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An American National Standard

Standard Test Method for Preliminary Examination of Hydraulic Fluids (Wear Test)[1]

This standard is issued under the fixed designation D 2271; 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 test method covers a constant volume high-pressure vane pump test procedure for indicating the wear preventative characteristics of petroleum and non-petroleum hydraulic fluids.

1.2 The values stated in either acceptable metric units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

1.3 *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.* For specific hazard statements, see 7.1.3, 7.2.4, and 8.1.10.

2. Referenced Documents

2.1 *ASTM Standards:*

D 2882 Test Method for Indicating the Wear Characteristics of Petroleum and Non-Petroleum Hydraulic Fluids in a Constant Volume Vane Pump[2]

3. Summary of Test Method

3.1 A hydraulic fluid is circulated through a rotary vane pump system for 1000 h at a pump speed of 1200 ± 60 r/min and a pump outlet pressure of 6.90 ± 0.14 MPa (1000 ± 20 psig). Fluid temperature at the pump inlet is 66 ± 3°C (150 ± 5°F) for all water glycols, emulsions, and other watercontaining fluids and for petroleum and synthetic fluids with 40°C (104°F) viscosities of 46 mm^2/s (213 SUS) or less. A temperature of 79°C (175°F) is used for all other synthetic and petroleum fluids. The result obtained is the total cam ring and vane weight losses during the test.

3.2 *Fluid Volume*—The volume of fluid in the test system shall not be limited but shall be as small as practical in order that the period required for a complete fluid-cycle through the pump, equal to

$$T = V/P \quad (1)$$

where:

T = recirculation time, min,
V = total volume, liters (gal), and
P = pump delivery, liters/min (gal/min) (shall be not less than 1 nor more than 1.5 min under operating conditions).

4. Significance and Use

4.1 The weight loss obtained from the use of this test method is an indicator of the wear preventative characteristics of petroleum and non-petroleum hydraulic fluids operating in a constant volume vane pump. Excessive wear in vane pumps can lead to malfunction of hydraulic systems in critical applications.

5. Apparatus

5.1 The basic system[3] is similar to that which is described in Test Method D 2882 and is shown in Fig. 1. The following are descriptions of the basic system components.

5.1.1 *Power System*, capability of 11 kw (15 hp) is suggested as a minimum requirement.

5.1.2 *Vane Pump*, rotary, replacement cartridge type[4] (Vickers 104 or 105°C rated at 28.4 L/min (7.5 gal/min) flow at 1200 r/min, 49°C (120°F), and 6.89 MPa (1000 psig).

5.1.2.1 There is to be no modification to the pump housing such as plugging the drain hole in the pump body or drilling and tapping a hole in the head for an external drain.

5.1.3 *Reservoir*, equipped with a removable 60-mesh stainless steel finger screen in its outlet. See 3.2 for system volume requirements.

NOTE 1—A tight-fitting stainless steel lid and a 6-mm (¼-in.) vent is recommended. When an acrylic lid is used, compatibility problems with some non-petroleum fluids can occur.

NOTE 2—A finger screen having a diameter of 76 mm (3 in.) and height of 54 mm (2.5 in.) has been found to be satisfactory.

5.1.3.1 The reservoir can be square or rectangular (with a flat bottom) or cylindrical (with a spherical or a cone-shaped

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricantsand is the direct responsibility of Subcommittee D02.Non Hydraulic Fluids.

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[2] *Annual Book of ASTM Standards*, Vol 05.01.

[3] A list of test equipment can be attained from ASTM.

[4] Order replacement pump cartridge kits (Vickers Part No. 429126). The individual parts for the pump cartridge can be purchased separately, if desired. The Vickers part numbers for these items are: Cam Ring No. 2013, Rotor No. 429446 or 2008, Bronze Bushings No. 2015/2016, and Vane Kit (12 vanes) No. 912021.

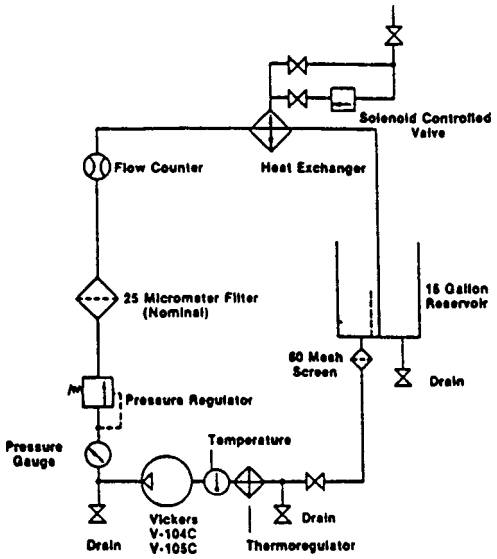


FIG. 1 Hydraulic Fluid Wear Test Schematic

bottom) and must be designed so as to avoid air entrainment in the fluid. The use of stainless steel is required to avoid surface rusting in the vapor space area. When using a stainless steel lid, it should not be fastened in place until the fluid is visibly deaerated (1.1.13). The use of a filter on the vent is optional.

