INTERNATIONAL STANDARD

ISO 3601-2

First edition
2008-06-15

Fluid power systems — O-rings —

Part 2: Housing dimensions for general applications

Transmissions hydrauliques et pneumatiques — Joints toriques —

Partie 2: Dimensions des logements pour applications générales

Reference number
ISO 3601-2:2008(E)

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Published in Switzerland

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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 3601-2 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 7, *Sealing devices*.

ISO 3601 consists of the following parts, under the general title *Fluid power systems — O-rings*:

— *Part 1: Inside diameters, cross-sections, tolerances and designation codes*

— *Part 2: Housing dimensions for general applications*

— *Part 3: Quality acceptance criteria*

— *Part 4: Anti-extrusion rings (back-up rings)*

— *Part 5: Suitability of elastomeric materials for industrial applications*

Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. To avoid leakage or to seal different chambers of a component from each other sealing devices are used. O-rings are one type of sealing devices. To seal properly, an O-ring has to be used in an appropriate housing for the application.

Annexes A and B of this part of ISO 3601 are for information only.

Fluid power systems — O-rings —

Part 2: Housing dimensions for general applications

1 Scope

This part of ISO 3601 specifies the housing (gland) dimensions for class A O-rings for general industrial applications conforming to ISO 3601-1, as well as housing dimensions for class B O-rings used on selected metric-dimensioned hardware, e.g. fluid power cylinder bores and piston rods. These O-rings are for use in general hydraulic and pneumatic applications without and with anti-extrusion rings (back-up rings). The dimensions of the O-rings (d_1 and d_2), size codes (SC) and tolerances conform to ISO 3601-1.

Housing dimensions for the O-rings intended for aerospace applications that are specified in ISO 3601-1 are addressed in informative Annex A.

NOTE 1 It is expected that O-ring housing dimensions for special applications be agreed upon between the O-ring manufacturer and the user.

NOTE 2 The terms “housing”, “groove” and “gland” are interchangeable, and their usage is a matter of local convenience. In this part of ISO 3601, the term “housing” is used exclusively.

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 3601-1:2008, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and designation codes*

ISO 3601-4, *Fluid power systems — O-rings — Part 4: Anti-extrusion rings (back-up rings)*

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

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

ISO 8015, *Technical drawings — Fundamental tolerancing principle*

3 Terms and definitions

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

4 Symbols

The following letter symbols are used in this part of ISO 3601:

A_{cs1} cross-sectional area of the O-ring

A_{cs2} cross-sectional area of the O-ring housing

a roughness of the side surface of the O-ring housing

b_x width of the O-ring housing

b_1 width of the O-ring housing without an anti-extrusion ring (back-up ring)

b_2 width of the O-ring housing with one anti-extrusion ring (back-up ring)

b_3 width of the O-ring housing with two anti-extrusion rings (back-up rings)

b_4 width of the O-ring axial housing

C percentage of effective O-ring cross-section compression

c roughness of the ground surface of the O-ring housing

d roughness of the mating surface of the O-ring

d_1 O-ring inside diameter

d_2 O-ring cross-section diameter

d_3 housing inside diameter for piston application

d_4 bore diameter for piston application

d_5 rod diameter

d_6 housing outside diameter for rod application

d_7 outside diameter of housing for axial sealing

d_8 inside diameter of housing for axial sealing

d_9 piston diameter

d_{10} bore diameter for rod application

e surface roughness of lead-in chamfer

F approximate percentage of housing fill

f housing radius (also known as edges of undefined shape)

g extrusion gap

h height of seal housing

R percentage of O-ring cross-sectional reduction resulting from diametral stretch

