Low Flow Sample Pump
222 Series

Operating Instructions

SKC Inc.
863 Valley View Road
Eighty Four, PA 15330 USA

Form 3707 Rev 1302

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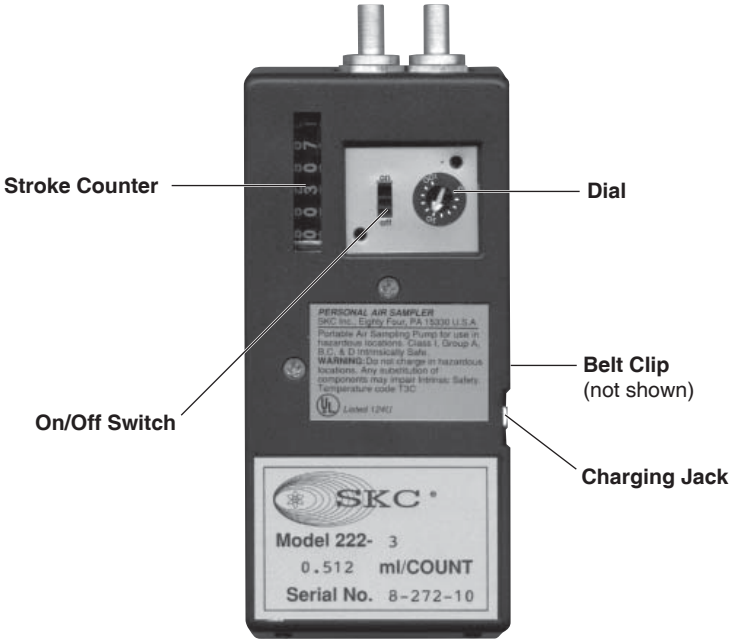
Indicates a reminder or note.

Indicates a warning or caution.

Description

SKC 222 Series Low Flow Pumps are miniature diaphragm-type pumps for personal or area sampling of gases and vapors in air using sorbent tubes or sample bags. These reliable lightweight pumps are motor-operated and powered by a rechargeable battery pack. Featuring reliable stroke counter technology, the pump's stroke counter indicates the number of times the pump's diaphragm has pulsed (or stroked) during the sampling period. By multiplying this stroke number by the volume of air per stroke, an accurate determination of air volume can be made. SKC sample pumps have special patented valves that close positively, ensuring zero leaks. All working parts are housed in a sturdy, shock-resistant case with belt clip. Model 222-3 pumps provide flows from 50 to 200 ml/min; Model 222-4 pumps provide flows from 20 to 80 ml/min.



222-3 Low Flow Pump

Performance Profile

Flow Rate:	**222-3:**	50 to 200 ml/min
	222-4:	20 to 80 ml/min
Operation Time:	10 hrs per battery charge	
Case:	Sturdy, lightweight plastic	
Battery:	Rechargeable NiCad, 2.4 V	
Charge Time: *(varies with battery capacity and level of discharge)*	6 to 8.5 hrs with PowerFlex charger	
Battery Regulator:	Holds voltage constant	
Counter Readout:	Shows pump strokes up to six digits	
Valves:	Zero-leak valves	
Pumping Action:	Diaphragm	
Temperature Ranges:	**Operating:**	32 to 113 F (0 to 45 C)
	Charging:	32 to 113 F (0 to 45 C)
	Storing:	-4 to 113 F (-20 to 45 C)

Protect sample pump from weather when in use outdoors.

Tubing:	Requires 1/4-inch ID tubing
Size:	5.1 x 2.5 x 1.25 in (13 x 6.4 x 3.2 cm)
Weight:	12 oz (340 gm)
Approvals:	UL Listed for intrinsic safety; Class I, Groups A, B, C, and D CE marked

Use only the SKC-approved battery and charger for this model to ensure reliable performance and to maintain the UL Listing for intrinsic safety. Failure to do so voids any warranty.

Battery Installation/Charging

Installing the Battery Pack

To enhance battery life, SKC ships the battery pack separate from the pump.

Once installed, completely charge the battery pack before operating the pump. It may be necessary to charge the battery a few times before maximum capacity is achieved.

1. Using a Phillips head screwdriver, remove six screws from the back of the pump case.
2. Insert the battery pack inside the pump case with the label facing up.
3. Grasp the white connector from inside the pump case and the white connector from the battery. Ensure the two pins inside the pump connector align with the two sockets inside the battery connector. Push the two connectors together firmly until they click.
4. Ensure the connector is seated inside the pump case.
5. Replace the back plate on the pump ensuring the belt clip opens downward.
6. Replace and tighten the six screws.

