Operating Instructions

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IOM Personal Samplers and IOM Samplers with MultiDust

Stainless steel IOM

Conductive plastic IOM

Description

The IOM Sampler is a sampling head that houses a reusable two-part filter cassette with specified 25-mm filter for the collection of inhalable airborne particles. The filter and cassette assembly are weighed as a single unit before and after sampling for gravimetric analysis. The IOM Sampler and cassette are available in conductive plastic or stainless steel. The stainless steel model is ideal for sampling vapor-phase isocyanates followed by chemical analysis. The IOM Sampler meets the following U.S. and international standards:

- ACGIH® sampling criteria for inhalable particulate
- ISO®/CEN health-related fractions of bioaerosols
- NIOSH Method 5700 for formaldehyde on dust
- Australian standard for inhalable particulate
- Preferred sampler for HSE Method MDHS 14/4 for inhalable and respirable dust
- Complies with MDHS 25/3 for organic isocyanates (*with stainless steel model only*)
- Complies with MDHS 6/3 for lead (*with accessory single-hole head*)
- OSHA equivalent method for particulates not otherwise regulated (PNOR)‡

The sampler is supplied with a cassette cover and cassette transport clip to prevent contamination during transport.

‡ *Reference: OSHA letter November 8, 2011*

IOM with MultiDust Foam Disc

The IOM can be used to sample for inhalable and respirable fractions simultaneously by using a filter and a MultiDust Foam Disc (polyurethane foam). In addition, a polycarbonate filter can be combined with a MultiDust Foam Disc for effective size-selective bioaerosol sampling and better microorganism survivability when compared to filter-only sampling.[1]

Performance Profile

Flow Rate:	2 L/min (personal sampling)
50% Cut-point:	100 µm at 2 L/min inhalable fraction 4.0 µm at 2 L/min respirable (with MultiDust Foam Disc)
Material:	Molded conductive plastic (polypropylene) or stainless steel
Maximum Operating Temperature:	***Plastic IOM and cassette:*** 212 F (100 C) with no pressure† ***Stainless steel IOM and cassette:*** 392 F (200 C) – suitable for autoclaving and solvent washing
Filters:	25-mm membrane or fibrous filter
Tubing:	1/4-inch ID
Weight: *(plastic model with cassette)*	< 2 oz (55 gm)
Dimensions:	3.3 x 1.1 in (8.5 x 2.8 cm)
Analysis:	Gravimetric or chemical (stainless steel model)

† *The plastic IOM is NOT suitable for autoclaving or ethylene oxide sterilization*

Components and O-ring Placement

Wear powder-free gloves when handling cassettes and use forceps when working with filters. Users may wish to use sterile gloves and forceps depending on the contaminant of interest.

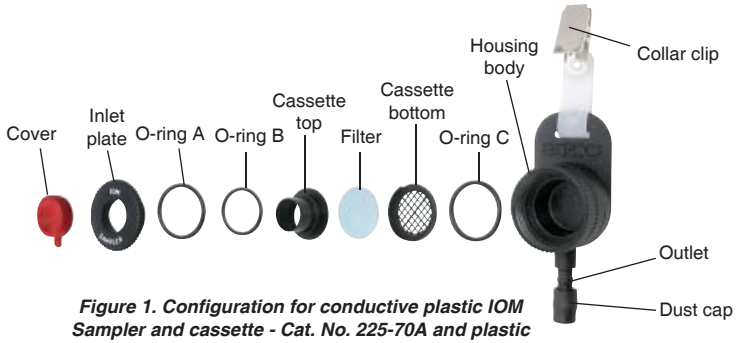

Figure 1. Configuration for conductive plastic IOM Sampler and cassette - Cat. No. 225-70A and plastic IOM with stainless steel cassette - Cat. No. 225-79A

