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Mechanical seals— General requirements

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Society of Industrial Machinery Manufacturers (JSIM)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS B 2405 : 1993** is replaced with this Standard.

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Mechanical seals—General requirements

1 Scope This Japanese Industrial Standard specifies the items relating to the performance, construction, dimensions, accuracy of machines to be fitted, performance tests and marking of mechanical seals for general use.

Remarks : Designation of products is given in Annex 1 (informative). Auxiliary apparatuses are given in Annex 2 (informative).

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0651 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Nominal characteristics of contact (stylus) instruments*

JIS B 7430 *Optical flats*

JIS K 2213 *Turbine oils*

3 Definitions For the purposes of this Standard, the terms given in Table 1 apply (see Figs. 1 to 4).

Further, idiomatic expressions and English equivalent are given for information.

Table 1 Definitions of terms

Term	Definition
sealing	To restrict leakage of fluid
sealing face; rubbing face	A surface of the mating ring or the seal ring (or parts of similar function) to rub against each other in close contact.
mating ring	A ring having a sealing face which does not move in the axial direction despite abrasion on the sealing face.
seal ring	A ring having a sealing face capable of moving in the axial direction by a spring or the like in proportion to abrasion of the sealing face.
stationary ring	A ring having a sealing face which does not rotate together with the shaft.
rotating ring	A ring having a sealing face which rotates together with the shaft.
secondary seal	The seal being interposed between the stationary ring and the casing or a mechanical seal cover (seal cover, cover plate), or that between the rotating ring and the shaft or the shaft sleeve. It is classified into the stationary side secondary seal and the rotating side secondary seal.
sealed fluid	Fluid used in machines, and with which leakage is expected to be restricted. Usually, it indicates the fluid at high pressure side.

Table 1 (continued)

Term	Definition
external sealing fluid	External injection fluid in a single mechanical seal, or intermediate fluid in a double and tandem mechanical seal.
quenching fluid	Fluid injected into or circulate through the atmospheric side of the sealing face.
flushing	Action to inject (self system)/discharge (reverse system) the sealed fluid into/from the stuffing box or circulate the fluid through it (through system), or to inject the external sealing fluid.
cooling	Cooling of the outer periphery of the mating ring, cooling by the heat exchanger in the flushing line, and cooling by the jacket in the fitted machine.
quenching	Action to inject the quenching fluid into or to circulate it through the atmospheric side of the sealing face.
setting length	The length in the axial direction in the state where the mechanical seal has been fitted (see Figs. 1 to 4).
balance ratio; balance factor	The ratio of the projection area (A_1) in the axial direction of the sealing face to the projection area (A_2) in the axial direction subjected to the sealed fluid pressure acting as the traveling force in the axial direction in respect to the seal ring [see Annex 1 Attached Fig. 4].
balanced mechanical seal	The type of the mechanical seal which is one or under in the balance ratio, and decreases the load at the sealing face due to sealed fluid pressure.
unbalanced mechanical seal	The type of the mechanical seal which is over one in the balance ratio, and cannot decrease the load at the sealing face due to sealed fluid pressure.
single mechanical seal	A system using a single piece of the mechanical seal, having one sealing face. This type is used most generally.
double mechanical seal	A system using two pieces of mechanical seals, having two sealing faces. Two mechanical seals are set to opposite directions, and made back-to-back or front-to-front. Generally, the external fluid is to be injected in the middle of two pieces of mechanical seals.
tandem mechanical seal	A system using two pieces of mechanical seals, having two sealing faces. Two mechanical seals are set to the same direction. Generally, this type of the mechanical seal is used for high pressure or for collecting the sealed fluid. In the case of use for high pressure, it decreases the pressure load per piece by bisecting the pressure of the sealed fluid to a high pressure side seal and the low pressure side seal. In the case for collecting sealed fluid, it collects the sealed fluid leaking from the in-machine side seal through between the in-machine side seal and the atmospheric side seal.

