International Standard ISO 6194/1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Rotary shaft lip type seals — Part 1 : Nominal dimensions and tolerances

Bagues d'étanchéité à lèvres pour arbres tournants — Partie 1 : Dimensions nominales et tolérances

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Descriptors : fluid power, hydraulic fluid power, hydraulic equipment, seals (stoppers), dimensions, dimensional tolerances.

Foreword

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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.

International Standard ISO 6194/1 was developed by Technical Committee ISO/TC 131, *Fluid power systems*, and was circulated to the member bodies in March 1981.

It has been approved by the member bodies of the following countries :

Austria	Hungary	Romania
Belgium	India	Spain
Canada	Japan	Sweden
China	Mexico	Switzerland
Egypt, Arab Rep. of	Netherlands	United Kingdom
Finland	Norway	USA
Germany, F. R.	Poland	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Czechoslovakia
France
Italy

This International Standard represents the first part of ISO 6194, *Rotary shaft lip type seals*. It will be completed by Part 2, *Terminology*; Part 3, *Guide to application and use*; and Part 4, *General performance test procedure.*

Rotary shaft lip type seals — Part 1 : Nominal dimensions and tolerances

0 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 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

1.1 This part of ISO 6194 lays down the nominal dimensions relating to rotary shaft lip type seals suitable for shafts from 6 to 400 mm diameter and accompanying housings from 16 to 440 mm. Seals of this type are not normally suitable for high pressure.

1.2 This part of ISO 6194 also includes dimensional limits for the shafts and housings to assure interchangeability of seals made by different seal manufacturers.

1.3 The recommended tolerances are also given for the principal seal dimensions.

1.4 The six basic types of seals covered by this International Standard are described and shown in figure 1.

1.5 The annex includes a recommended form for reaching agreement between purchaser and manufacturer.

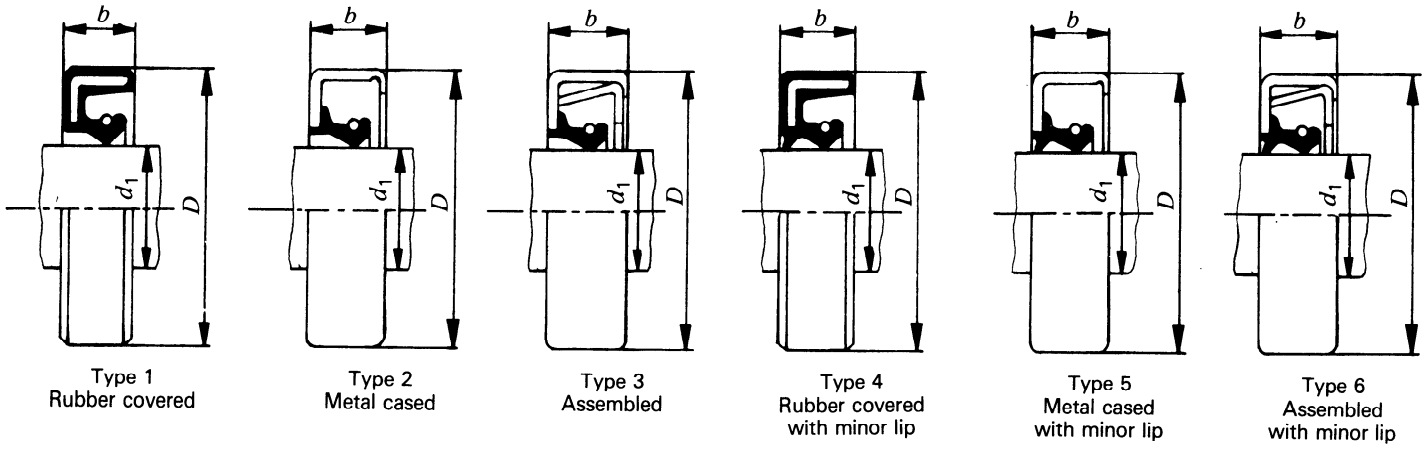


Figure 1 — Six basic types of seals

NOTE — Because of some variations in design details or seals made by different manufacturers, the constructions shown are intended only as representative examples of the six basic types.

2 References

ISO/R 286, *ISO System of limits and fits — Part 1 : General, tolerances and deviations.*

ISO 468, *Surface roughness.*

ISO 5598, *Fluid power systems — Vocabulary.*[1)]

3 Definitions

For definitions of terms used, see ISO 5598.