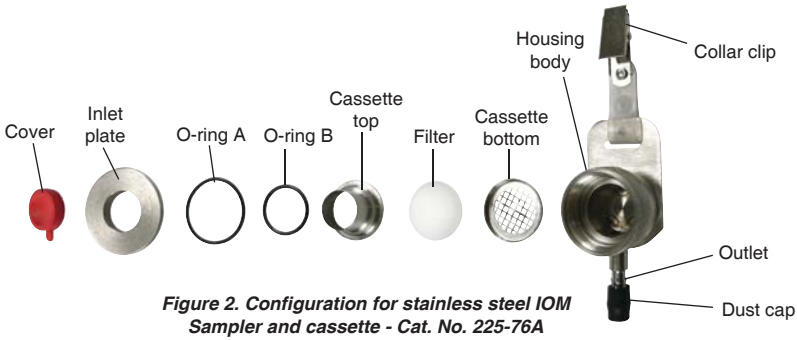

Figure 2. Configuration for stainless steel IOM Sampler and cassette - Cat. No. 225-76A

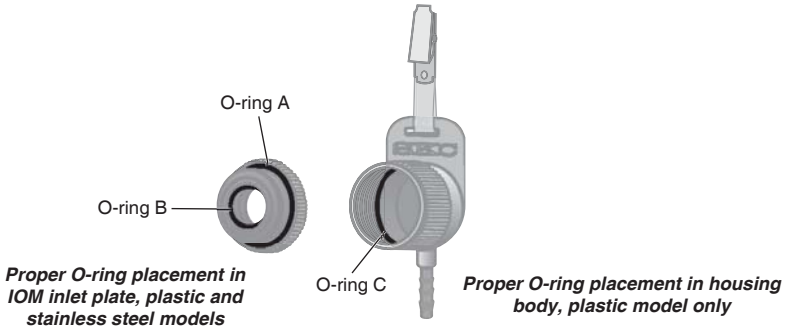

Figure 3. O-ring placement

Preparation and Assembly

Handling

Wear powder-free gloves when handling cassettes and use forceps when working with filters and foams to prevent the transfer of moisture, dust, or other contaminants onto the sampling media. Users may wish to use sterile gloves and forceps depending on the contaminant of interest.

Cleaning the Sampler

1. Disassemble the IOM Sampler (Figures 1, 2, and 3).
2. Place parts in an ultrasonic cleaner with water and a wetting agent such as a mild soap. IOM components may also be cleaned with a solvent such as isopropyl alcohol. O-rings should be cleaned separately using water only.

Do not use CFC-based substances to clean the plastic IOM. Do not use solvents on O-rings.

When using solvents, protect against splashes to the eye, vapor inhalation, and vapor ignition.

3. Clean the components using a clean lint-free paper, cloth, or soft brush. Allow components to dry completely.

Sterilizing Filter, Foam Disc, and Cassette (for Bioaerosol Sampling)

Polycarbonate Filter

Autoclave polycarbonate filter according to manufacturer instructions.

MultiDust Foam Disc

1. Place foam in a sonic bath of distilled water for 20 minutes. Remove from bath.
2. Rinse foam with distilled water.
3. Dry overnight at 158 F (70 C). Equilibrate to standard conditions of temperature and humidity.

Do not desiccate foam.

4. Expose foam to ultraviolet light according to a standard UV light exposure method.

IOM Stainless Steel Cassette
Use stainless steel cassette only.
Autoclave stainless steel cassette up to 392 F (200 C).

Reminder: Use powder-free gloves and forceps to insert the filter and foam into the cassette (*see Filter Cassette: Opening, Installing Filter, and Closing*). Users may wish to use sterile gloves and forceps depending on the contaminant of interest.

Storage Requirements for IOM MultiDust Foam Discs

IOM MultiDust Foam Discs are sensitive to heat, humidity, and ultraviolet light. The foams must be stored in the supplied packaging (including the resealable bag). Keep in a cool, dry place away from direct sunlight. SKC recommends checking the condition of the foams before use. Note that the expiration date on the package is subject to correct storage as detailed above.

