Test Procedure to Evaluate Fluids in Open Loop Axial Piston Pumps

Technical Data 03-06-0002-EN-0601

Pump Model
PVH57C-RF-2S-11-C25V-31

This test procedure is to evaluate fluids for use in open loop axial piston pumps. It consists of 250 hours of actual test time (not including break-in or performance running). The operation temperature is dependent upon the capability of the test fluid as specified by the fluid manufacturer or the rated temperature specified for the pump, whichever is lower. Inlet fluid temperature must be maintained per fluid/pump rating throughout the complete test.

The pump to be used is a PVH57 with a pressure compensator and load sensing control, model code PVH57C-RF-2S-11-C25V-31.

Table of Contents

Pump Break-In

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Break in the pump using anti-wear petroleum base hydraulic fluid that complies with Vickers Oil Recommendation Data Sheet M-2950-S. Run the break-in procedure step-by-step as listed in Table 2. Inlet is to be at atmospheric. No external leakage is allowed during the entire test.

Table 2 – Pump Break-In Procedure

STEP	DURATION MIN	SPEED RPM ±20	OUTLET PRESS BAR (PSIG) ±5 (72.5)	INLET OIL TEMP °C ±5 (°F ±9)
1	5	600	50 (725)	Ambient increase
2	5	1200	50 (725)	to
3	10	1200	100 (1450)	
4	10	1200	150 (2175)	
5	10	1800	150 (2175)	
6	10	1800	200 (2900)	
7	10	2400	220 (3190)	95 (203)

Overall Efficiency Percentage

Continue running the pump at full stroke displacement using the parameters in Table 2, Step 7 to determine its overall efficiency.

The outlet flow must be between 121 lpm (32 gpm) and 140 lpm (37 gpm).

If not, STOP THE TEST AND CONTACT YOUR EATON REPRESENTATIVE.

Record the output flow, input torque, and case flow. Compute the overall efficiency using the formulas in Appendix A.

If the overall efficiency is less than 85%, continue running the pump (20 hours maximum) using the parameters in Table 2, Step 7 and re-check overall efficiency using the formulas in Appendix A.

If the overall efficiency is not 85% or greater, DISCONTINUE TESTING AND NOTIFY YOUR EATON REPRESENTATIVE.

Performance Baseline Test

Continue using petroleum-based fluid, but at the conditions listed in Table 1 for the test fluid. Set the compensator at rated pressure; adjust speed and temperature per the ratings for the test fluid.

Perform the pump performance check procedure.

Pump Performance Check

Sequence of Operations

1 Energize 15 while 16 is de-energized. The pump is now at full flow with pump outlet pressure controlled by relief valve 14.
2 Vary pump outlet pressure by adjusting relief valve 14.

Performance Check Procedure

The pump performance check must be at 14 bar (203 psi) below the rated pressure specified in Table 1.

Record the following parameters on the blank Pump Performance Check Record (page 11).

- Input torque
- Output pressure
- Output flow
- Case flow
- Case temperature
- Case pressure
- Inlet temperature
- Inlet pressure

Use the results to compute the overall efficiency per the formulas in Appendix A.

Figure 2 shows an example of test data obtained from the pump performance check.

Figure 2

Company: Petro Oil Company Date: 19 January 1999

Technician: Joe Technical Pump Assembly: 690825

Test: Performance Pump Model: PVH57C-RF-2S-10-C25V-31

Pump Serial No. SC00002 Pump Inlet Fluid Temperature: 120° F

Baseline Performance Check with Petroleum-Based Fluid

Fluid: Western AW Hydraulic Fluid

Pressure: Speed (rpm): 1750

INPUT TORQUE	OUTPUT PRESSURE	OUTPUT FLOW	CASE FLOW	CASE TEMP	CASE PRESSURE	INLET TEMP	EFFICIENCY
1365 lb.in	2294 psig	25 gpm	.5 gpm	149 F	7 psig	120 F	88%

Disassembly and Inspection

Disassemble the pump per Vickers Overhaul Manual M-2210-S, Figure 3. Identify the pistons and respective bores in the cylinder barrel per Figure 4 for re-assembly into the same location.

