



Standard Test Method for Respirable Dust in Workplace Atmospheres¹

This standard is issued under the fixed designation D 4532; 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 test method is useful for the determination of respirable dust (see Terminology D 1356) in a range from 0.5 to 10 mg/m³ in workplace atmospheres.

1.2 *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 consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 1356 Terminology Relating to Sampling and Analysis of Atmospheres²
- D 3195 Practice for Rotameter Calibration²
- D 5337 Practice for Flow Rate for Calibration of Personal Sampling Pumps²
- D 6062M Guide for Personal Samplers of Health-Related Aerosol Fractions (Metric)²
- E 1 Specification for ASTM Thermometers³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *respirable fraction of the dust*—that mass which passes through a cyclone at the stated conditions **(1, 2)**.⁴

4. Summary of Test Method

4.1 Air is accurately drawn for a measured period of time through a 10-mm cyclone followed by a tared filter. The respirable dust concentration is calculated from the weight gain of the filter and the total volume of air sampled.

5. Significance and Use

5.1 This test method covers the determination of respirable dust in workplace atmospheres.

5.2 The limitations on the test method are a minimum weight of 0.2 mg of dust on the filter, and a maximum loading of 0.3 mg/cm² on the filter. The test method may be used at higher loadings if the flow rate can be maintained constant.

6. Apparatus

6.1 The sampling unit consists of a pump and a sampling head. The sampling head consists of a 10-mm cyclone and a filter assembly.

6.1.1 *Pump*—A personal sampling pump with a flow rate accurate to $\pm 5\%$. Pump pulsation not to exceed $\pm 20\%$ of the mean flow. The pump must be capable of maintaining the mean flow constant to within $\pm 5\%$ during the sampling period. Calibrate the sampling pump using Practice D 5337.

6.1.2 *Sampling Head*—The sampling head consists of a 10-mm cyclone, a filter, a filter-support pad, and a filter holder with suitable caps (see Fig. 1).

6.1.2.1 The cyclone⁵ must be shown to be unbiased relative to the appropriate respirable dust criterion and the dust size distribution being sampled **(3, 4, 5, 6)**. Based on the cyclone penetration curve for non-pulsating flow measured with a monodisperse aerosol, the bias in the test method is shown in Fig. 2 for sampling rates appropriate for individual cyclones. **(7)**.

6.1.2.2 Cyclone samples collected with pulsating flow have been shown to yield a negative bias as large as 22 % compared to samples collected under steady flow **(8)**.

6.1.2.3 Electrostatic charge on the dust and a non-conductive sampler can cause bias as large as 50 %. **(9)**.

6.1.3 The filter shall be non-hygroscopic and a collection efficiency greater than 95 % for the dust cloud of interest. The filter and its filter support shall be 37 mm in diameter.

NOTE 1—As an example, most glass fiber and membrane filters with nominal pore size of 5 μm will nearly always fulfill this requirement **(10)**. PVC is recommended for gravimetric analysis. The equilibrated filter is preweighed by the user. The weight of the filter holder is not used in any determination of weight gain in this test method. The filter holder material must not contribute to any weight change of the filter.

¹ This test method is under the jurisdiction of ASTM Committee D22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.04 on Workplace Atmospheres.

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

³ *Annual Book of ASTM Standards*, Vol 14.03.

⁴ The boldface numbers in parentheses refer to the list of references at the end of this test method.

⁵ The sole source of the 10-mm cyclones known to the committee at this time is Dorr-Oliver, Inc., Milford, CT 06460. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.