General Weighing Guidelines

- The plastic cassette with filter and MultiDust Foam Disc (if used) should be equilibrated overnight in a balance room under controlled humidity conditions and weighed. Maintain a stable humidity level in the balance room. ***A stainless steel cassette with filter may be desiccated.***
- Before pre and post-weighing, wipe the external surface of the sampler with a clean lint-free paper, cloth, or soft brush.
- For inhalable only, pre and post-weigh cassette with filter as a single unit. For inhalable and respirable, pre and post-weigh filter, foam, and cassette together first for inhalable result and then filter and cassette bottom together for respirable result.
- Field blanks can be used to correct weights when using plastic cassettes at low filter loadings. *See Sample Blanks on page 9.*
- **The IOM cassette assembled with filter or the filter alone should be weighed on a five-figure forced balance.** Allow the cassette three-and-a-half minutes to stabilize before taking a reading. The same balance should be used for both pre and post-weighing procedures.

Pre and Post-weighing for Specific Fractions

Particle Size Collected	Pre-weigh Components	Post-weigh Components
Inhalable only	Filter and cassette together	Filter and cassette together
Respirable (#1) and Inhalable (#2)	#1 Filter and cassette bottom together #2 Filter, foam, and cassette together	#1 Filter and cassette bottom together #2 Filter, foam, and cassette together

Filter Cassette: Opening, Installing Filter, and Closing (Figure 4)

1. Separate the cassette top from the cassette bottom.
    a. **Plastic cassette:** Use gentle pressure to separate the two halves of the plastic cassette (Figure 4).
    b. **Stainless steel cassette:** Twist cassette top in cassette bottom until notch on cassette top aligns with bump on cassette bottom. Pull straight up.
2. Place a filter into the cassette bottom (on the support grid) and insert cassette top into cassette bottom.
    a. **Plastic cassette:** Snap the plastic cassette top into the cassette bottom, ensuring a tight fit.
    b. **Stainless steel cassette:** Align the notch in the cassette top with the bump in the cassette bottom, set top into bottom, and twist top to secure.

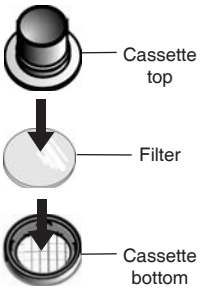

Figure 4. Exploded cassette

Pre-weighing Cassette for Inhalable Gravimetric Sampling

1. Equilibrate cassette and filter as indicated in *General Weighing Guidelines* on page 4.
2. Wipe the external surface of a loaded IOM cassette with a clean lint-free paper, cloth, or soft brush.
3. Pre-weigh the filter inside the IOM cassette as a single unit (Figure 5).
4. Note the result and assign a reference number or letter to the cassette or complete IOM sampler (cassette inside housing body).

Figure 5. Weigh cassette with filter on a five-figure balance.

Note: *The cassette cover (Figure 6) can be included in pre and post-weighing as part of the complete cassette, if required, but must be referenced to the cassette used.*

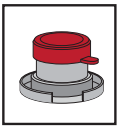

Figure 6. Cassette with cover

Pre-weighing Cassette for Inhalable and Respirable Gravimetric Sampling

1. Equilibrate cassette, filter, and foam as indicated in *General Weighing Guidelines* on page 4.
2. Wipe the external surface of a loaded IOM cassette with a clean lint-free paper, cloth, or soft brush.
3. Using forceps place a filter into the cassette bottom and weigh.
4. Record pre-weight #1 and assign a reference number or letter to the cassette or complete IOM Sampler (cassette inside a housing body).

5. Place a single MultiDust Foam Disc for respirable sampling (Cat. No. 225-772) into the inlet of the cassette top so that it sits just below the rim (Figure 7). Ensure that it is not creased and there are no gaps between it and the cassette wall.