Figure 3

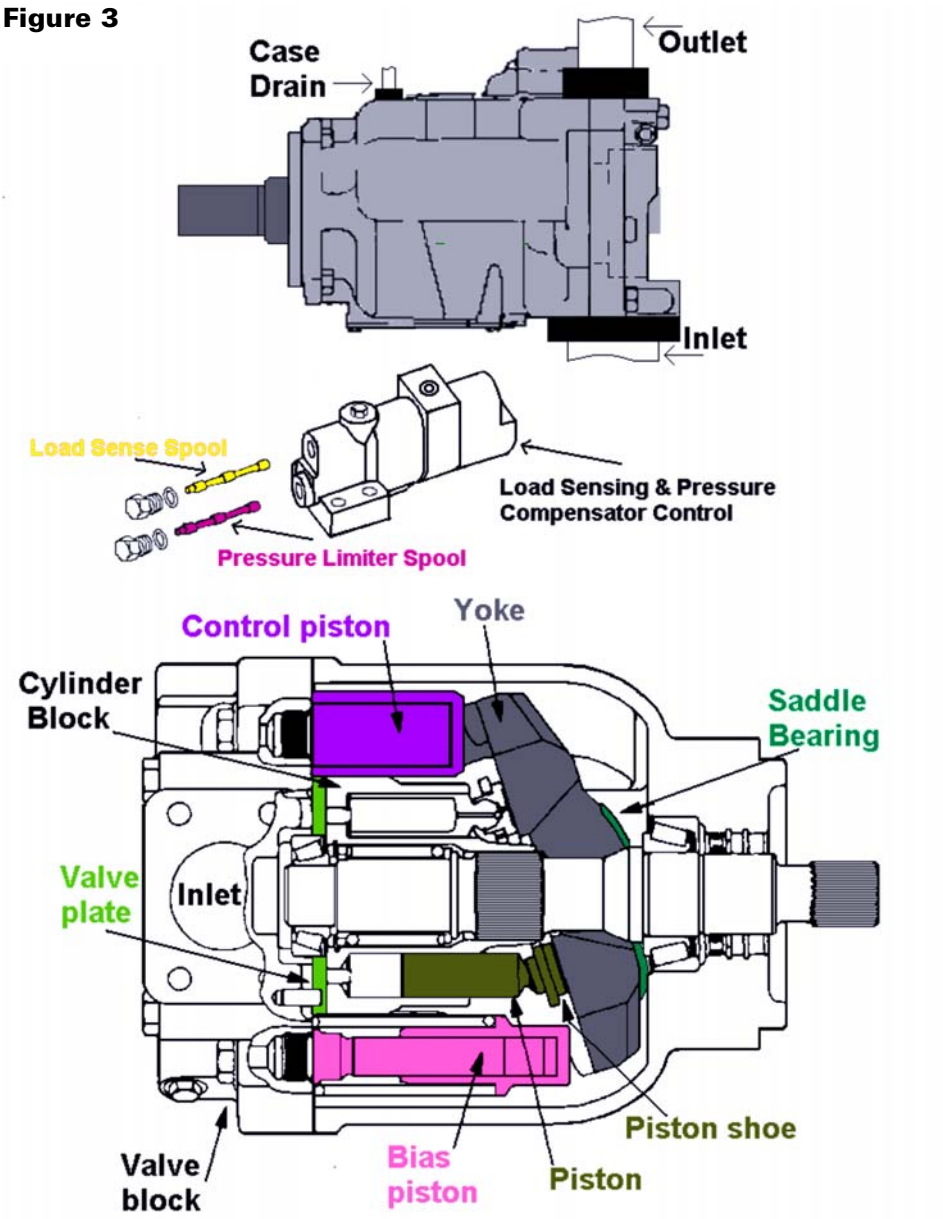
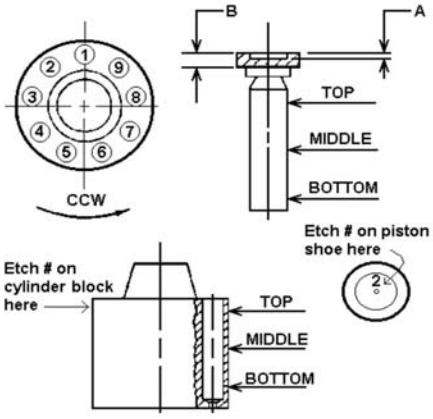


Figure 4



NOTE: In millimeters, measure cylinder barrel bores and piston OD to three decimal places (four decimal places if measuring in inches), and dimensions 'A' and 'B' to two decimal places (three decimal places if measuring in inches).

Record information on a blank Piston/Bore Record (pages 14 and 15).

