This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D7043 – 21

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

This standard is issued under the fixed designation D7043; 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 vane pump test procedure operated at 1200 r⁄min and 13.8 MPa.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.2.1 *Exception*—There are no SI equivalents for the inch fasteners and inch O-rings that are used in the apparatus in this test method.

1.2.2 *Exception*—In some cases English pressure values are given in parentheses as a safety measure.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2882 Test Method for Indicating Wear Characteristics of Petroleum and Non-Petroleum Hydraulic Fluids in Constant Volume Vane Pump (Withdrawn 2003)[3]

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

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

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

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

3.1.2 *snubber, n*—fluid restricting device used to dampen pressure pulsations.

3.1.3 *torquing, v*—process of tightening the pump head bolts to achieve a uniform clamping force.

4. Summary of Test Method

4.1 An amount of 18.9 L ± 0.5 L of a hydraulic fluid are circulated through a rotary vane pump system for 100 h at a pump speed of 1200 r⁄min ± 60 r⁄min and a pump outlet pressure of 13.8 MPa ± 0.3 MPa (2000 psi ± 40 psi). Fluid temperature at the pump inlet is 66 °C ± 3 °C for all water glycols, emulsions, and other water containing fluids and for petroleum and synthetic fluids of ISO Grade 46 or lower viscosity. A temperature of 80 °C ± 3 °C is used for all other synthetic and petroleum fluids.

4.2 The result obtained is the total mass loss from the cam ring and the twelve vanes during the test. Other reported values are initial flow rate and final flow rate.

4.3 The total quantity of test fluid required for a run is 26.5 L.

5. Significance and Use

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

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.N0 on Hydraulic Fluids.

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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] The last approved version of this historical standard is referenced on www.astm.org.

***A Summary of Changes section appears at the end of this standard**

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6. Apparatus

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

6.1.1 *AC Motor,* 1200 r/min, or other suitable drive, with 11 kW (15 hp) as suggested minimum power requirement (Item 5, Fig. 1). The motor must have right hand rotation (counterclockwise rotation as viewed from the shaft end).

6.1.1.1 When constructing the test stand some users build the test stand using a variable speed motor so that other, similar tests such as ISO 20763 (1440 rpm) may be performed using the same apparatus.

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

6.1.3 *Rotary Vane Pump,* replaceable cartridge type. A Conestoga USA B1 housing is used along with internal components from Conestoga USA, Inc.[4] Vickers housings V104C and V105C are acceptable for use in this test when used with Cam Rings and Vanes from Conestoga USA, Inc. Refer to D7043 – 17 for Vickers assembly part numbers and advisories concerning their use. The assembly should produce 28.4 L/min flow at 1200 r/min with ISO Grade 32 fluid at 49 °C, at 6.9 MPa (Item 3, Fig. 1; Fig. 2).

6.1.3.1 The replaceable cartridge consists of the cam ring, the rotor, two bushings, a set of twelve vanes, and an alignment pin.

6.1.3.2 The individual cartridge parts are purchased separately. Conestoga USA, Inc. part numbers for these items are: cam ring No. 2882-5, alignment pin No. 2882-10, rotor No. 2882-1D, bronze bushings No. 2882-4C and 2882-4E, and vane kit (12 vanes) No. 2882-V12A. Alternate bushings with a TiN coating are available (part No. 2882-4F and 2882-4G) for use where bushing wear has been a problem.

6.1.4 *Reservoir,* (Item 1, Fig. 1).

6.1.4.1 The reservoir shall be equipped with a removable baffle and a close fitting lid, all of stainless steel construction. The reservoir can be square or rectangular (with a flat bottom) or cylindrical (with a spherical or cone shaped bottom) and must be designed so as to avoid air entrainment in the fluid.

NOTE 1—A suitable reservoir design is presented in Test Method D2882 – 00.

6.1.4.2 To promote deaeration and thermal mixing of the fluid, the baffle shall be designed so that returning fluid will follow an indirect path from the return port to the outlet port.

6.1.4.3 To avoid air entrainment, the reservoir shall be designed so that the return line enters well below the fluid level, fluid flow does not cascade over the baffle, and there will be a minimum of 15 cm of fluid depth above the reservoir outlet Dimension C, Fig. 1).

6.1.4.4 Fluid ports may be added as required by the user for the installation of a low level switch, reservoir temperature sensor, bottom drain, and so forth.

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

6.1.4.6 In the reservoir return line the drop tube end may be cut at a 45° angle for better return flow characteristics.

6.1.5 *Outlet Pressure Control Valve,* Eaton-Vickers pressure relief valve (CT-06F or CS-06F, to 10.3 MPa to 20.7 MPa) with either manual or remote control (Item 8, Fig. 1).[5]

6.1.6 *Temperature Control Device,* suitable for controlling coolant flow to the heat exchanger to maintain test fluid at the specified temperature (Item 11, Fig. 1).

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

6.1.7.1 To prevent a flow restriction near the pump inlet port, the temperature probe shall have a diameter of not more than 3.2 mm.

6.1.7.2 The test fluid temperature shall be measured using the B1 pump sensor port. The sensing probe shall be inserted into the midpoint of flow.

NOTE 2—Some users have found the addition of a pump outlet temperature sensor to be a useful diagnostic tool. If used, it shall be suitable for 13.8 MPa duty and should be placed in the high pressure line between the pump and the relief valve (Item 18, Fig. 1).

6.1.8 *Heat Exchanger,* (Item 10, Fig. 1). The heat exchanger should be of adequate size and design to remove the excess heat from the test system when using the available coolant supply.

NOTE 3—It is suggested that a shell-and-tube-type heat exchanger, if used, should be connected in reverse (the hydraulic fluid is passed through the tubes and not around them) so that the interior of the heat exchanger can be effectively cleaned between tests.

6.1.9 *Pressure Indicator,* (Item 6, Fig. 1) to measure pump discharge pressure shall have an accuracy of at least ±0.3 MPa at 13.8 MPa. The gauge shall be suitable for 13.8 MPa duty.

6.1.9.1 The pressure indicator should be snubbed (Item 7, Fig. 1) to prevent damage or inaccurate readings from pulsations or sudden fluctuations of system pressure.

6.1.10 *Filter Unit (Item 9,* Fig. 1*),* a replacable element or spin-on type filter, having a fiberglass element, are both acceptable. The element shall have a minimum Beta Ratio of 100 for 3 µm size particles (β3 = 100, Filtration Efficiency = 99.0 %). One new filter element is required for each test.

6.1.10.1 The filter housing shall be non-bypassing and shall be provided with a pressure gauge (Item 13, Fig. 1) or another suitable indicator to monitor pressure across the filter to warn of impending collapse of the element.

6.1.10.2 The rated collapse pressure of the filter element should be known. The collapse pressure should be within the range of the gauge.

6.1.11 *Flow Measuring Device,* (Item 12, Fig. 1) with an accuracy of at least ±0.4 L/min.

[4] The sole source of supply of the apparatus known to the committee at this time is Conestoga USA Inc., P.O. Box 3052, Pottstown, PA 19464. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[5] Request Vickers publication I-3369-S for the relief valve service data. See http://hydraulics.eaton.com/products/vickers.html.

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