

MECHANICAL SEAL



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Standards compliance

- Testing based on Part III “Utensils, Containers and Packaging” in “Specifications and Standards for Food, Food Additives, Etc.” (Ministry of Health and Welfare Notification No. 370, 1959)
- Materials in the Positive List based on “Specifications and Standards for Food, Food Additives, Etc.” (Ministry of Health and Welfare Notification No. 196, 2020)
- Testing based on FDA standards

Please contact us separately on any details regarding these items.

Type PEC is an aerostatic type non-contact dry gas seal that was originally developed for turbines, blowers, and compressors. This seal mechanism has been used to ensure safety and prevent air pollution in plants that use toxic, flammable, and explosive gases. Taking advantage of its excellent cleanliness, this mechanism has also been adopted as a shaft sealing device in a wide range of fields that require a high level of cleanliness, such as pharmaceuticals and electronic materials.

■ Features

Type PEC has various outstanding characteristics.

This variety of characteristics is the reason Type PEC is adopted in a wide range of industrial sectors.

■ Completely sealed with a single seal

Process gas is completely sealed with a single seal. Not only does this product contribute to ensuring safety and environmental friendliness, it also makes accessories extremely simple in configuration, thereby making it possible to reduce both initial and maintenance costs.

■ High level of cleanliness

Compared to double mechanical seals and dry-contact seals, which have been conventionally used as shaft seals for gases, this product does not leak confined liquid into the process side or produce wear debris.

■ Wide speed range

This product can continuously retain its seal face in a non-contact state and can therefore handle various shaft states from a stopped state through to a high-speed rotation state.

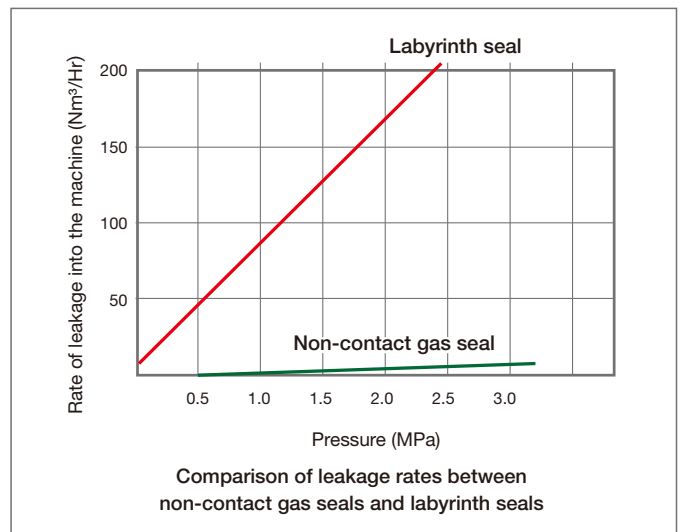
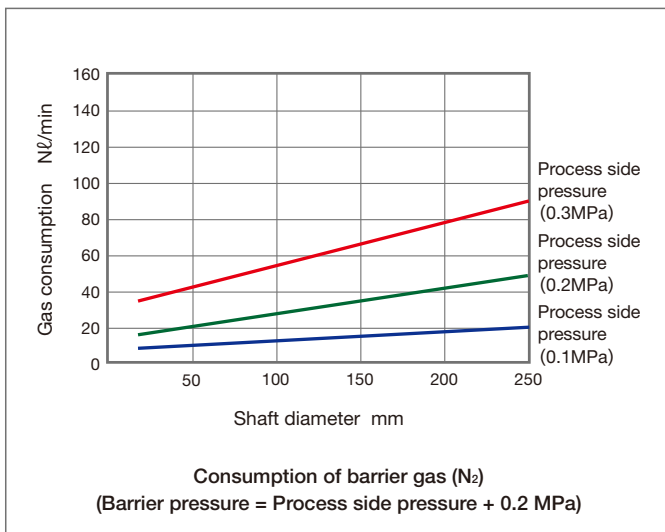
■ Long service life

This product maintains its seal face in a non-contact state and therefore protects the seal face from wear and damage, extending service life.

■ Low power consumption

The seal face is floated, which means that there is almost no loss of motive power.

