SURFACE VEHICLE RECOMMENDED PRACTICE

J1374	SEP2014
Issued 1985-05 Revised 2014-09 Superseding J1374 MAY1985	

Hydraulic Cylinder Rod Seal Endurance Test Procedure

RATIONALE

This Standard is revised to clarify definitions and incorporate ISO 4406 as reference for fluid cleanliness

1. SCOPE

Applies to hydraulic seals used to seal the rods of hydraulic cylinders which are components of Off-Road Self-Propelled Work Machines defined in SAE J1116.

1.1 Purpose

To establish an endurance testing and reporting procedure for reciprocating cylinder rod hydraulic seals to provide a basis for seal comparison.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1116 Categories of Off-Road Work Machines

SAE J1176 External Leakage Classifications for Hydraulic Systems

SAE J1276 Standardized Fluid for Hydraulic Component Tests

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 4406 Hydraulic Fluid Power – Fluids -- Method for coding the level of contamination by solid particles

3. DEFINITIONS

3.1 STROKE

The maximum distance traveled in one direction by the rod.

3.2 RETRACT STROKE

With reference to a single rod hydraulic cylinder, the movement of the cylinder rod into the cylinder.

3.3 EXTEND STROKE

With reference to a single rod hydraulic cylinder, the movement of the cylinder rod out of the cylinder.

3.4 CYCLE

The movement of the piston and rod from its starting point and return to its original position for a specified test stroke length.

3.5 RATED PRESSURE

The continuous duty operating pressure specified by the seal manufacturer.

3.6 LEAKAGE RATE

The amount of leakage per number of cycles. This is specified in units of mL/1000 cycles (in^3/1000 cycles) and mL/kilometers (in^3/ft).

3.7 PRIMARY TEST SEAL

Rod seal set which has high pressure applied during the retract stroke.

3.8 SECONDARY TEST SEAL

Rod seal which has high pressure applied during extend stroke.

4. TEST EQUIPMENT AND TEST PARAMETERS

4.1 Test Equipment

4.1.1 Test Fluid

Fluid shall be per SAE J1276 unless otherwise specified.

NOTE: For low temperature option on test procedure, a low temperature fluid should be used.

4.1.2 Test Apparatus

A standard cycle test set up is shown in Figures 1 and 2, and an optional cycle test set up for overrunning load is shown in Figures 2 and 4.

If a rod wiper seal is used to facilitate gathering leakage, it shall not contribute to sealing of the chamber. Seal gland dimensions and surface finish shall be as specified by seal supplier.

4.1.3 Test Rod

Surface Finish Ra 0.20 μm – 0.40 μm (8 microinch –16 microinch) hard chrome plated and polished. Induction hardening is optional. With each new seal test, use a new rod or one that has been re-plated and polished. If rod finish in proposed application differs, test should be made with surface finish of the application.

4.2 Test Parameters

4.2.1 Contamination Level OF Test Fluid

The maximum contamination level of the test fluid shall not exceed ISO 4406 Code -/17/14.

4.2.2 Accuracy of Measurement

The accuracy of measurements, unless otherwise stated, shall be;
Temperature ±3 °C, Pressure ±2%, Leakage ±2%, Time ±2%, and Length ±2%.

4.2.3 Stroke

300 mm ± 5 mm (12 in ± 0.2 in) or as agreed upon between user and supplier.

4.2.4 Rod Speed

0.30 m/s ± 0.03 m/s (60 fpm ± 6 fpm) or as agreed upon between user and supplier.

