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

Bagues d'étanchéité à lèvre pour arbres tournants -- Partie 4: Méthodes d'essai de performance

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INTERNATIONAL STANDARD

ISO 6194-4

Second edition
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Rotary shaft lip type seals —

Part 4:
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Bagues d'étanchéité à lèvre pour arbres tournants —

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International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 6194-4 was prepared by Technical Committee ISO/TC 131, *Fluid power systems,* Subcommittee SC 7, *Sealing devices*.

This second edition cancels and replaces the first edition (ISO 6194-4:1988), which has been technically revised.

ISO 6194 consists of the following parts, under the general title *Rotary shaft lip type seals*:

— *Part 1: Nominal dimensions and tolerances*

— *Part 2: Vocabulary*

— *Part 3: Storage, handling and installation*

— *Part 4: Performance test procedures*

— *Part 5: Identification of visual imperfections*

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Annexes A, B and C of this part of ISO 6194 are for information only.

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Introduction

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 a 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.

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Rotary shaft lip type seals —

Part 4:
Performance test procedures

1 Scope

This part of ISO 6194 specifies test requirements for rotary shaft lip type seals. The tests may be used for qualification purposes. Materials quality control, dynamic testing and supplementary low temperature testing requirements are also covered.

2 Normative references

The following normative documents contains provisions which, through reference in this text, constitute provisions of this part of ISO 6194. For dated references, subsequent amendments to, or revisions of, these publication do not apply. However, parties to agreements based on this part of ISO 6194 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 188:1998, *Rubber, vulcanized — Accelerated ageing and heat resistance tests.*

ISO 815:1991, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures.*

ISO 1432:1988, *Rubber, vulcanized or thermoplastic — Determination of low temperature stiffening (Gehman test).*

ISO 1817:1998, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 2781:1988, *Rubber, vulcanized — Determination of density.*

ISO 2921:1997, *Rubber, vulcanized — Determination of low-temperature characteristics — Temperature-retraction procedure (TR test).*

ISO 5598:1985, *Fluid power systems and components — Vocabulary.*

ISO 6194-1:1982, *Rotary shaft lip type seals — Part 1: Nominal dimensions and tolerances.*

ISO 6194-2:1991, *Rotary shaft lip type seals — Part 2: Vocabulary.*

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3 Terms and definitions

For the purposes of this part of ISO 6194, the terms and definitions given in ISO 6194-2 and ISO 5598 and the following definition apply.

3.1
batch
identifiable and traceable consignment of rubber compound of definite composition and manufactured in a single production operation

4 Pre-test procedure

4.1 Inspect all seals submitted for testing for conformity to a relevant drawing or detailed specification declared by the seal manufacturer.

4.2 For seals with an elastomeric component, ensure that the seal manufacturer has stated the material designation batch number from which the seals have been made, together with the nominal density, nominal hardness, maximum compression set value and maximum mass change after immersion in the test fluid.

Where the seal is required for the low temperature stiffness test, ensure that the seal manufacturer has also stated the maximum modulus after test at the selected test temperature.

Ensure that the batch of elastomer has been tested in accordance with clause 7.

4.3 To facilitate accurate analysis of the test results, determine the following data concerning the physical characteristics of the seal and test apparatus before testing:

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a) lip diameter (with spring);

b) lip diameter (without spring, measured not less than 24 h after removal of spring);

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c) outer case mean diameter and out-of-roundness;

d) shaft diameter, material hardness and surface roughness;

e) housing diameter, material and surface roughness;

f) minor lip diameter, where applicable (with and without primary lip spring fitted).

4.4 Ensure that the specified shaft eccentricity and housing off-set of the test apparatus have been incorporated.

5 Dynamic test

5.1 Test apparatus

The test apparatus shall be similar to the typical example shown in Figure 1 and shall consist 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 horizontally on suitable bearings. The design of the housing for the seal shall be in accordance with the dimensions specified in ISO 6194-1. The housing and the rotating member shall be capable of reproducing the eccentricity and off-set specified in 4.4.