Disassembly and Inspection (continued)

Inspect its components as follows:

1 Valve plate running-face – inspect surface finish visually and take a photograph. (Figure 5)
2 Cylinder barrel running face – inspect surface finish visually. (Figure 5)
3 Swashplate (yoke) running face – inspect surface finish visually. (Figure 5)
4 Swashplate (yoke) bearing journals – inspect visually. (Figure 5)
5 Cradle (saddle) bearings – inspect visually. (Figure 5)
6 Bias and control piston/rod – inspect visually. (Figure 6)
7 Hold-down arms and shoe face – inspect visually.
8 Shaft and shaft bearings – inspect visually. (Figure 6)
9 Measure metering lands' diameters and widths on both control spools (compensator). (Figure 6)
10 Measure shoe thickness (B), pocket depth (A), piston/shoe endplay (maximum allowable end play 0.13mm [0.005"]), piston diameter at top, middle, and bottom of piston and cylinder barrel bores at top, middle, and bottom. Record results on the blank Piston/Bore Record (page 14).
11 Shoe cage – inspect visually.
12 Shaft seal and mating shaft surface – inspect visually.
13 Photograph visually worn parts.

Figure 5

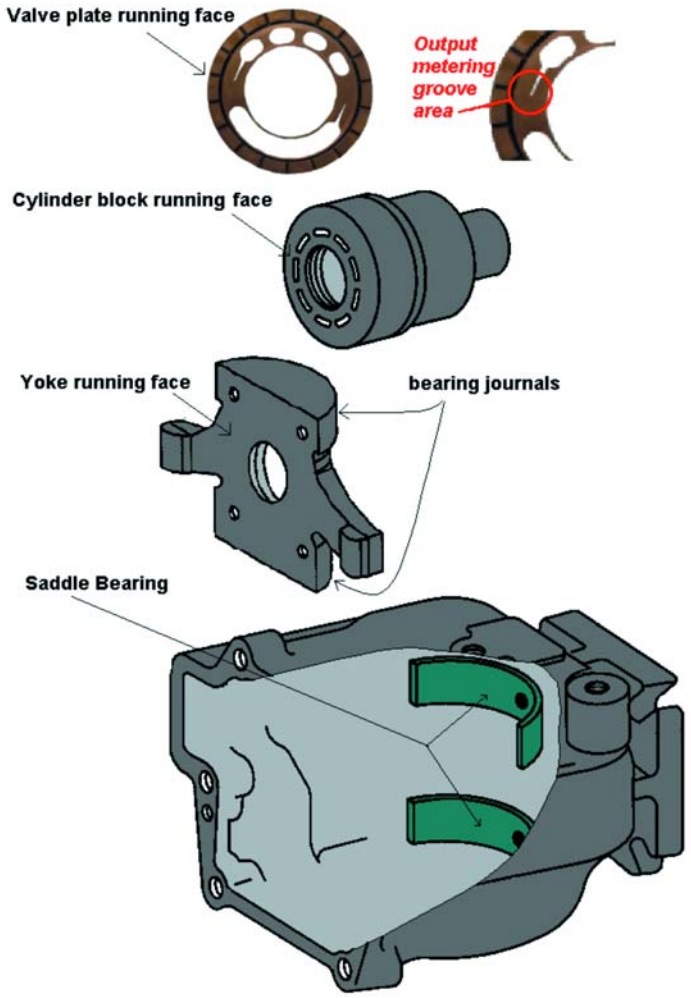
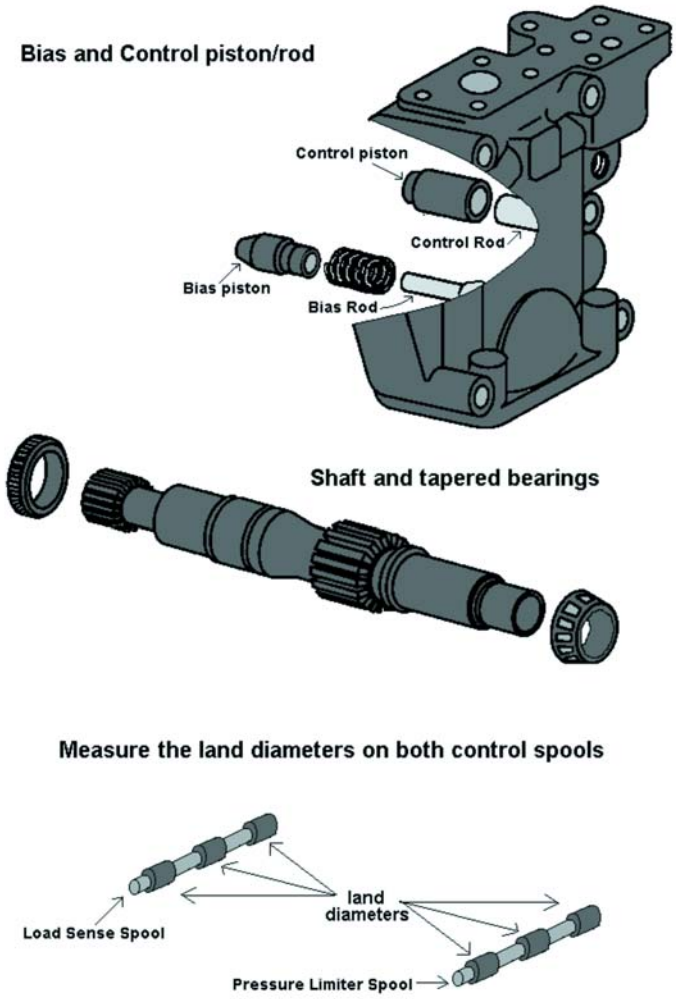
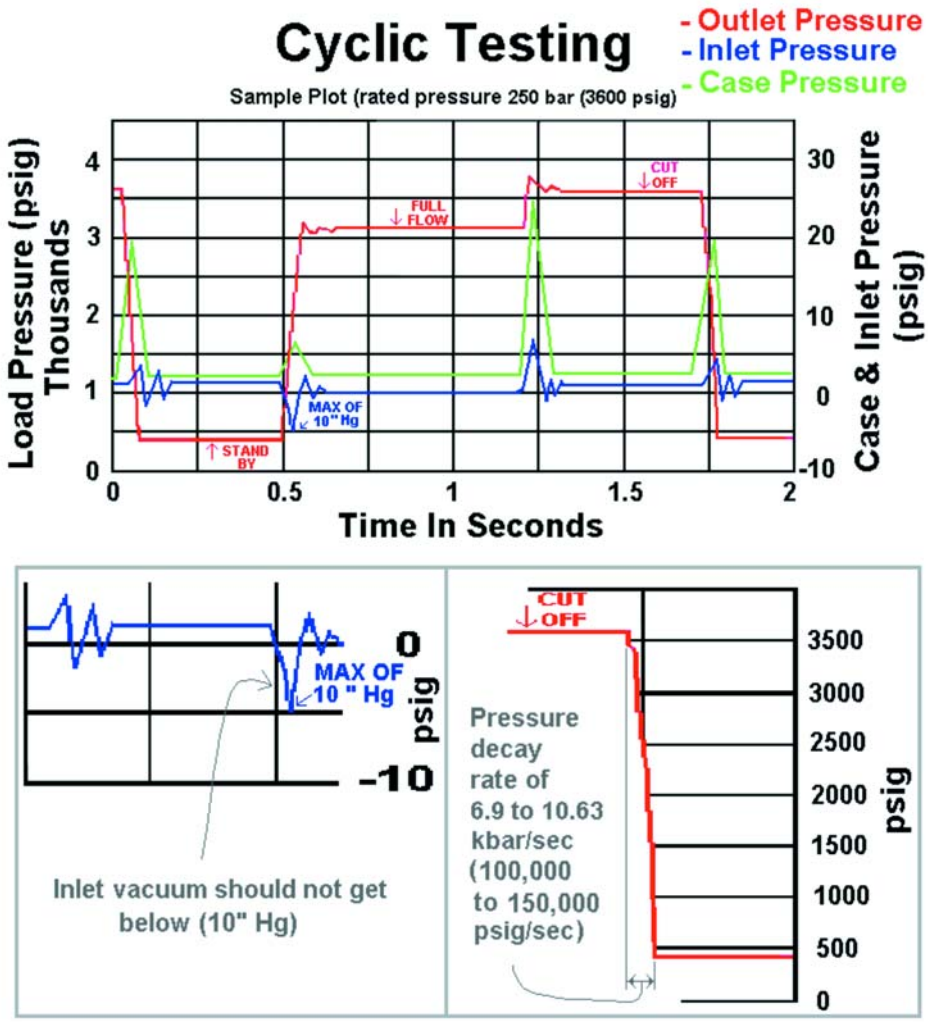


Figure 6



Figue 7



Final Fluid Testing

Measure the following on the test fluid after completion of testing. Record the results on the Test Fluid Record (page 13).

- Viscosity cSt @ 40°C
- Water content wt % (0.03% max. non-water based fluid)
- Cleanliness level ISO Code 18/16/14 or better
- Spectrographic analysis for at least the following elements (ppm): P, Zn, Ca, K, Ba, B, Si, Fe, Cu, Pb, Sn
- Total Acid Number (TAN) mg/KOH (Report only for vegetable and synthetic environmentally acceptable hydraulic fluids, and poly-olester fire resistant hydraulic fluids.)

