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**Rotary shaft lip-type seals incorporating  
thermoplastic sealing elements —**

**Part 3:  
Storage, handling and installation**

*Bagues d'étanchéité à lèvres pour arbres tournants incorporant des  
éléments d'étanchéité thermoplastiques —*

*Partie 3: Stockage, manipulation et montage*



Reference number  
ISO 16589-3:2011(E)

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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

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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 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16589-3 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 16589-3:2001), which has been technically revised.

ISO 16589 consists of the following parts, under the general title *Rotary shaft lip-type seals incorporating thermoplastic sealing elements*:

- *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*

## Introduction

Rotary shaft lip-type seals are used to retain fluid in equipment where the differential pressure is relatively low. Typically the shaft rotates and the housing is stationary, although in some applications the shaft is stationary and the housing rotates.

Dynamic sealing is normally the result of a designed interference fit between the shaft and a flexible element incorporated in the seal.

Similarly, a designed interference fit between the outside diameter of the seal and the diameter of the housing bore retains the seal and prevents static leakage.

Careful storage and handling and proper installation of all seals are necessary to avoid hazards, both prior to and during installation, which would adversely affect service life.



# Rotary shaft lip-type seals incorporating thermoplastic sealing elements —

## Part 3: Storage, handling and installation

### 1 Scope

ISO 16589 specifies seals utilizing sealing elements manufactured from suitably formulated compounds, based on thermoplastic materials, such as polytetrafluoroethylene (PTFE). They are considered suitable for use under low pressure conditions.

This part of ISO 16589 gives users of lip-type seals guidance on the careful storage and handling and proper installation of rotary shaft lip-type seals; attention is drawn to the hazards involved and ways of avoiding them are pointed out.

NOTE ISO 16589 is complementary to ISO 6194, which covers seals incorporating elastomeric sealing elements.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2230, *Rubber products — Guidelines for storage*

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

ISO 16589-1, *Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 1: Nominal dimensions and tolerances*

ISO 16589-2, *Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 2: Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and ISO 16589-2 apply.

### 4 General storage

**4.1** Rotary shaft lip-type seals need to be stored with caution because any damage to them can adversely affect their life and subsequently the service life of bearings and/or other costly machined parts. They shall be stored in accordance with ISO 2230; in addition, the requirements given in 4.2 to 4.6 apply.

**4.2** Seals shall be protected from insects and rodents, some of which thrive on rubber products.

**4.3** Lip seals should be stored in a place other than a work area to avoid possible mechanical damage by equipment or falling objects. A closed container will provide protection from mechanical damage, as well as from dust, grit and other contaminants.

**4.4** When cartons of lip seals are stacked, take care to avoid damage to the bottom parts due to excessive weight.

**4.5** Rotary shaft seals incorporating thermoplastic sealing elements can be supplied assembled on mandrels for ease of transport and storage. These mandrels have the advantage of protecting the sealing lip and preventing relaxation of the lip which could result in increased interference. When this is the case, the seals shall remain on mandrels until immediately prior to installation. In some cases, the seals are supplied with individual mandrels that can be used as assembly tools. The seal manufacturer should ensure that the seal/seals are assembled onto mandrels backside first, unless individual mandrels are supplied. The user should withdraw the seal from the mandrel backside first.

**4.6** Seals shall be protected from radioactive materials and fumes that can cause deterioration of the seal.

## **5 Packaging**

**5.1** The seals shall be protected from damage and foreign material en route from the manufacturer to the user and during storage.

**NOTE** Several methods are used to package lip-type seals. Good commercial practice dictates that the best packaging is the least expensive that still affords the protection desired. This needs to be assessed and agreed between the vendor and customer for each part shipped.

**5.2** During unpacking, care shall be exercised so as not to cut or tear the seal element with sharp instruments, such as knives, screwdrivers, etc., brought about by improperly unpacking bulk packs, roll packs, and individually wrapped or boxed packs.

**5.3** Seals shall not be removed from their packaging until they are ready for installation; this will ensure protection and identification.

## **6 Handling of loose parts**

**6.1** After seals have been removed from their packaging, they shall be handled carefully to prevent damage prior to installation. Seal lips are extremely vulnerable to damage and the smallest nick can provide a potential leak path.

**NOTE** Small nicks can even be caused by a fingernail.

**6.2** Seals shall never be threaded on wires or string, or be hung on nails or pegs. Mishandling seals in this way can lead to the lip being distorted or even cut.