Table 1 (concluded)

Term	Definition
inside mechanical seal	The type of the mechanical seal which seals the fluid liable to leak from the outer periphery of the sealing face towards the outer periphery.
outside mechanical seal	The type of the mechanical seal which seals the fluid liable to leak from the inner periphery of the sealing face towards the outer periphery.
rotating mechanical seal	The type of the mechanical seal of which a seal ring incorporating a spring or the like rotates together with the shaft.
stationary mechanical seal	The type of the mechanical seal of which a seal ring incorporating a spring or the like does not rotate.
cartridge mechanical seal	Full-integrated unit assembled before fitting with the dimensions thereof set (including a mechanical seal, a mechanical seal cover, a sleeve and a seat)
seal cavity	A space formed by a shaft and the stuffing box which is filled with the fluid, with the mechanical seal rotates therein.
stuffing box pressure	Pressure in the stuffing box.
seal chamber stuffing box	A component integrated with the pump casing or divided which stores a mechanical seal.
mechanical seal cover, seal gland plate, cover plate	A plate to hold a stationary side part of the mechanical seal, and to connect it to the stuffing box.
gland face	Mating face on the machine side with the mechanical seal cover connected thereto.

4 Performance The performance of the mechanical seal shall be evaluated by the amount of leakage, the amount of abrasion loss, torque and the like.

Since the mechanical seals are used for various kinds of machines as the machine elements, there are various factors which influence their performance. For example, the performance of the mechanical seals is changed largely depending on such conditions as the fluid to be treated (type of fluid, pressure, temperature, viscosity, presence of solid matters, etc.), fitted machines (type of machine, mechanical accuracy, size of nominal bore of the mechanical seal, rotational speed, frequency of start and stop, service frequency, etc.), and handling conditions (lubrication system, cooling system, acceptance/rejection of the fitting length).

The performance of the mechanical seal shall be expressed by the following evaluation items. The values of evaluation items may be as agreed between the parties concerned with delivery.

- a) **Amount of leakage** The amount of leakage of a mechanical seal shall be expressed by the amount of the sealed fluid or external sealing fluid per hour leaking from the sealing face and the secondary seal of the mechanical seal.

- b) **Amount of abrasion loss** The amount of abrasion loss of the mechanical seal shall be expressed by conversion per year (8 760 h), expressing the sealing face abrasion loss after a definite time of running as the length in the axial direction.
- c) **Torque** The torque of the mechanical seal shall be expressed by the starting torque when the mechanical seal starts and the running torque while it is running.

Furthermore, attention shall be paid to the variation of the torque of the mechanical seal which depends on the condition of the fluid to be treated, running conditions (for example, at the time of start and at the time of running), etc. as well as the material of the sealing face, the width of the sealing face, the balance ratio and the spring load.

5 Accuracy of structure, dimensions and fitted machine

5.1 Basic structure The mechanical seal shall consist of the seal ring capable of moving in the axial direction by a spring or the like with the abrasion of the sealing face and the stationary mating ring, and shall have a function to restrict the leakage of the fluid at the sealing face which is almost vertical to the shaft and rotates relatively.

The examples of construction of the unbalanced rotating mechanical seal, the balanced rotating mechanical seal, the balanced stationary mechanical seal, and the cartridge type mechanical seal shall be given in Figs. 1 to 4.

Remarks : Figs. 1 to 4 show the examples of construction of the mechanical seals, but do not specify the construction itself.