   Note: *The foam disc is larger than the inlet; therefore, it must be compressed evenly to fit properly.*

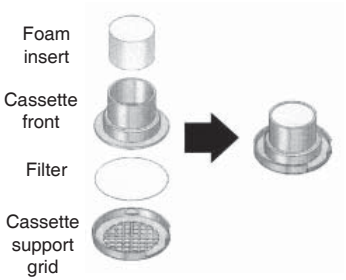

Figure 7. Foam inserted into cassette

6. Insert the cassette top containing the foam disc into the cassette bottom ensuring the filter is in place (*see Filter Cassette: Opening, Installing Filter, and Closing*).
7. Re-weigh the entire assembly and record pre-weight #2. If the cassette cover is included in this operation, reference it to the cassette with a number or letter. It is recommended that the cassette cover remain in place until ready to sample.

Transporting Loaded Cassettes

If not ready to sample immediately or if transporting pre-weighed loaded cassettes to a sampling location, place the cassette with cover into the provided transport clip (Figure 8). Ensure the cassette cover is in place. An alternative is to insert the loaded cassette into an IOM housing body and place the cover on the cassette opening (*See Loading a Cassette into the IOM Housing Body and Figure 9*). Users may wish to transport loaded cassettes or loaded IOM housing bodies in a sterile plastic bag depending on the contaminant of interest.

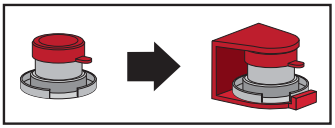

Figure 8. Insert cassette with cover into transport clip

Loading a Cassette into the IOM Housing Body

Reminder: Use powder-free gloves and forceps to handle cassette, filter, and foams. Users may wish to use sterile gloves and forceps depending on the contaminant of interest.

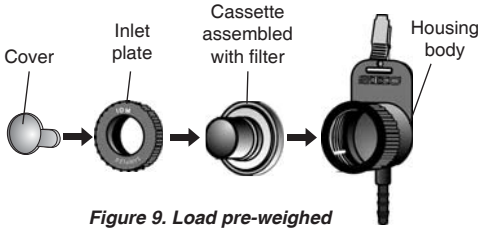

Figure 9. Load pre-weighed cassette into an IOM housing body; include cover.

1. Unscrew inlet plate from IOM housing body.
2. Ensure the O-rings are positioned correctly (Figures 1, 2, and 3).
3. Insert the cassette into the IOM housing body.
4. Screw the inlet plate into the housing body. Tighten securely to achieve a good seal. *Install cover on inlet until ready to sample.*

Calibration

Calibrate pump flow rate using a calibrator, IOM Calibration Adapter accessory, and a representative loaded IOM Sampler in line.

Calibration Adapter Setup (Figure 10)

1. Push an IOM Sampler loaded with a representative filter and cassette through the hinged bracket and place inlet against the adapter's foam ring.
2. Clamp IOM in place with plastic clamping screw until foam ring compresses by 1 mm. *Ensure IOM inlet is centered.*
3. Screw supplied hose barb into threaded hole in calibration adapter inlet.
4. Use a length of flexible tubing to connect hose barb to calibrator outlet.
5. Remove sampler dust cap from outlet.
6. Connect IOM outlet to the inlet of a sample pump.

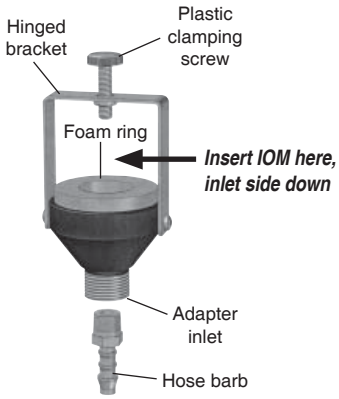

Figure 10. IOM Calibration Adapter

Calibrating Pump Flow Rate

Calibrate pump flow rate using the IOM Calibration Adapter accessory and an IOM sampler loaded with a representative filter and cassette in line.

1. Insert IOM with loaded filter cassette into the calibration adapter (*see Calibration Adapter Setup and Figure 10*).
2. Calibrate pump flow rate to 2 L/min. *See calibrator and sample pump operating instructions for additional information.*
3. Disconnect IOM from pump and calibrator and remove representative cassette. Set aside for flow rate verification after sampling.

