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Standard Practice for Flow Rate ~~Calibration~~Adjustment of Personal Sampling Pumps[1]

This standard is issued under the fixed designation D5337; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes the calibration of sampling pumps commonly used for monitoring personal airborne exposures in the work-place.

1.2 This practice includes procedures for describing primary and secondary calibration techniques.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

2.2 *NIOSH and OSHA Documents:*

HSM-99-71-31 Personal Sampling Pump for Charcoal Tubes; Final Report[3]

NIOSH— Manual of Analytical Methods, 4th ed.[4]

OSHA— Analytical Methods Manual[5]

3. Terminology

3.1 For definitions of terms used in this practice, refer to Terminology D1356.

3.2 The term *primary flow-rate calibration*, as used in this practice, does not imply the calibration is traceable to a primary standard, unless the apparatus used in the calibration (burets, stop-watches, etc.) has been demonstrated to be traceable to national or international standards, and that this traceability is established on a routine (generally annual) basis. Traceability of calibration is strongly recommended.

4. Summary of Practice

4.1 A bubble tube meter or electronic near-frictionless pump is used for primary calibration of personal sampling pumps. The practice is applicable to systems using air sampling devices. Provisions are made for both manual and automated bubble meters.

4.2 Secondary calibration procedures for field applications are also included in the practice (see 7.3).

5. Significance and Use

5.1 Most occupational exposure assessment methods require the use of personal sampling pumps to collect air samples at typical workplace sampling rates, with sampling volumes specified by (a) particular procedure(s). The precision and bias of these methods are directly affected by the precision and bias of the pumps used to measure the air volume(s) sampled.

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[1] This practice is under the jurisdiction of ASTM Committee D22 ~~on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee~~ on Air Quality and is the direct responsibility of Subcommittee D22.04 ~~on Analysis of Workplace Atmospheres.~~

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from the U.S. Department of Commerce, National Technical Information Service, Port Royal Road, Springfield, VA 22161.

[4] Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio (1994); Available from NIOSH Publications, 4676 Columbia Parkway, Cincinnati, Ohio 45226; www.cdc.gov/niosh/nmam

[5] Occupational Safety and Health Administration, Salt Lake Technical Center, Salt Lake City, Utah (1985); Available from OSHA Analytical Laboratory, 8660 S. Sandy Parkway, Sandy, UT 84070; www.osha.gov/dts/sltc/methods.

6. Apparatus

6.1 *Burets*, 1-L (for high flow) and 100-mL or 10 mL (for low flow).

6.2 *Manometer*.

6.3 *Rotameter*.

6.4 *Stop Watch*.

6.5 Electronic Bubble Meter or Near-frictionless Piston Flowmeter (alternates), should have traceable calibration (see 3.2).

7. Procedure

7.1 Calibrate the personal sampling pumps before and measure after each day's sampling.

7.2 *Primary Flow-rate Calibration Device(s)*:

(as noted in 3.2, these are not primary standards unless the apparatus used in the calibration has been demonstrated to be traceable to national and international standards):

7.2.1 *Bubble Meter Method*:

7.2.1.1 Allow the pump to run five minutes prior to calibration to stabilize pump.

7.2.1.2 Connect pump to an appropriate sampling train. Sampling trains identical to that used in sampling for sorbent tubes, filter cassettes, and cyclones are shown in Figs. 1-3.

7.2.1.3 Check all connections to insure their integrity.

7.2.1.4 Wet the inside surface of the 1-L buret with the soap solution (use a 100-mL buret for low flow pumps).

7.2.1.5 Turn on the pump and momentarily submerge the opening of the buret into the soap solution to form a bubble.

7.2.1.6 With a stop watch, time the travel of a single film from the zero mark to the calibrated volume mark. Note the time and repeat this procedure at least three times.

7.2.1.7 Calculate the flow rate using the formula:

$$\text{Flow Rate (L/min)} = \frac{\text{Volume (L)}}{\text{Time (min)}} \quad (1)$$

7.2.1.8 If using a pump equipped with a rotameter, record the position of center of the float that corresponds with the flow rate. The rotameter can then be used as an approximate indicator of flow-rate during the sampling period.

7.2.1.9 An automated electronic–bubble flow meter may be used in place of manual types. The flow meter has an electronic timer that measures the time taken for the bubble to move through a defined volume producing a direct read-out of flow-rate.

7.2.2 *Electronic Near-Frictionless Piston Method*—Allow the pump to stabilize and connect to an appropriate sampling train as in 7.3, Figs. 1-3 except that the soap bubble meter is replaced by a near-frictionless piston flow-meter. The flow meter has an electronic timer that measures the time taken for the piston to move through a defined volume producing a direct read-out of flow-rate.

7.3 *Secondary Flow-rate Calibration Devices*:

7.3.1 Set up a calibration apparatus appropriate for the sample collector to be used. See Figs. 1-3.

7.3.2 Place the secondary calibration device in line, between the bubble meter and sampler, connecting the inlet of the secondary calibrator to the outlet of the bubble meter and the outlet of the sampler.

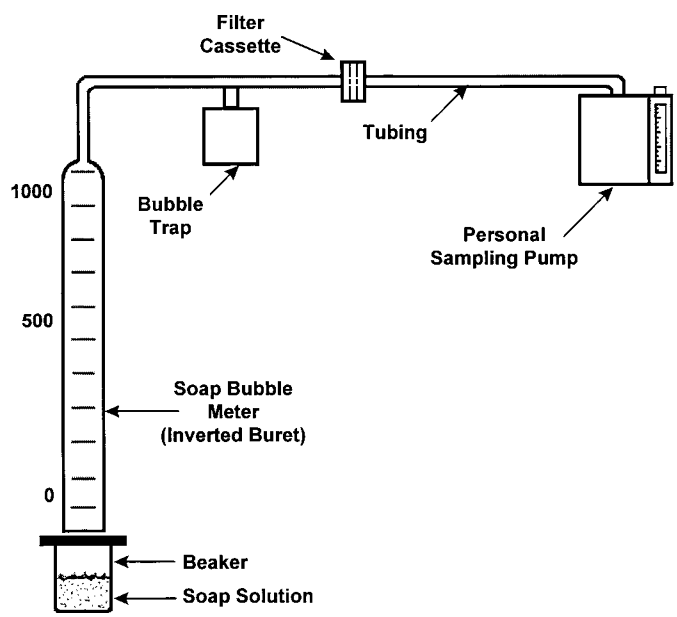

FIG. 1 Calibration Setup for Personal Sampling Pump with ~~Sampl~~ F~~ing Tub~~ilter Cassette