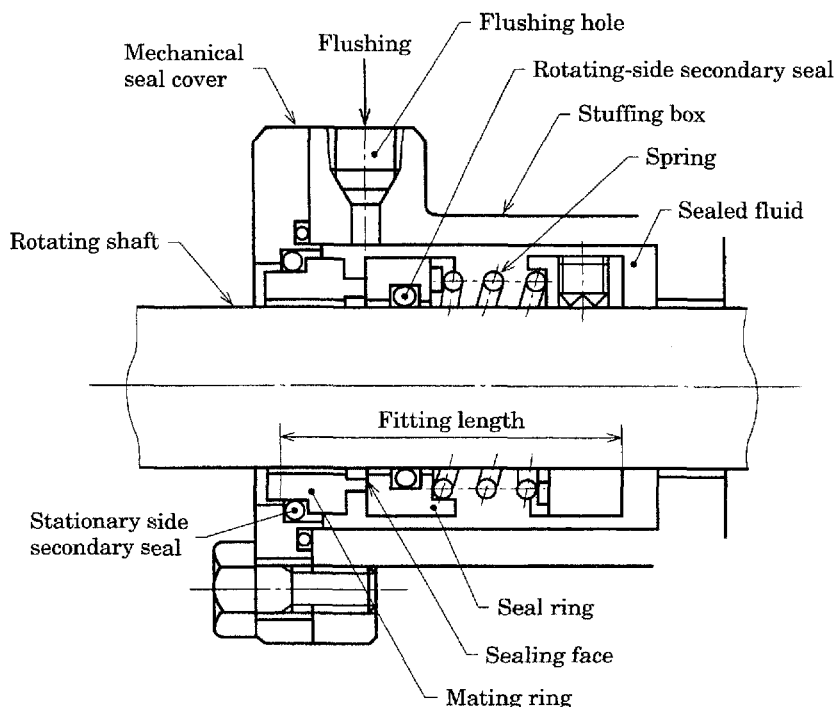


Fig. 1 Unbalanced rotating mechanical seal (example)

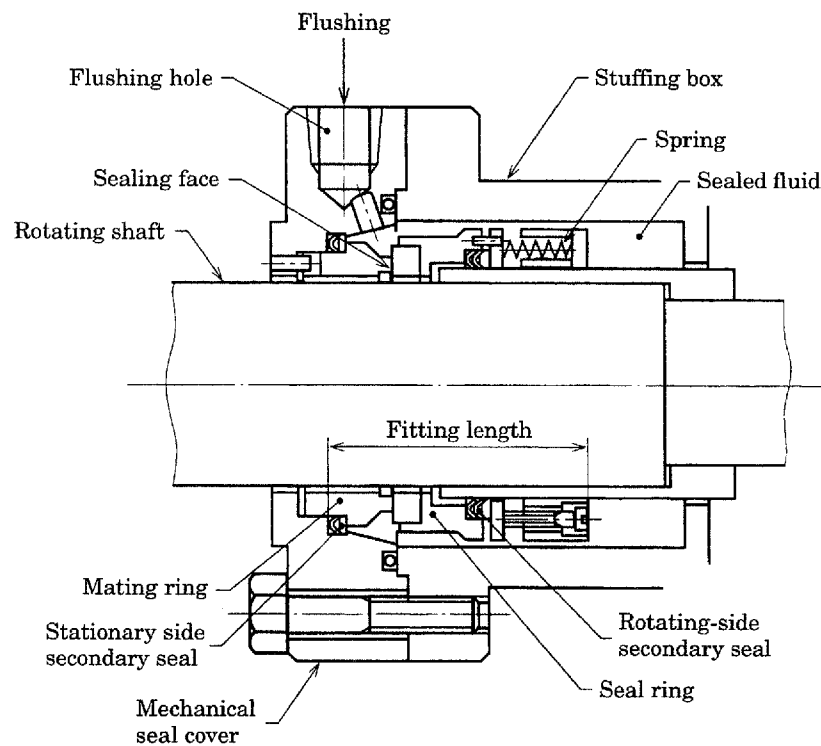


Fig. 2 Balanced rotating mechanical seal (example)

