Designation: D 923 – 97

Standard Practices for Sampling Electrical Insulating Liquids[1]

This standard is issued under the fixed designation D 923; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 These practices cover sampling of new electrical insulating liquids including oils, askarels, silicones, and synthetic liquids as well as such liquids in service or subsequent to service in cables, transformers, circuit breakers, and other electrical apparatus. These practices apply to liquids having a viscosity of less than 6.476×10^{-4} m^2/s (540 cSt) at 40°C (100°F).

1.2 The values stated in SI units are regarded as the standard where applicable. Inch pound units are used where there is no SI equivalent.

1.3 Sampling procedures using syringe-type devices, tin plated steel cans with flexible sides and stainless steel cylinders are described in Test Methods D 3613. This method describes preferred techniques to use when sampling for dissolved gas analysis and water content in insulating fluid.

1.4 The procedures appear in the following order:

Procedure	Section/Paragraph
Dip-Type Device (drum thief)	6.2, 13, and A1.1
Pressure-Type Device	6.3, 14, and A1.2
Tank Car-Type Device	6.4, 15, and A1.3
Manifold-Type Device	6.5, 21, and A1.4
Electric Equipment Sampling Outlet or Valve	6.6 and 18

1.5 These practices involve close contact with the electrical insulating liquids being sampled as well as liquids and other materials used to clean the sampling tools and devices. Proper use of personal protective equipment (PPE) is suggested.

1.6 Handle askarels as outlined in IEEE 799-1992 to avoid environmental contamination. For methods of testing askarels see Methods D 901.

1.7 Properly contain, package and dispose of any liquid or material resulting from the use of these practices in a manner that is in accordance with local, state and federal regulations.

1.8 *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 precautionary statements are given in 1.5, 1.7, 14.2, Section 17, 19.2, and 21.2.3.

2. Referenced Documents

2.1 *ASTM Standards:*

D901 Methods of Testing Askarels[2]

D 1933 Specification for Nitrogen Gas as an Electrical Insulating Material[2]

D 3613 Test Methods of Sampling Electrical Insulating Oils for Gas Analysis and Determination of Water Content[2]

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products[3]

2.2 *IEEE Standards:*

799-1992 Guide for Handling and Disposal of Transformer Grade Insulating Fluids Containing PCBs[4]

3. Terminology

3.1 *Definition:*

3.1.1 *sampling*—the obtaining of that amount of a material which is adequate for making the required tests and which is representative of that portion of the material from which it is taken.

3.1.1.1 *Discussion*—In most cases the detection of contaminants that are not ordinarily dispersed uniformly through the liquid being sampled, such as water or solid particles, necessitates taking samples at specific locations where the contaminants are likely to be found. For a liquid having a relative density (specific gravity) less than one, water and some other impurities are most likely to be found on the bottom, whereas in the case of a liquid having a specific gravity greater than one, some of these impurities are most likely to be found on the surface.

4. Summary of Practice

4.1 Representative samples of electrical insulating liquids are taken for test specimens so that the quality pertinent to their use may be determined. The quality in different portions of a

[1] This test method is under the jurisdiction of ASTM Committee D-27 on Electrical Insulating Liquids and Gasesand is the direct responsibility of Subcommittee D27.07on Physical Tests.

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[2] *Annual Book of ASTM Standards*, Vol 10.03.

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

[4] Available from the IEEE, 345 E. 47th St., NY, NY 10017-2394.

given container, or the average quality of the whole bulk may be ascertained if desired.

5. Significance and Use

5.1 Accurate sampling, whether of the complete contents or only parts thereof, is extremely important from the standpoint of evaluating the quality of the product sampled. Obviously, examination of a test specimen that, because of careless sampling procedure or contamination in sampling equipment, is not directly representative, leads to erroneous conclusions concerning quality and in addition results in a loss of time, effort, and expense in securing, transporting, and testing the sample.

SAMPLING DEVICES

6. Application

6.1 Devices suitable for withdrawing samples of liquid from containers, electrical equipment, cable feeders, and cable joints are shown in Figs. 1-5.

