Designation: D6973 – 08$^{\varepsilon 1}$

Standard Test Method for Indicating Wear Characteristics of Petroleum Hydraulic Fluids in a High Pressure Constant Volume Vane Pump[1]

This standard is issued under the fixed designation D6973; 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.

ε[1] NOTE—Changes were made to Fig. 1 and Note 4, and Note 7 was added editorially in May 2008.

1. Scope

1.1 This test method covers a constant volume high-pressure vane pump test procedure for indicating the wear characteristics of petroleum hydraulic fluids. See Annex A1 for recommended testing conditions for water-based synthetic fluids.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ISO Standards:*[3]

ISO 4021 Hydraulic Fluid Power—Particulate Contamination Analysis—Extraction of Fluid Samples from Lines of an Operating System

ISO 4406 Hydraulic Fluid Power—Fluids—Method for Coding the Level of Contamination by Solids Particles

ISO 7745 Hydraulic Fluid Power—Fire-Resistant (FR) Fluids—Guidelines for Use

ISO 11171 Hydraulic Fluid Power—Calibration of Automatic Particle Counters for Liquids

ISO 11500 Hydraulic Fluid Power—Determination of Particulate Contamination by Automatic Counting Using the Light Extinction Principle

2.3 *Other Documents:*

SAE 100R13–20 Hydraulic Hose Specification[4]

ANSI/(NFPA) T2.13.1 R3-1998 Recommended Practice—Hydraulic Fluid Power—Use of Fire-Resistant Fluids in Industrial Systems[5]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *flushing, v*—the process of cleaning the test system before testing to prevent cross-contamination.

4. Summary of Test Method

4.1 Hydraulic fluid in the amount of 190 ± 4 L (50 ± 1 gal) is circulated through a rotary vane pump system for 50 h at a pump speed of 2400 ± 20 r/min and a pump outlet pressure of 20.7 ± 0.2 MPa (3000 ± 20 psig). Fluid temperature at the pump inlet is 95 ± 3°C (203 ± 5°F). An ISO Grade 32 or 10W viscosity is required.

4.2 The cam ring and all ten vanes should be individually weighed before and after the test. The weight loss of the cam ring should be reported with the combined weight loss of all ten vanes. The intra-vanes (inserts) are not part of the required weight loss measurements and should be separately measured if desired. Other reported values are fluid cleanliness before and after the test, initial flow rate, and final flow rate.

4.3 Prior to installing the hydraulic test fluid into the rig, a stand flush is required to remove any contaminants. A minimum quantity of 190 ± 4 L (50 ± 1 gal) of fluid (see Note 1) made of the same chemical formulation as the test fluid, is required for the stand flush. Therefore the total quantity of oil required for the test is 380 L (100 gal).

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.N0.07 on Lubricating Properties.

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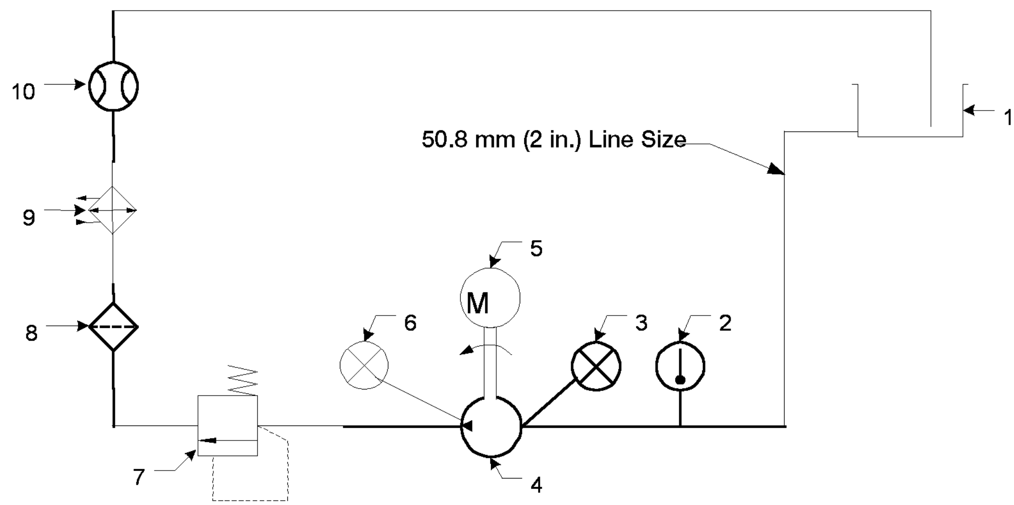
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.



