

**(R) METHOD FOR ASSESSING THE CLEANLINESS LEVEL OF NEW HYDRAULIC FLUID**

1. **Scope**—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 Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.
    - 2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.  
SAE J1165—Reporting Cleanliness Levels of Hydraulic Fluids
    - 2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.  
ASTM D 95—Method of Test for Water in Petroleum Products and Bituminous Materials by Distillation  
ASTM D 96—Test Method for Determination of Sediment and Water and Crude Oil by the Centrifuge Method  
ASTM D 270—Method of Sampling Petroleum and Petroleum Products  
ASTM D 1744—Method of Test for Water in Liquid Petroleum Products by Karl Fischer Reagent
    - 2.1.3 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.  
ISO 3722 (ANSI B93.20-1972)  
ISO 4402 (ANSI B93.28-1973)  
ISO 4406
  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).

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- 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 250 mL sample bottles containing less than 15 particles/mL of bottle volume greater than 5  $\mu\text{m}$  in size as qualified per ISO Standard 3722 (ANSI Standard B93.20-1972).
- 3.5 Use an automatic particle counter calibrated per ISO Standard 4402 (ANSI Standard B93.28-1973).

**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.

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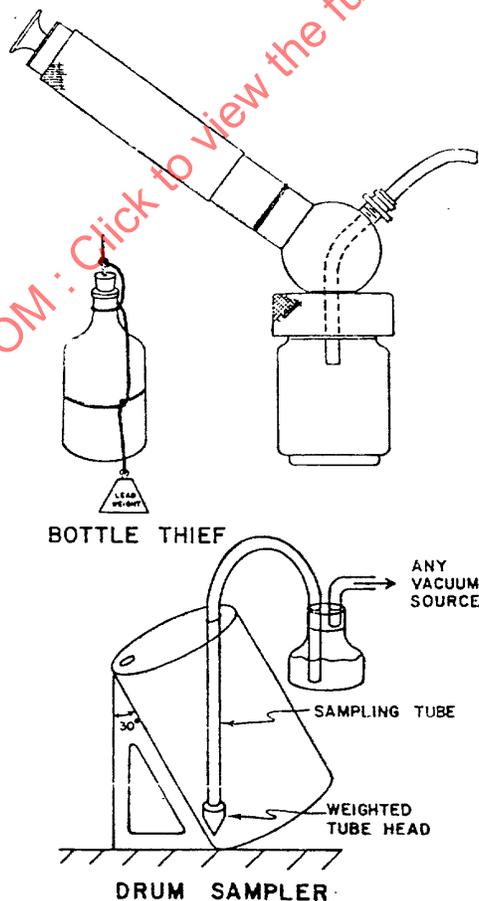


FIGURE 1—

- 4.4 After the flushing volume has been removed, insert the sampling appendage to within 5% from the bottom of the vessel and withdraw and deposit a maximum of 200 mL of fluid in a 250 mL 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.

## 5. **Sample Analysis**

- 5.1 Using an automatic particle counter 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 5, 10, 15, 20, 30, and 40  $\mu\text{m}$ . Repeat at least three times.

- 5.2 The average of three different counts on the sample should be reported.

## 6. **Presentation of Results**

- 6.1 A plot of all six points, the cumulative particle count data for the sample on a log-log<sup>2</sup> chart constitutes the official means of presenting the results.

- 6.2 Using the 5  $\mu\text{m}$  count and the 15  $\mu\text{m}$  count, assign an ISO Solid Contaminant Cleanliness Code value to the distribution per SAE J1165 or ISO Standard 4406.

- 6.3 Calculate the water detection ratio by dividing the number of particles greater than 10  $\mu\text{m/mL}$  by the number of particles greater than 40  $\mu\text{m/mL}$ .

NOTE—Data can be presented by the use of 6.1, 6.2, or 6.3.

## 7. **Interpretation of Results**

- 7.1 The ISO range number for the population of 5  $\mu\text{m}$  particles reflects the "silt levels" of the fluid.

- 7.2 The ISO range for the concentration of 15  $\mu\text{m}$  particles provides a good indication of the presence of large particles in the fluid.

- 7.3 "The value of the water detection ratio is one indication of the presence of free water in the fluid sample. A value of 10 or less should be cause for alarm and can be verified by using one of the established water-in-oil analysis techniques (ASTM D 95 and D 1744 for total water and ASTM D 96 for free water)."

## 8. **Notes**

- 8.1 **Marginal Indicia**—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.