



Standard Practice for Validation of Process Stream Analyzers¹

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1. Scope

1.1 This practice serves as a guide for the validation of process stream analyzers used in determining the physical or chemical characteristics of petroleum and petrochemical products.

1.2 Procedures for treating data from automatic process stream analyzers are outlined. Definitions, terms, calibration techniques, and applicable statistical tests for validation are described.

1.3 The implementation of this process requires that the analyzer be installed in compliance with the principles set forth in *Part II Process Stream Analyzers* of the “Manual on Installation of Refinery Instruments and Control Systems” APIRP-550 of the American Petroleum Institute and in agreement with the supplier’s recommendation. In addition it assumes that the analyzer is designed to monitor the specific quality parameter of interest and at the time of validation the analyzer is operating at the conditions specified by the manufacturer.

1.4 The units of measure used in this practice shall be the same as those applicable to the laboratory test standard used as the reference for analyzer validation.

1.5 *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:

- D 1265 Practice for Sampling Liquefied Petroleum (LP) Gases—Manual Method²
- D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³
- D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products³

¹ This practice is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.25 on Validation of Process Analyzers.

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² *Annual Book of ASTM Standards*, Vol 05.01.

³ *Annual Book of ASTM Standards*, Vol 05.02.

F 307 Practice for Sampling Pressurized Gas for Gas Analysis⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard: Time Units

3.1.1 *Lag Time, n*—The time interval from a step change in the measured variable at various points in the system to the first corresponding change in the analyzer signal readout.

3.1.1.1 *Discussion*—It is a function of system design (length and diameter of lines, number of fittings, flow restrictions, etc.) and the flow rate of the process or product stream. (See Fig. 1 and Fig. 2.) It consists of the following elements:

3.1.2 *Sample Loop Lag Time, n*—The time required for a step change in process or product stream quality to traverse the distance between the start of the process or product stream sample loop to the inlet of the sample conditioning unit.

3.1.3 *Sample Conditioning Unit Lag Time, n*—The time required for a step change in the process or product stream quality to pass through the sample conditioning unit from the junction with the sample loop to the inlet of the analyzer unit.

3.1.4 *Analyzer Lag Time, n*—A function of the analyzer’s operating characteristics.

3.1.4.1 *Discussion*—Where the analyzer is designed to operate at a specific flow rate, the sum of the elements contributing to the analyzer lag time 3.1.4.2 (1) and 3.1.4.3 (1) will be a constant value. For the analyzer designed for variable flow rates the analyzer lag time and its elements must be determined for each of the flow rates used. These elements are as follows:

3.1.4.2 (1) *Analyzer Dead Time, n*—The time interval between the introduction of a step change in quality at the inlet of the analyzer unit and the initial indication of analyzer response to this change at a specific sample flow rate.

3.1.4.3 (1) *Analyzer Time Constant* (See Fig. 2)—The time interval between the initial response of the analyzer unit and the time required for the analyzer output to reach a value of 63 % of the final output value for a step change in sample quality.

Analyzer Parameters

3.1.5 *Analyzer Output, n*—A signal that is proportional to the quality parameter being measured and suitable for input to readout instrumentation. It can be either a pneumatic, an electrical, or a digital signal.

⁴ *Annual Book of ASTM Standards*, Vol 10.05.