev. 2 · October 2026

About this manual

The SKC Personal Environmental Monitor (PEM™), Model 200, is a small impactor that a worker wears in the breathing zone, connected to a personal sampling pump. It separates the airborne particles at a fixed size: the larger ones stay on an oiled impaction ring, the smaller ones — PM2.5 or PM10, depending on the model — collect on a 37 mm filter for gravimetric or chemical analysis. The PEM was developed for indoor air and is referenced in EPA Method IP-10A.

This manual covers the six models: 2.5 µm and 10 µm cut size, each at 2, 4 or 10 L/min. Start with Product description (p. 7) to choose the model and understand its parts, then work through Operation (p. 9) in order: preparing the sampler, Verifying the flow rate (p. 11) and Sampling (p. 12). Analyt-MTC supplies and supports the PEM; for questions and orders see Service, warranty and contacts (p. 16).

Use the PEM only as described here: any other use is outside its intended use, and the cut size is then no longer assured.

Keep this manual for the lifetime of the product. The current revision is on the product page at analyt-mtc.com.

Abbreviations

Abbreviation	Meaning
EPA	US Environmental Protection Agency
PM	Particulate matter

How this manual marks information

⚠ WARNING

A hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

A hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Practices not related to personal injury — damage to the product, the process or the sample.

Note
Information that helps understanding; never a hazard.

When the sampler arrives

Take the PEM out of its box and check it for transport damage. If you find any, report it to the carrier and to Analyt-MTC.

Document information

Title	SKC Personal Environmental Monitor (PEM) — Operating manual
Document number	AMTC-MN-0031
Revision	Rev. 2 — October 2026
Applies to	PEM Model 200, Cat. Nos. 761-200, 761-200A, 761-200B, 761-203, 761-203A and 761-203B
Language	English
Manufacturer	SKC Inc.

Revision history

Rev.	Date	Change
2	October 2026	Quality programme: new document type, number and identity pages.
1	October 2026	First issue.

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CHAPTER 1

Safety

Read this chapter before you prepare the PEM and give it to a worker. One safety message protects your hands and concerns the solvent used to clean the impaction ring; the others protect the cut size and the sample.

Intended use

The PEM, Model 200, is a single-stage impactor with an after-filter for personal sampling of PM2.5 or PM10. A worker wears it in the breathing zone while going about normal work, connected to a personal sampling pump that draws 2, 4 or 10 L/min through it, depending on the model. The particles collected on the 37 mm after-filter are analysed gravimetrically or chemically.

Use the PEM only as this manual describes. The manufacturer regards any other use as improper, and the cut size is then no longer assured. Where the wearer might open the sampler during sampling, close it with spanner screws (see Product description (p. 7)).

Cleaning the impaction ring

⚠ CAUTION

A knife or razor blade can slip while you scrape the ring and cut your hand. Scrape away from your hand.

⚠ WARNING

Cyclohexane, a solvent you may use instead, is highly flammable, and its vapour can ignite and start a fire. Keep it away from flames and other sources of ignition, and follow its safety data sheet.

Protecting the cut size and the sample

Note

Without its oil coating, the impaction ring lets particles bounce off. The cut size then no longer holds. Never sample with a dry impaction ring.

NOTICE

Too much oil on the impaction ring can run off. It then reaches the filter. Remove the excess oil before you assemble the sampler.

Note

If one screw is tighter than the other, the nozzle cap sits at an angle and clamps the filter unevenly. Air can then bypass the filter. Tighten both screws equally.

Note

A pump that cannot hold the flow within ±5 % of the nominal flow rate shifts the cut size. The cut size is then no longer the one stated for the model. Keep the flow within ±5 % of the nominal flow rate for the whole sample.

Repairs and spare parts

Do not alter or repair the PEM yourself. Use only replacement parts approved by the manufacturer, and order them through Analyt-MTC (see Ordering information (p. 14)).

CHAPTER 2

Product description

Each PEM separates at one cut size — 2.5 µm or 10 µm aerodynamic diameter — at one flow rate. Choose the model by the fraction your method asks for and the flow your pump can deliver.

Models

The colour of the body tells the six models apart, and the cut size and flow rate are stamped inside the nozzle cap. Order the 37 mm after-filters separately (see Ordering information (p. 14)).

PEM models

Order code	Cut size	Flow rate	Colour	Nozzles
PM2.5				
761-203	2.5 µm	2 L/min	Blue	5
761-203A	2.5 µm	4 L/min	Black	10
761-203B	2.5 µm	10 L/min	Red	10
PM10				
761-200	10 µm	2 L/min	Green	5
761-200A	10 µm	4 L/min	Gold	10
761-200B	10 µm	10 L/min	Bronze	10



761-203 2.5 µm · 2 L/min | 761-203A 2.5 µm · 4 L/min | 761-203B 2.5 µm · 10 L/min | 761-200 10 µm · 2 L/min | 761-200A 10 µm · 4 L/min | 761-200B 10 µm · 10 L/min

Figure 1. The six PEM models. The nozzles sit in a circle near the edge of the nozzle cap.

