



## Operating Instructions

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### SKC Reusable Parallel Particle Impactors (PPI)

The patented<sup>†</sup> impaction-based SKC Reusable Parallel Particle Impactor (PPI<sup>®</sup>) Samplers are designed to match precisely the collection efficiency curves for respirable and thoracic dust specified by ISO 7708/CEN and adopted by ACGIH, CEN, and other occupational hygiene organizations. The performance of the respirable PPI samplers also meets the ISO 7708/CEN criteria included in the OSHA final silica rule. The thoracic model meets the requirements of NIOSH Method 5524 for metalworking fluids and compounds with ACGIH<sup>®</sup> thoracic TLV<sup>®</sup>s. Constructed of conductive aluminum, these PPI Samplers may be reused and offer a choice of flow rates for maximum flexibility in pump options, sample duration, and contaminant concentration.



#### Performance Profile

**Sampling Rate:** 2 L/min respirable or thoracic and 4 or 8 L/min respirable

**Sample Pump:**

- Universal XR or AirChek<sup>®</sup> Series for 2 and 4 L/min
- Leland Legacy<sup>®</sup> for 8 L/min

**Sample Time:** *Dependent on method used. **Note:** SKC tests indicate that a particulate mass of up to 6.8 mg on the four impaction substrates would not affect PPI performance. This amount is equivalent to sampling for 6 hours at 4 L/min in environments where respirable mass concentration is 4.76 mg/m<sup>3</sup> and equals 50% of total dust. However, labs have reported to SKC that they prefer no more than 2 mg on the filter for analytical reasons. Therefore, SKC recommends that you work with your lab to determine optimum sample times for your unique sampling conditions.*

**Sample Media:** 37-mm PVC filter, 5.0- $\mu$ m pore size or  
37-mm PTFE filter,\* 2.0- $\mu$ m pore size (NIOSH 5524) or  
37-mm MCE filter, 0.8- $\mu$ m pore size  
Use cellulose pad or stainless steel screen for support.

#### Impaction

**Substrate:** Four 3/8-in diameter pre-oiled porous plastic discs

**Analysis:** Gravimetric or chemical

**Body Material:** Conductive aluminum

#### Dimensions:

**Height:** 4.25 in (10.8 cm) - clip to exhaust

**Diameter:** 1.8 in (4.6 cm)

**Depth:** 1.2 in (3.0 cm)

**Weight:** 3.3 oz (93.6 gm)

<sup>†</sup> U.S. Patent No. 7,073,402

\* Back pressure on PTFE filters can vary within the same lot.

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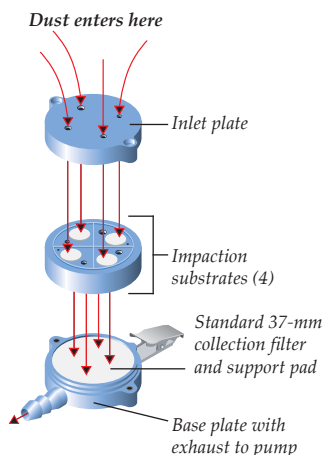


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## Principle of Operation

SKC Reusable PPI Samplers are impaction-based filter samplers that perform precise size selection for either thoracic or respirable dust, depending on the model. PPI Samplers contain four small impactors in the inlet section of the device. Each impactor features a unique 50% cut-point to target a specific one-quarter segment of the ISO/CEN curve resulting in a precise fit along the entire curve. A sample pump operating at 2, 4, or 8 L/min (2 L/min only for thoracic) pulls air through the inlet nozzle of each impactor in the inlet plate. Particles larger than each impactor's 50% cut-point are scrubbed and retained by impaction onto the porous oiled impaction substrate contained in each impactor. Smaller particles continue to the standard 37-mm collection filter for analysis. See [www.skcinco.com/ppi-sampler-for-performance-graphs](http://www.skcinco.com/ppi-sampler-for-performance-graphs).



## Media Preparation

**Filters:** Condition and weigh filters according to method used. Record the weight as the pre-sample weight.

**Impaction Substrate:** Using an oiled impaction substrate reduces particle bounce. Replacement pre-oiled disposable porous plastic discs are available as SKC Cat. No. 225-388. See *Ordering Information*.

## Inserting a Collection Filter into the PPI

The PPI will arrive already assembled. Disassemble it to insert collection filter.

1. Unscrew and remove two screws that hold the inlet plate to the base plate.
2. Lift off inlet plate to expose impaction plate.
3. Lift off impaction plate to expose base plate.



