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Jawaharlal Nehru
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Indian Standard

ROTARY SHAFT LIP-TYPE SEALS INCORPORATING THERMOPLASTIC SEALING ELEMENTS

PART 2 VOCABULARY

ICS 01.040.23; 23.100.60; 83.140.50

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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NATIONAL FOREWORD

This Indian Standard (Part 2) which is identical with ISO 16589-2:2001 'Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 2: Vocabulary' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Basic Fluid Power Sectional Committee and approval of the Medical Instruments, General and Production Engineering Division Council.

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

Only English language has been retained while adopting this ISO Standard.

The text of the ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCE

In this adopted standard, reference appears to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the edition indicated:

<table>
<thead>
<tr>
<th>International Standard</th>
<th>Corresponding Indian Standard</th>
<th>Degree of Equivalence</th>
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<tbody>
<tr>
<td>ISO 5598 : 1985 Fluid power</td>
<td>IS 10416 : 1992 Fluid power</td>
<td>Identical</td>
</tr>
<tr>
<td>systems and components —</td>
<td>systems and components —</td>
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</tr>
<tr>
<td>Vocabulary</td>
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</tbody>
</table>

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following ISO Standards and has decided that it is acceptable for use in conjunction with the Standard:

ISO 4287:1997 Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters


(Continued on third cover)
1 Scope

ISO 16589 describes seals utilizing sealing elements manufactured from suitably formulated compounds, based on thermoplastic materials, such as polytetrafluoroethylene (PTFE).

NOTE ISO 16589 is complementary to ISO 6194 which covers elastomeric seals.

This part of ISO 16589 establishes the vocabulary for rotary shaft seals incorporating thermoplastic sealing elements, where the terms and definitions given in ISO 5598 apply.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 16589. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 16589 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.


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

3 Terms and definitions

3.1 Types of seal (see Figure 1)

3.1.1 rotary shaft lip seal

seal having a deformable section and usually an adjacent metal support capable of preventing leakage due to inward or outward radial force imposed by the sealing edge

3.1.2 hydrodynamically aided seal

seal having an additional sealing device on a back lip face, formed by uniform directional or bidirectional helical flutes, scrolls or other configurations, which alter the shape of the area of contact between the seal and the shaft in such a way that fluid which would otherwise leak is prevented from doing so

3.1.3 metal-cased seal

seal in which the sealing element is mechanically retained between the inner and outer metal shells

See Figure 1 a).

3.1.4 metal-cased seal with thermoplastic minor lip

seal with a minor lip in which both lips are manufactured in thermoplastic materials and which is mechanically retained between the inner and outer metal shells

See Figure 1 b).

3.1.5 semi-rubber-covered seal

metal-cased seal (3.1.3) having the outer diameter of the metal case partly covered with rubber which is bonded to the outer metal shell

See Figure 1 c).
3.1.6 semi-rubber-covered seal with rubber minor lip
semi-rubber-covered seal (3.1.5) having the rubber covering extended to form a minor lip
See Figure 1 d).

3.1.7 rubber-covered seal
metal-cased seal (3.1.3) having the outer diameter of the metal case completely covered with rubber which is bonded to the outer metal shell
See Figure 1 e).

3.1.8 rubber-covered seal with rubber minor lip
rubber-covered seal (3.1.7) having the rubber covering extended to form a minor lip
See Figure 1 f).

3.1.9 metal-cased hydrodynamically aided seal
metal-cased seal (3.1.3), the sealing element of which incorporates hydrodynamic aids
See also 3.1.2.
See Figure 1 g).

3.1.10 metal-cased seal with two sealing elements and thermoplastic minor lip
seal incorporating two sealing elements and a thermoplastic minor lip, mechanically retained between the inner and outer metal shells
See Figure 1 h).

3.2 Parts of sealing devices, tolerances and fits (see Figure 2)

3.2.1 thickness of sealing element
See Figure 2, reference 1.

3.2.2 sealant
material applied to the outside diameter of the outer case to prevent leakage at the housing bore
See Figure 2, reference 2.

3.2.3 metal outer case
rigid cup-shaped component of a seal which encases the inner case
See Figure 2, reference 3.

3.2.4 thickness of metal inner case
See Figure 2, reference 4.

3.2.5 metal inner case
rigid cup-shaped component of a seal which is placed inside the outer case
See Figure 2, reference 5.

3.2.6 front lip face
frontside surface of the sealing lip, the minor diameter of which is the lip diameter
See Figure 2, reference 6.

3.2.7 sealing lip contact area
part of the sealing lip which forms the seal/shaft interface
See Figure 2, reference 7.

3.2.8 front lip height
axial distance from the back face to the front of the lip face with seal assembled on the shaft
See Figure 2, reference 8.