S percentage of inside diameter stretch

SC O-ring size code from ISO 3601-1

t radial housing depth

t_x approximate radial housing depth

Y maximum run-out tolerance

z length of lead-in chamfer

5 O-ring housings

5.1 Typical O-ring applications

5.1.1 Figure 1 shows a typical O-ring as presented in ISO 3601-1.

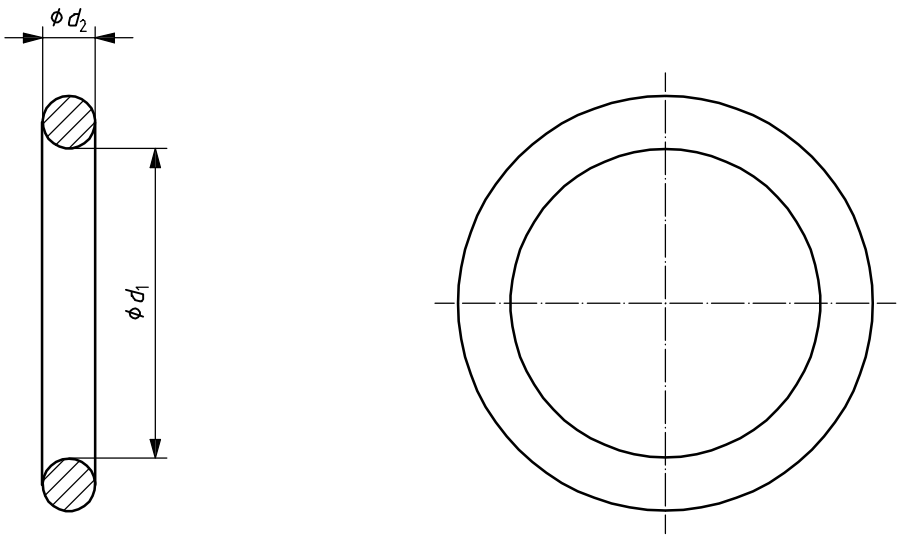


Figure 1 — Typical O-ring configuration

5.1.2 Figure 2 shows the features of an O-ring housing for use in dynamic rod and piston applications.

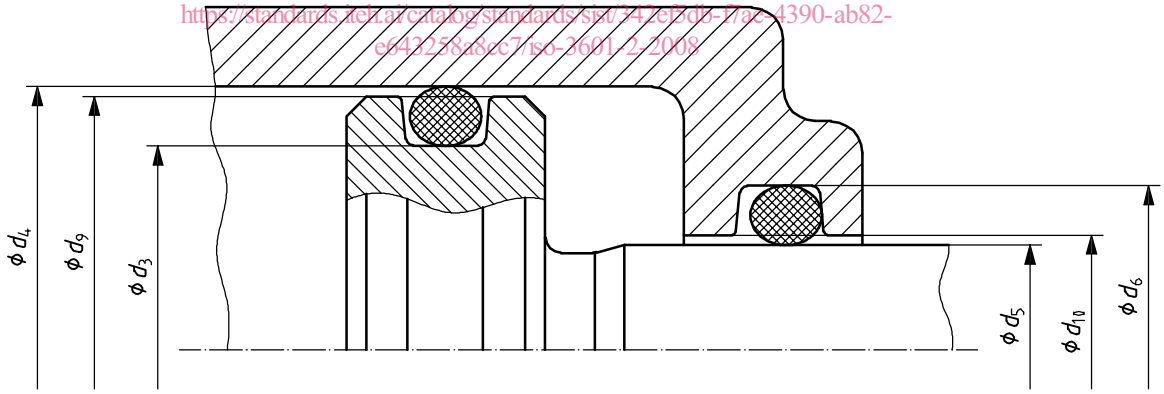


Figure 2 — Features of housings for dynamic rod and piston applications

5.1.3 Figure 3 shows the features of O-ring housings used in static rod and piston applications. It also shows an example of a face (axial) seal.