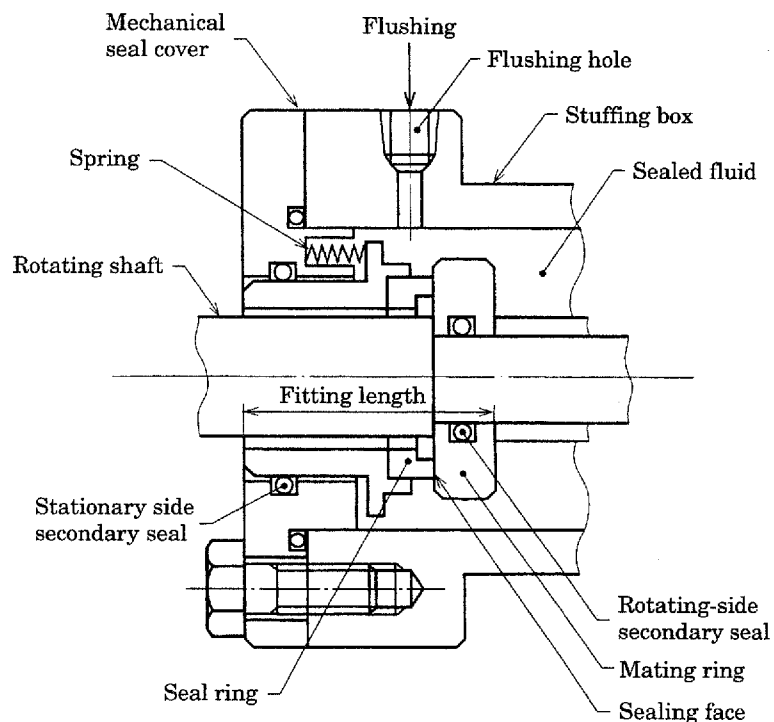


Fig. 3 Balanced stationary mechanical seal (example)

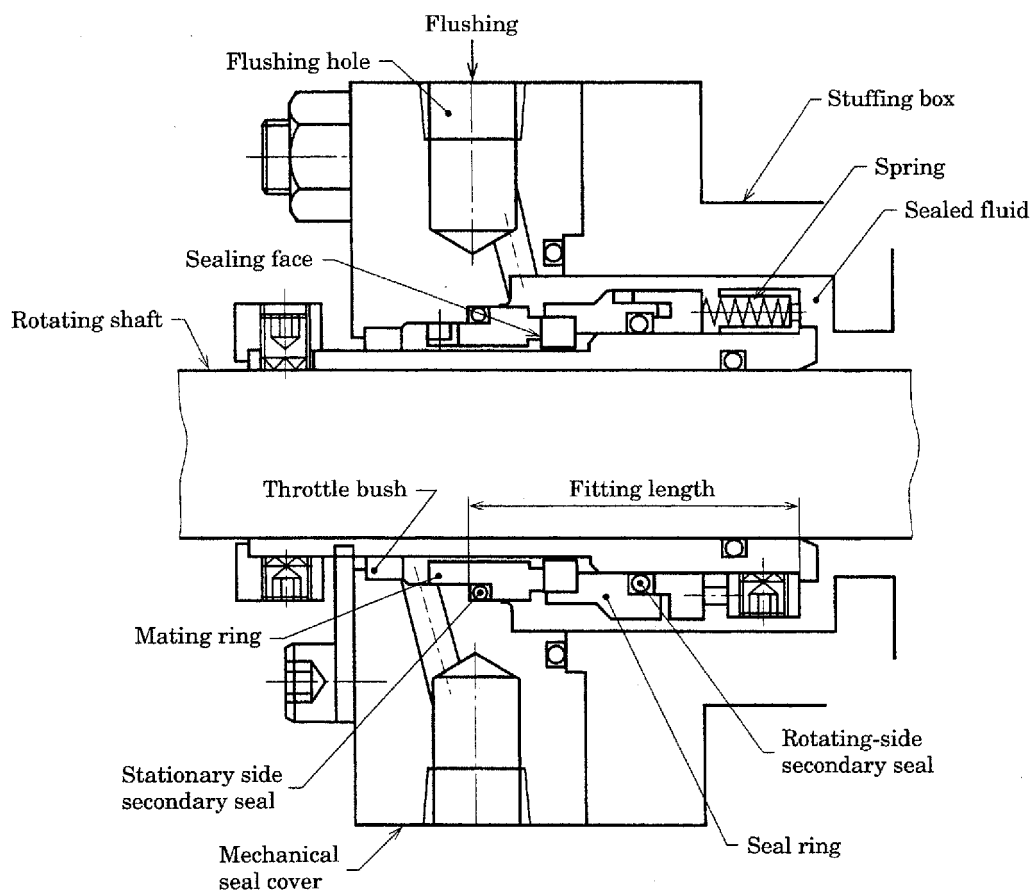


Fig. 4 Cartridge type mechanical seal (example)

5.2 Main dimensions of seal cavity and nominal dimensions of mechanical seal

5.2.1 Mechanical seal of general-purpose duties

5.2.1.1 Main dimensions of seal cavity The main dimensions of the seal cavity shall be as specified in Table 2.

The dimensional symbols of Table 2 shall be as given in the following (see Figs. 5 to 7).

