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Hydraulic fluid power cylinders — Dimensions and tolerances of housings for elastomer-energized, plastic-faced seals —

Part 1: Piston seal housings

Vérins hydrauliques — Dimensions et tolérances des logements pour joints en élastomère renforcé par des matières plastiques —

Partie 1: Logements de joints de piston

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document 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 7425-1:1988), which has been technically revised.

The main changes compared to the previous edition are as follows:

— 60 bore was added to Table 3 to ensure consistency with ISO 3320 and to Clause 8 to ensure consistency with ISO 5597.

A list of all parts in the ISO 7425 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Sealing devices are used to contain the pressurized fluid with components with elements with linear motion, i.e. hydraulic cylinders. In general, these sealing devices are used with both cylinder rod and piston seal housings. This document covers piston seal housings.

This document is one part of the ISO 7425 series of standards covering dimensions and tolerances of reciprocating seal housings.

Hydraulic fluid power cylinders — Dimensions and tolerances of housings for elastomer-energized, plastic-faced seals —

Part 1: Piston seal housings

1 Scope

This document specifies the dimensions and associated tolerances for a series of hydraulic cylinder piston seal housings to accommodate elastomer-energized, plastic-faced seals used in reciprocating applications.

This document does not stipulate details of seal design, since the manner of construction of seals varies with each manufacturer. The design and material of the seals, and any associated anti-extrusion components, are determined by conditions such as temperature and pressure.

This document only applies to the dimensional characteristics of products manufactured in accordance with this document. It does not apply to their functional characteristics.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3320, *Fluid power systems and components — Cylinder bores and piston rod diameters and area ratios — Metric series*

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*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols

a	roughness of the side surface of the seal housing
b	roughness of the static pressure mating surface of the seal housing
C	axial length of the lead-in chamfer
$C0$	reference material ratio level (see ISO 4287:1997, 4.5.4)
D	bore diameter (outside diameter of the seal housing)
d	piston seal groove diameter (inside diameter of the seal housing)
d_3	clearance diameter of the piston
e	roughness of dynamic pressure mating surface
f	surface roughness of lead-in chamfer
g	extrusion gap
L_1	axial length (seal groove length) of the seal housing without back-up rings
L_2	axial length (seal groove length) of the seal housing with back-up rings
r	groove corner radius
Ra	arithmetical mean deviation of the assessed profile (see ISO 4287:1997, 4.2.1)
$R\delta c$	profile section height difference (see ISO 4287:1997, 4.5.3)
Rmr	material ratio of the profile (see ISO 4287:1997, 4.5.1)
Rz	maximum height of profile (see ISO 4287:1997, 4.1.3)
S	$\frac{(D-d)}{2}$ radial depth (cross-section) of the seal housing
X	reference surface
Y	maximum run-out tolerance

5 Seal housings

5.1 General

5.1.1 An illustrated example of a typical hydraulic cylinder piston seal housing covered by this document is given in Figure 1.

NOTE The figure is diagrammatic only and does not represent an endorsement or recommendation of a particular housing design.

5.1.2 All sharp edges and burrs shall be removed from the corners of supporting surfaces and rounded, although it should be borne in mind that these surfaces are required to provide maximum support against extrusion.

5.1.3 The seal manufacturer shall be consulted for details of housing design which are not specified in this document.

5.2 Axial length

For axial lengths for the nominal piston diameters, see Table 3.

If the extrusion gap exceeds the capabilities of the plastic-faced material to bridge such a gap, length L_2 should be selected and back-up rings (anti-extrusion rings) used (see Clause 7).

5.3 Radial depth

5.3.1 For radial depths, see Table 3.

NOTE This document includes an alternative seal housing radial depth for bore diameters where $D \geq 25$ mm.

5.3.2 The larger radial depths shall be selected where higher stresses or wider tolerances are involved. Consultation with the manufacturer, however, is recommended when making the appropriate selection.

6 Dimensions and tolerances

Seal housing dimensions and tolerances shall be selected from Table 3.