3.2.9 lip diameter
inside diameter of the lip before forming
See Figure 2, reference 9.
3.2.10  
**back lip face**  
outside surface of the lip which terminates at the sealing edge

See Figure 2, reference 10.

3.2.11  
**gasket**  
device which is positioned between the inside face of the outer case and the sealing element to prevent a potential leakage path

See Figure 2, reference 11.

3.2.12  
**axial width**  
total axial dimension of the seal

See Figure 2, reference 12.

3.2.13  
**front face**  
surface of the seal which faces the fluid being sealed

See Figure 2, reference 13.

3.2.14  
**radial width**  
radial distance between the outside surface of the seal and the sealing edge

See Figure 2, reference 14.

3.2.15  
**outside diameter of seal case assembly**  
external diameter of the seal case assembly: normally the press fit diameter

See Figure 2, reference 15.

3.2.16  
**hydrodynamic aid**  
additional sealing device on the back face of the sealing element, formed by uniform directional or bidirectional helical flutes, scrolls or other configurations, which alter the shape of the area of contact between the seal and the shaft in such a way that fluid which would otherwise leak is prevented from doing so

See Figure 2, reference 16.

3.2.17  
**thickness of metal outer case**  
See Figure 2, reference 17.

3.2.18  
**sealing element**  
thermoplastic element which is an interference fit with the shaft to retain the system fluid

See Figure 2, reference 18.

3.2.19  
**inside diameter of the gasket**  
See Figure 2, reference 19.

3.2.20  
**outside diameter of the gasket**  
gasket diameter, which is a location fit with the inside diameter of the outer case

See Figure 2, reference 20.

3.2.21  
**back face**  
surface of the seal perpendicular to the shaft axis which is not in contact with the fluid being sealed

See Figure 2, reference 21.

3.2.22  
**thickness of spacer**  
See Figure 2, reference 22.

3.2.23  
**spacer**  
device placed between the primary and secondary sealing elements to prevent the sealing lips touching one another when assembled on the shaft

See Figure 2, reference 23.

3.2.24  
**outside diameter of spacer**  
See Figure 2, reference 24.
3.2.25 inside diameter of spacer
See Figure 2, reference 25.

3.2.26 primary sealing element
seal element on the fluid pressure side
See Figure 2, reference 26.

3.2.27 secondary sealing element
supplementary sealing element on the air side of the primary element
See Figure 2, reference 27.

3.2.28 thickness of minor lip
thickness of the thermoplastic minor element
See Figure 2, reference 28.

3.2.29 outer case inside diameter
See Figure 2, reference 29.

3.2.30 minor lip front side
portion of the dust lip facing the inside of the seal
See Figure 2, reference 30.

3.2.31 minor lip
short lip located at the back face of a seal to protect the shaft and to prevent ingress of contaminants
See Figure 2, reference 31.

3.2.32 minor lip back side
portion of the dust lip facing the back side of the seal
See Figure 2, reference 32.

3.2.33 identification
preferred position of identification marks
See Figure 2, reference 33.

3.2.34 outside surface
external surface of the seal, normally the press-fit surface
See Figure 2, reference 34.

3.2.35 retaining flange
portion of the outer case which is deformed to securely retain the inner components
See Figure 2, reference 35.

3.2.36 inner case inside diameter
See Figure 2, reference 36.

3.2.37 axial lip clearance
axial distance between the front face of the lip and the front face of the outer case when assembled on the shaft
See Figure 2, reference 37.

3.2.38 sealing lip
flexible component of a seal which bears against the shaft and effects sealing
See Figure 2, reference 38.

3.2.39 free gasket thickness
thickness of gasket prior to assembly
See Figure 2, reference 39.

3.2.40 housing bore depth
axial dimension of the housing bore
See Figure 2, reference 40.
3.2.41 **housing chamfer depth**
axial depth of the housing chamfer

See Figure 2, reference 41.

3.2.42 **seal radial space**
radial distance between the outside diameter of the shaft and the inside diameter of the housing bore

See Figure 2, reference 42.

3.2.43 **housing bore diameter**

See Figure 2, reference 43.

3.2.44 **shaft diameter**
diameter of the shaft where lip contact occurs

See Figure 2, reference 44.

3.2.45 **lead-in chamfer**
lead-in on a housing bore of shaft to facilitate the assembly of the seal

See Figure 2, reference 45.

3.2.46 **housing bore**
internal space of the housing cavity which retains the seal

See Figure 2, reference 46.

3.2.47 **housing bore radius**
inside corner radius of the housing

See Figure 2, reference 47.

3.2.48 **housing/shaft bore**
bore in which the shaft rotates

See Figure 2, reference 48.

