INTERNATIONAL STANDARD

**ISO 3069**

Second edition
2000-11-01

# End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing

*Pompes centrifuges à aspiration en bout — Dimensions des logements de garnitures mécaniques et de tresses*

Reference number
ISO 3069:2000(E)

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.



ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

# Contents

Page

# 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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3069 was prepared by Technical Committee ISO/TC 115, *Pumps*, Subcommittee SC 1, *Dimensions and technical specifications of pumps*.

This second edition cancels and replaces the first edition (ISO 3069:1974), which has been technically revised by having a broadened scope and the inclusion of an alternative heavy-duty seal cavity. The previously published cavity dimensions have not been amended, but the sizes available have been increased. To meet the growing demand for cartridge mechanical seals, an informative annex has been included to assist in the rationalization of seal cavity dimensions for this product group. The dimensional recommendations have been applied to seal chambers with parallel bores, although reference is made, where appropriate, to the equivalent performance of conical shaped seal chambers.

Annex A of this International Standard is for information only.

# End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing

## 1 Scope

This International Standard specifies the dimensions of the seal cavity for step-balanced mechanical seals, mechanical seals suitable for straight shafts, and for soft packing, to be used with horizontal end-suction centrifugal pumps, including those conforming to ISO 2858. Although applicable to general-purpose and heavy-duty process applications, this International Standard is not intended for use in processes with slurries or with high levels of solids.

This International Standard offers two options:

a) a range of stuffing boxes suitable for soft packing or mechanical seals for general-purpose duties up to a seal chamber limit of a gauge pressure of 16 bar;

b) a range of larger cavities suitable for mechanical seals, including cartridge mechanical seals, for general and heavy-duty process applications, up to a seal chamber limit of a gauge pressure of 40 bar.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 5199, *Technical specifications for centrifugal pumps — Class II*.

ISO 9905, *Technical specifications for centrifugal pumps — Class I*.

ISO 9908, *Technical specifications for centrifugal pumps — Class III*.

EN 12756, *Mechanical seals — Principal dimensions, designation and material codes*.

## 3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

**3.1**
**cartridge mechanical seal**
a completely self-contained unit (including mechanical seal, gland plate, sleeve, and mating ring), pre-assembled and preset before installation

**3.2**
**flush**
flow of fluid introduced into the seal cavity on the process fluid side, in close proximity to the sealing faces, and usually used for cooling the mechanical seal and continuously removing vapour and/or contaminants from the seal cavity

**3.3**
**gland face**
mounting arrangement and equipment surface to which the seal gland plate is clamped

NOTE This is normally the seal end of the seal chamber.

**3.4**
**seal cavity**
fluid-filled space contained by the seal chamber

NOTE The mechanical seal rotates in the seal cavity.

**3.5**
**seal chamber**
component, either integral with or separate from the pump case, forming the containment between the shaft and casing

NOTE The mechanical seal is installed in the seal chamber.

**3.6**
**seal gland plate**
end plate connecting the stationary assembly of a mechanical seal to the seal chamber

**3.7**
**spigot**
male part of a joint used for accurate radial location of two machined components

**3.8**
**stuffing box**
cylindrical seal chamber, designed for the use of soft packing, for the purpose of reducing leakage along the shaft

**3.9**
**total axial run-out tolerance**
tolerance zone limited by two parallel planes, a defined distance apart, and perpendicular to the shaft datum axis

NOTE It can be measured by securing a dial indicator to the shaft, rotating it against a specified perpendicular surface (normally the gland face) and measuring the full indicated movement over several revolutions.

**3.10**
**total radial run-out tolerance**
tolerance zone limited by two coaxial cylinders, the defined radial distance apart, whose axes coincide with the datum axis

NOTE It can be measured by securing a dial indicator to the datum axis component (the shaft or seal chamber, depending on the tolerance zone to be recorded) and measuring the full indicated movement against the specified adjacent cylindrical surface over several revolutions.

# 4 Specification of dimensions of seal cavity and seal gland plate attachments

## 4.1 Dimensions of stuffing box and seal cavity attachments for general-purpose duties (designated ISO 3069-S)

The diameters shown in Figures 1, 2 and 3 shall have the values given in Table 1, and are intended to permit the use of either gland packing or mechanical seals.