**6.3** Care shall be exercised when handling seals with metal outside surfaces, which can damage other seals, especially if the metal edges come into contact with the sealing elements.

**6.4** The seal surfaces shall be free of grit, chips, and other abrasives since lip seals which have been prelubricated are particularly susceptible to this hazard.

**6.5** If it becomes necessary to clean seals, the manufacturer shall be asked to recommend a suitable cleaning solution. These cleaning materials vary with the type of compound used for the seal element. Commonly used solvents include high-flash naphthas and fluorocarbon solvents.

Abrasive cleaners shall not be used as they can remove thermoplastic, rubber and metal, causing flat spots and operating deficiencies.



Solvents, corrosive liquids and chemical cleaners shall not be allowed to come into contact with the seals. These materials can be absorbed by the seal element, causing it to swell, disintegrate or otherwise lose its physical properties.

Improper solutions, which can cause a breakdown in the rubber/thermoplastic-to-metal between the sealing elements and the case, shall not be used. In case of doubt as to the compatibility of the cleaning solution, the manufacturer of the seal should be contacted.

## 7 Seal installation

**7.1** The seal shall be examined before installation to ensure that it is clean and undamaged.

**7.2** The sealing lip can be assembled onto the shaft unlubricated unless otherwise specified by the supplier. If specified, the amount and type of lubricant should be agreed between the purchaser and supplier.

**7.3** A light application of suitable clean lubricant should be made to the outside surface of rubber-covered seals. The amount and type should be agreed between the purchaser and supplier.

**NOTE** The installed squareness is a significant factor in the performance of a lip-type seal. Squareness is obtained by pressing the seal even with the front face of the bore or bottoming against the shoulder of the bore.

**7.4** The end of the shaft and the mouth of the housing bore shall be provided with lead-in chamfers as specified in ISO 16589-1.

**7.5** Installation tools, such as illustrated in Figure 1 a), shall be used to press the seal into place.

**7.6** The seal shall be aligned with a machined surface whether the seal is installed even with the housing bore front or bottomed against a shoulder (see Figures 1 and 2). Unfinished surfaces shall not be used because of the danger of misalignment of the seal. Care shall be taken not to deform the seal case by applying excessive pressure.

**7.7** Any surfaces over which the seal lip has to slide during installation shall be smooth and free from rough spots.

**7.8** Special installation tools (see Figure 4) shall be used to prevent seal lip damage if the seal element slides over splines, keyways or holes.

Tools of this type shall not become nicked, otherwise they will cause lip damage themselves.

Soft metals such as aluminium shall never be used for this purpose since they nick very easily.

**7.9** If press-fitted components have to be forced over the running area of the seal, the shaft diameter shall be reduced by 0,2 mm in the running area. The particular rotary shaft lip-type seal designed for the shaft may be used without any negative effect on the sealing action. See Figure 5.

**7.10** When using rubber-covered seals, a light application of suitable clean lubricant should be applied on the outside surface. Assembly into the housing shall be carried out by pressing with uniform speed and pressure to its intended position and holding briefly to prevent any spring back.

**7.11** If seals have to be assembled at low temperatures, flexibility of the sealing lip may be restored by placing the seal for 10 min to 15 min in a clean, compatible fluid at a temperature not exceeding 50 °C.

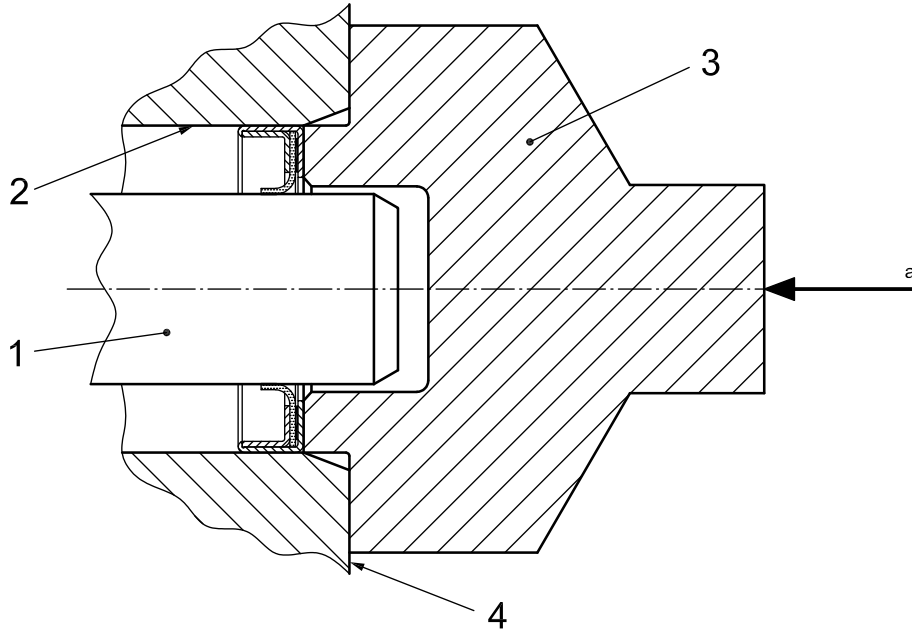
**7.12** In case of replacement, a new rotary shaft lip-type seal shall always be used. The sealing lip of the new seal shall not be allowed to engage with the previous track of rotation; it shall be shifted to the fluid side. This can be achieved by fitting spacers or exchanging the shaft bushes or the race rings or by varying the depth to which the seal is pressed into the housing bore.