4 Letter symbols

Letter symbols used in this part of ISO 6194 are as follows :

d_1 is the nominal diameter of the shaft to be used with the seal;

d_2 is the minor diameter at shaft lead-in chamfer (see figure 2);

D is the nominal diameter of the housing bore and of the outer diameter of the seal;

b is the nominal width of the seal and is associated with the housing bore depth.

5 Nominal dimensions

The nominal dimensions of the seals are given in table 1.

Table 1 — Nominal dimensions

Dimensions in millimetres

d_1	D	b	d_1	D	b	d_1	D	b	d_1	D	b
6	16	7	**25**	52	7	**45**	65	8	**120**	150	12
6	22	7	**28**	40	7	**50**	68	8	**130**	160	12
7	22	7	**28**	47	7	**50**	72	8	**140**	170	15
8	22	7	**28**	52	7	**55**	72	8	**150**	180	15
8	24	7	**30**	42	7	**55**	80	8	**160**	190	15
9	22	7	**30**	47	7	**60**	80	8	**170**	200	15
10	22	7	**30**	52	7	**60**	85	8	**180**	210	15
10	25	7	**32**	45	8	**65**	85	10	**190**	220	15
12	24	7	**32**	47	8	**65**	90	10	**200**	230	15
12	25	7	**32**	52	8	**70**	90	10	**220**	250	15
12	30	7	**35**	50	8	**70**	95	10	**240**	270	15
15	26	7	**35**	52	8	**75**	95	10	**260**	300	20
15	30	7	**35**	55	8	**75**	100	10	**280**	320	20
15	35	7	**38**	55	8	**80**	100	10	**300**	340	20
16	30	7	**38**	58	8	**80**	110	10	**320**	360	20
18	30	7	**38**	62	8	**85**	110	12	**340**	380	20
18	35	7	**40**	55	8	**85**	120	12	**360**	400	20
20	35	7	**40**	62	8	**90**	120	12	**380**	420	20
20	40	7	**42**	55	8	**95**	120	12	**400**	440	20
22	35	7	**42**	62	8	**100**	125	12			
22	40	7	**45**	62	8	**110**	140	12			
22	47	7									
25	40	7									
25	47	7									

1) At present at the stage of draft.

6 Shafts

6.1 The end of the shaft shall be provided with a lead-in chamfer as given in figure 2 and table 2 and shall be free from burrs, sharp corners or rough machining marks.

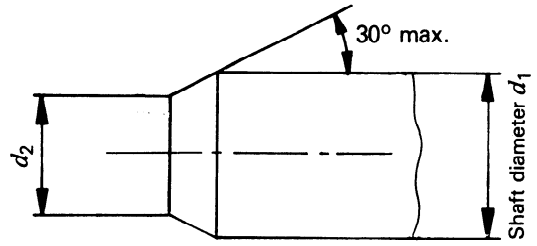


Figure 2 — Shaft lead-in chamfer

Table 2 — Shaft lead-in chamfer

Dimensions in millimetres

Shaft diameter d_1	$d_1 - d_2$ [1]	Shaft diameter d_1	$d_1 - d_2$ [1]
$d_1 \leqslant 10$	1,5	$50 < d_1 \leqslant 70$	4,0
$10 < d_1 \leqslant 20$	2,0	$70 < d_1 \leqslant 95$	4,5
$20 < d_1 \leqslant 30$	2,5	$95 < d_1 \leqslant 130$	5,5
$30 < d_1 \leqslant 40$	3,0	$130 < d_1 \leqslant 240$	7,0
$40 < d_1 \leqslant 50$	3,5	$240 < d_1 \leqslant 400$	11,0

1) If a shaft lead-in chamfer radius is used, it shall be no less than this diametral difference.

6.2 Diametral tolerance

Shafts shall have a diametral tolerance not greater than h11, in accordance with ISO/R 286.

6.3 Surface roughness

The seal contact surface of a plunge ground shaft shall be finished to a surface roughness of not less than 0,2 or more than 0,63 µm R_a and not less than 0,8 or more than 2,5 µm R_{max}, in accordance with ISO 468.

6.3.1 The seal contact surface shall be free of machining leads.

NOTE — In certain applications, higher surface roughness values may be acceptable.