Consumption of barrier gas (N₂) and comparison of leakage rates between non-contact gas seals and labyrinth seals

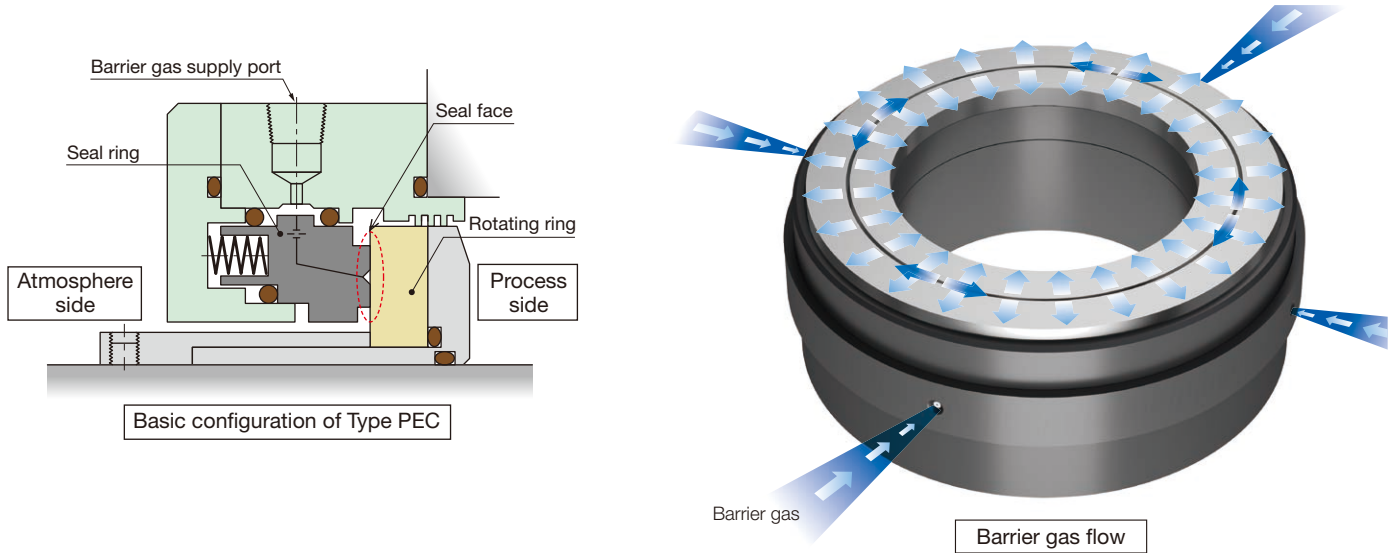


* For Type PEC, the consumption of barrier gas can be adjusted according to the customer's specifications.
We also offer designs to further suppress the consumption of barrier gas. For details, please consult with us.

Basic structure

Type PEC consists of a rotating ring seal face, which is perpendicular to the rotating shaft, and a seal ring seal face, which moves in the axial direction.

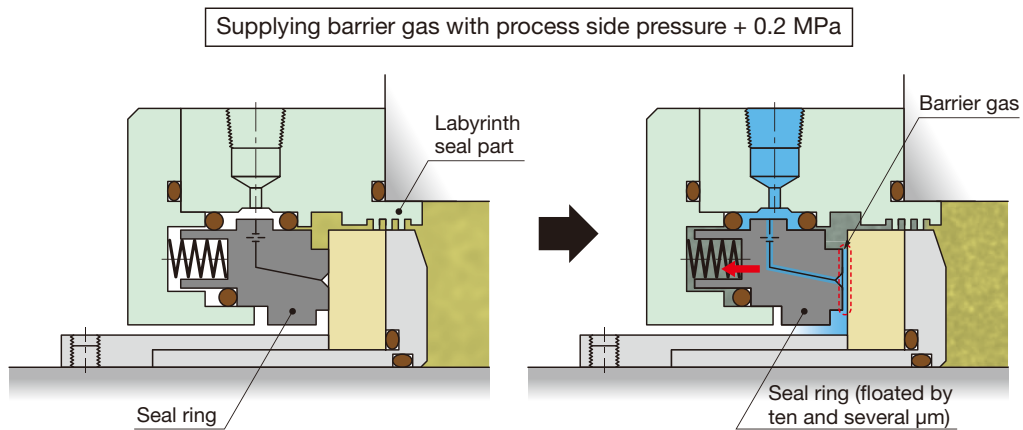
The major difference between Type PEC and general mechanical seals is that barrier gas (nitrogen gas, dry air, etc.) is supplied from the outer circumference of the seal ring to the seal face through the orifice.



Mechanism

Supplying barrier gas to the seal face from outside generates static pressure on the seal face that retains a floating gap with a width of ten and several micrometers (µm). A gas barrier is formed in the gap and completely seals the process side gas. The leakage rate of barrier gas is as small as 1/1000 times that of labyrinth seal.