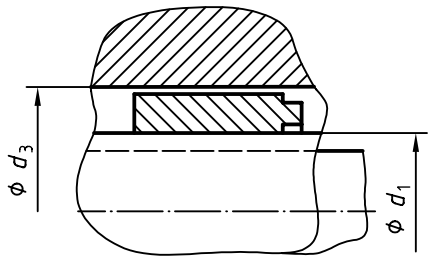



**Figure 1 — Mechanical seal or soft packing with or without a sleeve**

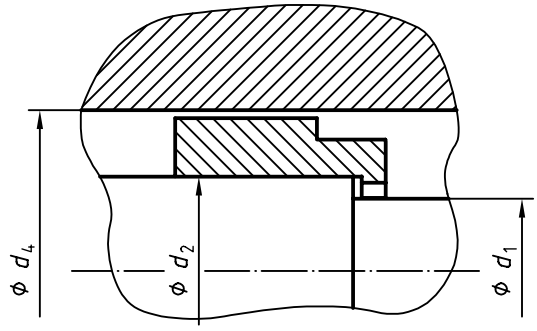



**Figure 2 — Step-balanced mechanical seal with or without a short sleeve**

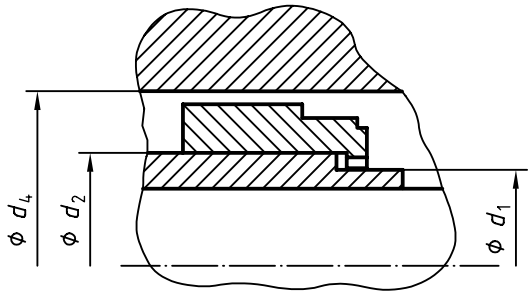



**Figure 3 — Step-balanced mechanical seal with an extended sleeve**

**Table 1 — Stuffing box and seal cavity dimensions**

Dimensions in millimetres

| $d_1$ (h6) [a] | $d_2$ (h6) | Min. [b] $d_3$ [c] | Min. [b] $d_4$ |
|---|---|---|---|
| 18 | 22 | 34 | 38 |
| 20 | 24 | 36 | 40 |
| 22 | 26 | 38 | 42 |
| 24 | 28 | 40 | 44 |
| 25 | 30 | 41 | 46 |
| 28 | 33 | 44 | 49 |
| 30 | 35 | 46 | 51 |
| 32 [d] | 38 | 48 | 58 |
| 33 | 38 | 49 | 58 |
| 35 | 40 | 51 | 60 |
| 38 | 43 | 58 | 63 |
| 40 | 45 | 60 | 65 |
| 43 | 48 | 63 | 68 |
| 45 | 50 | 65 | 70 |
| 48 | 53 | 68 | 73 |
| 50 | 55 | 70 | 75 |
| 53 | 58 | 73 | 83 |
| 55 | 60 | 75 | 85 |
| 58 [d] | 63 | 83 | 88 |
| 60 | 65 | 85 | 90 |
| 63 [d] | 68 | 88 | 93 |
| 65 | 70 | 90 | 95 |
| 68 [d] | — | 93 | — |
| 70 | 75 | 95 | 104 |
| 75 | 80 | 104 | 109 |
| 80 | 85 | 109 | 114 |
| 85 | 90 | 114 | 119 |
| 90 | 95 | 119 | 124 |
| 95 | 100 | 124 | 129 |
| 100 | 105 | 129 | 134 |

[a] h6 tolerance is not applicable to $d_1$ of Figure 2 and Figure 3.

[b] Mechanical seal reliability is affected by the radial clearance between its rotating parts and the seal chamber bore. Arduous services such as those with significant solid content, or those that could result in excessive seal face temperature, should have a minimum 3 mm radial clearance. This is particularly important in the case of unflushed mechanical seals, for which conical shaping of the bore can additionally contribute to the performance of the seal.

[c] H11 tolerance when used with soft packing.

[d] Non-preferred sizes, should not be used for new designs.

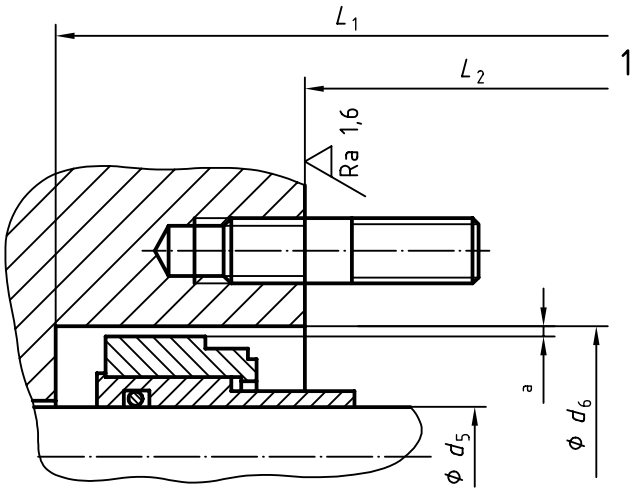
Dimensions suitable for cartridge mechanical seals are shown in annex A.