4. Using forceps, insert a 37-mm support pad and a 37-mm collection filter into the base plate.



## Inserting Impaction Substrates into the PPI

1. Ensure a support and collection filter have been loaded into the base plate. *See Inserting a Collection Filter into the PPI.*
2. Using forceps, insert a pre-oiled impaction substrate into each of the four indentations in the impaction plate.

**Tip** *Impaction substrates have a smooth/shiny side and a rough/dull side. For optimum particle capture efficiency, place substrate smooth/shiny side down in the impaction plate.*



3. Align pins in inlet plate with holes in impaction plate and press together.



**Pins will allow impactor to be assembled one way only.**



4. Grip impaction plate and inlet plate together and twist on base plate until screw holes are aligned.



5. Replace and tighten two screws to secure inlet plate to base plate.



### Tips

- Use forceps to carefully insert or remove impaction substrate and collection filter. *See Accessories for forceps.*
- SKC recommends using new impaction substrates for each sample period.

## Flow Rate Verification and Sampling

**Tip** As the particle load on the filter increases during sampling, the pressure drop will also increase. Therefore, use a compensating sample pump such as the AirChek Series or Leland Legacy depending on flow rate requirements.

### Flow Rate Verification

Verify pump flow rate with the PPI (support, filter, and impaction substrates loaded) in line. **Note:** If using SKC High Flow chek-mate Flowmeter, Pulsation Dampener Cat. No. 375-150 is also required in line. **See pump and flowmeter operating instructions.**

1. Ensure impactor is loaded with a support, collection filter, and impaction substrates and that it is fully assembled. *See Inserting a Collection Filter into the PPI and Inserting Impaction Substrates into the PPI.*
2. Use a calibration jar to verify pump flow rate. **Note:** For jarless flow rate verification (chek-mate Flowmeter only), see Jarless Flow Rate Verification Method on page 5.

- a. Unscrew jar lid and remove.



- b. Using supplied adapter, attach soft tubing end to PPI outlet. Attach rigid end of adapter to Luer adapter in center of jar lid.



- c. With PPI attached, place lid on jar and screw down until tight.



- d. Attach center tubing on outside of jar lid to pump inlet.



- e. Use 1/4-inch tubing to attach flowmeter to barbed elbow fitting on outside of jar lid.

3. Verify that the pump flow is the specified flow rate.  
*See sample pump and flowmeter operating instructions.*
4. Disconnect tubing and remove calibration jar and flowmeter when flow rate verification is completed.



**Jarless Flow Rate Verification Method:** Attach the sample pump to the chek-mate Flowmeter outlet (suction port). Attach the PPI to the chek-mate inlet using the shortest length of tubing possible. If using High Flow chek-mate Flowmeter for 8 L/min PPI, place Pulsation Dampener Cat. No. 375-150 in line between pump and flowmeter. Proceed to verify flow rate per pump and flowmeter operating instructions.



## Sampling



*SKC tests indicate that a particulate mass of up to 6.8 mg on the four impaction substrates would not affect PPI performance. This amount is equivalent to sampling for 6 hours at 4 L/min in environments where respirable mass concentration is 4.76 mg/m<sup>3</sup> and equals 50% of total dust. However, labs have reported to SKC that they prefer no more than 2 mg on the filter for analytical reasons. Therefore, SKC recommends that you work with your lab to determine optimum sample times for your unique sampling conditions.*

1. If required, replace representative sample media used for flow rate verification with new, preweighed media. *See Media Preparation.*
2. Record sample start time on label.
3. Clip PPI onto a worker's collar or lapel in the breathing zone or in the area to be sampled.
4. Clip sample pump at the worker's waist or close to the PPI.
5. Use flexible tubing to attach the PPI outlet to the inlet of the sample pump.
6. Turn on pump and record pertinent sample data.
7. After the desired sample time has elapsed, turn off the pump and record sample stop time.
8. Reinstate flow rate verification train and verify flow rate. *See Flow Rate Verification.*
9. Remove pump and tubing from the impactor.

## Removing the Collection Filter and Impaction Substrates

1. Unscrew and remove the two screws that hold the inlet plate to the base plate.
2. Lift off inlet plate to expose impaction plate.
3. Use a thin, flat implement to remove impaction substrates and discard them.
4. Lift off impaction plate to expose base plate.
5. Use forceps to remove collection filter and place in an appropriate container for shipment to a laboratory.