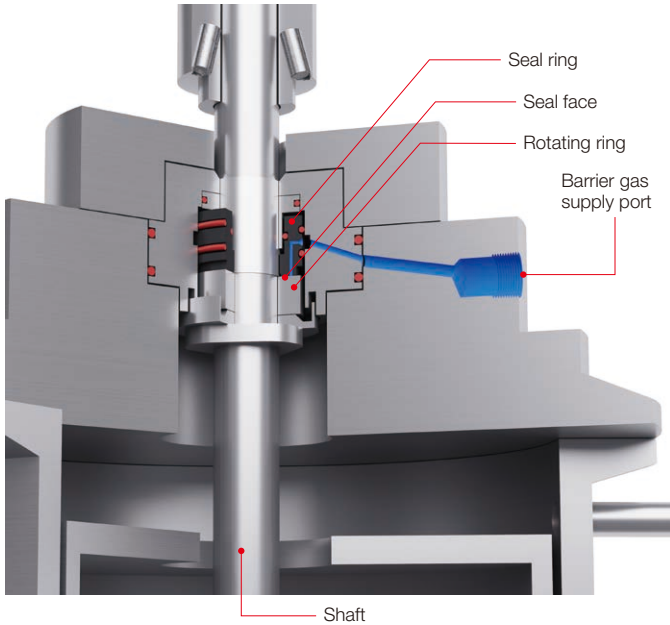
Moreover, the barrier gas supply grooves developed using our thorough design expertise automatically control the seal face gap according to pressure distribution, thereby providing high reliability.



Main models

| Model name | Outline | Speed (m/s) | Pressure (MPaG) | Application examples |
|------------|--------------------------------|-------------|-----------------|---|
| PEC-3SB | Static balanced type | 80 max. | 0.8 max. | Seal for blowers and compressors, and upper seal for mixers |
| PEC-2SA | Static unbalanced type | 80 max. | 0.05 max. | Seal for various types of powder equipment and blowers, and upper seal for mixers |
| PEC-9RB | Rotary balanced type (outside) | 20 max. | 0.2 max. | Seal for various types of powder equipment, and upper seal for mixers |

- Examples of applicable devices
- For high-speed dispersers, blowers, compressors, and upper seals for mixers
- Application image of high-speed disperser



- This aerostatic type non-contact dry gas seal provides a stable gap of several μm to ten and several μm between the seal faces.
- The PEC-3SB adopts the static balanced type and can be used for high-pressure applications.

Application examples

Nanomaterials, functional materials, and fine and specialty chemicals

Because the seal face has no contact, high-speed rotation can be supported. No wear debris is produced, so a high level of cleanliness can be achieved.

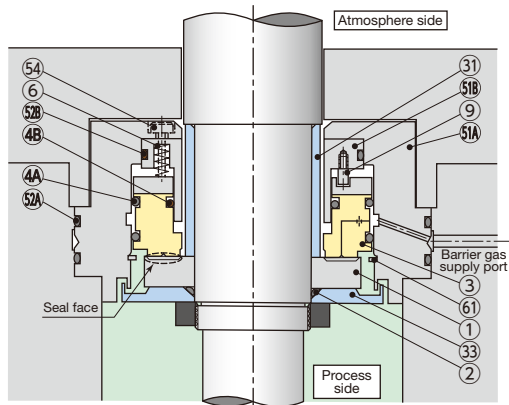
Bulk chemicals and steel

Flammable, volatile, and toxic gases can be sealed with a single seal structure.

Specification conditions

| | |
|-------------|-----------------|
| Speed (m/s) | Pressure (MPaG) |
| 80 max. | 0.8 max. |

PEC-3SBJ: Basic structure and materials

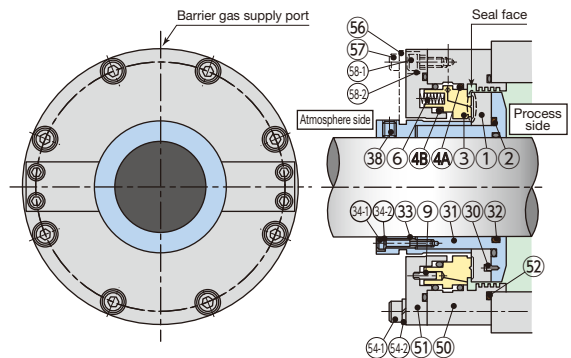


Standard materials

| No. | Part name | Material | Qty |
|-----|--------------------------|--------------------------------------|-----|
| 1 | Rotating ring | SUS316 or equiv. and ceramic coating | 1 |
| 2 | O-ring | FKM | 1 |
| 3 | Seal ring | Carbon | 1 |
| 4A | O-ring | FKM | 2 |
| 4B | O-ring | FKM | 1 |
| 6 | Spring | Alloy 20 | 1S |
| 9 | Pin | SUS316 or equiv. | 1S |
| 31 | Sleeve | SUS304 or equiv. | 1 |
| 33 | Collar | SUS304 or equiv. | 1 |
| 51A | Seal case A | SUS304 or equiv. | 1 |
| 51B | Seal case A | SUS304 or equiv. | 1 |
| 52A | O-ring | FKM | 2 |
| 52B | O-ring | FKM | 1 |
| 54 | Hexagon socket head bolt | SUS304 or equiv. | 1S |
| 61 | Snap ring | SUS304 or equiv. | 1 |

Note: The materials shown above are based on the standard specifications.

