



Standard Practice for Testing Variable-Wavelength Photometric Detectors Used in Liquid Chromatography¹

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1. Scope

1.1 This practice is intended to serve as a guide for the testing of the performance of a variable-wavelength photometric detector (VWPD) used as the detection component of a liquid-chromatographic (LC) system operating at one or more wavelengths in the range 190 to 800 nm. Many of the measurements are made at 254 nm for consistency with Practice E 685. Measurements at other wavelengths are optional.

1.2 This practice is intended to describe the performance of the detector both independently of the chromatographic system (static conditions) and with flowing solvent (dynamic conditions).

1.3 For general liquid chromatographic procedures, consult Refs (1-9).²

1.4 For general information concerning the principles, construction, operation, and evaluation of liquid-chromatography detectors, see Refs (10, 11) in addition to the sections devoted to detectors in Refs (1-7).

1.5 The values stated in SI units are to be regarded as standard.

1.6 *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.*

2. Referenced Documents

2.1 ASTM Standards:

E 275 Practice for Describing and Measuring Performance of Ultraviolet, Visible, and Near-Infrared Spectrophotometers³

E 682 Practice for Liquid Chromatography Terms and Relationships⁴

E 685 Practice for Testing Fixed-Wavelength Photometric Detectors Used in Liquid Chromatography⁴

¹ This practice is under the jurisdiction of ASTM Committee E13 on Molecular Spectroscopy and is the direct responsibility of Subcommittee E13.19 on Chromatography.

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² The boldface numbers in parentheses refer to the list of references at the end of this practice.

³ Annual Book of ASTM Standards, Vol 03.06.

⁴ Annual Book of ASTM Standards, Vol 14.02.

3. Terminology

3.1 Definitions:

3.1.1 *absorbance calibration*—the procedure that verifies that the absorbance scale is correct within $\pm 5\%$.

3.1.2 *drift*—the average slope of the noise envelope expressed in absorbance units per hour (AU/h) as measured over a period of 1 h.

3.1.3 *dynamic*—under conditions of a flow rate of 1.0 mL/min.

3.1.4 *linear range*—of a VWPD, the range of concentrations of a test substance in a test solvent over which the ratio of response of the detector versus concentration of test substance is constant to within 5 % as determined from the linearity plot specified in 7.1.2 and illustrated in Fig. 1. The *linear range* should be expressed as the ratio of the upper limit of linearity obtained from the plot to either a) the lower linear concentration, or b) the *minimum detectable* concentration, if the *minimum detectable* concentration is greater than the lower linear concentration.

3.1.5 *long-term noise*—the maximum amplitude in AU for all random variations of the detector signal of frequencies between 6 and 60 cycles per hour (0.1 and 1.0 cycles per min).

3.1.5.1 *Discussion*—It represents noise that can be mistaken for a late-eluting peak. This noise corresponds to the observed noise only and may not always be present.

3.1.6 *minimum detectability*—of a VWPD, that concentration of a specific solute in a specific solvent that results in a detector response corresponding to twice the static short-term noise.

3.1.6.1 *Discussion*—The static short-term noise is a measurement of peak-to-peak noise. A statistical approach to noise suggests that a value of three times the rms (root-mean-square) noise would insure that any value outside this range would not be noise with a confidence level of greater than 99 %. Since peak-to-peak noise is approximately five times the rms noise (12), the minimum detectability defined in this practice is a more conservative estimate.

3.1.7 *response time (speed of output)*—the detector, the time required for the detector output to change from 10 % to 90 % of the new equilibrium value when the composition of the mobile phase is changed in a stepwise manner, within the linear range of the detector.

3.1.7.1 *Discussion*—Because the detector volume is very small and the transport rate is not diffusion dependent, the