

**(R) Method for Assessing the Cleanliness Level of New Hydraulic Fluid**

## RATIONALE

Changes to this document were to update references, and use ISO 4406 for displaying contamination levels of fluids.

## 1. SCOPE

To provide a method by which to assess the cleanliness of new hydraulic fluids. The method is applicable to new mineral and synthetic hydraulic fluids - regardless of packaging. This SAE Standard is not intended as a procedure for operating equipment.

## 1.1 Purpose

To establish a quality control procedure suitable for both users and producers by which the cleanliness level of new hydraulic fluid can be quantified, certified, and specified.

## 2. REFERENCES

## 2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

## 2.1.1 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM D 4057 Method for Manual Sampling of Petroleum Products

ASTM D 6304 Method of Test for Water in Liquid Petroleum Products by Karl Fischer Reagent

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### 2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

- ISO 3722 Fluid Sample Containers - Qualifying and Controlling Cleaning Methods
- ISO 11171 Calibration of Automatic Particle Counters for Liquids
- ISO 11500 Determination of Oil Contamination Levels Using Automatic Particle Counters
- ISO 4406 Fluids - Method for Coding the Level of Contamination by Solid Particles

### 3. MATERIALS AND APPARATUS

- 3.1 Use an appropriate means of agitating the fluid in its normal storage container (for example, a paint shaker for small containers, a drum rocker for large shipping containers, and a high volume circulating system for bulk storage vessels).
- 3.2 Use a device to facilitate the withdrawal of a fluid specimen at the prescribed level in the container. Examples of such devices are illustrated in Figure 1 - a bottle thief (ASTM D 270) for tanks, a drum sampler, and a crankcase sample for cans.
- 3.3 Use a clean opener to provide an access hole in small containers. In larger vessels, appropriate openings usually exist.
- 3.4 Use sample bottles containing less than 15 particles/mL of bottle volume greater than 5  $\mu\text{m}$  in size as qualified per ISO 3722). The sample bottles shall be large enough in size to contain enough fluid to run at least 4 tests.
- 3.5 Use an automatic particle counter calibrated per ISO 11171.

### 4. SAMPLING PROCEDURE

- 4.1 Agitate the fluid in the container using an appropriate means such as suggested in 3.1, if it is possible.
- 4.2 Clean the area around the location for the access hole with a lint-free cloth which is visibly free of dirt.
- 4.3 Open the container and insert the sampling appendage where its fluid entrance is well below the surface and extract a volume of fluid equal to at least five times, preferably ten times, the total sampling apparatus volume for the purpose of flushing the wetted surfaces. This hydraulic fluid may be discarded or returned to the container. Care should be taken to keep the external surfaces of the sampling device that is inserted into the container free from contaminant prior to and during sampling.
- 4.4 After the flushing volume has been removed, insert the sampling appendage to within 5% from the bottom of the vessel and withdraw a sufficient amount of fluid to run four analyses into the sample container.

NOTE: Where appropriate, the sample should be taken with the container tilted approximately 30 degrees from the vertical such that the opening through which the sample is taken is on a vertical line passing through the lowest point of the vessel.

NOTE: When using the bottle thief, the cork should not be opened for at least 30 s to allow particles on external surfaces to settle past the bottle.

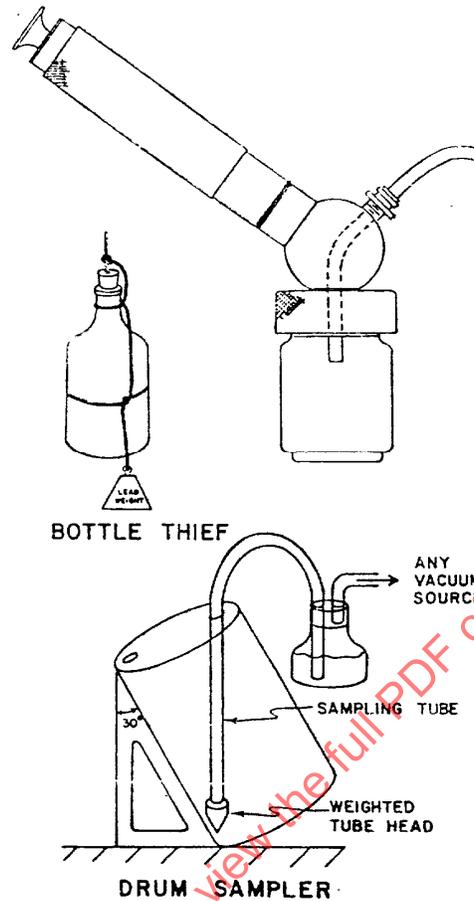


FIGURE 1- WITHDRAWAL DEVICES

## 5. SAMPLE ANALYSIS

5.1 Using an automatic particle counter (APC) calibrated as specified in 3.5, count and record the number of particles in at least 10 mL of fluid in the following size ranges - numbers greater than 4, 6, and 14  $\mu\text{m}$ . Repeat at least three times. The first analysis is to be considered a "flushing" procedure to cleanse the APC and is not to be included in the final results. Discard these results and run the next three analyses to use as particle count data. The final three analysis runs are to be averaged into a final result.

5.2 The average of three different counts from the same sample should be reported.

## 6. PRESENTATION OF RESULTS

6.1 The raw data from each analysis run should be reported in tabular format to clearly display the particle count for each level, i.e., 4, 6, and 14  $\mu\text{m}$ . The cleanliness code should also be displayed per ISO 4406 as the average of all three analysis runs, i.e. 23/17/14. Additional displays or plots can be provided as instructed by the customer.