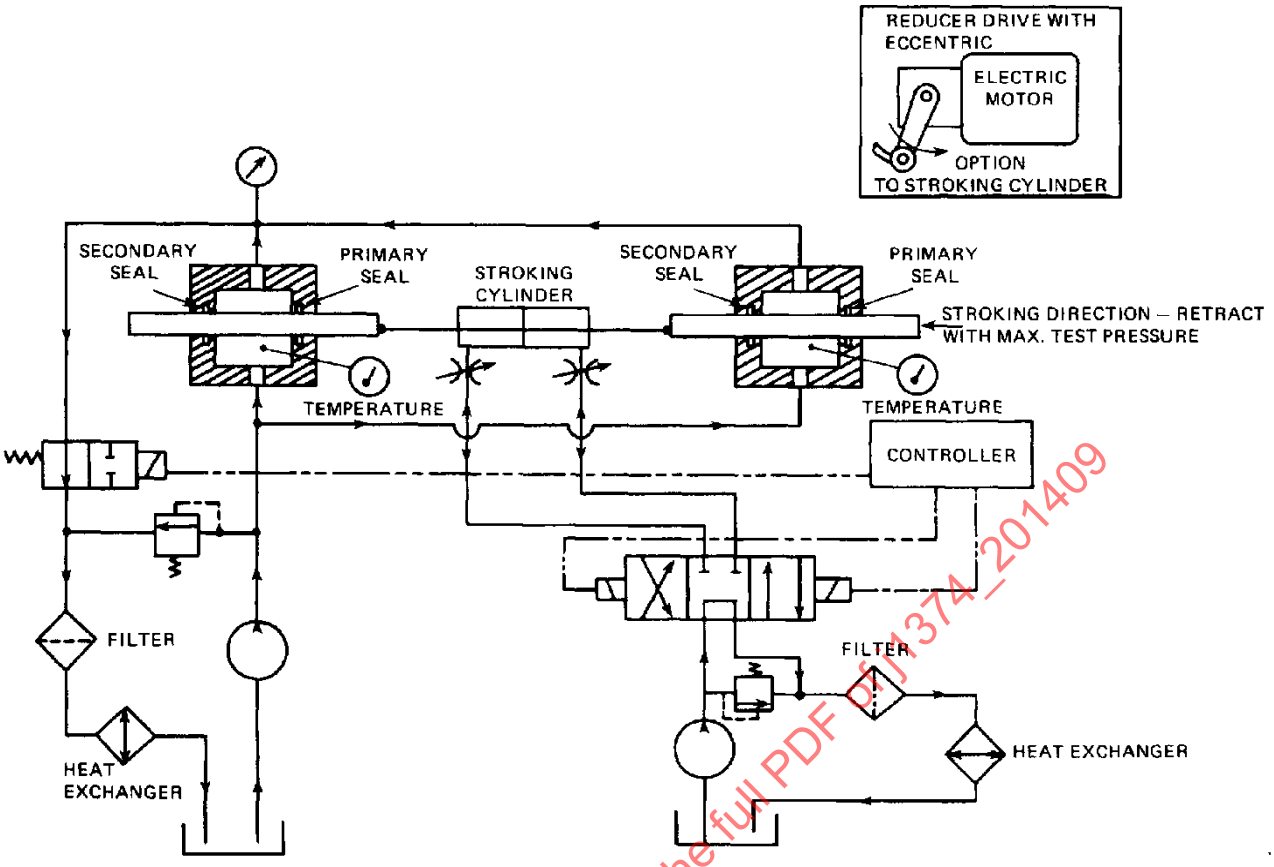

FIGURE 1 - TYPICAL TEST SETUP FOR CYLINDER ROD SEAL ENDURANCE TEST

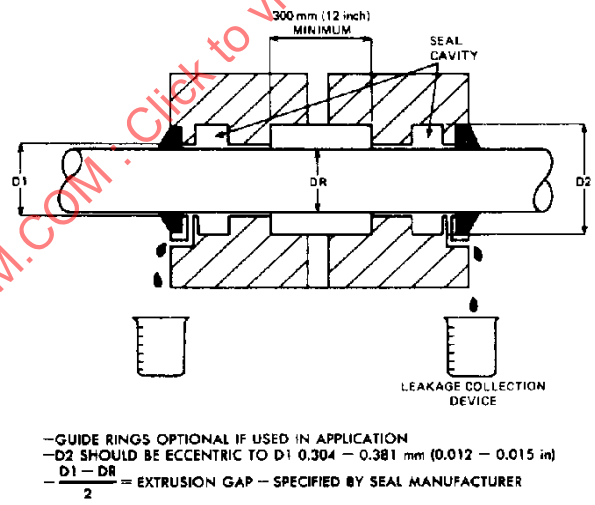

FIGURE 2 - ROD SEAL TEST CHAMBER (TYPICAL)

4.2.5 Pressure-stroke Cycle Profile

Pressurized to 110% of rated pressure for retract portion of stroking cycle.

The pressure rise-rate shall be 100 MPa/s ± 20 MPa/s. (14 500 psi/s ± 2900 psi/s.) The peak pressure overshoot shall not exceed 120% of rated pressure. Pressure during the extend portion of the stroking cycle shall not exceed 310 kPa (45 psi). Rod movement in each direction shall not start until the pressure stabilizes within + 2.5%.