5.1.4 *Outlet Pressure Control Valve.*[5]

5.1.5 *Temperature-Control Device.*

5.1.6 *Temperature Indicators*, with appropriate sensors for fluid in and out temperatures.

5.1.7 *Pressure Indicators*, for pump discharge and filter pressures.

5.1.8 *Heat-Exchanger System*—(heating and cooling), suggested minimum size 1.4 m^2 (15 ft^2).

5.1.9 *Filter Unit,*[6] 25-µm, (nominal) replaceable paper element with housing. Two new filter elements are required for each test.

5.1.10 *Flow-Measuring Device.*

5.1.11 *Low-Level or High-Temperature Safety System*, or both.

5.2 The various components of the test system shall be placed in the system as indicated in Fig. 1. The test system must be arranged so that complete draining is possible with no fluid trap areas. Fig. 2 and Fig. 3 are cartridge parts and total pump assembly diagrams for the required pump.

5.2.1 A check should be made to ensure that the fluid to be tested is not corrosive to any metals in the system.

NOTE 3—The use of galvanized iron, aluminum, zinc, and cadmium should be avoided due to their high potential for corrosion in the presence of many non-petroleum hydraulic fluids.

5.2.2 The test pump must have right-hand rotation (clockwise rotation as viewed from the pump drive end).

5.2.3 The reservoir bottom must be mounted sufficiently higher than the pump inlet so a positive pressure is maintained at the pump inlet to prevent cavitation.

NOTE 4—A distance of 610 mm (24 in.) from the centerline of the pump housing inlet to the top of the fluid surface in the reservoir has been found to be satisfactory.

5.2.4 The inlet line (from the reservoir to the pump intake) should have an inside diameter of at least 25 mm (1 in.).

5.2.5 The high-pressure discharge line (from the pump to the pressure control valve) should be 19 mm (¾ in.) Schedule 160 steel or stainless steel pipe, or equivalent highpressure hydraulic hose.

5.2.6 The fluid return line and fittings (from the pressure control valve to the filter, flow counter, heat exchanger, and reservoir) should have an inside diameter of at least 19 mm (¾ in.).

[5] Vickers pressure relief valve (CT-06-C/500–2000 psi) has been found satisfactory for this purpose. An equivalent may be used.

[6] A Purolator P-92-03-0 housing and P-92 filter have been found satisfactory. An equivalent may be used.

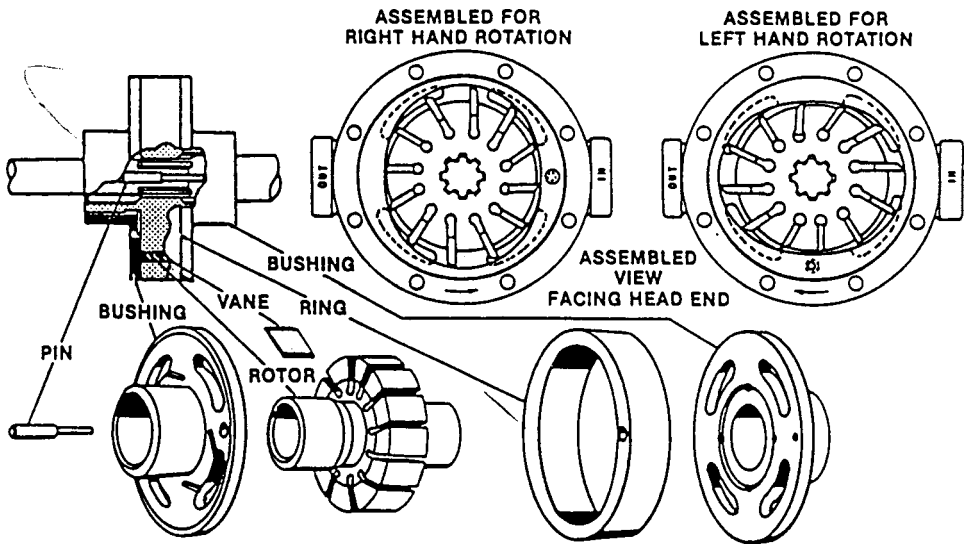
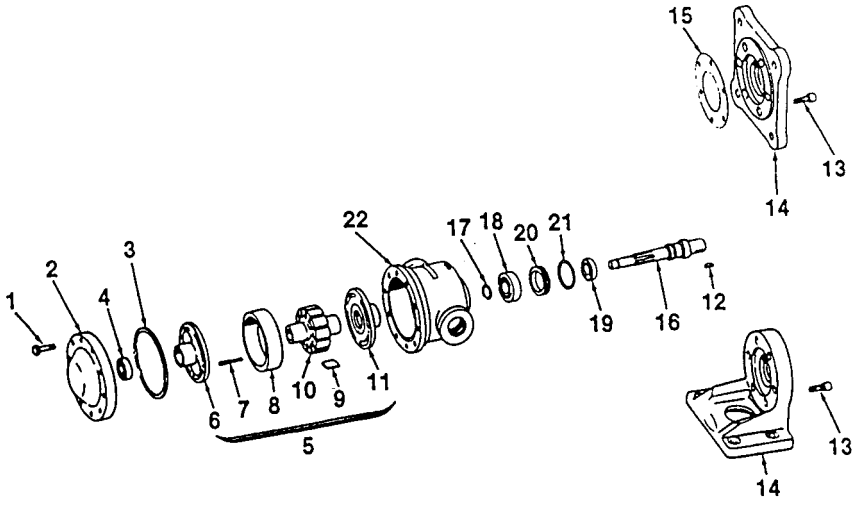