Description of Components:
1 Reservoir, 190 L (50 gal) of oil; elevated above pump centerline to provide gravity feed
2 Temperature gage or thermocouple
3 Inlet pressure gage
4 Pump: 35VQ25A-11*20 (Cartridge kit P/N 4998040–002)
5 Electric motor, 93 kW (125 hp)
6 Outlet pressure gage
7 Pressure relief valve
8 Filter
9 Cooler
10 Flowmeter

NOTE 1—See Eaton Overhaul Manual I-3144–S (Appendix B) (available from any Eaton distributor).

FIG. 1 System Schematic

5. Significance and Use

5.1 This test method is an indicator of the wear characteristics of petroleum hydraulic fluids operating in a constant volume vane pump. Excessive wear in vane pumps could lead to malfunction of hydraulic systems in critical industrial or mobile hydraulic applications.

6. Apparatus

6.1 The basic system consists of the following (see Fig. 1):

6.1.1 *Electric Motor,* or other suitable drive, capable of a rotational speed of 2400 rpm with 93 kW (125 hp) as suggested minimum power requirement (see Fig. 1, Item 5).

6.1.2 *Test Stand Base,* with appropriate, rigid mounting for the motor, pump, reservoir, and other components.

6.1.3 *Rotary Intra-Vane Pump,* replaceable cartridge type,[6,7] Vickers 35VQ25A-11*20 (Cartridge Kit P/N 4998040-002)[8] rated at 81 cm^3/rev (4.98 $in.^3$/rev) flow at 1200 rev/min. A protective shield around the pump is recommended.

6.1.3.1 There are to be no modifications to the pump housing.

6.1.4 *Reservoir,* equipped with a baffle and lid, all of stainless steel construction.

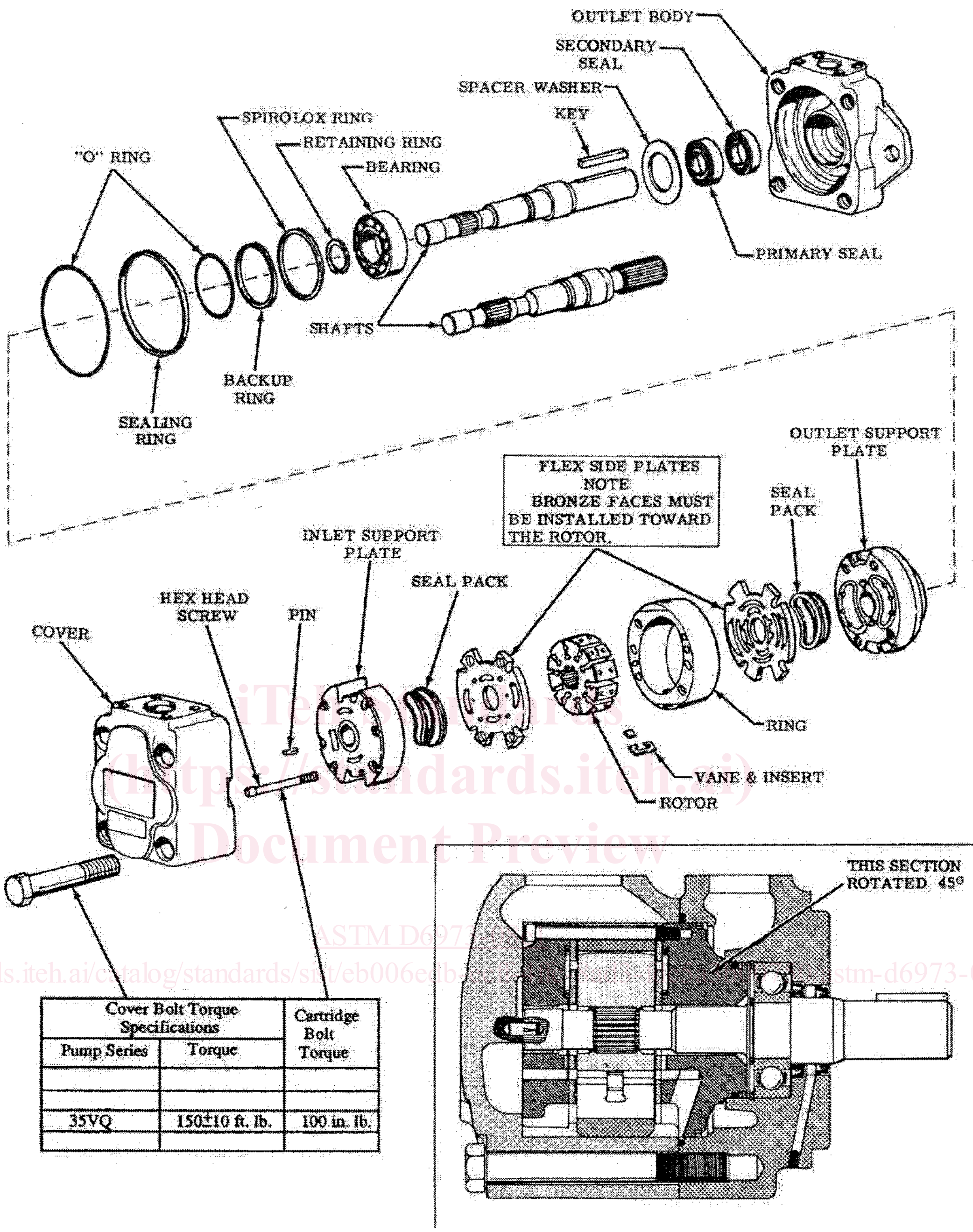
6.1.4.1 Additional fluid ports may be added to the reservoir as required by the user to assist in measuring fluid level, reservoir temperature, and so forth.