How the PEM separates the particles

The PEM is a single-stage impactor followed by a filter. The pump draws the air through 5 or 10 identical nozzles in the nozzle cap. Each nozzle forms a jet aimed at a ring of porous stainless steel just below it.

Particles larger than the cut size are too heavy to follow the air as it turns away from the ring: they strike the ring and stay in its oil film. Smaller particles follow the air past the ring and collect on the 37 mm after-filter. The after-filter is the sample; the particles on the ring are normally discarded.

The impaction ring has a second job. It is cemented onto a support ring that presses the after-filter onto the support screen in the base. When you screw the nozzle cap down, this hold-down ring clamps the edge of the filter and seals it, so that no air bypasses the filter.

Figure 2 shows the parts. The impaction ring (4) and its support (5) form one unit, the impaction ring assembly. The 37 mm after-filter lies between the support screen (6) and the impaction ring assembly.

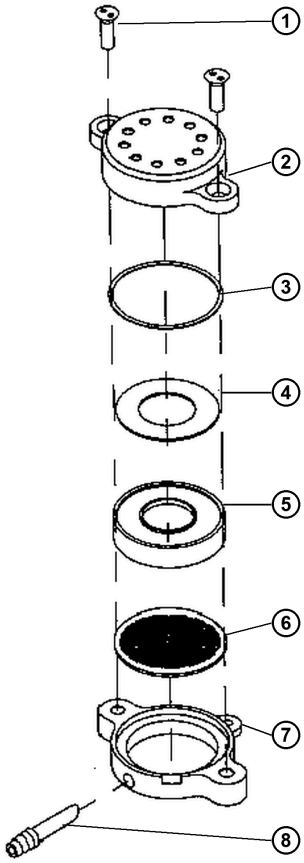


Figure 2. Parts of the PEM; the numbers are callouts added by Analyt-MTC.
1 Screws (2) · **2** Nozzle cap · **3** Nozzle cap gasket · **4** Porous stainless steel impaction ring · **5** Impaction ring support · **6** Stainless steel support screen · **7** Base · **8** Outlet tube, to the pump

Note
The PEM is normally closed with Phillips flat-head screws. Where the wearer might open the sampler, use spanner screws instead — flat-head screws with two holes, which open only with the matching screwdriver.

Sample pump

Use a personal sampling pump that the worker can wear and that holds the PEM's flow rate within ±5 % for the whole sample against the resistance of the sampler and filter. With a 37 mm glass fibre filter the PEM's typical pressure drop ranges from 1.37 in wg (2 L/min) to 7.03 in wg (10 L/min); the values per model are listed under Pressure drop (p. 13).

CHAPTER 3

Operation

Operation runs from the prepared sampler to the after-filter for the laboratory: prepare and close the PEM; verify the flow rate at its inlet; take the sample; then unload the sampler.

Before each sample, open the PEM, clean it, make sure the impaction ring carries a fresh oil film, put in a new after-filter and close the sampler with even clamping force.

Opening the PEM

1. Remove the two screws that hold the nozzle cap to the base.
2. Lift the nozzle cap straight up, clear of the impaction ring assembly.
3. Lift out the impaction ring assembly. The after-filter, if one is in place, is now uncovered.

Cleaning

- Rinse the nozzle cap with isopropyl alcohol.
- Clean the other parts and let everything dry before you assemble the sampler.
- Treat the impaction ring as described in Coating the impaction ring (p. 9).

Coating the impaction ring

Particles that hit a dry metal surface can bounce off and reach the filter, which shifts the cut size. The porous ring is therefore kept soaked with light mineral oil: as particles land, the oil rises through the deposit and keeps offering a fresh, sticky surface.

Note
Without its oil coating, the impaction ring lets particles bounce off. The cut size then no longer holds. Never sample with a dry impaction ring.

Oiling the ring

1. With an eye dropper, put drops of light mineral oil on the ring, spread evenly around it. The ring holds about 14 drops at most.
2. Stop adding oil as soon as a drop takes 5 to 10 seconds to soak into the ring. The ring is then saturated.

NOTICE

Too much oil on the impaction ring can run off. It then reaches the filter. Remove the excess oil before you assemble the sampler.

3. Hold the ring upright. If oil runs off, there is too much: touch a tissue to the porous surface to take up the excess.

Between samples

Choose one of two ways to treat the ring after each sample:

⚠ CAUTION

A knife or razor blade can slip while you scrape the ring and cut your hand. Scrape away from your hand.