Sampling

Wear powder-free gloves when handling cassettes. Users may wish to use sterile gloves depending on the contaminant of interest.

1. Remove a newly loaded cassette from its transport clip and remove the cassette cover. Ensure the O-rings are fitted correctly inside the sampler housing body. Insert the cassette into a clean IOM housing body. Screw the inlet plate into the housing body. Tighten to achieve a good seal (Figure 11).
2. Clip onto a worker's clothing in the breathing zone (Figure 12).
3. Ensure sampler dust cap is removed from the outlet. Using flexible tubing, connect outlet of the IOM Sampler with the inlet of a sample pump calibrated to 2 L/min (Figure 12).
4. Remove cover, start pump, and sample for the time specified in the method used.

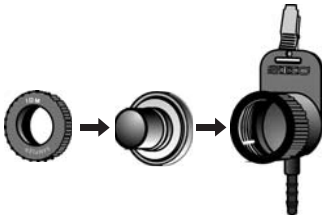

Figure 11. Insert loaded cassette in sampler body and screw on inlet plate.

5. After sampling, stop the pump. Unscrew the inlet plate from the housing body and remove the cassette from the sampler (may use sterile forceps and gloves depending on the contaminant of interest). Place the cover on the cassette and wipe the external surface of the cassette with a clean lint-free paper, cloth, or soft brush (may use sterile items depending on the contaminant of interest). Place cassette with cover into the supplied transport clip (Figure 8). For post-weighing instructions, *see Analysis on page 9*. If not performing post-weighing on the premises, *see Transporting Samples to a Laboratory on page 9.*

   Note: *If inhalable samples were collected to determine exposure to formaldehyde on dust using NIOSH Method 5700, place the cassette cover on the cassette and load it into the transport clip. Send cassette in clip, a blank, and all other pertinent sampling information to a laboratory for analysis.*

Figure 12. IOM Sampler and pump on worker

Sampling for Bioaerosols

Using MultiDust Foam Disc and Filter

- *Use stainless steel cassettes only.*
- *MultiDust Foam Discs are designed for single use only. MultiDust Foam Discs are pre-washed to ensure the highest quality and accurate results. Use only MultiDust Foam Discs with the IOM.*

Filters, foam discs, and cassette must be sterilized and handled aseptically. ***See Preparation and Assembly on page 3.***

1. Sterilize stainless steel cassette, filter, and foam disc. A 25-mm polycarbonate filter is recommended. *See Sterilizing Filter, Foam, and Cassette (for Bioaerosol Sampling) on page 3.*
2. Load filter into cassette. *See Filter Cassette: Opening, Installing Filter, and Closing, page 4.*
3. Place the MultiDust Foam Disc for respirable (Cat. No. 225-772) into the inlet of the cassette top so that it sits just below the rim (Figure 7). Ensure the foam is not creased and there are no gaps between the foam and the cassette wall.

   Note: *The foam disc is larger than the inlet; therefore, it must be compressed evenly to fit properly.*

4. Insert the cassette top containing the foam disc into the cassette bottom ensuring the filter is in place. *See Filter Cassette: Opening, Installing Filter, and Closing, page 4.*
5. Calibrate the sample pump using representative sample media. *See Calibration on page 6.*
6. Sample using the procedure in *Sampling* on page 7.
7. If shipping samples to a laboratory for analysis, *see Transporting Samples to a Laboratory on page 9.* If performing analysis on the premises, *see Analysis on page 9.*

Transporting Samples to a Laboratory

Wear powder-free gloves when handling cassettes and use forceps when working with filters. Users may wish to use sterile gloves and forceps depending on the contaminant of interest.