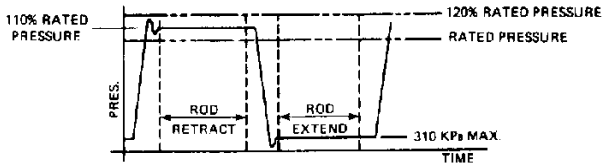

FIGURE 3 - TYPICAL PRESSURE-STROKE CYCLE

4.2.6 Fluid Temperature

The temperature of the fluid shall be measured in the test chamber and is to be 105 °C ± 3 °C (221 °F ± 5 °F) for 80% of the test and 30 °C ± 3 °C (86 °F ± 5 °F) for 20% of the test. Other temperatures could be used as specified by the seal supplier, depending on material and test fluid.

4.2.7 Test Duration

The test shall run for 500 000 cycles or until maximum leakage rate of the test seal is exceeded.

4.2.7.1 The number of samples tested of each seal shall be a minimum of four.

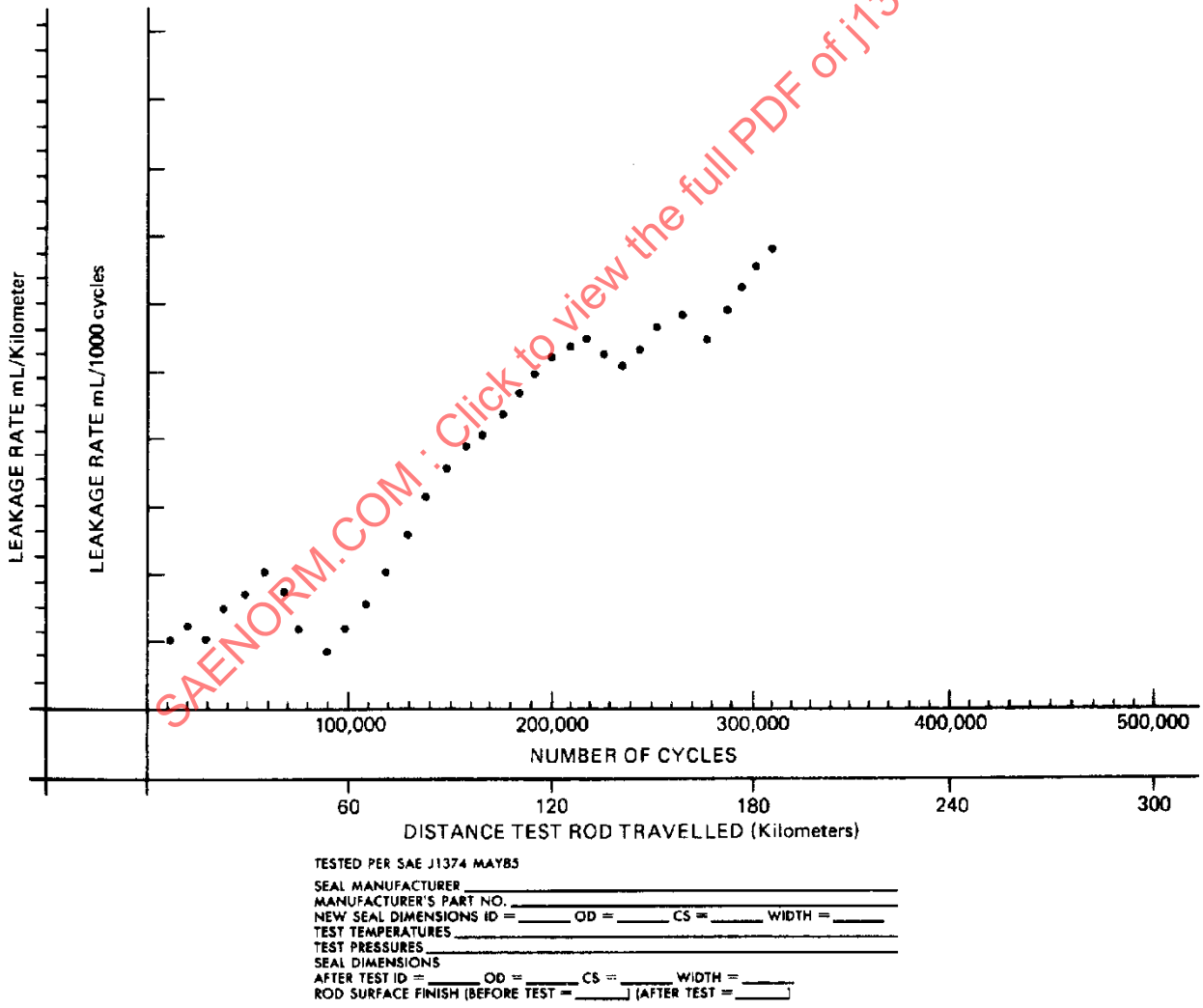

FIGURE 4 - TYPICAL PLOT OF DATA PRESENTATION