## Transporting Samples and Analysis

Package and transport samples and blanks in a manner that will prevent sample loss and contamination and send to an accredited laboratory for gravimetric or chemical analysis.

## Cleaning

For optimum performance, the PPI inlet and the impaction and base plates should be cleaned after five runs or upon a noticeable buildup of material to remove oil and other residue built up from frequent sampling. Disassemble the PPI and wash parts in water with a liquid detergent or soap. Rinse and air-dry all parts thoroughly in a clean environment.



**Do not place any mechanical object in the inlet nozzles.**

## References

Trakumas, S., Hall, P., *Personal Respirable Sampler Containing Four Impactors Arranged in Parallel, Abstracts of 23rd Annual AAAR Conference, Atlanta, GA, 2004, p. 78*

Trakumas, S., Salter, E., "Parallel Particle Impactor - Novel Size-selective Particle Sampler for Accurate Fractioning of Inhalable Particles," *Journal of Physics: Conference Series* 151 (2009), 16 pp., 012060, [www.skinc.com/knowledgecenter](http://www.skinc.com/knowledgecenter)

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Trakumas, S., "High-flow Personal Sampler to Monitor Exposure to Respirable Crystalline Silica at New Lower TLV," IOHA 2010 8th Conference Book of Abstracts, Rome, p. 59

Trakumas, S., Salter, E., "High-Flow Personal Sampler to Monitor Exposure to Respirable Crystalline Silica at New Lower TLV" PowerPoint Presentation

OSHA Final Rule on Respirable Crystalline Silica, [www.osha.gov/silica](http://www.osha.gov/silica)

ISO 7708:1995 (2008), Air Quality — Particle Size Fraction Definitions for Health-related Sampling, [www.iso.org](http://www.iso.org), search on 7708

Stacey, P., Thorpe, A., and Echt, A., "Performance of High Flow Rate Personal Respirable Samplers When Challenged with Mineral Aerosols of Different Particle Size Distributions," *Ann. Occup. Hyg.*, 60, 2016, pp. 479-492, <http://annhyg.oxfordjournals.org/content/60/4/479.full.pdf>

Görner, P., Simon, X., Boivin, A., Bau, S., "Sampling Efficiency and Performance of Selected Thoracic Aerosol Samplers," *Annals of Work Exposure and Health*, 2017, Vol. 61, No. 7, 784-796

## Ordering Information

<b>PPI Samplers, require filter, substrates, and support</b>	<b>Cat. No.</b>
<b>Respirable PPI (gold), 2 L/min, aluminum</b>	<b>225-380</b>
<b>Thoracic PPI (blue), 2 L/min, aluminum</b>	<b>225-381</b>
<b>Respirable PPI (orange), 4 L/min, aluminum</b>	<b>225-382</b>
<b>Respirable PPI (red), 8 L/min, aluminum</b>	<b>225-383</b>
<b>Recommended Collection Filters for PPI, required for sampling</b> <i>Select a filter based on your application.</i>	
<b>PVC Filters, 37 mm, 5.0-µm pore size, pk/100</b>	<b>225-5-37</b>
<b>PTFE Filters,* 37 mm, 2.0-µm pore size, unlaminated, no support pad included, for metalworking fluids (NIOSH 5524), pk/100</b>	<b>225-17-33</b>
<b>MCE Filters, 37 mm, 0.8-µm pore size, pk/100</b>	<b>225-1939</b>
<b>Filter Supports, required for sampling. Select either cellulose or stainless steel.</b>	
<b>Support Pads, cellulose, 37 mm, pk/100</b>	<b>225-27</b>
<b>Support Screen, stainless steel, 37 mm, wide mesh, ea</b>	<b>225-26</b>
<b>Impaction Substrates, four required for each sample</b>	
<b>Porous Plastic Discs, <sup>3</sup>/<sub>8</sub>-inch diameter, pre-oiled, ready to use, disposable, pk/200</b>	<b>225-388</b>
<b>Accessories</b>	
<b>Multi-purpose Calibration Jar</b>	<b>225-111</b>
<b>Forceps, stainless steel, with non-serrated flat tips</b>	<b>225-8371</b>
<b>Filter-Keeper, for transporting and storing 37-mm filter samples, pk/10</b>	<b>225-8303A</b>

\* Back pressure on PTFE filters can vary within the same lot.

## 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 [skcinc.com/warranty](http://skcinc.com/warranty).

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