For gravimetric samples:

Immediately following sampling, unscrew IOM inlet plate and remove cassette from housing body. Place cassette cover on cassette and insert into a transport clip (Figure 8). Place unit into a sterile plastic bag depending on the contaminant of interest. Package in a padded envelope and send to a laboratory for analysis. Include pertinent sampling information and blanks (*see Sample Blanks*). If post-weighing on the premises, *see Analysis.*

For chemical samples (stainless steel cassette only):

1. Unscrew the IOM inlet plate.
2. Remove the stainless steel cassette.
3. Choose from the following options:
    a. Immediately place entire cassette/filter assembly into a large vial filled with method-specified desorbing solution and cap the vial or,
    b. Immediately remove cassette top and use forceps to remove filter. Place filter in a vial filled with method-specified desorbing solution and cap the vial.
4. Package securely to prevent leakage and breakage, include pertinent sampling information and blanks, and send to a laboratory for analysis.

For bioaerosol samples:

Transport samples in vials filled with Peptone Inositol Tween (PIT), a biological buffer, as indicated in Method 1 or 2 on page 10. Users may wish to place vials in a sterile plastic bag depending on the contaminant of interest. Samples can be stored overnight at 39.2 F (4 C) in vials or bags and analyzed the next day.

Sample Blanks

Load and handle the blank IOM Sampler in the same manner as the IOM used for sampling. Do not pull air through the blank. Send the blank with the samples to a laboratory.

Analysis

Post-weighing for Inhalable Fraction

Wear powder-free gloves when handling cassettes and use forceps when working with filters.

1. Equilibrate filter and plastic cassette for a reasonable time based on humidity conditions.
2. Remove the cassette from the transport clip or sampler housing body. The cassette cover can remain on the cassette if it was included in the pre-weight.
3. Weigh the entire cassette. Compare the pre and post-weights. The difference between weights is the amount of inhalable particles collected.

The IOM cassette can be cleaned, reloaded with a fresh filter, and reused. *See Cleaning the Sampler on page 3*.

Post-weighing for Inhalable and Respirable Fraction

Wear powder-free gloves when handling cassettes and use forceps when working with filters.

1. Equilibrate plastic cassette, filter, and foam for a reasonable time based on humidity conditions.
2. Remove the cassette from the transport clip or sampler housing body. The cassette cover can remain on the cassette if it was included in the pre-weight. Before proceeding, *see table on Pre and Post-weighing for Specific Fractions on page 4*. Weigh the cassette with filter and foam disc together. Record post-weight #2. Compare pre-weight #2 to post-weight #2. The difference between weights is the amount of inhalable particles collected.
3. Gently split the cassette apart (*see Filter Cassette: Opening, Installing Filter, and Closing on page 4*), taking care not to dislodge the filter.
4. Before proceeding, *see table on Pre and Post-weighing for Specific Fractions on page 4*. Weigh the cassette bottom with filter only.
5. Record post-weight #1. Compare pre-weight #1 to post-weight #1. The difference between weights is the amount of respirable particles collected.

The IOM cassette can be cleaned, reloaded with a fresh filter and foam, and reused. *See Cleaning the Sampler on page 3*.

Chemical Analysis

Follow method instructions for sample preparation and analysis.

Bioaerosol Sample Extraction[1] and Analysis

1. Using sterile forceps and gloves, remove the cassette from the transport clip.
2. Gently split the cassette apart; do not dislodge the filter.
3. Remove the foam and filter from the cassette.

Push foam down through the flanged end of the cassette, not through the inlet.

4. There are two methods for extracting the sample from the MultiDust Foam Disc and the filter.
    a. **Method 1**
    Place the foam and the filter in individual vials each filled with 10 ml of Peptone Inositol Tween (PIT). When analyzed, this method provides data on inhalable and respirable bioaerosol fractions.
    b. **Method 2**
    Place filter and foam together in a vial filled with PIT. When analyzed, this method provides data on the inhalable fraction only of the bioaerosols collected.
5. Create a suspension.
    a. **Using Method 1 with filter only:** Whirlimix the filter in PIT for one minute to re-suspend collected particles.
    b. **Using Method 1 with foam only:** Whirlimix the foam for one minute, and then plunge rapidly for one minute *in situ* using a sterile 20-ml hypodermic syringe plunger.
    c. **Using Method 2 with foam/filter combined:** Whirlimix the foam for one minute, and then plunge rapidly for one minute *in situ* using a sterile 20-ml hypodermic syringe plunger.