3.2.49 **circularity of shaft**
development of a cross-section through the shaft taken at right angles to the axis of the shaft, from a true circle

See Figure 3 a), reference 1.

3.2.50 **housing bore eccentricity**
radial distance that the geometric centre of the housing bore is displaced from the axis of shaft rotation

3.2.51 **eccentricity of shaft**
development from the axis of rotation, of the geometric centre of a cross-section through the shaft, taken at right angles to that axis

3.2.52 **outside diameter interference**
diametral difference between the outside diameter of the seal and the inside diameter of the housing bore

3.2.53 **lip interference**
diametral difference between the inside diameter of the seal lip and the diameter of the shaft where lip contact occurs

3.2.54 **plunge ground finish**
surface texture of the shaft or wear sleeve produced by presenting the grinding wheel to the rotating shaft without axial motion

3.2.55 **surface roughness**
surface profile irregularities measured in accordance with ISO 4287 and ISO 4288

3.2.56 **run-out of shaft**
twice the shaft eccentricity expressed in FIM (full indicator movement)

3.2.57 **seal land**
part of the shaft surface prepared for the seal lip contact

3.3 **Visual imperfections** (see Figure 3)

3.3.1 **sealing element reversal**
sealing element incorrectly fitted inside out during manufacture

See Figure 3 a), reference 1.
3.3.2
nick
localized loss of material due to damage

See Figure 3 a), reference 2.

3.3.3
incorrect hydrodynamic aid feature
spiral direction of hydrodynamic aids unsuitable for the application

See Figure 3 a), reference 3.

3.3.4
uneven outer diameter sealant
sealant unevenly applied to outer diameter of metal case

See Figure 3 b), reference 4.

3.3.5
cut
relatively deep discontinuity in the sealing lip caused by a sharp instrument and involving no material removal

See Figure 3 b), reference 5.

3.3.6
crack
sharp break or fissure in the thermoplastic sealing element

See Figure 3 b), reference 6.

3.3.7
inclusion
foreign matter included in the seal material

See Figure 3 b), reference 7.

3.3.8
polymer window
area of foreign polymer within the sealing element

See Figure 3 b), reference 8.

3.3.9
tear
radial split in sealing lip

See Figure 3 b), reference 9.

3.3.10
filler projection
filler protruding above the face of the sealing element

See Figure 3 b), reference 10.

3.3.11
gasket extrusion
inner diameter of gasket protruding radially inwards

See Figure 3 b), reference 11.

3.3.12
sealing lip inversion
partial inversion of the sealing lip

See Figure 3 b), reference 12.

3.3.13
incomplete trim
trimmed surface which does not have all designated material removed

See Figure 3 b), reference 13.

3.3.14
eccentricity of lip
inside diameter of the sealing lip which is eccentric to the outside of the seal

3.3.15
indentation
imperfection caused by the removal of an inclusion from the surface

3.3.16
missing component parts
internal component part not fitted during seal assembly

3.3.17
rough surface finish of sealing element
unacceptably rough surface finish on sealing element

3.3.18
uneven roll over of retaining flange
retaining flange of the outer case unevenly or insufficiently deformed to secure inner components
3.4 Storage, handling and installation

3.4.1 direction of shaft rotation for a hydrodynamic seal

NOTE The direction of rotation should be specified as seen from the backside of the seal.

3.4.2 dry installation
sealing lip which is assembled to the shaft in a clean and unlubricated condition

3.4.3 installed squareness
alignment of the seal with the radial plane perpendicular to the axis of the shaft

3.4.4 service life
length of time a seal is usable in service

3.5 Performance test procedure

3.5.1 test head
part of the test machine in which the test seals are mounted

3.5.2 shaft dynamic run-out
twice the distance the centre of the shafts is displaced from the centre of rotation and expressed in (TIR) total indicator reading

3.5.3 test qualification
means by which a seal is assessed to perform satisfactorily to an application specification
Figure 1 — Types of seal including additional types
Figure 2 — Parts of sealing devices
a) Before lip has been formed

b) After lip has been formed

Figure 3 — Visual imperfections
Under the general title, Rotary shaft lip-type seals incorporating thermoplastic sealing elements, there are five parts as per following:

- IS 15545 (Part 1): 2004 Nominal dimensions and tolerances
- IS 15545 (Part 2): 2004 Vocabulary
- IS 15545 (Part 3): 2004 Storage, handling and installation
- IS 15545 (Part 4): 2004 Performance test procedures
- IS 15545 (Part 5): 2004 Identification of visual imperfections
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This Indian Standard has been developed from Doc : No. MGP 14 (393).

Amendments Issued Since Publication

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