6.2 *Dip Type or Drum Thief*—The device shown in Fig. 1 is used for taking bottom samples from drums, storage tanks, and small de-energized electrical equipment, that are to be subjected to routine tests. It is not recommended for use under the following conditions:

6.2.1 When the samples are to be subjected to referee tests,

6.2.2 When the relative humidity of the atmosphere exceeds 50 %,

6.2.3 When the samples are to be tested for dissipation factor, resistivity, or moisture content, and

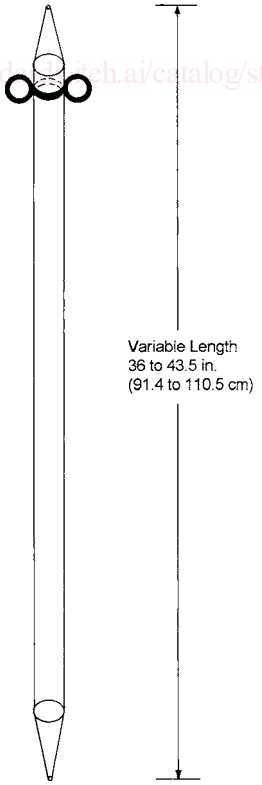
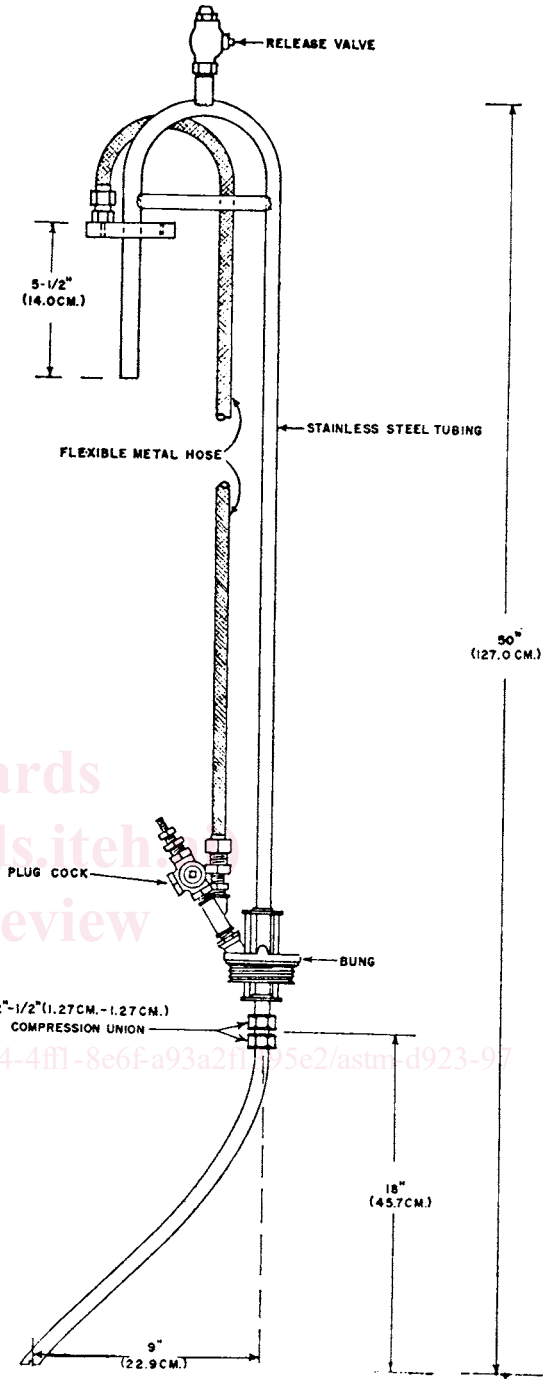


FIG. 1 Dip-Type Sampling Device



NOTE 1—The offset section of tubing at the bottom of the device shall be in the same vertical plane as the U-bend. This will permit easy alignment for obtaining a bottom sample from the center of the drum.

