Designation: D7453 – 22

Standard Practice for Sampling of Petroleum Products for Analysis by Process Stream Analyzers and for Process Stream Analyzer System Validation[1]

This standard is issued under the fixed designation D7453; 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.

INTRODUCTION

The primary focus of sampling petroleum product is the timely presentation of the sample for *(1)* analysis by online analyzers, *(2)* validation of an analyzer system and *(3)* collecting a composite sample for batch physical property determination. Sediment, free water, rust, and other contaminants found in the sample may be removed in the sample conditioning system to protect the hardware and analytical systems. If a sample is being collected for later analysis, the sample must be collected, stored, and transported in a manner that does not affect the property of interest. If a sample is being fed to an analyzer or sampled for later determination of water or particulate contamination then filtering is not an option.

1. Scope*

1.1 This practice covers the performance requirements for sample systems employed to deliver process stream samples *(1)* to analyzer system for analyses or *(2)* for analyzer validation or *(3)* for composite sample systems. It also outlines the selection and operation of line or batch sampling equipment intended for analyzer flow proportioned average property value system validation. Sample handling, mixing, and conditioning procedures are required to ensure that a representative sample of the liquid petroleum product is collected from the sampling source.

1.2 *Applicable Fluids*—This practice is applicable to single liquid phase petroleum products whose vapor pressure at sampling and sample storage conditions is less than or equal to 110 kPa (16.0 psi), and, with a D86 final boiling point less than or equal to 400 °C (752 °F).

1.2.1 Specialized sample handling may be necessary to maintain sample integrity of more volatile materials at high temperatures or extended residence time in the receiver. Such handling requirements are not within the scope of this practice. Users should consult the analytical methods to be performed on the sample for special sample storage or conditioning requirements.

1.3 Some or all of the processes outlined in this practice may be applicable to other liquids. Applying this practice to other liquids will require the consideration of additional methods and practices. It is the responsibility of the user of this standard to identify any and all applicable safety and sampling considerations and establish appropriate procedures to handle these additional considerations.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

1.6 *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]

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.25 on Performance Assessment and Validation of Process Stream Analyzer Systems.

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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.

***A Summary of Changes section appears at the end of this standard**

D1265 Practice for Sampling Liquefied Petroleum (LP) Gases, Manual Method
D3700 Practice for Obtaining LPG Samples Using a Floating Piston Cylinder
D3764 Practice for Validation of the Performance of Process Stream Analyzer Systems
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
D5842 Practice for Sampling and Handling of Fuels for Volatility Measurement
D6122 Practice for Validation of the Performance of Multivariate Online, At-Line, Field and Laboratory Infrared Spectrophotometer, and Raman Spectrometer Based Analyzer Systems
D6624 Practice for Determining a Flow-Proportioned Average Property Value (FPAPV) for a Collected Batch of Process Stream Material Using Stream Analyzer Data
D7278 Guide for Prediction of Analyzer Sample System Lag Times
D7453 Practice for Sampling of Petroleum Products for Analysis by Process Stream Analyzers and for Process Stream Analyzer System Validation
D8009 Practice for Manual Piston Cylinder Sampling for Volatile Crude Oils, Condensates, and Liquid Petroleum Products
D8340 Practice for Performance-Based Qualification of Spectroscopic Analyzer Systems

3. Terminology

3.1 *Definitions:*

3.1.1 *analyzer unit response time, n*—time interval between the introduction of a step change in property characteristic at the inlet of the analyzer unit and when the analyzer output indicates a value corresponding to 99.5 % of the subsequent change in analyzer results. **D3764**

3.1.2 *automatic sample collector, n*—device used to repetitively extract a grab and collect a representative sample of a batch or process stream.

3.1.3 *automatic sampling system, n*—system consisting of a sample probe, sample fast cycle loop, sample supply line stream conditioning, an automatic sample collector and an associated controller, a flow measuring device, and sample holding, mixing and handling capabilities.

3.1.4 *batch, n*—discrete shipment of commodity defined by a specified quantity, a time interval, or quality. **D4177**

3.1.5 *flow proportional sampler, n*—sampler designed to automatically adjust the sampling rate to be proportional to the flow rate of the stream.

3.1.6 *grab, n*—volume of sample extracted from a batch by a single actuation of the sample extractor.

3.1.7 *lag time, n*—the time required for material to travel from point A to point B in the total analyzer system (points A and B are user-defined). **D3764**

3.1.8 *line sample, n*—process material that can be safely withdrawn from a sample port or associated facilities without significantly altering the property of interest so that the material can be used to perform analyzer system validation; the material is withdrawn in accordance with Practices D1265, D3700, D4057, D4177, D5842, D7453, or D8009, whichever is applicable, during a period when the material flowing through the analyzer is of uniform quality and the analyzer results are practically constant. **D3764**

3.1.9 *liquid petroleum product and fuels, n—in relation to process analyzers*, any single-phase liquid material that is produced at a facility in the petroleum and petrochemical industries and will be in whole or in part of a petroleum product; it is inclusive of biofuels, renewable fuels, blendstocks, alternative blendstocks, and additives. **D8340**

3.1.10 *primary test method (PTM), n*—the analytical procedure used to generate the reference values against which the analyzer is both calibrated and validated. **D3764**

3.1.11 *sample conditioning unit lag time, n*—the time required for material to flow from the sample conditioning unit inlet to the analyzer unit inlet. **D3764**

3.1.12 *sample fast cycle loop, n*—a system that continually and rapidly transports a representative sample of process material from the sample probe past the sample supply line and returns the remaining material to the process.

3.1.12.1 *sample fast loop lag time, n*—time required for material to transport from the product takeoff point of the sample loop to the sample conditioning unit inlet.

3.1.13 *total analyzer system response time, n*—time interval between the when a step change in property characteristic arrives at the sample loop inlet and when the analyzer output indicates a value corresponding to 99.5 % of the subsequent change in analyzer results. **D3764**

3.1.13.1 *Discussion*—The total analyzer system response time is the sum of the sample fast loop lag time, the sample conditioning unit lag time, and the analyzer unit response time. **D3764**

3.1.14 *validation, n—for equipment used in the analysis of liquid petroleum products and fuels*, statistically quantified judgment that the analyzer system or subsystem being assessed, in conjunction with any correlation applied, can produce acceptable precision and bias performance on the prediction deviations (δ for materials that were not used to develop the correlation). **D3764**

4. Summary of Practice

4.1 Analyzer measurement systems require a process sample that is delivered in a timely manner commensurate with the analyzer and process cycle time at pressure, temperature and flow conditions meeting system requirements, is free of contaminants, and is representative of the process stream.

4.2 Line samples collected from the process or blender stream need to accurately reflect the composition of the analyzer feed stream. This is accomplished by taking into account the total analyzer system response time in order to properly validate online analyzer systems.

4.3 This practice describes functional requirements that need to be addressed in the design and operation of automatic