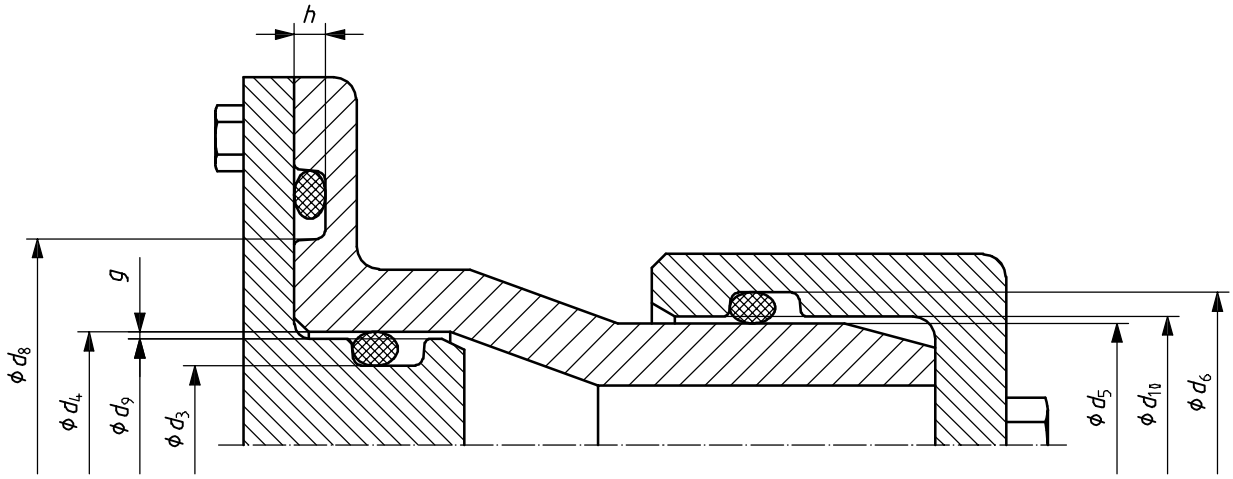
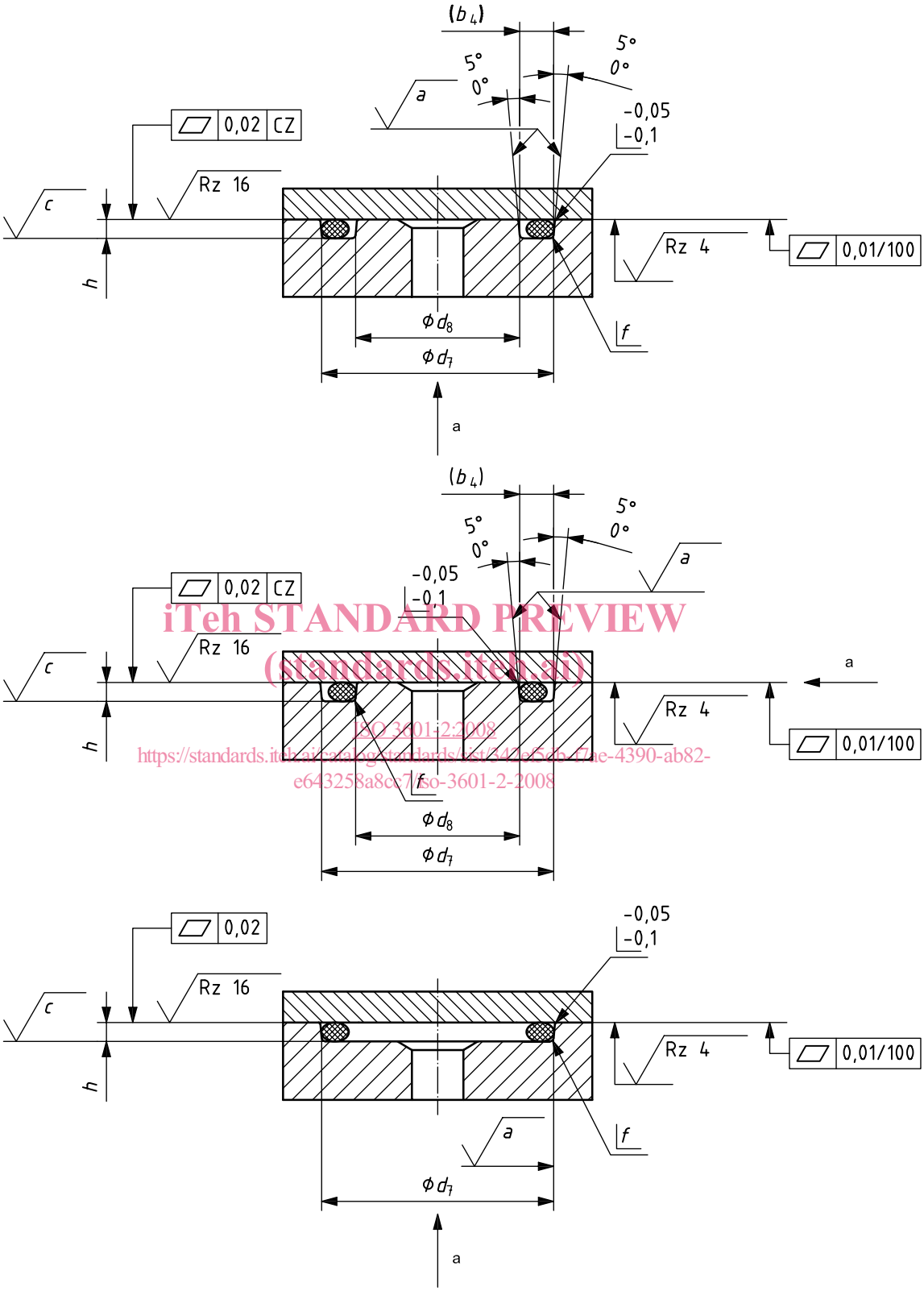