FIG. 2 Pressure-Type Sampling Device

6.2.4 When the viscosity of the liquid to be sampled exceeds 2.28×10^{-5} $m^2/5$ (21 cSt) at 40°C.

6.3 *Pressure Type*—The device shown in Fig. 2 and Fig. 3 is intended primarily for sampling drums of high-viscosity liquids. However, it is particularly suitable for obtaining samples of all electrical insulating liquids in drums where it is desired that all contact of the sample with the atmosphere is eliminated. When possible, this device should be used for

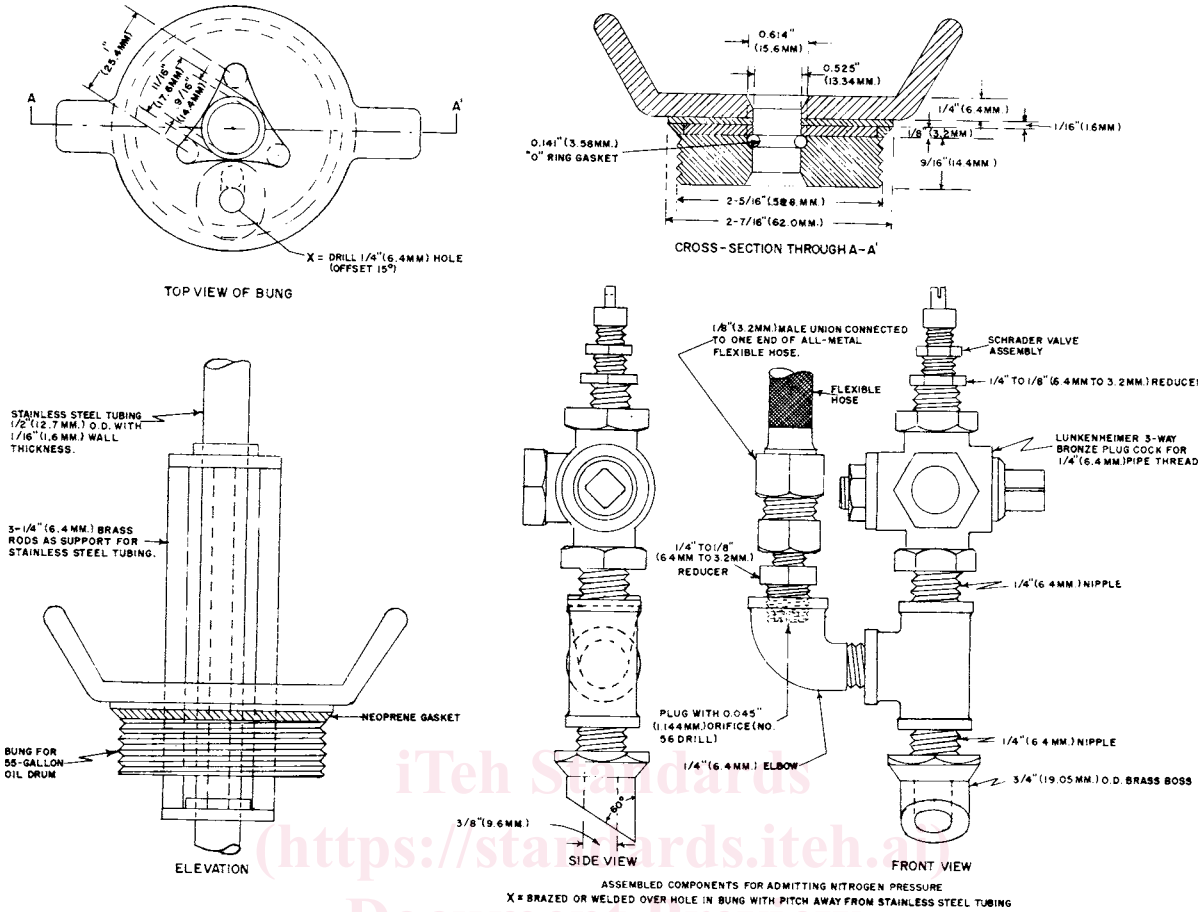


FIG. 3 Details of Bung and Fittings for Pressure-Type Sampling Device

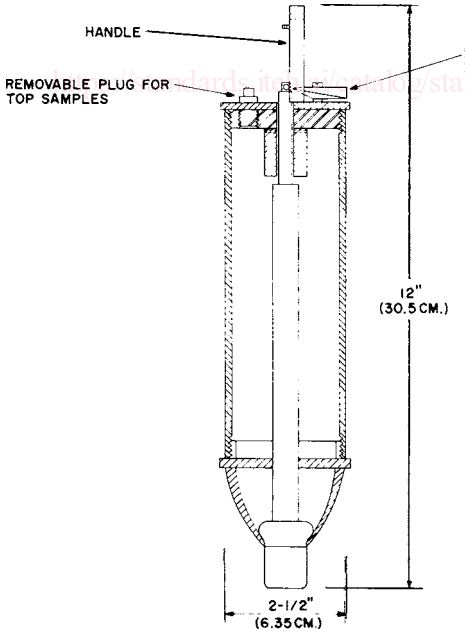


FIG. 4 Tank Car-Type Sampling Device

obtaining samples from drums when these samples are to be subjected to referee tests.

6.4 *Tank Car Type*—The device shown in Fig. 4 is used for taking either top, middle, or bottom samples from containers of large capacity such as tank cars, tank trucks, and large storage tanks not provided with a sampling-test nipple. This device is not recommended for use under the conditions described in 6.2.1 through 6.2.4.