The sealing surfaces (shaft and housing bore) shall be thoroughly cleaned, care being taken not to damage them.

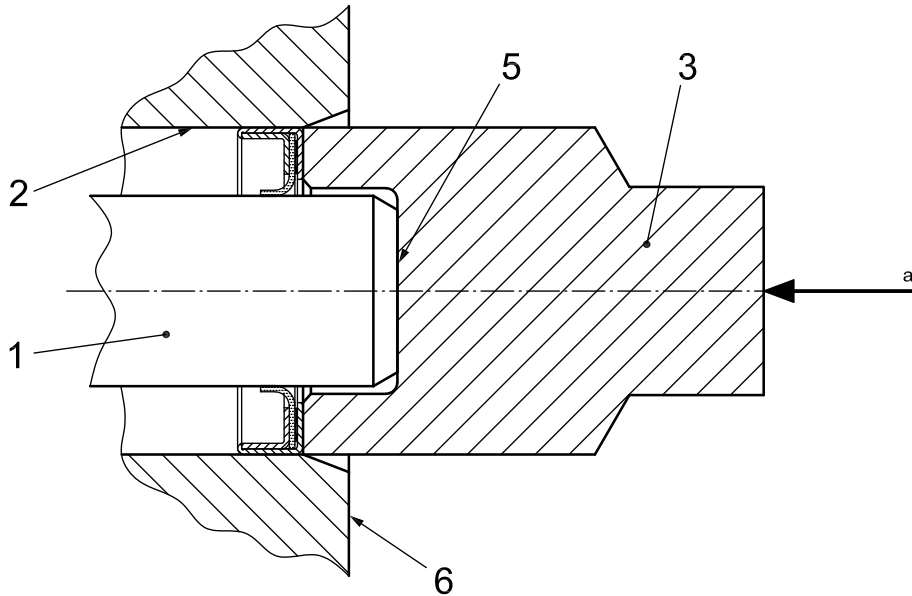
**8 Identification statement** (Reference to this part of ISO 16589)

Use the following statement in test reports, catalogues and sales literature when electing to comply with this part of ISO 16589:

“Storage, handling and installation procedures in accordance with ISO 16589-3, *Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 3: Storage, handling and installation.*”