⚠ WARNING

Cyclohexane, a solvent you may use instead, is highly flammable, and its vapour can ignite and start a fire. Keep it away from flames and other sources of ignition, and follow its safety data sheet.

- **Keep the oil:** scrape the collected particles off the ring with a knife or razor blade, and add oil from time to time as described above.
- **Re-coat every time:** remove all oil by soaking the ring in a soap solution or in a solvent such as cyclohexane, rinse it, let it dry completely and oil it again.

Very coarse particles

Very coarse particles such as sand can bounce even from an oiled ring. For such dust, spread a thin layer of heavy-duty silicone grease on the ring surface, and remove and renew the grease before every sample.

Loading and closing the PEM

1. Place the support screen in the base, and a new 37 mm after-filter on the screen.
2. Set the coated impaction ring assembly on top of the filter.
3. Place the nozzle cap over the impaction ring assembly so that its screw holes line up with those of the base.

   Note
   If one screw is tighter than the other, the nozzle cap sits at an angle and clamps the filter unevenly. Air can then bypass the filter. Tighten both screws equally.

4. Fasten the nozzle cap to the base with the two 8-32 × 1/2 in flat-head screws. Tighten both screws to the same torque.

Closing with the Clamping Device

The PEM Clamping Device (Cat. No. 761-201) holds the nozzle cap parallel to the base and applies the correct clamping force to the after-filter while you put in the screws.

1. Load the PEM as in steps 1 to 3 above and place it in the Clamping Device.
2. Turn the handle of the Clamping Device until its clutch slips.
3. Put in and tighten the two screws.
4. Take the closed PEM (Figure 4) out of the Clamping Device.

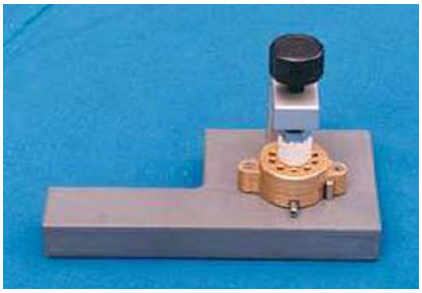


Figure 3. PEM in the Clamping Device.



Figure 4. The PEM, assembled.

Verifying the flow rate

The cut size of the PEM holds only at its nominal flow rate. Measure the flow at the inlet of the loaded sampler and keep it within ±5 % of the nominal value of your model — 2.0, 4.0 or 10 L/min.

> **Note**
> A pump that cannot hold the flow within ±5 % of the nominal flow rate shifts the cut size. The cut size is then no longer the one stated for the model. Keep the flow within ±5 % of the nominal flow rate for the whole sample.

The Calibration Cap

The PEM draws air in through several nozzles, so a flowmeter cannot be connected to it directly. The Calibration Cap (Cat. No. 761-202) presses onto the nozzle cap and gives the PEM a single inlet: a 1/2 in diameter tube on top, for the flowmeter.

A barbed fitting on the side of the cap is a pressure tap for a pressure gauge. You need it only with a flowmeter that has a large pressure drop of its own. With a low-pressure-drop flowmeter — a mass flowmeter, a bubble flowmeter or a laminar flow element — close the tap with a rubber cap.



Figure 5. Calibration Cap, with the inlet tube on top and the pressure tap on the side.

Verifying the flow

1. Check that the PEM is loaded with an after-filter and fully assembled (see Loading and closing the PEM (p. 10)).
2. Connect the pump to the outlet tube of the PEM.
3. Connect the flowmeter to the inlet tube of the Calibration Cap.
4. Switch the pump on.
5. Check that the O-ring is seated in its groove inside the Calibration Cap, then press the cap onto the nozzle cap of the PEM.
6. Read the flow on the flowmeter. If it is not within ±5 % of the nominal flow rate, adjust the pump as described in its instructions and read again.

7. Remove the Calibration Cap and the flowmeter.

> **Note**
> Verify the flow before and after each sample, with the PEM and filter type you sample with: the filter's resistance changes the flow the pump delivers.

Sampling

The worker wears the PEM in the breathing zone and the pump on the belt, and goes about the normal day's work. After sampling, the after-filter goes to the laboratory.

Sample time

The sample time depends on the flow rate of your PEM and on the particle concentration at the place you sample. To determine an 8-hour average concentration at a workplace, a typical sample runs for 8 hours.

Taking the sample

1. Prepare the PEM with a coated impaction ring and a new after-filter (see Coating the impaction ring (p. 9) and Loading and closing the PEM (p. 10)), and verify the flow rate (see Verifying the flow rate (p. 11)).
2. Attach the PEM in the worker's breathing zone, for example with the alligator clip, or place it at the location to be sampled.
3. Attach the pump to the worker's belt and connect it to the outlet tube of the PEM with flexible tubing.
4. Switch the pump on and record the start time and the sample data your method needs.
5. At the end of the sample time, switch the pump off and record the stop time.
6. Verify the flow rate again to confirm that it stayed within ±5 % of the nominal value.
7. Disconnect the pump and the tubing.

