



Designation: D7670 – 10 (Reapproved 2021)

Standard Practice for Processing In-service Fluid Samples for Particulate Contamination Analysis Using Membrane Filters¹

This standard is issued under the fixed designation D7670; 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 processing of in-service fluids in preparation for particulate contamination analysis using membrane filters and is limited only by the liquid-to-membrane filter compatibility.

1.2 The practice covers the procedure for filtering a measured volume of liquid through a membrane filter. When this practice is used, the particulate matter will be randomly distributed on the filter surface for subsequent contamination analysis methods.

1.3 The practice describes procedures to allow handling particles in the size range between 2 μm and 1000 μm with minimum losses during handling.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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

D287 Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)

D1078 Test Method for Distillation Range of Volatile Organic Liquids

D1193 Specification for Reagent Water

D1353 Test Method for Nonvolatile Matter in Volatile Solvents for Use in Paint, Varnish, Lacquer, and Related Products

D1836 Specification for Commercial Hexanes

D2021 Specification for Neutral Detergent, 40 Percent Alkylbenzene Sulfonate Type (Withdrawn 2000)³

F312 Test Methods for Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters

3. Terminology

3.1 *Definitions:*

3.1.1 *filtered liquid dispenser, n*—as used in this practice, a dispenser capable of delivering rinse liquid through a filter with pore size no larger than half the size of the smallest particle being considered for measurement.

3.1.2 *filter patch test, n*—preparation of a sample by membrane filtration, as described in this practice, is often referred to as a patch test, or a filter patch test.

4. Significance and Use

4.1 This practice provides for the processing of liquid samples. It will provide the optimum sample processing for visual contamination methods such as Test Methods **F312**.

5. Apparatus and Materials

5.1 *Filtration Funnel.*

5.2 *Membrane Filter Support*—Either a fritted-glass, sintered-metal, polyphenyl-sulfone, or stainless steel screen may be used. The support shall be so designed as to enable attachment to a vacuum flask.

5.3 *Vacuum Flask.*

5.4 *Funnel-Holding Device*—A provision should be made for the dissipation of static electricity from the funnel.

5.5 *Clean Bench or Hood*—Supplied with unidirectional flow filtered air in which uncovered components may be placed.

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 **D02.96.06** on Practices and Techniques for Prediction and Determination of Microscopic Wear and Wear-related Properties.

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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.

5.6 *Vacuum Source*—Minimum vacuum gauge reading of 61 kPa (or other metric units acceptable to ASTM).

5.7 *Forceps*—Unserrated tips.

5.8 *Filtered Liquid Dispenser*.

5.9 *Membrane Filter*—Pore size no greater than half the size of the smallest particle being considered for measurement.

5.10 *Petri Dishes*—Glass. Plastic petri dishes may be used only if the selected plastic is known to be compatible with the filtered liquid.

6. Reagents and Materials

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁴ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification **D1193**, Type III or clearer.

6.3 *Detergent*—Free-rinsing. Material conforming to Specification **D2021** is suitable.

6.4 *Isopropyl Alcohol*—Acetone-free.⁵

6.5 *Solvent*—Conforming to the following requirements (**Note 1**):

6.5.1 *Distillation Range*—Initial boiling point 27 °C min; dry point 71 °C max, as determined in accordance with Test Method **D1078**.

6.5.2 *API Gravity*—70 deg min, as determined in accordance with Test Method **D287**.

6.5.3 *Residue*, 0.004 g/100 mL max, as determined in accordance with Test Method **D1353**.

NOTE 1—Commercial hexanes conforming to Specification **D1836** meet this requirement.

6.6 *Rinse Liquid*—This liquid shall be specified by the user and shall be compatible with the sample liquid, plastic film, and the membrane filter.

⁴ *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

⁵ Material conforming to *USP XVII*, 1965, p. 995 is suitable.

7. Preparation of Apparatus

7.1 Wash the apparatus thoroughly in a solution of liquid detergent and hot water and rinse with hot tap water (**Note 2**). Rinse with filtered isopropyl alcohol to remove the water; then rinse twice with filtered solvent.

NOTE 2—Distilled or deionized water shall be used in areas where hardness or contamination increase the blank count over the allowable level.

7.2 *Sample Bottle Preparation*—Repeat the procedure of **7.1** for both the sample bottles and caps, then allow them to drip dry. Place a piece of plastic film that has been rinsed with filtered liquid over the mouth of the bottle. Hold the film while screwing on the cap to prevent the film from rotating.

NOTE 3—It is important to hold the film when applying and removing the cap to prevent serration.

8. Procedure

8.1 Filter Preparation:

8.1.1 Remove a membrane from the container and rinse with filtered liquid. Place the membrane on the support, lower the funnel, and secure with the holding device. Cover the funnel.

8.1.2 Place an amount of filtered liquid equal to the amount of fluid used in the routine sample filtration in a sample bottle and agitate. Remove the cover and pour the contents of the bottle into the funnel. Place approximately 50 mL of rinse liquid into the bottle and agitate. Pour rinse liquid into the funnel and cover.

8.1.3 Turn on the vacuum and allow the liquid to filter until approximately one third remains. Lift the cover and carefully wash down the funnel walls with rinse liquid (**Note 4**). Replace the cover and filter until the membrane is dry. Remove the holding device and funnel (see **Notes 5 and 6**), then turn off the vacuum immediately. Remove the membrane using the forceps and place it in a petri dish. Label the petri dish giving the sample volume and identification. The filter is now ready for particulate contamination analysis.

NOTE 4—When the fluid filtration rate is excessive, the vacuum should be released to allow adequate rinsing of the funnel walls.

NOTE 5—Do not slide the funnel during this operation.

NOTE 6—When filtration is completed the rate of repressurization shall be such that no fluid agitation shall occur that could re-wet the filter membrane.

9. Keywords

9.1 filter patch test; filtration; liquid sample handling; membrane filters; particulate contamination; patch test; vacuum filtration