**a) Installation tool bottoms on face machined square with housing bore**

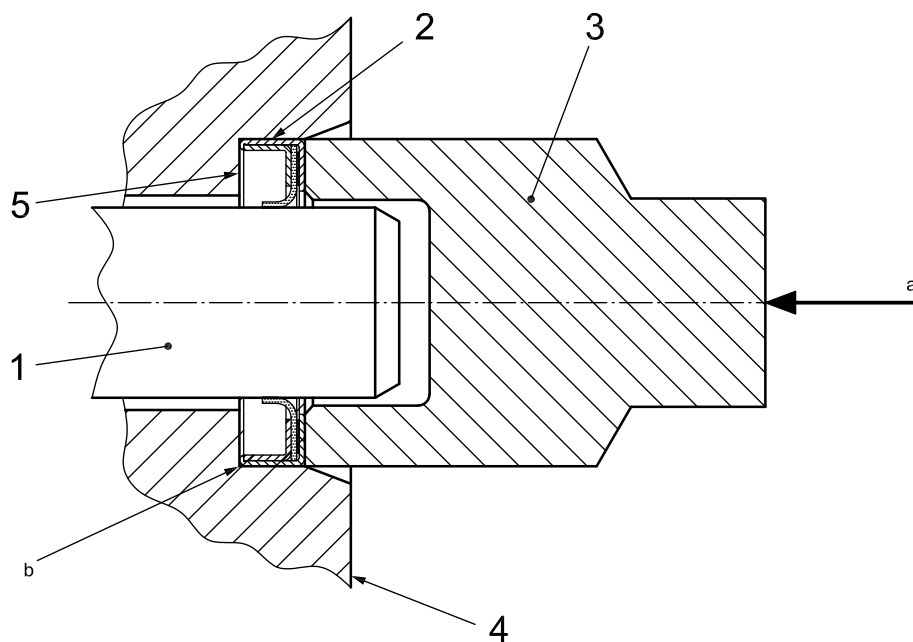


**b) Installation tool bottoms on shaft**

**Key**

- |                          |   |
|--------------------------|---|
| 1 shaft                  | 4 face machined square with housing bore    |
| 2 housing bore           | 5 shaft end machined square with shaft axis |
| 3 installation tool      | 6 as-cast housing bore front                |
| a Load; see 7.5 and 7.6. |   |

**Figure 1 — Installation of seal — Through bore**

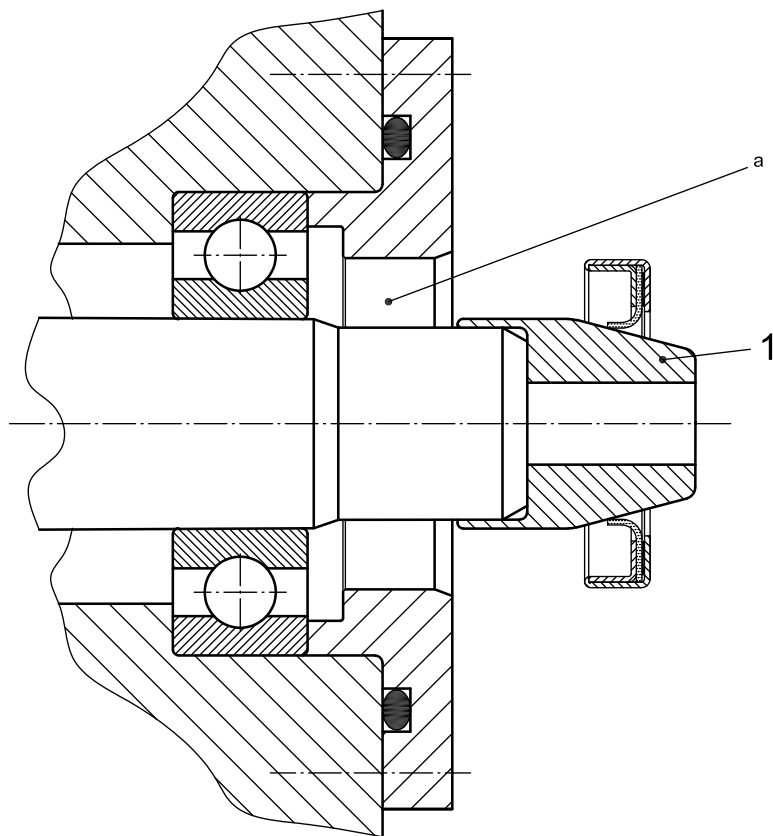
**Key**

- 1 shaft
- 2 housing bore
- 3 installation tool
- 4 as-cast housing bore front
- 5 shoulder machined square with housing bore

a Load; see 7.6.

b Back minimum radius.

