

## Seals—Testing of Radial Lip

**1. Scope**—This SAE Recommended Practice covers equipment and procedures for general performance and low-temperature tests on radial lip type seals for rotating shafts. Three test sections are included: General Performance Test, Alternate General Performance Test, and Low-Temperature Test.

### 2. References

**2.1 Applicable Publications**—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J946—Application Guide to Radial Lip Seals

2.1.2 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 6194-4—Rotary shaft lip type seals—Part 4: Performance test procedures

### 3. General Performance Test

**3.1 Introduction**—This section covers equipment and procedures for high-temperature tests to qualify radial lip type seals using application operating conditions.

#### 3.2 Description of Test Apparatus

3.2.1 The test head shall consist of an externally mounted spindle and a suitable housing for retaining the test fluid and positioning the seal(s) with respect to the rotating test shaft (Figure 1).

3.2.2 The spindle shall be capable of cycling and/or maintaining constant shaft speeds within  $\pm 3\%$ .

3.2.3 The spindle shall be rigid enough to maintain the specified test shaft runout under dynamic conditions within  $\pm 0.03$  mm ( $\pm 0.001$  in) up to 6000 rpm. Since high-frequency vibrations imposed on the driveshaft due to the drive mechanism or eccentric positioning of the tooling is detrimental to seal qualification, these conditions should be avoided or kept to a minimum.

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3.2.4 The test head shall be suitably designed and constructed to maintain the preset seal bore alignment to the test shaft axis within  $\pm 0.03$  mm ( $\pm 0.001$  in) through the operating temperature range.

3.2.4.1 The test head support shall be sufficiently rigid to insure minimum vibration.

3.2.4.2 The test head shall be suitably constructed and equipped to compensate for misalignment due to temperature gradient and to maintain pressure and test fluid level conditions required for the test.

3.2.4.3 The test head shall be equipped with a suitable arrangement for leakage determination, such as a collector and/or absorption pads.

3.2.4.4 The test head and heat transfer system shall be capable of maintaining the temperature of the test fluid within  $\pm 3$  °C ( $\pm 5$  °F). Heat must be supplied in a manner that does not subject the test fluid to high localized temperatures and cause fluid decomposition. Two acceptable methods would be external electrical heaters with wall temperature controllers or circulation of externally heated fluid (Figure 1).<sup>1</sup>

3.2.4.5 The test head shall be vented to the atmosphere. Length of pipe vent to be agreed upon by user and supplier.

3.2.5 Test shafts shall be hardened to 30 to 45 R<sub>c</sub> and plunge ground to a surface roughness of 0.25 to 0.50  $\mu$ m (10 to 20  $\mu$ in R<sub>a</sub>), with no measurable lead, unless agreed upon by user and supplier. This finish may be obtained by plunge grinding using a non-whole number wheel to work-piece speed ratio. Finishing methods other than plunge grinding to be agreed upon by user and supplier. If wear sleeves are used for the application, they should also be tested. All test shaft surfaces should be free of nicks, burrs, inclusions, or other detrimental imperfections. The specifications in this section conform to ISO 6194-4. Shaft Lead measurements to be conducted in accordance with SAE J946, Section 10 guidelines.

**3.3 Test Conditions**—The test should be realistic and cover the application operating conditions. The operating conditions shall be shown in the form of Figure 2.

In the event that actual application operating conditions are not known or are difficult to duplicate on test equipment, test conditions shown on Tables 2A, 2B, or 3 are recommended. In addition, it is recommended that a seal design be evaluated in the actual application following successful completion of the laboratory test.

**3.4 Test Schedule**—The actual application operation conditions should serve as a guide for the selection of the test schedule. It shall consist of a predetermined number of hourly and/or daily test cycles such as shown in Table 1. The test temperature shall be maintained during the shutdown period of the hourly cycle. During the shutdown period of the daily cycle, the test head temperature should be allowed to drop to ambient.

**TABLE 1—TEST SCHEDULE**

| Cycle  | Running Time | Shutdown Time |
|--------|--------------|---------------|
| Hourly | 45 min       | 15 min        |
| Daily  | 20 h         | 4 h           |

1. Information on machines which are commercially available and meet these specifications may be obtained from seal manufacturers.

