

Standard Practice for Optimization of Flame Atomic Absorption Spectrometric Equipment¹

This standard is issued under the fixed designation E 1812; 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 covers the optimization of flame atomic absorption spectrometers and the checking of spectrometer performance criteria.

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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazards associated with the use of this practice see Practices E 50 and warning statement included in this practice.

2. Referenced Documents

2.1 ASTM Standards:

E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals²

E 863 Practice for Describing Flame Atomic Absorption Spectroscopy Equipment³

E 1452 Practice for Preparation of Calibration Solutions for Spectrophotometric and Spectroscopic Atomic Analysis³

3. Significance and Use

3.1 This practice is used for optimizing the parameters in the analysis of metals and alloys by flame atomic absorption spectrometry and also describes the practice of checking the spectrometer performance. The work is expected to be performed in a properly equipped laboratory, and appropriate disposal procedures are to be followed.

4. Apparatus

4.1 *Atomic Absorption Spectrometer*, equipped with an appropriate background corrector, a signal output device (such as a video display screen, or VDS), a digital computer, a printer or strip chart recorder, and an optional autosampler.

4.2 *Radiation Source*—Hollow cathode lamp or electrodeless discharge lamp for the analyte(s).

4.3 For a general discussion of the instrumental requirements for flame atomic absorption see Practice E 863.

4.4 For a general discussion of apparatus requirements see Practices E 50.

5. Reagents

5.1 *Purity and Concentration of Reagents*—The purity and concentration of common chemical reagents shall conform to Practices E 50. The reagents should be free of or contain minimal amounts (<0.1 µg/g) of the analyte of interest.

5.2 *Calibration Solutions*—Refer to the preparation of calibration solutions in the relevant analytical method and 7.1.1 of this practice. Also refer to Practice E 1452.

6. Instrument Adjustments

6.1 Determine the flame type (air-acetylene or nitrous oxide/acetylene) to be used by the relevant analytical procedure. Set up the atomic absorption spectrometer to operate with the appropriate single slot laminar flow burner head in accordance with the manufacturer's instructions.

NOTE 1—**Warning:** A “flashback” may occur if a nitrous oxide/acetylene flame is used with burners not specifically designed for a nitrous oxide/acetylene flame, particularly on older or more basic instruments.

6.2 Use a single-element radiation source (hollow cathode or electrodeless discharge lamp) as the light source under test. Operate the lamp as directed by the manufacturer.

NOTE 2—The use of multielement lamps is not generally recommended, especially if one of the elements contained in them is iron. However, some binary alloy lamps give a more stable emission than single-element lamps.

6.3 Light the burner and aspirate water until a thermal equilibrium is reached. Pass a cleaning wire through the nebulizer. Check the burner slot for any buildup which may clog the burner.

6.4 Aspirate a mid-range calibration solution of the element being tested and adjust the instrument to give optimum absorption. Use the wavelength setting specified in the relevant analytical method. Use the slit setting or bandpass recommended by the instrument manufacturer for the element being tested and the wavelength specified. Adjust the burner heights and alignment for optimum absorption. The use of scale expansion may be necessary.

6.5 Adjust the nebulizer for maximum absorption.

6.6 Flush the burner system with HCl (1 + 19), HNO₃ (1 + 19), or deionized water and zero the instrument. Proceed

¹ This practice is under the jurisdiction of ASTM Committee E-1 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.20 on Fundamental Practices.

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² *Annual Book of ASTM Standards*, Vol 03.05.

³ *Annual Book of ASTM Standards*, Vol 03.06.