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Standard Method of SAMPLING PETROLEUM AND PETROLEUM PRODUCTS[1]

This Standard is issued under the fixed designation D 270; 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. This is also a standard of the American Petroleum Institute issued under the fixed designation API 2546.

This method was adopted as a joint ASTM-API standard in 1965.

1. Scope

1.1 This method covers procedures for obtaining representative samples of stocks or shipments of crude petroleum and petroleum products, except electrical insulating oils, and butane, propane, and other petroleum products that are gases at atmospheric temperature and pressure.

NOTE 1—The procedures described in this method may also find application in sampling most noncorrosive liquid industrial chemicals.

NOTE 2—The procedure for sampling liquefied petroleum gases is described in ASTM Method D-1265, Sampling Liquefied Petroleum (LP) Gases,[2] the procedure for sampling electrical insulating oils in ASTM Method D 923, Sampling Electrical Insulating Liquids;[3] and the procedure for sampling natural gas in ASTM Method D 1145, Sampling Natural Gas.[4]

NOTE 3—The values stated in U.S. customary units are to be regarded as the standard. Metric equivalents have been rationalized where tolerances are considered non-critical.

2. Summary of Method

2.1 Samples of petroleum and petroleum products are examined by various methods of test for the determination of physical and chemical characteristics. It is accordingly necessary that the samples be truly representative of the petroleum or petroleum products in question. The precautions required to ensure the representative character of the samples are numerous and depend upon the type of material being sampled, the tank, carrier, container or line from which the sample is being obtained, the type and cleanliness of the sample container, and the sampling procedure that is to be used. A summary of the sampling procedures and their application is presented in Table 1. Each procedure is suitable for sampling a number of specific materials under definite storage, transportation, or container conditions. The basic principle of each procedure is to obtain a sample or a composite of several samples in such manner and from such locations in the tank or other container that the sample or composite will be truly representative of the petroleum or petroleum product.

3. Description of Terms

3.1 *Average Sample* is one that consists of proportionate parts from all sections of the container.

3.2 *All-Levels Sample* is one obtained by submerging a stoppered beaker or bottle to a point as near as possible to the draw-off level, then opening the sampler and raising it at a rate such that it is about three-fourths full (maximum 85 percent) as it emerges from the liquid. An all-levels sample is not necessarily an average sample because the tank volume

[1] This method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and the API Central Committee on Petroleum Measurement.

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In 1965, this method was rewritten as a joint method with the American Petroleum Institute to take care of features on ASTM and API methods for sampling.

[2] *Annual Book of ASTM Standards*, Part 23.

[3] *Annual Book of ASTM Standards*, Part 40.

[4] *Annual Book of ASTM Standards*, Part 26.

may not be proportional to the depth and because the operator may not be able to raise the sampler at the variable rate required for proportionate filling. The rate of filling is proportional to the square root of the depth of immersion.

NOTE 4—The tube sampling procedure, Section 22, may be used to obtain an all-levels sample from a barrel or drum.

3.3 *Running Sample* is one obtained by lowering an unstoppered beaker or bottle from the top of the oil to the level of the bottom of the outlet connection or swing line, and returning it to the top of the oil at a uniform rate of speed such that the beaker or bottle is about three-fourths full when withdrawn from the oil.

3.4 *Spot Sample* is one obtained at some specific location in the tank by means of a thief, bottle, or beaker.

3.5 *Top Sample* is a spot sample obtained 6 in. (150 mm) below the top surface of the liquid (Fig. 1).

3.6 *Upper Sample* is a spot sample taken at the mid-point of the upper third of the tank contents (Fig. 1).

3.7 *Middle Sample* is a spot sample obtained from the middle of the tank contents (Fig. 1).

3.8 *Lower Sample* is a spot sample obtained at the level of the fixed tank outlet or the swing line outlet (Fig. 1).

3.9 *Clearance Sample* is a spot sample taken 4 in. (100 mm) below the level of the tank outlet (Fig. 1).

3.10 *Bottom Sample* is one obtained from the material on the bottom surface of the tank, container, or line at its lowest point.

3.11 *Drain Sample* is one obtained from the draw-off or discharge valve. Occasionally, a drain sample may be the same as a bottom sample, as in the case of a tank car.

3.12 *Water and Sediment Sample* is one obtained with a thief to determine the amount of nonmerchantable material at the bottom of the tank.

3.13 *Composite Sample* is one made up of equal portions of two or more spot samples obtained from a tank. The term also applies to a series of line samples obtained from a free-flowing pipe line. (See Fig. 1 for location of spot samples.)

3.14 *Single Tank Composite Sample* is used in sampling petroleum products and is a blend of the upper, middle, and lower samples. For a tank of uniform cross section, such as an upright cylindrical tank, the blend consists of equal parts of the three samples. For a horizontal cylindrical tank, the blend consists of the three samples in the proportions shown in Table 2.

3.15 *Multiple Tank Composite Sample (Ships, Barges, etc.)*, is a mixture of individual all-levels samples from the several compartments each of which contains the same grade of petroleum material. The mixture is blended in proportion to the volume of material in each compartment.