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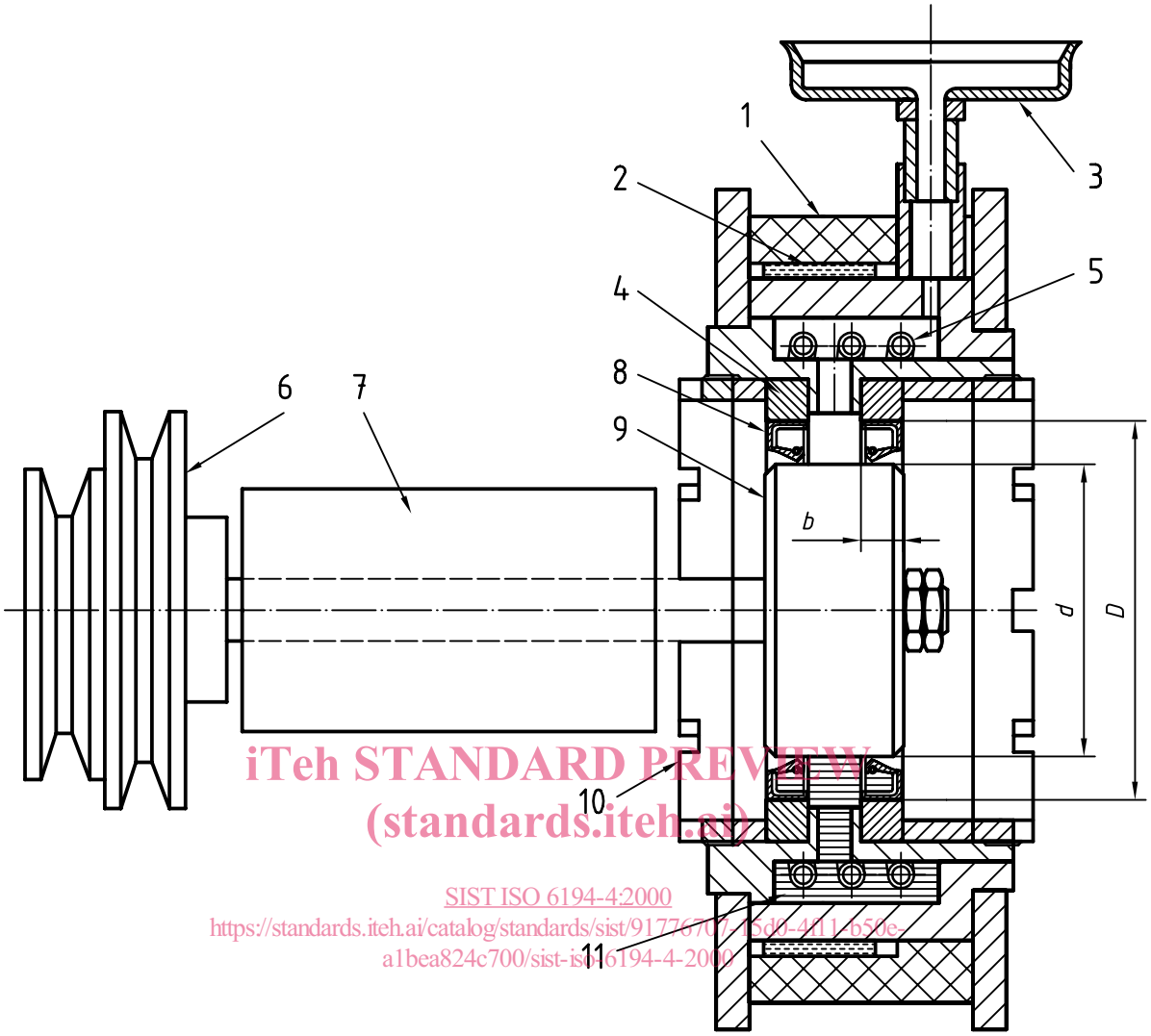

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Key

1	Insulation	7	Test head support
2	Heater band	8	Test seal
3	Filler tray	9	Test shaft
4	Seal housing	10	Locking ring
5	Cooling coils	11	Test fluid
6	Drive from prime mover		

Figure 1 — Typical example of dynamic test apparatus

Where it is not practicable to provide a test apparatus with the particular shaft and housing size relevant to the application, the test apparatus shall be selected from the standard sizes listed in Table 1. The size selected shall be that nearest to the application size.