Fluid Pass/Fail Criteria

The following are the criteria by which the fluid is judged to have passed or failed the test:

- The overall efficiency of the pump is equal to or greater than 85%.
- The volumetric efficiency of the pump is not degraded by more than 5% at the end of the 200-hour cyclic test.
- The control pressure hysteresis is less than or equal to 45 bar (652.5 psi) at the end of the 200-hour cyclic test.

Appendix B
Control Pressure Hysteresis Test

Sequence of Operations

1 Energize 15 while 16 is de-energized. Pump is now at cut-off (pressure compensation mode, high pressure, no flow).
2 Open variable orifice valve 22 to vary the pump outlet pressure to run a control pressure hysteresis check per Appendix B.
3 Once the control pressure hysteresis check has been completed, close the variable orifice valve 22 and resume test.

Control Pressure Hysteresis Check Procedure

Control pressure hysteresis is calculated using a plot of outlet flow versus control pressure. To check control pressure hysteresis, plot outlet flow (on the y-axis) versus control piston pressure while varying outlet pressure from 500 psi (at full flow) to the compensator setting (high-pressure, no-flow condition) and back to 500 psi (at full flow).

An adapter block needs to be assembled between the control and the end cover (valve block) to pick up control piston pressure. Use a variable orifice valve to vary the pump's outlet pressure (refer to page 3 for preparatory steps). It may take 1.5 to 2.0 minutes to run a sweep from full flow to pressure compensation and back again. The majority of the sweep time should be while the pump is going into and out of the compensator mode.

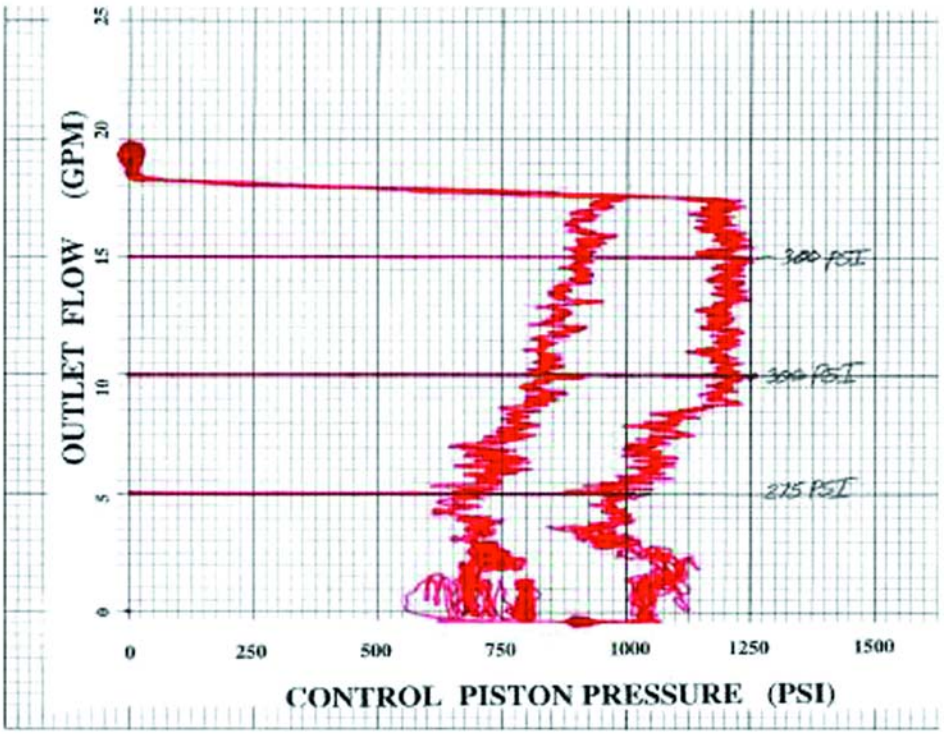
After generating a plot of outlet flow vs. control piston pressure:

- Determine the full flow value.
- Draw horizontal lines on the plot at 75%, 50% and 25% of full flow.
- Determine the pressure values at which these lines intersect the vertical sections of the plot. (Note: There will be two intersection points for each horizontal line.)
- Calculate the difference between each pair of pressure values (one Δp for 75% flow, one Δp for 50% flow, and one Δp for 25% flow).
- Take the average of these three Δp values.

This is considered the average control pressure hysteresis. This value should not exceed 45 bar (652.5 psi).

A sample curve is shown in Figure 8.

Figure 8



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