3.16 *Composite Spot Sample* is a blend of spot samples mixed in equal proportions for testing. Tests may also be made on the spot samples before blending and the results averaged. Spot samples from crude oil tanks are collected as follows:

3.16.1 *Three-Way*—On tanks larger than 1000-barrel (160-m^3) capacity which contain in excess of 15 ft (5 m) of oil, samples should be taken at the upper, middle, and lower, or outlet, connection of the merchantable oil, in the order named. On tanks of 1000-barrel capacity and under, this method may be used also.

3.16.2 *Two-Way*—On tanks larger than 1000-barrel capacity which contain in excess of 10 ft (3 m) and up to 15 ft (5 m) of oil, samples should be taken at the upper and lower, or outlet, connection of the merchantable oil, in the order named. On tanks of 1000-barrel capacity and under, this method may also be used.

3.17 *Middle Spot Sample*—On tanks larger than 1000-barrel capacity containing 10 ft (3 m) or less of crude oil, one spot sample should be taken as near the center of the vertical column of oil as possible.

3.18 *Continuous Sample* is one obtained from a pipeline in such manner as to give a representative average of a moving stream.

3.19 *Dipper Sample* is one obtained by placing a dipper or other collecting vessel into the path of a free-flowing stream so as to collect a definite volume from the full cross section of the stream at regular time intervals for a constant rate of flow, or at time intervals varied in proportion to the rate of flow.

3.20 *Mixed Sample* is one obtained after

mixing or vigorously stirring the contents of the original container, and then pouring out or drawing off the quantity desired.

3.21 *Tube of Thief Sample* is one obtained with a sampling tube or special thief, either as a core sample or spot sample from a specified point in the container.

3.22 *Borings Sample* is one obtained by collecting the chips made by boring holes with a ship auger from top to bottom of the material contained in a barrel, case, bag, or cake.

3.23 *Grab Sample* is one obtained by collecting loose solids in equal quantities from each part or package of a shipment and in sufficient amount to be representative of all sizes and components.

3.24 *Grease Sample* is one obtained by scooping or dipping a quantity of soft or semi-liquid material, such as grease, from a package in such a manner that the material on the scoop or dipper is representative of the material in the package.

APPARATUS

4. Sample Containers

4.1 *Container Specifications*—Sample containers may be clear or brown glass bottles, or cans. The clear glass bottle is advantageous because it may be examined visually for cleanliness, and also allows visual inspection of the sample for free water or solid impurities. The brown glass bottle affords some protection from light. The only cans permissible are those with the seams soldered on the exterior surfaces with a flux of rosin in a suitable solvent. Such a flux is easily removed with gasoline, whereas many others are very difficult to remove. Minute traces of flux may contaminate the sample so that results obtained on tests for dielectric strength, resistance to oxidation, and sludge formation may be erroneous. Sample containers for manual sampling of crude petroleum should be vapor-tight, equipped with delivery tube extending through the top to within ½ in. (12 mm) of the bottom, and with a funnel and positive closure to allow for submerged filling.

4.2 *Container Closure*—Cork or glass stoppers, or screw caps of plastic or metal, may be used for glass bottles; screw caps only shall be used for cans to provide a vaportight closure seal. Corks must be of good quality, clean and free from holes and loose bits of cork. Never use rubber stoppers. Contact of the sample with the cork may be prevented by wrapping tin or aluminum foil around the cork before forcing it into the bottle. Glass stoppers must be a perfect fit. Screw caps must be protected by a fork disk faced with tin or aluminum foil, or other material that will not affect petroleum or petroleum products.

4.3 *Cleaning Procedure*—All sample containers must be *absolutely* clean and free of water, dirt, lint, washing compounds, naphtha, or other solvents, soldering fluxes or acids, corrosion, rust, and oil. Before using a container, rinse it with Stoddard solvent or other naphtha of similar volatility. (It may be necessary to use sludge solvents to remove all traces of sediment and sludge from containers previously used.) Then wash the container with strong soap solution, rinse it thoroughly with tap water, and finally with distilled water. Dry either by passing a current of clean, warm air through the container or by placing it in a hot dust-free cabinet at 104 F (40 C) or higher. When dry, stopper or cap the container immediately. In the ordinary field sampling of crude petroleum, washing with soap and rinsing with water may be eliminated.

5. Sampling Apparatus

5.1 Sampling apparatus is described in detail under each of the specific sampling procedures. Clean, dry, and free all sampling apparatus from any substance that might contaminate the material, using the procedure described in 4.3.

SAMPLING INSTRUCTIONS AND PRECAUTIONS

6. Time and Place of Sampling

6.1 *Crude Petroleum:* By mutual agreement, samples may be taken either from tanks or from pipelines. The pipeline samples may be obtained by either manual or mechanical methods as described in Sections 18 to 20, inclusive.

6.1.1 *Stationary Tanks*—Samples may be taken from tanks by mutual agreement as follows: composite spot, middle spot, all-levels, running samples, or by sample cocks. Addi-