Mechanical seals designed to meet the dimensions required by EN 12756 will fit the seal cavity ISO 3069-S.

## 4.2 Dimensions of seal cavity and seal gland plate attachments for heavy-duty process applications (designated ISO 3069-H)

The dimensions shown in Figures 4, 5 and 6 shall have the values given in Table 2.

NOTE The design is suitable for cartridge mechanical seals, but is unlikely to be available in pumps conforming to ISO 2858 because of its dimensional constraints.

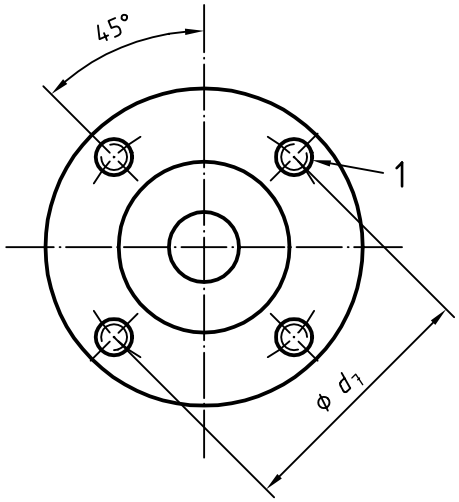



**Key**

1 To nearest obstruction

a Minimum radial 3 mm

**Figure 4 — Seal cavity**




**Key**

1 4 off studs $d_8$

**Figure 5 — Gland face and studs**

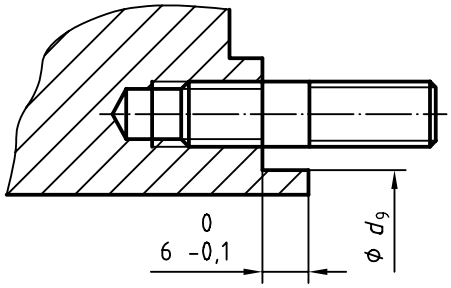



**Figure 6 — Optional external spigot**

**Table 2 — Dimensions of seal cavity and seal gland plate attachments**

Dimensions in millimetres

| Max. $d_5$ (h6) | $d_6$ (H7) | $d_7$ (± 0,5) | $d_8$ | $d_9$ (H7/f7) | Min. $L_1$ | Min. $L_2$ |
|---|---|---|---|---|---|---|
| 20 | 70 | 105 | M12 × 1,75 | 85 | 150 | 100 |
| 30 | 80 | 115 | M12 × 1,75 | 95 | 155 | 100 |
| 40 | 90 | 125 | M12 × 1,75 | 105 | 160 | 100 |
| 50 | 100 | 140 | M16 × 2,0 | 115 | 165 | 110 |
| 60 | 120 | 160 | M16 × 2,0 | 135 | 170 | 110 |
| 70 | 130 | 170 | M16 × 2,0 | 145 | 175 | 110 |
| 80 | 140 | 180 | M16 × 2,0 | 155 | 180 | 110 |
| 90 | 160 | 205 | M20 × 2,5 | 175 | 185 | 120 |
| 100 | 170 | 215 | M20 × 2,5 | 185 | 190 | 120 |
| 110 | 180 | 225 | M20 × 2,5 | 195 | 195 | 120 |

NOTE 1 The gland plate should be radially located by an internal spigot in the bore dimension $d_6$.

NOTE 2 An optional external spigot is shown in Figure 6.

# 5 Design requirements for seal cavities

## 5.1 Vent and drain

Mechanical seal reliability can be adversely affected by periods of operation in air or gas. Therefore the seal cavity shall include a means of eliminating trapped air or gas. Vent connections, when required for this purpose, shall be located at the highest point.

Process liquids can be hazardous or pollute the environment during disassembly. When a means of adequately draining the seal cavity is required, drain connections shall be located at the lowest practical point.

## 5.2 Squareness and concentricity of surfaces

Mechanical seal performance is influenced by the squareness and concentricity of the cavity and gland face surfaces.

The following tolerances shall not be exceeded.

a) The seal gland plate concentricity to the shaft is controlled by the spigot diameter $d_9$ or the bore diameter $d_3$, $d_4$ or $d_6$ depending on the cavity design. This surface shall have a total radial run-out tolerance not greater than 0,13 mm.

b) The squareness of the gland face to the shaft axis can be checked by measuring its total axial run-out tolerance. The gland face shall have a total axial run-out tolerance not greater than 0,01 mm per 20 mm of seal chamber bore.