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Table 1 — Standard shaft and housing dimensions

Dimensions in millimetres

Shaft diameter *d*	Housing diameter *D*	Seal width *b*
20	35	7
40	55	8
60	80	8
90	120	12
200	230	15

The test apparatus shall also conform to the following additional requirements:

a) the shaft shall be capable of cycling and/or maintaining the shaft speeds to within ± 3 %;

b) the shaft shall be capable of maintaining the specified test eccentricity under dynamic conditions to within ± 0,03 mm throughout each test;

c) the test head shall be designed and constructed so as to maintain the housing bore alignment relative to the test shaft axis within 0,03 mm throughout the operating temperature range;

d) the design of the test head support shall ensure minimum deformation and vibration;

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e) the test head and heat transfer system shall be capable of maintaining the temperature of the test fluid within ± 3 °C, and shall be vented to atmosphere;

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f) heat shall be applied in a manner that does not subject the test fluid to high localized temperatures that could cause fluid decomposition;

g) the test shaft shall have a surface that is free of helical machine marks and shall comply with the requirements for shafts specified in ISO 6194-1;

h) the test housing bore shall comply with the requirements specified in ISO 6194-1;

i) the materials, surface finish and dimensions of the test shaft and test housing bore shall conform as closely as possible to the shaft and housing bore to be used in service;

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 0,3d to 0,5d above the lowest point of the shaft diameter d;

l) for seal housings with inboard bearings, the test housing shall be suitably relieved at the bearing supports to prevent excessive fluid pressure between the bearing and seals;

m) means shall be provided for collecting and measuring the mass of any fluid leakage from the seals during the test;

n) the test head shall have a device capable of pressurising the seal housing to the working pressure;

o) a liquid level measuring device shall be provided on the test head.

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5.2 Installation

5.2.1 Thoroughly clean the test head of contaminants and extraneous matter.

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

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

5.2.4 Locate the test shaft in such a position that a clean unused area of its surface is in contact with the sealing element of the test seal.

5.3 Test conditions

Apply test conditions that simulate the seal application operating conditions specified by the customer, i.e. normal operating temperature, normal operating shaft speed, maximum envisaged operating temperature and maximum envisaged shaft speed (see annex A).

5.4 Test procedure

Submit six seals to 10 cycles, each of 24 h duration, consisting of 14 h at normal operating temperature and speed, according to service conditions, and 6 h at the maximum envisaged operating temperature and speed, followed by a 4 h shut-down when the test machine is allowed to cool to room temperature. If applicable, each alternate cycle shall be in the reverse direction of rotation.

5.5 Post-test measurements

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After completion of the test, determine the seal lip diameters, the minor lip diameters where applicable, and the contact band width. Inspect the seal lip, noting any cracks, tears, splits or any imperfections that may have appeared as a result of the test.

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5.6 Recording

Record all test data on a seal test report. An example of a seal test report for a dynamic test is shown in annex A.

5.7 Acceptance criteria

Unless otherwise agreed between manufacturer and purchaser, the total leakage from all six seals shall not be greater than 12 ml, and the leakage from any single seal shall not be greater than 3 ml.

6 Dynamic low temperature test

6.1 General

This test is applicable to all rotary shaft lip type seals for which the minimum specified operating temperature is stated to be – 10 °C or lower.

6.2 Test fixture

The test fixture shall be similar to the typical example shown in Figure 2.

The test shaft and seal housing shall simulate the envisaged maximum eccentricities specified by the customer. The test shaft diameter, the test shaft surface roughness and seal housing dimensions shall also be those specified by the customer or as specified in ISO 6194-1.