FIG. 2 Cartridge Parts



1. Head screw
2. Head
3. Head gasket
4. Head bearing
5. Cartridge (includes items 6 thru 11)
6. Bushing
7. Pin—Locating
8. Ring
9. Vane
10. Rotor
11. Bushing
12. Shaft key
13. Bracket screw
14. Bracket (foot/flange)
15. Flange gasket
16. Drive shaft
17. Snap ring
18. Shaft bearing
19. Shaft seal
20. Spacer
21. "O" ring (Spacer)
22. Body

FIG. 3 Pump Assembly

5.2.7 The fluid return to the reservoir must be below the fluid level and away from the reservoir outlet located in the bottom of the reservoir.

5.2.8 The test fluid temperature must be measured within 102 mm (4 in.) of the pump inlet. The sensing probe must be inserted into the midpoint of flow.

5.2.9 The fluid cooler should be located above the center line of the pump to allow for good drainage.

6. Sampling

6.1 The sample of new fluid shall be thoroughly representative of the material in question and the portion used for the test shall be thoroughly representative of the sample itself.

7. Preparation of Apparatus

7.1 *Cleaning and Flushing of Test System*—Proper cleaning and flushing of the entire test system is extremely important in order to prevent cross-contamination of test fluids.

7.1.1 Open all drain valves and the petcocks at all low areas to permit removal of the used test fluid.

7.1.2 Remove the used pump cartridge, if not already done.

7.1.3 Clean the pump housing with an appropriate solvent (use Stoddard Solvent (**Warning**—see Combustible. Health hazard.) for petroleum and synthetic fluids; hot water for water glycol and other water-based fluids).

7.1.4 Visually examine the pump head and the interior of the pump body. Replace when evidence of deterioration is observed.

7.1.5 Inspect the pump drive shaft, shaft seal, and bearings[7] after every run. If these parts appear to have wear or damage, replace any suspect part prior to starting the next test.

7.1.6 Insert a good used pump cartridge into the pump housing to circulate the flushing fluid.

7.1.7 Check pump alignment.

7.1.8 Remove the used filter element, clean the filter housing, and install a new filter element.

7.1.9 Remove, clean, and reinstall the 60-mesh screen in the reservoir outlet.

7.1.10 Close the reservoir outlet valve and pour 60 % of a full charge (3.2) of the appropriate cleaning solvent (7.1.3) into the reservoir.

7.1.11 Close all drain valves and petcocks and open the reservoir outlet valve to allow the flushing fluid to fill the pump and the lower lines of the system.

7.1.12 Reduce the setting of the pressure control valve, if not already done.

7.1.13 Jog the pump drive motor ON and OFF switches to remove the air from the test system. Continue until the fluid returning to the reservoir is visually free of air.

NOTE 5—If fluid cannot be visually observed in the reservoir, the lack

[7] The Vickers part numbers for the pump shaft and bearings are as follows: drive shaft—188328, head bearing—1700, and shaft bearing—1704. Special seals are required for testing with synthetic fluids. The different Vickers gasket kits that are available for the V-104C/105C pump are as follows: 919005 for water glycols, water-in-oil emulsions, and petroleum; 919298 for water-in-oil emulsions, water glycols, aryl phosphate esters, and phosphate ester-hydrocarbon blends; and 919038 for alkyl and aryl phosphate esters.