Figure 3 — Features of housings for static rod and piston applications

5.1.4 O-ring housings for face seal applications have different dimensional requirements depending upon whether the pressure is internal or external to the system. See Figure 4 for illustrations.

Dimensions in millimetres



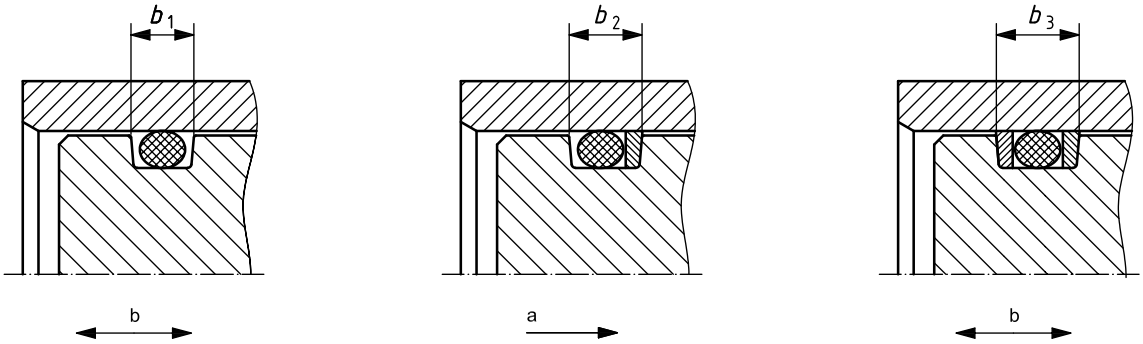
Key

a, c surface roughness; see Table 6
b_4 bore diameter for piston application; see Table 6
f housing radius; see Table 6
a Direction of pressure.

NOTE Tolerancing is in accordance with ISO 8015.

Figure 4 — Illustrations of housings for face seal applications

5.1.5 Figure 5 shows examples of widths of O-ring housings for use with or without anti-extrusion rings (back-up rings). Recommendations for the use of anti-extrusion rings are given in ISO 3601-4.



a) Without anti-extrusion rings **b) With one anti-extrusion ring** **c) With two anti-extrusion rings**

[a] Pressure acting in one direction.

[b] Pressure acting in alternating directions.

Figure 5 — Widths of O-ring housings, for use with or without anti-extrusion rings (back-up rings)

5.2 Surface roughness

5.2.1 The surface roughness of the O-ring housing and any mating part has a significant impact on the life and sealing performance of the O-ring.