**Figure 2 — Installation of seal — Bottom bore: seal bottoms on machined housing bore shoulder**

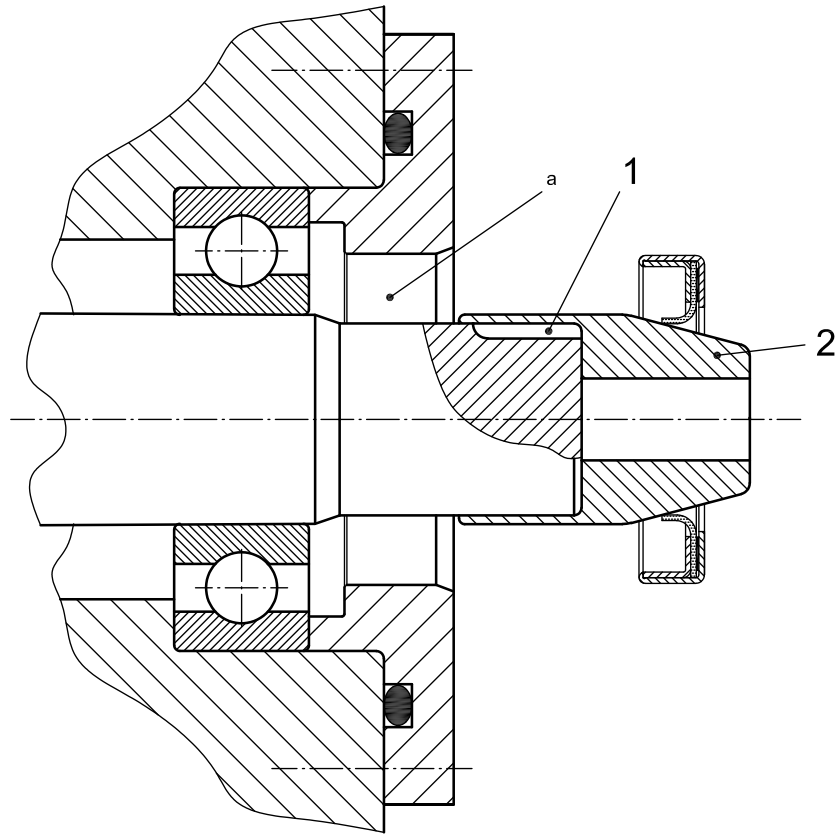


**Key**

1 bullet nosed tool

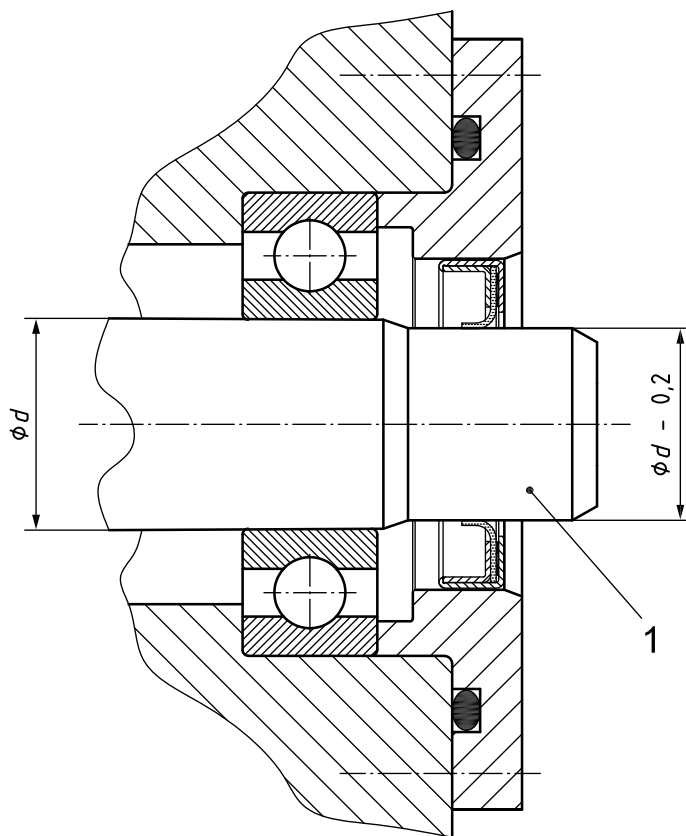
a Required seal installation position.

**Figure 3 — Typical installation using bullet nosed assembly tool to assist assembly**

**Key**

- 1 splines, keyways or holes
- 2 bullet nosed tool
- a Required seal installation position.

**Figure 4 — Special installation tool for use with seal elements which slide over splines, keyways or holes**



**Key**

1 shaft

**Figure 5 — Installation of seal — Press-fitted components forced over running area**

## Bibliography

- [1] ISO 6194-1, *Rotary shaft lip-type seals incorporating elastomeric sealing elements — Part 1: Nominal dimensions and tolerances*
- [2] ISO 6194-2, *Rotary shaft lip-type seals incorporating elastomeric sealing elements — Part 2: Vocabulary*
- [3] ISO 6194-3, *Rotary shaft lip-type seals incorporating elastomeric sealing elements — Part 3: Storage, handling and installation*
- [4] ISO 6194-4, *Rotary shaft lip-type seals incorporating elastomeric sealing elements — Part 4: Performance test procedures*
- [5] ISO 6194-5, *Rotary shaft lip-type seals incorporating elastomeric sealing elements — Part 5: Identification of visual imperfections*

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