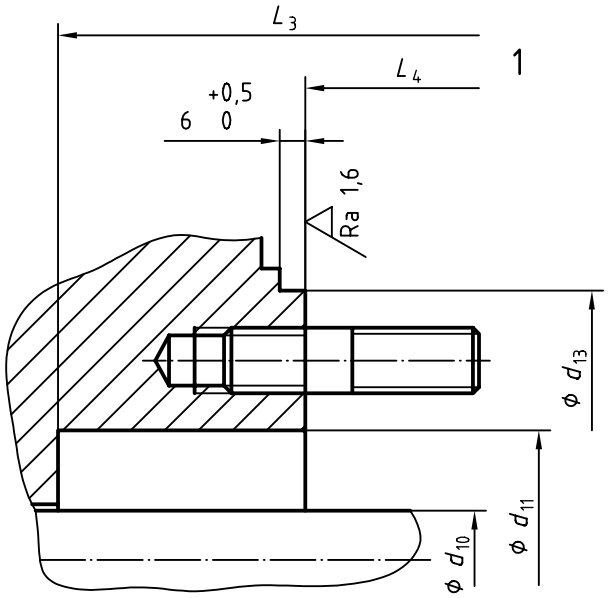
c) Manufacture and assembly of the shaft and sleeve, if fitted, shall ensure that the total radial run-out tolerance, using the seal chamber as a datum, and at an axial position aligned with the gland face, conforms to ISO 9905, ISO 5199 and ISO 9908.

# Annex A
(informative)

# Dimensions of cavities for cartridge mechanical seals for general-purpose duties (designated ISO 3069-C)

Cartridge mechanical seals, utilizing proven metric seal assemblies, are difficult to fit in the stuffing box dimensions for general-purpose duties (see Table 1). The preference for spigot locations, and a rationalized seal gland plate, would be simplified by dimensional conformity of the gland face.

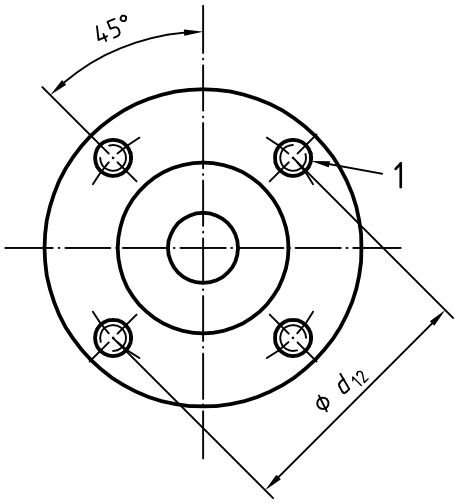
Figure A.1, A.2 and Table A.1 recommend dimensions suitable for fitting cartridge mechanical seals in centrifugal pumps designed for general-purpose duties, up to a seal chamber limit of a gauge pressure of 16 bar.




**Key**

1 To nearest obstruction

**Figure A.1 — Seal cavity**




**Key**

1 4 off studs $d_{14}$

**Figure A.2 — Gland face and studs**

**Table A.1 — Dimensions of seal cavity and seal gland plate attachments**

Dimensions in millimetres

| Max. $d_{10}$ (h6) | $d_{11}$ | $d_{12}$ (± 0,5) | $d_{13}$ (H7/f7) [b] | $d_{14}$ | Min. $L_3$ | Min. $L_4$ |
|---|---|---|---|---|---|---|
| 22 | 44 | 85 | 105 | M10 × 1,5 [a] | 110 | 60 |
| 25 | 46 | 85 | 105 | M10 × 1,5 [a] | 110 | 60 |
| 30 | 51 | 90 | 110 | M10 × 1,5 [a] | 110 | 60 |
| 35 | 60 | 100 | 120 | M10 × 1,5 [a] | 115 | 60 |
| 40 | 65 | 110 | 130 | M12 × 1,75 | 115 | 60 |
| 45 | 70 | 115 | 135 | M12 × 1,75 | 125 | 65 |
| 50 | 75 | 115 | 135 | M12 × 1,75 | 125 | 65 |
| 55 | 85 | 125 | 145 | M12 × 1,75 | 135 | 70 |
| 60 | 90 | 145 | 170 | M16 × 2,0 | 135 | 70 |
| 65 | 95 | 145 | 170 | M16 × 2,0 | 150 | 75 |
| 75 | 109 | 155 | 180 | M16 × 2,0 | 150 | 75 |
| 85 | 119 | 165 | 190 | M16 × 2,0 | 160 | 75 |

[a] ISO 9905 and ISO 5199 recommend minimum stud size M12 unless impractical owing to space limitations.

[b] Dimension $d_{13}$ is positioned to permit an external spigot to radially locate the seal gland plate.

# Bibliography

[1] ISO 1101, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out.*

[2] ISO 2858, *End-suction centrifugal pumps (rating 16 bar) — Designation, nominal duty point and dimensions*.

**ICS 23.080**

Price based on 10 pages