7 Extrusion gap

7.1 The extrusion gap (g, see Figure 1) is determined by the bore diameter and adjacent metal components on either side of the seal.

NOTE 1 The extrusion gap varies considerably depending upon use or non-use of non-metallic bearings on the piston.

NOTE 2 Maximum value for the extrusion gap is achieved when the piston is in contact with one side of the cylinder or bearing (i.e. D-d_3 – see Figure 1).

NOTE 3 The extrusion gap is widened by the expansion of the cylinder due to internal pressure.

7.2 It is recommended that details concerning the extrusion gap and need for non-extrusion rings be the subject of consultation between the housing designer and seal manufacturer.

8 Surface finish

8.1 General statement

The surface roughness of the seal housing and any mating part has a significant impact on the life and sealing performance of the seal.

Where surface roughness measurements are taken, it is recommended that instruments complying with ISO 3274, including an electric wave filter, be used.

8.2 Sliding and static sealing surfaces

8.2.1 Unless otherwise agreed, the roughness values shall be in accordance with Table 1.

8.2.2 Unless otherwise agreed the material ratio, *Rmr*, of housing surfaces that are in mating contact with the seal should be between 50 % and 80 % at a profile section level (*Rδc*) of 25 % of *Rz*, from a reference level, *C*0, of 5 % *Rmr* (in accordance with ISO 4287:1997, 4.5.4).

8.2.3 For some seal designs, a minimum surface roughness of 0,1 µm *Ra* can be required for the sliding sealing surface as the surface otherwise can be too smooth to provide adequate lubrication for the seal.

8.2.4 Exceptional service conditions can necessitate the selection of other grades of surface roughness, in which case they should be subject to agreement between manufacturer and user.

8.2.5 All surfaces against which a seal operates should be free from chatter marks and scores along the operating axis of the seal.

Table 1 — Surface roughness requirements for piston seal housings [a]

Dimensions in micrometres (µm) unless otherwise noted

Radial depth of seal housing *S* mm	Surface roughness values [b,c,d]				Minimum required measuring length mm (5 times single sampling length plus 2 times cut off)
	Dynamic pressure mating surface [e] *e*	Static pressure mating surface [e] *b*	Side surface *a*	Chamfer *f*	
S < 3,75	*Ra* 0,4 *Rz* 1,6	*Ra* 1,6 visual inspection *Rz* 6,3 visual inspection	*Ra* 1,6 visual inspection *Rz* 6,3 visual inspection	*Ra* 4 visual inspection or *Rz* 16 visual inspection	5,6
3,75 ≤ *S* < 5		*Ra*1 1,6 *Rz*1 6,3	*Ra*2 1,6 *Rz*2 6,3		
5 ≤ *S* < 7,5		*Ra*2 1,6 *Rz*2 6,3	*Ra*4 1,6 *Rz*4 6,3		
S ≥ 7,5		*Ra* 1,6 *Rz* 6,3	*Ra* 1,6 *Rz* 6,3		

[a] Indication of surface roughness to ISO 1302.

[b] See also Figure 1. See ISO 13715 for design of edges and undefined shapes.

[c] The descriptions of *Ra*4 1,6 or *Rz*4 6,3 do not describe a surface roughness of *Ra* 41,6 or *Rz* 46,3.

According to ISO 1302 and ISO 4288 they show four sampling lengths and that the roughness does not exceed 1,6 µm for *Ra* and 6,3 µm for *Rz*.

A value of *Ra* 1,6 or *Rz* 6,3 can only be measured if the length to be measured is 5,6 mm or longer.

[d] Special applications can require different surface roughness values.

[e] Visual surface imperfections are not allowed on surfaces *b* and *e* (see ISO 8785).

9 Lead-in chamfer

9.1 To protect the seal from damage during assembly, lead-in chamfers are required, either as an integral part of housing components or on separate assembly tools.

9.2 Reference shall be made to Figure 1 for typical locations of lead-in chamfers when these are part of the housing component.

9.3 The minimum axial length of lead-in chamfers, whether on housing components or assembly tools, is given in Table 2.

