



Standard Test Method for Monitoring Diesel Particulate Exhaust in the Workplace¹

This standard is issued under the fixed designation D 6877; 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 covers determination of organic and elemental carbon in the particulate fraction of diesel engine exhaust, hereafter referred to as diesel particulate matter (DPM). Samples of workplace atmospheres are collected on quartz-fiber filters. The method also is suitable for other types of carbonaceous aerosols, but it is not appropriate for sampling volatile or semi-volatile components. These components require sorbents for efficient collection.

NOTE 1—Sample collection and handling procedures for environmental samples differ from occupational samples. This standard addresses occupational monitoring of DPM in workplaces where diesel-powered equipment is used.

1.2 The method is based on a thermal-optical technique (1, 2)². Speciation of organic and elemental carbon is achieved through temperature and atmosphere control, and an optical feature that corrects for sample charring.

1.3 A portion of a 37-mm, quartz-fiber filter sample is analyzed. Results for the portion are used to calculate the total mass of organic and elemental carbon on the filter. The portion must be representative of the entire filter deposit. If the deposit is uneven, two or more representative portions should be analyzed for an average. Open-faced cassettes give even deposits but are often not practical. Closed-face cassettes give equivalent results if other dusts are absent. Other samplers may be required, depending on the sampling environment (2-5).

1.4 The calculated limit of detection (LOD) depends on the level of contamination of the media blanks (5). A LOD of approximately 0.2 μg carbon per cm^2 of filter was estimated when analyzing a sucrose standard solution applied to filter portions cleaned immediately before analysis. LODs based on media blanks stored after cleaning are usually higher. LODs based on a set of media blanks from a commercial laboratory were $OC = 1.2 \mu\text{g}/\text{cm}^2$, $EC = 0.4 \mu\text{g}/\text{cm}^2$, and $TC = 1.3 \mu\text{g}/\text{cm}^2$, where OC , EC , and TC refer to organic, elemental, and total carbon, respectively.

1.5 OC - EC methods are operational, which means the analytical procedure defines the analyte. The test method offers

greater selectivity and precision than thermal techniques that do not correct for charring of organic components. The analysis method is simple and relatively quick (about 15 min). The analysis and data reduction are automated, and the instrument is programmable (different methods can be saved as methods for other applications).

1.6 A method (5040) for DPM based on thermal-optical analysis has been published by the National Institute for Occupational Safety and Health (NIOSH). Method updates (3, 4) have been published since its initial (1996) publication in the NIOSH Manual of Analytical Methods (NMAM). Both OC and EC are determined by NMAM 5040. An EC exposure marker was recommended because EC is a more selective measure of exposure. A comprehensive review of the method and rationale for selection of an EC marker are provided in a recent Chapter of NMAM (5).

1.7 The thermal-optical instrument required for the analysis is manufactured by a private laboratory.³ As with most instrumentation, design improvements continue to be made. Different laboratories may be using different instrument models.

1.8 *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.* Specific precautionary statements are given in 7.1.5, 8.3, and 12.12.2.

2. Referenced Documents

2.1 ASTM Standards:

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres⁴

3. Terminology

3.1 Definitions:

3.2 For definitions of terms used in this practice, refer to Terminology D 1356.

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

³ The carbon analyzer used in the development and performance evaluation of this test method was manufactured by Sunset Laboratory, 2017 19th Avenue, Forest Grove, Oregon 97116, which is the sole source of supply of the instrument known to the committee at this time. 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 which you may attend.

⁴ Annual Book of ASTM Standards, Vol 11.03.

