



Standard Practice for Collection by Filtration and Determination of Mass, Number, and Optical Sizing of Atmospheric Particulates¹

This standard is issued under the fixed designation D 2009; 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.

This practice has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This recommended practice covers the sample collection of particulate matter from an atmosphere by filtration and for measurement of mass amount, particle size, and particle size distribution of the collected material. Variations in the recommended practice permit sampling to meet a number of widely different assay needs. Although especially applicable to collection of solid particles, the filter method may be used also to collect liquid particles if droplet size need not be determined.

2. Referenced Documents

- 2.1 *ASTM Standards:*
D 1356 Definitions of Terms Relating to Atmospheric Sampling and Analysis²
D 1357 Practice for Planning the Sampling of the Ambient Atmosphere²
D 1704 Test Method for Particulate Matter in the Atmosphere (Optical Density of Filtered Deposit)²

3. Definitions

3.1 For definitions of terms used in this recommended practice, refer to Definitions D 1356.

4. Summary of Recommended Practice

4.1 A measured and representative sample of the atmosphere under investigation is drawn through a filter medium selected to arrest and permit measurement of the particles that are to be studied. For most purposes, the exposed filter medium is removed from the sampling device and appropriate examination methods then applied to the collected matter. This recommended practice provides for determination of mass loading, particle concentration, particle size and size distribution, and particle inspection. Chemical composition, radioactivity, and other characteristics of the particles may be determined by additional methods not included in this recommended practice. Studies by phase microscopy, electron microscopy, or other techniques also may be made on the collected material.

5. Apparatus

5.1 *Sample Collector*—Figure 1 shows, schematically, a typical arrangement of apparatus parts in a filter sampling system. These include a sampling nozzle, filter holder, filter medium, flow-measuring device, flow-inducing device, and means for regulating the flow of the sample air or gas.

5.1.1 It is important that the filter be upstream from the rest of the apparatus so that any dirt in the system, manometer liquid, or pump oil will not be carried accidentally into the filter. The filter should be as close as possible to the sampling point, and any sampling lines must be perfectly clean. When sampling from a moving stream, as in a duct or stack, careful attention must be given to the shape and position of the nozzle. Recognized principles of stream sampling must be used, otherwise the particles collected may not be representative of those in the test atmosphere (1).³ For sampling in the open, a nozzle is not needed.

5.1.1.1 *Filter Holder*—The filter holder must be such as to hold the proper size of filter without waste of filtering area and without chance of channeling or leak around the filter. An inert metal screen or other mechanical support usually is required to prevent rupture or displacement of the filter in service. If the holder is not properly designed, flow through the medium will not be uniform over the face of the filter. Uniform flow distribution is especially desirable where particle counts are to be made. Many kinds of filter media are available, and the one selected should best suit the purpose for which the particle collection is made. Properties of various media have been published (2).

5.1.1.2 *Flow Meter*—The flow meter may be of the orifice type, a rotameter, bellows gas meter, rotary gas meter, or other recognized device. In any case, it must be carefully calibrated under the conditions of use to give an accurate measure of sample volume or flow rate.

5.1.1.3 Various types of air-moving equipment may be employed to draw the sample of air or gas through the system, the most usual being a turbine-type blower, mechanical vane pump, piston or diaphragm pump, or ejector. For large volumes and for long sampling periods, turbine blowers are most satisfactory; multi-stage units are preferred since they will provide the necessary pressure drop. Mechanical pumps are particularly useful where there is high flow resistance in the system (caused by special filters, long sampling lines, etc.). Except for flow rates of 1 ft³/min (0.028

¹ This recommended practice is under the jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.03 on Ambient Atmospheres and Source Emissions.

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² *Annual Book of ASTM Standards*, Vol 11.03.

³ The boldface numbers in parentheses refer to the list of references at the end of this recommended practice.