6.5 *Manifold*—The device shown in Fig. 5 is used for taking samples from low-pressure oil-filled cable feeders with the use of vacuum and either dry carbon dioxide gas or dry nitrogen gas. Its use is recommended when high relative humidity conditions exist and it is desired to take the samples through a closed system.

6.6 *Electrical Equipment Sampling Outlet or Valve*, used for taking top or bottom samples from energized or de-energized electrical apparatus. This device is especially suitable when collecting samples in a glass jar, metal can, or other suitable containers as described in Section 9.

7. Construction

7.1 The construction of each of the devices shown in Figs. 1-5 is described in the Annex.

8. Storage

8.1 When not in use, clean sampling devices such as shown in Figs. 1-5 as described in 13.1, Sections 14 and 15, respectively, and keep at all times in a vertical position in a dry, dust-free cabinet or a clean sealed plastic bag. Provide the cabinet with a rack having a suitable drainage receptacle at the base.

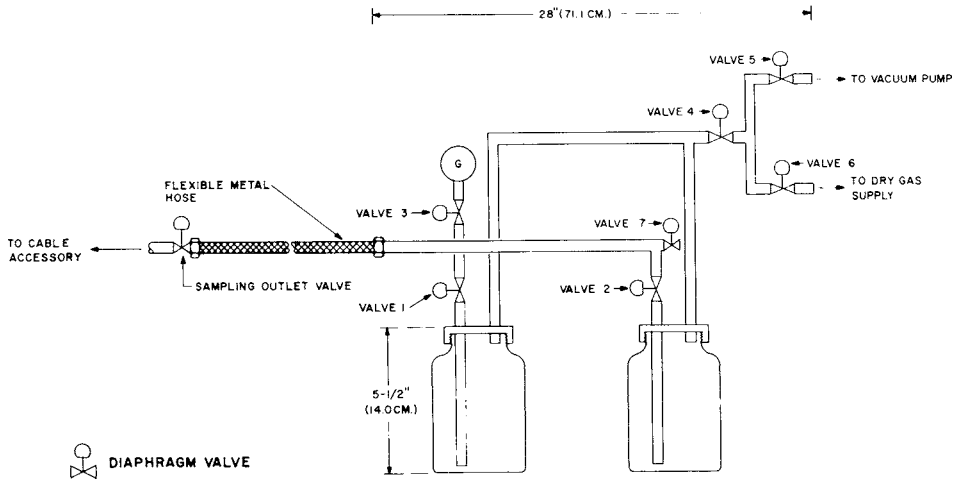


FIG. 5 Apparatus for Sampling Oil from Low-Pressure Filled Cable with Use of Vacuum and Dry Gas

