



Standard Practice for Describing and Specifying a Direct Current Plasma Atomic Emission Spectrometer¹

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1. Scope

1.1 This practice describes the components of a direct current plasma (DCP) atomic emission spectrometer. This practice does not attempt to specify component tolerances or performance criteria. This practice does, however, attempt to identify critical factors affecting bias, precision, and sensitivity. A prospective user should consult with the vendor before placing an order to design a testing protocol for demonstrating that the instrument meets all anticipated needs.

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.* Specific hazards statements are given in Section 9.

2. Referenced Documents

2.1 ASTM Standards:²

[E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials](#)

[E158 Practice for Fundamental Calculations to Convert Intensities into Concentrations in Optical Emission Spectrochemical Analysis](#) (Withdrawn 2004)³

[E172 Practice for Describing and Specifying the Excitation Source in Emission Spectrochemical Analysis](#) (Withdrawn 2001)³

[E406 Practice for Using Controlled Atmospheres in Spectrochemical Analysis](#)

[E416 Practice for Planning and Safe Operation of a Spectrochemical Laboratory](#) (Withdrawn 2005)³

¹ This practice is under the jurisdiction of ASTM Committee E01 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 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.

[E520 Practice for Describing Photomultiplier Detectors in Emission and Absorption Spectrometry](#)

[E528 Practice for Grounding Basic Optical Emission Spectrochemical Equipment](#) (Withdrawn 1998)³

[E1097 Guide for Determination of Various Elements by Direct Current Plasma Atomic Emission Spectrometry](#)

3. Terminology

3.1 For terminology relating to emission spectrometry, refer to Terminology [E135](#).

4. Significance and Use

4.1 This practice describes the essential components of the DCP spectrometer. This description allows the user or potential user to gain a basic understanding of this system. It also provides a means of comparing and evaluating this system with similar systems, as well as understanding the capabilities and limitations of each instrument.

5. Overview

5.1 A DCP spectrometer is an instrument for determining concentration of elements in solution. It typically is comprised of several assemblies including a direct current (dc) electrical source, a sample introduction system, components to form and contain the plasma, an entrance slit, elements to disperse radiation emitted from the plasma, one or more exit slits, one or more photomultipliers for converting the emitted radiation into electrical current, one or more electrical capacitors for storing this current as electrical charge, electrical circuitry for measuring the voltage on each storage device, and a dedicated computer with printer. The liquid sample is introduced into a spray chamber at a right angle to a stream of argon gas. The sample is broken up into a fine aerosol by this argon stream and carried into the plasma produced by a dc-arc discharge between a tungsten electrode and two or more graphite electrodes. When the sample passes through the plasma, it is vaporized and atomized, and many elements are ionized. Free atoms and ions are excited from their ground states. When electrons of excited atoms and ions fall to a lower-energy state, photons of specific wavelengths unique to each emitting species are emitted. This radiation, focussed by a lens onto the entrance slit of the spectrometer and directed to an echelle grating and