



Designation: E3193 – 23

Standard Test Method for Measurement of Lead (Pb) by Flame Atomic Absorption Spectrophotometry (FAAS)¹

This standard is issued under the fixed designation E3193; 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 the determination of lead (Pb) in airborne particulate, dust by wipe and micro-vacuuming, paint, and soil collected in and around buildings and related structures by flame atomic absorption spectrophotometry (FAAS) and is derived from Test Methods [D4185](#) and [E1613](#).

1.2 The sensitivity, detection limit, and optimum working concentration for lead (Pb) are given in [Table 1](#).

1.3 The values stated in SI units are to be regarded as standard. No other values of measurement are included in this standard.

1.3.1 *Exception*—The SI and inch-pound units shown for wipe and micro-vacuuming sampling data are to be individually regarded as standard for wipe and micro-vacuuming sampling data ([14.4.2](#) and [14.4.3](#)).

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[D1193](#) Specification for Reagent Water

[D1356](#) Terminology Relating to Sampling and Analysis of Atmospheres

[D4185](#) Test Method for Measurement of Metals in Workplace Atmospheres by Flame Atomic Absorption Spectrophotometry

[D4210](#) Practice for Intralaboratory Quality Control Procedures and a Discussion on Reporting Low-Level Data (Withdrawn 2002)³

[D4532](#) Test Method for Respirable Dust in Workplace Atmospheres Using Cyclone Samplers

[D4697](#) Guide for Maintaining Test Methods in the User's Laboratory (Withdrawn 2009)³

[D4840](#) Guide for Sample Chain-of-Custody Procedures

[D6785](#) Test Method for Determination of Lead in Workplace Air Using Flame or Graphite Furnace Atomic Absorption Spectrometry

[D6966](#) Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals

[D7035](#) Test Method for Determination of Metals and Metalloids in Airborne Particulate Matter by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)

[D7144](#) Practice for Collection of Surface Dust by Micro-vacuum Sampling for Subsequent Determination of Metals and Metalloids

[E456](#) Terminology Relating to Quality and Statistics

[E631](#) Terminology of Building Constructions

[E691](#) Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

[E1188](#) Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator

[E1583](#) Practice for Evaluating Laboratories Engaged in Determination of Lead in Paint, Dust, Airborne Particulates, and Soil Taken From and Around Buildings and Related Structures

[E1605](#) Terminology Relating to Lead in Buildings

[E1613](#) Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques (Withdrawn 2021)³

¹ This test method is under the jurisdiction of ASTM Committee [D22](#) on Air Quality and is the direct responsibility of Subcommittee [D22.12](#) on Sampling and Analysis of Lead for Exposure and Risk Assessment.

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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 The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 FAAS Instrumental Detection Limit and Optimum Working Concentration for Lead (Pb)

Element	Detection Limit, µg/mL (approximately three times standard deviation of blank) ⁴	Optimum Linear Range Upper Limit, µg/mL	Elements, Compound Classes, and Oxides
Pb	0.02	10	Inorganic compounds, airborne particulate, paint, dust by wipe and micro-vacuuming, soil

⁴ Detection limit represents ideal laboratory conditions; variability due to sampling, digestion, reagents, and sample handling has not been taken into account.

E1644 Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead

E1645 Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis

E1726 Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis

E1727 Practice for Field Collection of Soil Samples for Subsequent Lead Determination

E1728 Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

E1729 Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination

E1741 Practice for Preparation of Airborne Particulate Lead Samples Collected During Abatement and Construction Activities for Subsequent Analysis by Atomic Spectrometry (Withdrawn 2009)³

E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust

E1864 Practice for Evaluating Quality Systems of Organizations Conducting Facility and Hazard Assessments for Lead in Paint, Dust, Airborne Particulate, and Soil in and around Buildings and Related Structures (Withdrawn 2011)³

E1908 Practice for Sample Selection of Debris Waste from a Building Renovation or Lead Abatement Project for Toxicity Characteristic Leaching Procedure (TCLP) Testing for Leachable Lead (Pb)

E1979 Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead

E2115 Guide for Conducting Lead Hazard Assessments of Dwellings and of Other Child-Occupied Facilities

E2239 Practice for Record Keeping and Record Preservation for Lead Hazard Activities

E2271/E2271M Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Multifamily Dwellings

E2913/E2913M Practice for Hotplate Digestion of Lead from Composited Wipe Samples

E2914/E2914M Practice for Ultrasonic Extraction of Lead from Composited Wipe Samples

E3074/E3074M Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Single Family Dwellings, in Individual Units of Multifamily Dwellings, and in Other Child-Occupied Facilities

2.2 *Code of Federal Regulations*:⁴

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures

2.3 *Governmental Agency Guidance*:⁵

U.S. Environmental Protection Agency National Lead Laboratory Accreditation Program (NLLAP)

U.S. Environmental Protection Agency SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure

2.4 *ISO Standard*:⁶

ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminologies **D1356**, **E456**, **E631**, and **E1605**.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *analysis run, n*—a period of measurement time on a given analytical instrument during which data are calculated from a single calibration curve (or single set of curves).

3.2.1.1 *Discussion*—Recalibration of a given instrument produces a new analysis run.

3.2.2 *calibration standards, n*—solutions of known analyte concentrations used to calibrate instruments.

3.2.2.1 *Discussion*—Calibration standards must be matrix matched to the acid content present in sample digestates or extracts and must be measured prior to analyzing samples.

3.2.3 *initial calibration blank (ICB), n*—a standard containing no analyte that is used for the initial calibration and zeroing of the instrument response.

3.2.3.1 *Discussion*—The ICB must be matrix matched to the acid content of sample extracts and digestates. The ICB must be measured during and after calibration. The measured value is to be (at most) less than five times the IDL.

3.2.4 *initial calibration verification (ICV), n*—a solution (or set of solutions) of known analyte concentration used to verify calibration standard levels; the concentration of analyte is to be near the mid-range of the linear curve that is made from a stock

⁴ Available from U.S. Government Publishing Office, 732 N. Capitol St., NW, Washington, DC 20401, <http://www.gpo.gov>.

⁵ Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, <http://www.epa.gov>.

⁶ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.