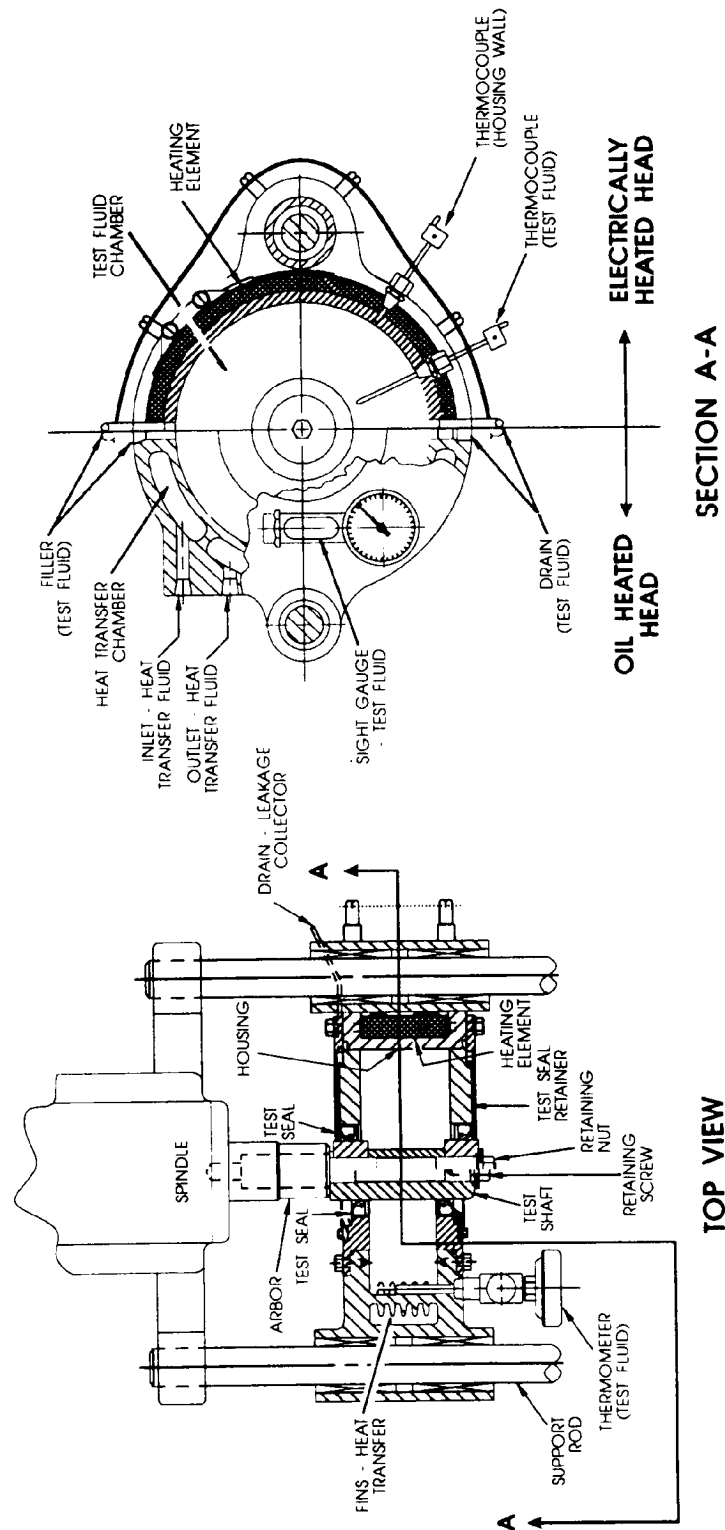


FIGURE 1—SCHEMATIC SHOWING TOP VIEW/CROSS SECTION OF STANDARD OIL OR ELECTRICALLY HEATED SEAL TEST HEAD

SAE J110 Cancelled OCT2002

SHAFT: MATERIAL \_\_\_\_\_ FINISH \_\_\_\_\_ HARDNESS \_\_\_\_\_

MAX DIA \_\_\_\_\_ MIN DIA \_\_\_\_\_ LEAD \_\_\_\_\_  
RH \_\_\_\_\_  
LH \_\_\_\_\_

DYNAMIC RUNOUT \_\_\_\_\_ ROTATION\* \_\_\_\_\_  
RH \_\_\_\_\_  
LH \_\_\_\_\_ RPM \_\_\_\_\_

RECIPROCATION (CPM) \_\_\_\_\_ LENGTH \_\_\_\_\_

BORE: MATERIAL \_\_\_\_\_ FINISH \_\_\_\_\_ HARDNESS \_\_\_\_\_

MAX DIA \_\_\_\_\_ MIN DIA \_\_\_\_\_ DEPTH \_\_\_\_\_

MISALIGNMENT TO SHAFT \_\_\_\_\_

SEAL ASSEMBLY INFORMATION \_\_\_\_\_

FLUID: MANUFACTURER \_\_\_\_\_ BRAND \_\_\_\_\_ VISCOSITY \_\_\_\_\_

PRESSURE \_\_\_\_\_ LEVEL \_\_\_\_\_

TEMP, MAX \_\_\_\_\_ TEMP, MIN \_\_\_\_\_

ADDITIONAL DATA: \_\_\_\_\_

QUALIFICATION OR QUALITY CONTROL TEST: \_\_\_\_\_

TEST SCHEDULE \_\_\_\_\_ TEST CYCLES \_\_\_\_\_

TEST TEMPERATURE(S) \_\_\_\_\_ ALLOWABLE LEAKAGE \_\_\_\_\_

\* AS VIEWED FROM THE OUTSIDE FACE OF THE SEAL.

FIGURE 2—SEAL APPLICATION DATA CHART