- d_1 : when the unbalanced mechanical seal is fitted, the diameter of the shaft or the sleeve; or when the balanced mechanical seal is fitted, the smaller diameter of the shaft or the sleeve
- d_2 : when the balanced mechanical seal is fitted, the larger diameter of the shaft or the sleeve
- d_3 : when the unbalanced mechanical seal is fitted, the bore of the stuffing box
- d_4 : when the balanced mechanical seal is fitted, the bore of the stuffing box
- b : the dimension of $(d_3 - d_1)/2$ or $(d_4 - d_2)/2$

5.2.1.2 Nominal dimensions of mechanical seal The nominal dimensions of the mechanical seal shall be indicated by the nominal bore and nominal outside diameter.

The nominal bore shall be expressed by the value of the diameter d_1 of the shaft or the sleeve to be fitted, and the nominal outside diameter shall be expressed by the value of the bore d_3 or d_4 of the stuffing box (see Figs. 5 to 7).

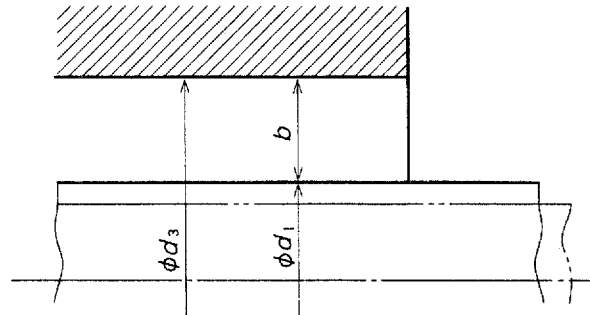


Fig. 5 Unbalanced mechanical seal with or without a sleeve

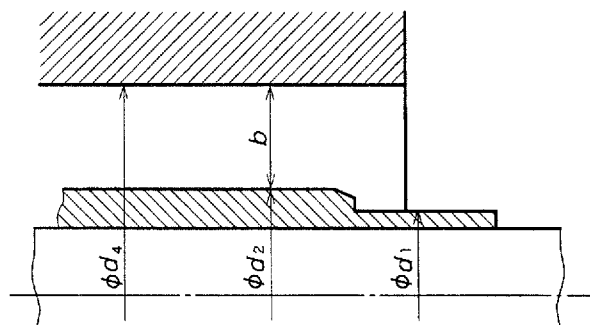


Fig. 6 Balanced mechanical seal with a sleeve

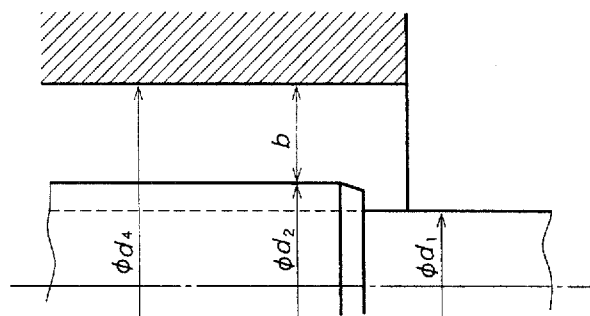


Fig. 7 Balanced mechanical seal with or without a short sleeve

5.2.1.3 Preferential order of dimensions For the dimension b of Table 2, the smaller one shall be preferably applied, and d_3 and d_4 shall be the minimum values.

Table 2 Dimensions

Unit: mm

d_1 (h7)	d_2 (h7)	b																	
		6		8		10		12.5		14.5		16		20		25		31.5	
		d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4	d_3	d_4
4	8	16	20	20	24														
5	9	17	21	21	25														
6	10	18	22	22	26														
7	11	19	23	23	27														