7 Housings

7.1 The housing contains the bore into which the seal is to be fitted.

7.2 Where this housing is a rigid fully machined ferrous part, the housing bore shall conform to 7.5 and 7.6.

7.3 The housing bore shall be provided with a lead-in chamfer, free from burrs, as given in figure 3 and table 3.

7.4 The housing bore depth and corner radius shall conform to figure 3 and table 3.

NOTE — If the housing does not comply with the above (for example, non-ferrous or non-metallic material, pressing of ferrous or non-ferrous material), the dimensions, tolerances and lead-in configuration should be agreed between the purchaser and manufacturer.

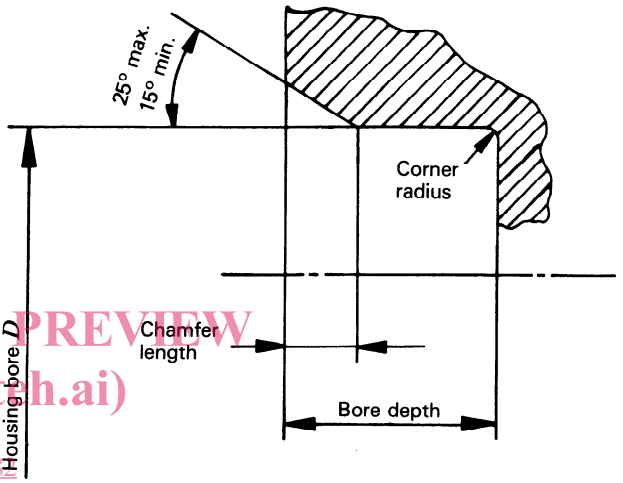


Figure 3 — Housing bore

Table 3 — Housing bore dimensions

Dimensions in millimetres

Nominal width b	Housing bore depth	Chamfer length	Maximum housing bore corner radius
$\leqslant 10$	$b + 0,9$	0,70 to 1,00	0,50
> 10	$b + 1,2$	1,20 to 1,50	0,75

7.5 Housing bore tolerance

The housing bore shall have a diametral tolerance not greater than H8 in accordance with ISO/R 286.

7.6 Housing bore surface roughness

The surface roughness of the housing bore surface shall not exceed either 3,2 µm R_a or 12,5 µm R_{max}, in accordance with ISO 468.

NOTE — The housing bore surface roughness may require lower values when metal cased seals are used.

8 Seal tolerances

8.1 The recommended seal width tolerances are given in table 4.

Table 4 — Seal width tolerance

Values in millimetres

Seal width b	Tolerance
$b \leqslant 10$	± 0,3
$b > 10$	± 0,4

8.2 To provide an interference fit between the seal outside surface and the housing bore surface, the recommended tolerances for the outside diameter of the seal shall be as given in table 5.

NOTE — Since the interference between the seal outside surface and the housing bore surface are characteristics related to the design of the seal, it may be necessary for agreement to be reached between purchaser and manufacturer on the limits to be used. See the annex for recommended form.

9 Size identification code

9.1 The International Standard size identification code shall consist of the nominal dimensions of the shaft and housing, as given in table 1.

9.2 Examples of size identification code are given in table 6.

Table 6 — Size identification code

d_1	D	Size code
6	16	006016
70	90	070090
400	440	400440

10 Identification statement (Reference to this International Standard)

The following statement shall be used in test reports, catalogues and sales literature when electing to comply with this International Standard :

"Dimensions and tolerances conform to ISO 6194/1, *Rotary shaft lip type seals — Part 1 : Nominal dimensions and tolerances.*"

Table 5 — Seal outside diameter tolerances

Values in millimetres

Nominal outside diameter D	Diametral tolerance		Roundness tolerance[1]	
	Metal cased	Rubber covered[2) 3)]	Metal cased	Rubber covered
$D \leqslant 50$	+ 0,20 + 0,08	+ 0,30 + 0,15	0,18	0,25
$50 < D_1 \leqslant 80$	+ 0,23 + 0,09	+ 0,35 + 0,20	0,25	0,35
$80 < D_1 \leqslant 120$	+ 0,25 + 0,10	+ 0,35 + 0,20	0,30	0,50
$120 < D_1 \leqslant 180$	+ 0,28 + 0,12	+ 0,45 + 0,25	0,40	0,65
$180 < D_1 \leqslant 300$	+ 0,35 + 0,15	+ 0,45 + 0,25	0,25 % of outside diameter	0,80
$300 < D_1 \leqslant 440$	+ 0,45 + 0,20	+ 0,55 + 0,30	0,25 % of outside diameter	1,00

1) The roundness tolerance is equal to the difference between the maximum diameter and the minimum diameter derived from three or more equally spaced measurements.