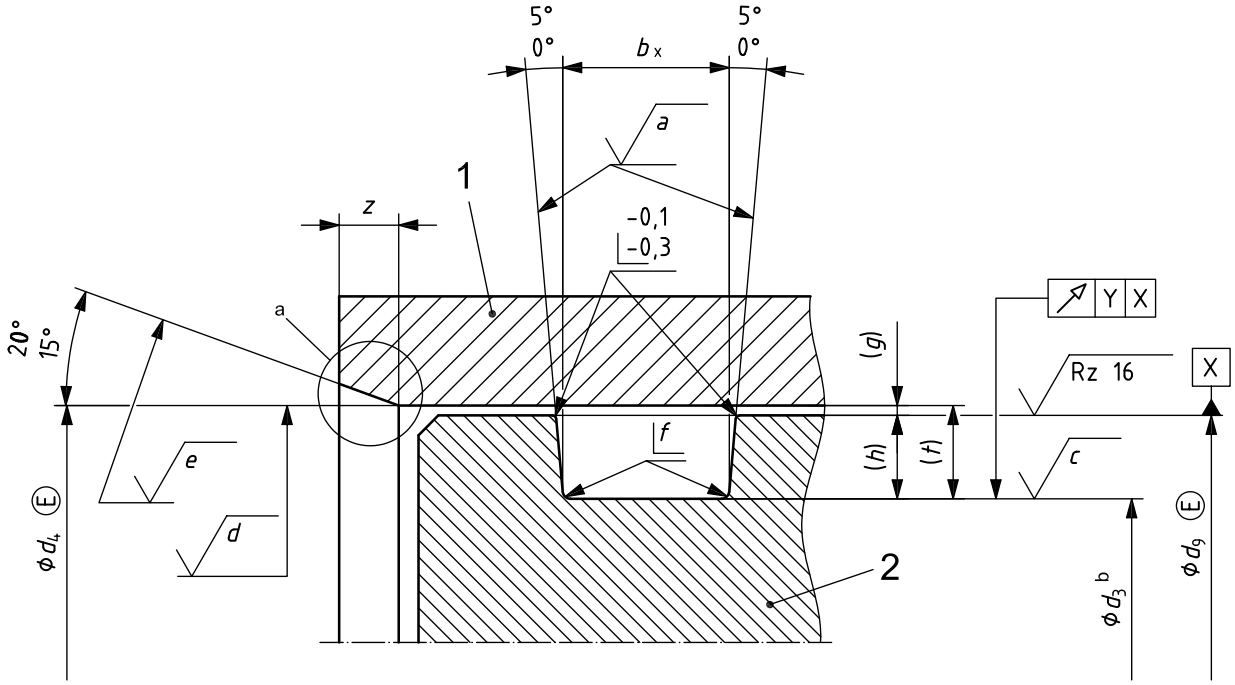
5.2.2 Unless otherwise agreed, surface roughness values shall be in accordance with Table 1. Surface roughness values of the housings for the O-rings intended for aerospace applications that are specified in ISO 3601-1 are addressed in informative Annex A.

5.2.3 Unless otherwise agreed, the material ratio, R_{mr}, should be 50 % to 80 % for surfaces of mating parts, determined at a cut depth of $C = 0{,}25$ Rz, relative to a reference profile line of $C_0 = 0{,}05\ R_{mr}$ (see ISO 4287:1997, 4.5.2).

5.3 Housing dimensions

5.3.1 Figure 6 shows a cross-section of a typical piston housing, illustrating the housing width, b_x, housing height, h, the total distance between the sealing surface and the housing height, t, the gap between the sealing elements, g, the edges of undefined shape, f, and the surfaces for which surface roughness requirements are specified. All of these features have different values depending on the application.

Dimensions in millimetres



Key

1	bore
2	piston
a, c, d, e	surface roughness; see Table 1
f	housing radius; see Table 1
b_x	width of O-ring housing

a No burrs are permitted in this area; the edge shall be rounded.