Charging the Battery

For a complete charge, ensure the pump is not running during charging. Charge the battery by connecting the charger plug to the sampler charging jack on the right side of the pump (*see charger operating instructions*). Ensure that the battery is fully charged before sampling.

After charging the battery pack, it is good practice to run the pump for approximately 5 minutes before measuring the flow rate. This ensures the battery is in more steady state conditions.

The battery pack may be kept on the SKC-approved charger for an indefinite time.

Do not charge or operate pump from charger in hazardous locations.

Use only an SKC-approved charger designated for this model to ensure reliable performance. Failure to do so voids any warranty.

Tampering with the battery pack voids any warranty.

Ensure proper orientation of charging cable before plugging it into the charging jack. Improper orientation/contact will short circuit the battery and voids any warranty.

Short-circuiting the battery pack will render it immediately inoperative.

Failure to follow warnings and cautions voids any warranty.

For more information on SKC pump batteries, go to http://www.skcinc.com/instructions/1756.pdf.

Operation

Setting the Sampling Rate

1. Using a slotted screwdriver, remove the metal plate on the front of the pump.
2. Use the screwdriver to turn the flow adjust dial. Turning the dial clockwise toward the 100 position increases flow, turning it counterclockwise toward the 0 position decreases flow. The scale on the dial is arbitrary.

Measuring Flow Rate

Before use, allow pump to equilibrate after moving it from one temperature extreme to another.

1. Ensure pump has run for 5 minutes before measuring flow rate.
2. Using flexible tubing, attach the outlet of a representative sample tube to the pump inlet.
3. Attach the inlet of the sample tube to a film flowmeter.
4. Turn on the pump using the on/off switch between the counter and the dial.
5. Measure the flow rate following the flowmeter operating instructions. Adjust the flow by using the screwdriver to turn the dial clockwise to increase flow or counterclockwise to decrease flow.
6. Disconnect the film flowmeter and the representative sample tube.

Sampling with Sorbent Tubes

Using the Stroke Counter

Before use, allow pump to equilibrate after moving it from one temperature extreme to another.

Protect sample pump from weather when in use outdoors.

Use of any device other than the approved battery pack to power the pump voids the UL Listing for intrinsic safety and any warranty.

1. **Record the initial counter reading.**
2. Break the ends off a new sorbent tube.
3. Using flexible tubing, connect the inlet of the sample pump to the outlet of the sorbent tube.
4. Turn on the pump and sample for the desired sample period.
5. When sampling is completed, turn off the pump.
6. Disconnect and seal the sorbent tube.
7. **Record the final counter reading.** Calculate the air volume using the following equation. *To determine the pump factor, see page 5.*

$$\text{Air Volume} = \left(\text{Final Counter Reading} - \text{Initial Counter Reading}\right) \times \text{Pump Factor}$$

Determining the Pump Factor

To determine the relation between the counter and the pump volume:

1. Using flexible tubing, connect the pump inlet to the outlet of a film flowmeter.
2. Turn on the pump.
3. Turn the flow adjust dial to set the pump flow rate to 100 ml/min.
4. Turn off the pump.
5. **Record the counter reading.**
6. Turn on the pump and allow the pump to run for one minute.
7. Turn off the pump. **Record the counter reading.**
8. Subtract the first counter reading from the second reading. This yields the number of counts per 100 ml.
9. Calculate the pump factor (ml per count) using the following equation:

$$\text{Pump Factor (ml per count)} = \frac{100}{\text{Number of Counts per 100 ml}}$$

The pump factor should be checked periodically. SKC recommends performing this procedure after every 40 hours of operation.

Sampling with Bags

The SKC 222 Series Low Flow samplers are also designed for sampling with bags. It is important that precautions be taken to prevent contamination of the pump when performing bag sampling.

Before use, allow pump to equilibrate after moving it from one temperature extreme to another.

Protect sample pump from weather when in use outdoors.

Use of any device other than the approved battery pack to power the pump voids the UL Listing for intrinsic safety and any warranty.

1. Loosen the set screw on the outlet (exhaust) fitting on top of the pump (*see Figure 1 on page 6*).
2. Remove the fitting by unscrewing counterclockwise.
3. Attach PTFE tubing to the exposed special fitting. Attach the other end of the tubing to the inlet valve on the sample bag.
4. See the bag operating instructions for details on the operation of the bag fitting(s).

When collecting bag samples, the contaminant passes through the interior of the pump. The pump should be purged after bag sampling to remove any remaining contaminant. To purge the pump, run it for several minutes in a clean air environment. If the contaminant is hazardous, take all necessary safety precautions.

Failure to follow warnings and cautions voids any warranty.