2) Rubber-covered seals having a wave profile outside surface are acceptable but will require different tolerances to be agreed between manufacturer and purchaser.

3) Rubber-covered seals employing certain materials other than nitrile may require different tolerances to be agreed between manufacturer and purchaser.

Annex

Seal specification

A.1 For the convenience of both purchaser and manufacturer it is recommended that the purchaser complete a form such as in table 7, to supply the necessary information to the manufacturer so that he can supply a seal suitable for the application.

A.2 It is also recommended that the manufacturer complete a form such as in table 8 to supply the purchaser with the necessary information to ensure that the seal will comply with his equipment design and application, and will enable the purchaser to carry out inspection or quality control on the seals supplied by the manufacturer.

Table 7 — Purchaser information

Purchaser :	**Reference :**
Application :	**Assembly drawing :**

1 Shaft information

a) Diameter (d_1) .....mm max. .....mm min.
b) Material .....
c) Surface roughness R_a.....µm R_{max}.....µm
d) Type of finish .....
e) Hardness .....
f) Chamfer information .....
g) Rotation

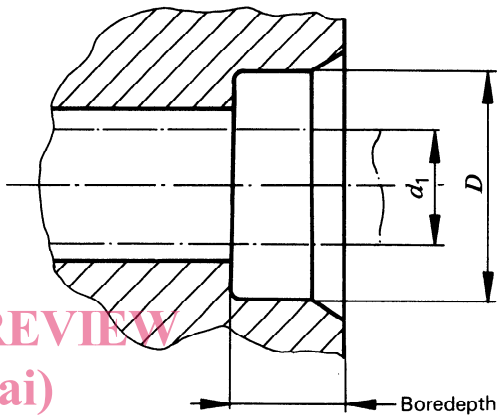
1) Direction of rotation (viewed in direction of arrow as shown in example drawing).
- Clockwise .....
- Anti-clockwise .....
- Birotational.....

2) Rotation speed .....r/min
3) Rotation cycle (Time on .....Time off .....)

h) Other shaft motion (if applicable)

1) Reciprocation
- Length of stroke .....mm
- Cycles per minute.....
- Reciprocation cycle (Time on .....Time off .....)

2) Oscillation
- Magnitude of oscillation (Degrees).....
- Cycles per minute.....
- Oscillation cycle (Time on .....Time off .....)



j) Additional information (i.e., splines, holes, keyways, shaft lead, etc.)
.....
.....

2 Housing information

a) Bore diameter (D) .....mm max. .....mm min.
b) Bore depth .....mm max. .....mm min.
c) Material .....
c) Surface roughness R_a.....µm R_{max}.....µm
e) Chamfer information .....
f) Housing rotation (if applicable)

1) Direction of rotation (viewed in direction of arrow as shown in example drawing)
- Clockwise.....
- Anti-clockwise.....
- Birotational .....

2) Rotation speed.....r/min

3 Contained fluid information

a) Type of fluid .....Grades .....
b) Fluid temperature Normal .....°C max. .....°C min. .....°C
c) Temperature cycle .....
d) Fluid level .....
e) Fluid pressure .....bar .....kPa
f) Pressure cycle .....

4 Alignment

a) Housing bore eccentricity .....
b) Shaft runout (FIM).....

5 External conditions

a) External pressure .....bar .....kPa
b) Materials to be excluded (i.e., dust, mud, water, etc.) .....
.....

Table 8 — Manufacturer information

Manufacturer : ..... Part No. .....

Change No. .....Date .....

Seal specifications :

Type : .....

Outside diameter D : ..... mm max. .....mm min.

Seal width b : ..... mm max. .....mm min.

Inner case diameter A : ..... mm max. .....mm min.

Sealing lip description (delete where not applicable) :

Plain — Hydrodynamic aided

Unirotational — Birotational

Sealing lip material specifications :

Material type : ..... Specification : .....

Case specifications :

Case material : ..... Inner case material : .....

Case thickness : ..... Inner case thickness : .....

Spring material : .....

Optional information : .....

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Test classifications

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Example drawing :