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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

## Rotary shaft lip type seals —

### Part 4 : Performance test procedures

*Bagues d'étanchéité à lèvres pour arbres tournants —*

*Partie 4 : Méthodes d'essai de performance*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6194-4 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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# Rotary shaft lip type seals —

## Part 4 : Performance test procedures

### 0 Introduction

0.1 This International Standard on rotary shaft lip type seals will consist of the following parts :

Part 1 : Nominal dimensions and tolerances.

Part 2 : Terminology.

Part 3 : Storage, handling and installation.

Part 4 : Performance test procedures.

Part 5 : Quality acceptance criteria.

0.2 Lip type seals are used for retaining fluid or grease in equipment employing rotating shafts. In some instances, the shaft is stationary and the housing rotates. Sealing of a lip type seal with low differential pressure is normally a result of a designed interference fit between the shaft and the flexible sealing element, which is usually fitted with a garter spring. An interference fit between the outside surface of the seal and the housing bore surface retains the seal in the housing and prevents leakage at the outer diameter.

### 1 Scope and field of application

This part of ISO 6194 specifies general performance tests on rotary shaft lip type seals which can be used for seal qualification test purposes.

### 2 References

ISO 5598, *Fluid power systems and components — Vocabulary.*

ISO 6194-1, *Rotary shaft lip type seals — Nominal dimensions and tolerances.*

### 3 Definitions

For the purposes of this part of ISO 6194, the definitions given in ISO 5598 apply.

NOTE — Terminology specific to rotary shaft lip type seals will be dealt with in ISO 6194-2.

### 4 Test apparatus

4.1 **Test machine**, consisting of a suitable housing for retaining the test fluid and for positioning the test seals, as well as a rotating member having a spindle mounted on suitable bearings, capable of being adjusted to meet the test requirements.

The test apparatus shall also meet the following additional requirements :

- a) the spindle of the test machine shall be capable of cycling and/or maintaining shaft speeds within  $\pm 3\%$ ;
- b) the spindle shall be rigid enough to maintain the specified test run-out under dynamic conditions to within  $\pm 0,03$  mm;
- c) the test head shall be suitably designed and constructed so as to maintain the housing bore alignment to the test shaft axis within 0,03 mm throughout the operating temperature range;
- d) the test head support shall be rigid enough to ensure minimum deformation and vibration;
- e) the test head and heat transfer system shall be capable of maintaining the temperature of the test fluid within  $\pm 3\text{ }^{\circ}\text{C}$ ;
- f) heat shall be applied in a manner that does not subject the test fluid to high localized temperatures which could cause fluid decomposition;

- g) the test shaft shall conform as closely as possible to the shaft to be used in service;
- h) the test shaft shall be free of helical machine marks and shall comply with the requirements for shafts laid down in ISO 6194-1;
- i) the housing bore surface finish and dimensions shall comply with the requirements laid down in ISO 6194-1;
- j) a minimum quantity of 0,75 l of test fluid shall be used;
- k) the level of the test fluid in the test head shall be 0,3  $d_1$  to 0,5  $d_1$  above the lowest point of the shaft diameter,  $d_1$ ;
- l) for seal housings with inboard bearings, the housing shall be suitably relieved at the bearing supports to prevent excessive fluid pressure between bearings and seal;
- m) a suitable means shall be provided for collecting and measuring, in grams, the fluid leakage from the test seals.

## 5 Test conditions

**5.1** In order to be able to analyse the test results accurately, the following data on the physical characteristics of the seal shall be obtained before testing :

- a) lip diameter;
- b) outer case mean diameter and out-of-roundness;
- c) shaft diameter, hardness and surface roughness;
- d) housing diameter and surface roughness;
- e) wiper lip diameter, where applicable;
- f) radial lip load<sup>1)</sup> (if possible).

**5.2** After the test, only a), e), and f) shall be checked.

**5.3** Install the seal into the test head so that the cumulative eccentricities of the seal and the test head are known.

Ensure that the plane of the seal lip is perpendicular to the shaft axis, unless otherwise specified.

Place the test shaft in such a position that an unused surface is in contact with the sealing element.

**5.4** This test shall be started and carried out in accordance with the specified test procedure.

**5.5** When the test has been completed, carefully examine the seal and test shaft. Then evaluate and record the seal and test shaft conditions.

## 6 Test procedures

### 6.1 Qualification test

**6.1.1** Six seals shall constitute a full test.

**6.1.2** The seal application operation conditions shall be used as a guide for selecting the test conditions.

**6.1.3** The test procedure shall consist of ten periods of 24 h, each period consisting of 14 h at the normal operating temperature, 6 h at the maximum operating temperature and 4 h with the test machines stopped and the seals allowed to cool down to room temperature.

The total duration of the test shall be 240 h.

**6.1.4** Since the values of normal and maximum operating temperatures will differ from application to application, agreement shall be reached between seal manufacturer and user.

### 6.2 Acceptance criteria for test results

The maximum permitted leakage from the six seals is 12 g and the maximum from any single seal is 3 g.

## 7 Seal application data

A recommended format for a seal application data chart is given in the figure.

## 8 Identification statement (Reference to this International Standard)

Use the following statement in test reports, catalogues and sales literature when electing to comply with this part of ISO 6194 :

"Performance test procedure in accordance with ISO 6194-4, *Rotary shaft lip type seals — Part 4 : Performance test procedures.*"

1) There is currently no internationally agreed method of measuring lip loads.

### Seal application data chart

Test report reference : .....  
 Drawing reference : .....  
 Compound : ..... Ref. No. : .....  
 Seal type : .....

#### Pre-test measurements

Seal sample No. :						
Seal lip diameter (before fitting spring)*, mm						
Seal lip diameter (with spring), mm						
Wiper diameter (where applicable), mm						
Seal outside diameter, mm						
Radial load of sealing lip						

\* Applicable only to seals with elastomeric sealing elements; to be measured not less than 24 h after the spring has been removed.

#### Test conditions

Fluid : ..... Ref. No. : .....  
 Seal sample No. : .....  
 Shaft diameter, mm : ..... Hardness : ..... Surface roughness value : .....  
 Shaft dynamic run-out (full indicator movement), mm : .....  
 Shaft speed, r/min : .....  
 Seal housing diameter, mm : ..... Surface roughness value : .....  
 Seal housing eccentricity (full indicator movement), mm : .....  
 Fluid temperature, °C : .....  
 Fluid pressure and level, bar<sup>1)</sup> (kPa) : .....  
 Test duration, h : .....

#### Test results

Leakage, g : .....  
 Total leakage from six seals, g : .....

#### Post-test measurements

Seal lip diameter (with spring), mm						
Wiper diameter (where applicable), mm						
Radial load of sealing lip						

Comments on seal condition before and after test : .....  
 .....  
 .....

Figure — Recommended format for seal application data chart

1) 1 bar = 10<sup>5</sup> MPa; 1 Pa = 1 N/m<sup>2</sup>

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