6. Create five 10-fold serial dilutions (to 10^{-5} of original suspension) from each suspension and spread 0.1 ml of each dilution (plus 0.2 ml of undiluted sample if a low bioaerosol count is expected) onto the surface of duplicate agar plates. Select agar media based on the expected microbial species.
7. Incubate plates at appropriate temperatures and count emerging colonies after four to seven days of incubation. Use total number of CFU per plate to calculate airborne viable cell concentrations. Samples can be stained and analyzed with epifluorescent microscope.

References

[1] *Kenny, L.C., Bowry, A., Crook, B., and Stancliffe, J.D., "Field Testing of a Personal Size-selective Bioaerosol Sampler," American Occupational Hygiene, Vol. 43, No. 6, 1999, pp. 393-404*

[2] *Kenny, L.C., Stancliffe, J.D., Crook, B., Staff, S., Griffiths, W.D., Stewart, I.W., and Futter, S.J., "The Adaptation of Existing Personal Inhalable Aerosol Samplers for Bioaerosol Sampling," American Industrial Hygiene Association Journal, Vol. 59, 1998, pp. 831-841*

[3] *Kenny, L.C., Chung, K.Y.K., and Dilworth, M., "Applications of Low-cost Multifraction Aerosol Samplers - Final Report," IR/EXM/99/06, Health and Safety Laboratory, U.K., 1999*

[4] *Kenny, L.C., Chung, K.Y.K., Dilworth, M., Hammond, C., Jones, J. Wynn, Shreeve, Z., and Winton, J., "Applications of Low-cost Dual-fraction Dust Samplers," Ann. Occup. Hyg., Vol. 45, No. 1, 2001, pp. 35-42*

[5] *Mark, D. and Vincent, J. H., "A New Personal Sampler for Airborne Total Dust in Workplaces," Ann. Occup. Hyg. Vol. 30, 1986, pp. 89-102*

[6] *ACGIH Technical Committee on Air Sampling Procedures: Particle Size-selective Sampling in the Workplace, ACGIH, Cincinnati, Ohio, 1984*

Ordering Information

Description	Cat. No.
IOM Sampler and cassette,§ in conductive plastic, with transport clip and cover	**225-70A**
IOM Sampler and cassette,§ in stainless steel, with transport clip and cover	**225-76A**
IOM Sampler,§ in conductive plastic, with stainless steel cassette, transport clip, and cover	**225-79A**

Accessories		
Cassette assembly, in conductive plastic, with transport clip and cover		**225-71A**
Cassette assembly, in stainless steel, with transport clip and cover		**225-75A**
Transport Clip and Cover		**225-72A**
IOM Calibration Adapter		**391-01**
Single Hole Lead Head, for sampling lead according to MDHS 6		**225-52**
Seven Hole Head		**225-50**
Asbestos Head, 25-mm cowled aluminum sampler designed for use with a gridded filter as per HSG (UK) 248 for asbestos fibers		**225-54A**

MultiDust Foam Discs, use with filters below		
MultiDust Foam Discs for Respirable and Inhalable PM	pk/10	**225-772**
	pk/50	**225-772-50**

25-mm Filters for IOM, *each sample requires its own filter*	
PVC, 5.0 µm, pk/100	**225-5-25**
Glass Fiber, 1.0 µm, pk/500	**225-702**
MCE, 0.8 µm, pk/100	**225-1930**
Polycarbonate, 0.8 µm, pk/100	**225-1601**
Gelatin, sterilized, pk/50	**225-9551**

§ *The IOM requires a 25-mm filter; see above.*

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.

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