Maintenance

Checking for Leaks

To function properly and provide correct pumping volume, the diaphragm must be free from leaks and close positively. Remove cover plate and check the following:

Intake Valves

1. To check the intake valves for leaks, connect a water manometer and a tee connection to the pump inlet as shown in Figure 1 below.

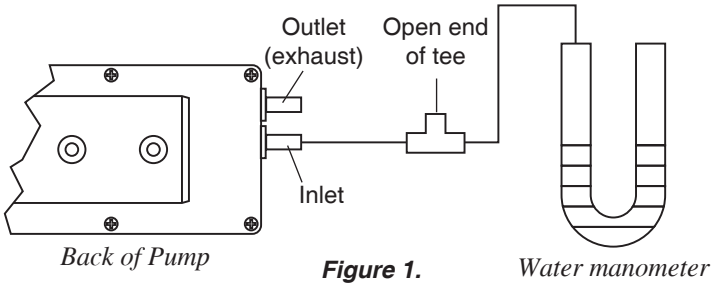


Figure 1.

2. On the open end of the tee, draw vacuum by mouth until 4 to 5 inches of water vacuum register on the manometer.
3. Seal off the open end of the tee and watch the manometer. The water level should drop less than one-half inch in ten seconds.

Diaphragm and Valve System Integrity

1. With the water manometer and tee connected to the inlet (*see Figure 1 above*), seal off the outlet of the pump and introduce positive pressure through the open end of the tee until 4 to 5 inches of water register on the manometer.
2. While maintaining the pressure, seal off the open end of the tee and watch the manometer. The water level should drop less than one-half inch in ten seconds.

Exhaust Valve Seating

1. Disconnect the tee and water manometer from the pump inlet and connect them to the outlet of the pump.
2. Introduce positive pressure through the open end of the tee until 4 to 5 inches of water register on the manometer.
3. While holding this pressure, seal off the open end of the tee. Watch the manometer. The water level should drop less than one-half inch in ten seconds.

Changing the Battery

1. Remove the six screws on the back of the pump case.
2. Grasp the white connector and pull it apart.
3. Gently pull the battery pack from the case.

Do not pull on red and black wires.

4. Remove the old battery pack and replace with the new battery pack.
5. Place the new battery pack inside the pump case with the label facing up.
6. Grasp the white connector from inside the pump case and the white connector from the battery. Ensure the two pins inside the pump connector align with the two sockets inside the battery connector. Push the two connectors together firmly until they click.
7. Ensure the connector is seated inside the pump case.
8. Replace the back plate on the pump ensuring the belt clip opens downward.
9. Replace and tighten the six screws.
10. Charge battery completely.

Tampering with the battery pack voids the UL Listing for intrinsic safety and any warranty.

Use of a repaired or rebuilt battery pack voids any warranty.

Failure to follow warnings and cautions voids any warranty.

For more information on SKC pump batteries,
go to http://www.skcinc.com/instructions/1756.pdf.

Replacement Parts and Accessories

Part Description	Cat. No.
Motor (Model 222-3)	P222301
Motor (Model 222-4)	P222402
Battery Pack	222-3SR-04
Eccentric	P222302
Counter	P222304
Bearing/Ring/Stem Assembly	P222305
Diaphragm Disc Assembly	P222308
Switch	P222310
Links - Counter/Eccentric	P222313
Pump case with Meter, Switch, Pot, and Window	P222314UL
Potentiometer Control	P222316
C-1 Connector	P222317
C-2 Connector	P222319
Window	P222322
Body/Valve Assembly	P222323
Neoprene Gasket	P222324
Stainless Steel Back Plate	P222325
Case Fitting - Inner-Male	P222326
Case Fitting - Outer-Female	P222327
O-ring (pk/10)	P222328
Jack	P222331
Angle Bracket	P222332
Body Valve Set	P222334

Accessories	Cat. No.
Film Flowmeter Kit, 5 to 500 ml/min measuring range	303
PowerFlex Charger	
5-station, 100-240 V	223-1000
Single, 100-240 V	223-2000
PowerFlex Charging Cable for 222 Low Flow Pumps	223-1005
Tube Holders:	
Type A fits tubes 6 mm OD x 70 mm L	222-3-1
Type B fits tubes 8 mm OD x 110 mm L	222-3L-1
Type C fits tubes 10 mm OD x 150 mm L	222-3XL-1
Type D fits tubes 10 mm OD x 220 mm L	222-3XD-1

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.

SKC pumps must be repaired by SKC or an authorized SKC repair center. Failure to do so voids intrinsic safety approvals and any warranty.

Use only SKC-approved parts to ensure reliable performance. Failure to do so voids any warranty.

Failure to follow warnings and cautions voids any warranty.