Unloading the sampler

1. Open the PEM as in Opening the PEM (p. 9).
2. Take out the after-filter and put it in a suitable container for transport to the laboratory.
3. Clean the impaction ring: scrape off the particles or remove the oil entirely, as described in Between samples (p. 10). The particles on the ring are normally discarded.

The particles on the after-filter can be analysed gravimetrically for mass, chemically for specific compounds, or both.

CHAPTER 4

Specifications

Sampler

Principle	Single-stage impactor with after-filter; 5 or 10 nozzles, porous stainless steel impaction ring
Cut size	2.5 µm or 10 µm aerodynamic diameter, depending on the model
Flow rate	2.0, 4.0 or 10.0 L/min, depending on the model; to be held within ±5 %
After-filter	37 mm diameter
Impaction ring coating	Light mineral oil; heavy-duty silicone grease for very coarse particles
Analysis	Gravimetric and/or chemical
Dimensions (L × W × H)	60 × 65 × 22 mm (2.3 × 2.5 × 0.9 in)
Weight	48 g (1.7 oz)
Screws	Two 8-32 × 1/2 in flat-head screws
Patent	U.S. Patent No. 4,827,779

Pressure drop

Typical pressure drops of each model with a 37 mm glass fibre filter (type A/E). Other filters give other values. Diameters in inches, pressure drops in inches of water gauge (in wg), as the source prints them.

Order code	Cut size	Flow	Nozzles	Nozzle Ø (in)	Nozzle Δp (in wg)	Filter Δp (in wg)	Total Δp (in wg)
761-203	2.5 µm	2 L/min	5	0.0430	0.190	1.37	1.56
761-203A	2.5 µm	4 L/min	10	0.0430	0.190	2.73	2.92
761-203B	2.5 µm	10 L/min	10	0.0670	0.201	6.83	7.03
761-200	10 µm	2 L/min	5	0.1200	0.003	1.37	1.37
761-200A	10 µm	4 L/min	10	0.1200	0.003	2.73	2.73
761-200B	10 µm	10 L/min	10	0.1520	0.008	6.83	6.84

References

1. Marple, V.A.: History of Impactors — The First 110 Years. Aerosol Science and Technology 38 (2004), pp. 247–292.
2. Marple, V.A.: PEM Development, Fabrication, Evaluation and Calibration. Final report to Research Triangle Institute, July 1989.

CHAPTER 5

Ordering information

Order from Analyt-MTC with the order codes.

Order the 37 mm after-filters separately.

Samplers

Description	Order code
PM2.5 (2.5 MM CUT SIZE)	
Personal Environmental Monitor (blue), 2 L/min	761-203
Personal Environmental Monitor (black), 4 L/min	761-203A
Personal Environmental Monitor (red), 10 L/min	761-203B
PM10 (10 MM CUT SIZE)	
Personal Environmental Monitor (green), 2 L/min	761-200
Personal Environmental Monitor (gold), 4 L/min	761-200A
Personal Environmental Monitor (bronze), 10 L/min	761-200B

Sample media

Description	Order code
After-filters, 37 mm polytetrafluoroethylene (PTFE)*, 2 µm pore size, with polymethylpentene (PMP) support ring, pack of 50	225-1709

* The back pressure of PTFE filters can vary within one lot. PTFE filters with PMP support ring may be used up to 240 °C.

Accessories

Description	Order code
Calibration Cap, for flow rate verification at the PEM inlet	761-202
Clamping Device, clamps the nozzle cap parallel to the base with the correct force	761-201

Spare parts

For these parts, ask Analyt-MTC, naming the part and your PEM model.

Description	Pack
Nozzle cap gaskets	Kit of 4
Support screen, stainless steel	Each
Screws, 8-32 × 1/2 in, flat head	Pack of 4
Alligator clip	Each
Split ring	Each

Note
Use only replacement parts supplied or approved by Analyt-MTC, and order them through Analyt-MTC.

CHAPTER 6

Service, warranty and contacts

Analyt-MTC is your contact for everything concerning the PEM: choosing the model for your method, orders of samplers, filters, accessories and spare parts, technical questions and complaints. Warranty and returns follow Analyt-MTC's terms and conditions of sale.

Contact

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Before you contact Analyt-MTC

Have the following at hand so that Analyt-MTC can help you quickly:

- the catalogue number of the PEM, for example 761-203A, or its colour;
- the filter you sample with;
- the pump and flowmeter you use, and the flow rate you verified.

Disposal

Dispose of the PEM under local regulations; separate metal, glass and plastic parts for recycling where possible.

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