8.2 When the sampling device shown in Fig. 5 is not in use, store in a room having low humidity.

SAMPLE CONTAINERS

9. Construction

9.1 Use amber colored glass (Note 1) or high-density polyethylene bottles (do not use for long term storage when water content is to be determined), aluminum or TFE-flurocarbon lined or welded seam metal cans as containers for the samples. The glass bottles may be either glass-stoppered or fitted with screw caps having a pulp-board liner faced with tin or aluminum foil, or with a suitable oil-resistant plastic such as polyvinylidene chloride or polytetrafluoroethylene. Do not use any incompatible natural or synthetic rubber materials.

NOTE 1—While amber-colored glass bottles are used for storing samples as protection against light, clear glass bottles afford better visual inspection of the samples or test specimens for impurities such as water and foreign particles. Take samples that are to be subjected to referee tests in new amber-colored containers that have been cleaned as described in 10.2. Refer to Test Method D 3613 for the proper techniques and materials used to retrieve test specimens for dissolved gas analysis.

9.2 If glass-stoppered bottles are used, take precautions to ensure that the stoppers provide a perfect fit. If tin-plated steel cans are used, use only those having welded seams and provided with screw caps lined as described in 9.1. Cans with soldered seams should not be used because the sample may become contaminated.

10. Cleaning and Preparation

10.1 Because of the inherent susceptibility of most insulating liquids to contaminating influences of the most minute nature, the cleanliness of the sample container is of paramount importance for ensuring that the sample obtained is representative of the bulk from which it was taken. For these reasons, it is essential that the procedures outlined in the following paragraphs are strictly observed.

10.2 If containers have been previously used for sampling liquids that are to be subjected to referee tests, thoroughly rinse the container with Stoddard solvent, precipitation naphtha, or other suitable cleaning agent that completely dissolves the liquid residue, and then subject to a soap and water cleaning and water rinse. If a water-soluble cleaning agent such as trisodium phosphate is used, rinse thoroughly with tap water. Invert the containers and drain for 10 min; then immerse in a 10 % solution of non-chro-mate acid-based cleaner for not less than 1 h. At the end of this period rinse with tap water, then with distilled water, and dry in an upright position in a forced-draft oven at 110°C for not less than 1 h. In the case of containers that have not been previously used, the initial cleaning may be omitted and the containers placed immediately in the non-chromate solution followed by the rinsing and drying outlined above.

10.3 Clean and dry containers for samples or test specimens to be subjected to routine tests as described in 10.2 except that after the initial tap-water rinse, rinse with distilled water.

10.4 Clean and dry glass stoppers in a manner similar to that of the container in which they are to be used. Do not reuse covers having vinyl liners. Dry new covers with vinyl liners in an oven at 110°C for not less than 30 min immediately prior to being placed on the bottles.

10.5 When the drying periods for the bottles and covers or stoppers have expired, tightly stopper each bottle immediately as it is removed from the oven, taking care not to touch the lip of the container or that portion of the stopper or cover likely to come in contact with the sample.

11. Storage and Handling

11.1 Keep containers that are to be stored for future use in a warm, dry storage cabinet. Store all sample containers with or without samples or test specimens in them in such manner that the possibility of their being contaminated is eliminated. Keep containers sealed until immediately before sampling, and seal again as soon as the sample or test specimen is taken to prevent contamination by dirt or moisture. As soon as samples are taken, properly identify them. To prevent breakage, handle the sample container after filling with care during transportation and storage. Store samples in the dark when clear glass bottles are used. Amber-colored glass bottles provide good protection against degradation of the sample by sunlight.