6.1.4.2 If the reservoir is positioned so that the contents cannot be visually checked for air entrainment by removing the lid, a fluid-sight glass viewing port may be located in the side of the reservoir.

[6] The replaceable cartridge consists of the inlet support plate, outlet support plate, flex side plates, seal pack, rotor, cam ring, intra-vane, and vanes.

[7] The individual cartridge parts can be purchased separately, if desired. The Eaton part numbers for these items are cartridge screws: P/N 410609, alignment pins: P/N 418108, inlet support plate: P/N 430806, outlet support plate: P/N 412003, flex side plate kit: P/N 923953, seal pack: P/N 433766, rotor: P/N 262154, cam ring: P/N 4999594-001, vane kit (includes ten intra-vanes and ten vanes): 922700.

[8] Available from any Eaton distributor.



Cover Bolt Torque Specifications		Cartridge Bolt Torque
Pump Series	Torque	
35VQ	150±10 ft. lb.	100 in. lb.

NOTE 1—See Eaton Overhaul Manual I-3144–S (Appendix C) (available from any Eaton distributor).

FIG. 2 Pump Components

6.1.5 *Pump Outlet Pressure Control Valve,* with either manual or remote control (see Fig. 1, Item 7).

6.1.6 *Temperature-control Device,* suitable for controlling coolant flow to the heat exchanger to maintain test fluid at the specified temperature (see Fig. 1, Item 9).

6.1.7 *Temperature Indicator,* (see Fig. 1, Item 2) shall have a minimum accuracy of ±1°C and shall have an appropriate sensor to monitor pump inlet temperature.

6.1.7.1 To prevent a flow disturbance near the pump inlet port, the temperature probe shall have a diameter of not more than 6 mm (0.25 in.) and positioned not less than 30 cm (12 in.) from the pump inlet port.

6.1.7.2 The test fluid temperature probe shall be positioned greater than 30 cm (12 in.) from the pump inlet cover (see Fig. 2). The fluid temperature probe shall be inserted into the midpoint of flow.

6.1.8 *Heat-Exchanger,* (see Fig. 1, Item 9). The heat exchanger should be of adequate size and design to remove the excess heat from the test system when utilizing the available coolant supply.