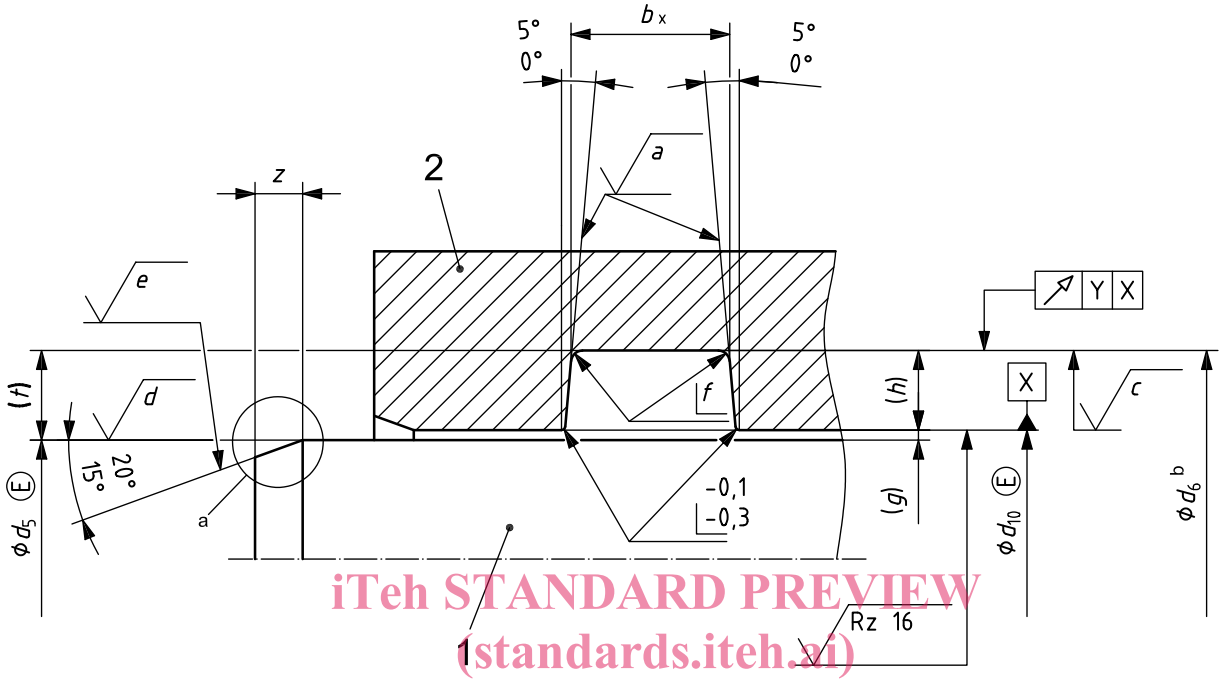
b Housing diameter $d_3 \leqslant 50$: maximum run-out tolerance $Y = 0{,}025$;
housing diameter $d_3 > 50$: maximum run-out tolerance $Y = 0{,}05$.

NOTE Tolerancing is in accordance with ISO 8015.

Figure 6 — Dimensions of piston seal housings

5.3.2 Figure 7 shows a cross-section of a typical rod housing, illustrating the housing width, b_x, housing height, h, the total distance between the sealing surface and the housing height, t, the gap between the sealing elements, g, edges of undefined shape, f, and the surfaces for which surface roughness requirements are specified. All of these features have different values depending on the application.

Dimensions in millimetres



Key

1	rod	
2	bore	

a, c, d, e	surface roughness; see Table 1
f	housing radius; see Table 1
b_x	width of O-ring housing

a No burrs are permitted in this area; the edge shall be rounded.

b Housing diameter $d_6 \leqslant 50$: maximum run-out tolerance $Y = 0{,}025$;
housing diameter $d_6 > 50$: maximum run-out tolerance $Y = 0{,}05$.

NOTE Tolerancing is in accordance with ISO 8015.

Figure 7 — Dimensions of rod seal housings

5.3.3 The latest International Standards for surface roughness measurement require new statements for roughness requirements. Because of the short measuring length, an exact roughness is not measurable. In these cases, a visual inspection using master parts is permitted.

5.4 Corners and edges of undefined shape

Values for inside corner edge, f, that depend on the cross-sections of housings and rods are specified in Table 1. Values for the undefined edge of the housing outside corner are specified in Figures 6 and 7.

5.5 Lead-in chamfer

5.5.1 A lead-in chamfer with an angle of 15° to 20° shall be used to prevent damage to the O-ring by either the rod or the piston upon assembly into the cylinder bore. Chamfer edges shall be rounded. Figures 6 and 7 illustrate lead-in chamfers for piston and rod housings, respectively.

5.5.2 Values for the lengths of lead-in chamfers, dimension z, for the cross-sections of housings and rods are specified in Table 1.

5.6 Calculation of housing dimensions for radial sealing applications

5.6.1 General

For the basic dimensions of housings for O-rings, see Tables 2 through 5. Dimensions d_3 (for piston sealing applications) and d_6 (for rod sealing applications) and the depth of the housing apply if the percentage of effective O-ring cross-sectional compression is within the limits given in Figure 8, depending on the application and O-ring cross-section.