PEC-3SBJ: Basic structure and materials

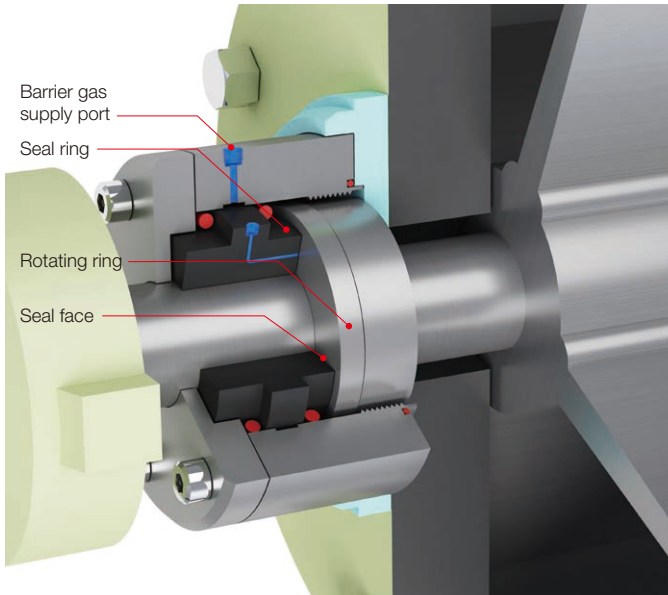


Standard materials

| No. | Part name | Material | Qty |
|------|--------------------------|--------------------------------------|-----|
| 1 | Rotating ring | SUS316 or equiv. and ceramic coating | 1 |
| 2 | O-ring | FKM | 1 |
| 3 | Seal ring | Carbon | 1 |
| 4A | O-ring | FKM | 2 |
| 4B | O-ring | FKM | 1 |
| 6 | Spring | Alloy 20 | 1S |
| 9 | Pin | SUS316 or equiv. | 1S |
| 30 | Pin | SUS316 or equiv. | 1 |
| 31 | Sleeve | SUS304 or equiv. | 1 |
| 32 | O-ring | FKM | 1 |
| 33 | Stopper ring | SUS304 or equiv. | 1 |
| 34-1 | Hexagon socket head bolt | SUS304 or equiv. | 1S |
| 34-2 | Spring washer | SUS304 or equiv. | 1S |
| 38 | Set screw | SUS316 or equiv. | 1S |
| 50 | Seal case | SUS304 or equiv. | 1 |
| 51 | Sealing flange | SUS304 or equiv. | 1 |
| 52 | O-ring | FKM | 2 |
| 54-1 | Hexagon socket head bolt | SUS304 or equiv. | 1S |
| 54-2 | Spring washer | SUS304 or equiv. | 1S |
| 56 | Set plate | SUS304 or equiv. | 2 |
| 57 | Hexagon socket head bolt | SUS304 or equiv. | 4 |
| 58-1 | Hexagon socket head bolt | SUS304 or equiv. | 1S |
| 58-2 | Spring washer | SUS304 or equiv. | 1S |

Note: The materials shown above are based on the standard specifications.

Examples of applicable devices
For various types of powder equipment, blowers, and upper seals for mixers
Application image of rotary valve (PEC-2SA)



- This aerostatic type non-contact dry gas seal provides a stable gap of several μm to ten and several μm between the seal faces.
- The PEC-2SA adopts the static unbalanced type and can be used for low-pressure applications.

Application example

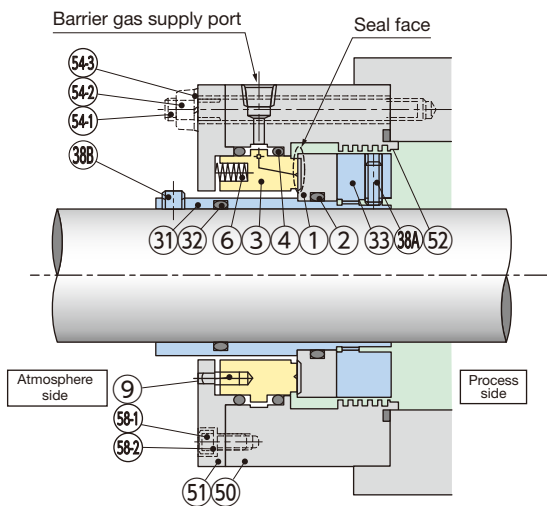
Various powder equipment sectors

Various types of powder equipment can be sealed by using Type PEC, which performs gas sealing. Stable, long-term sealing performance is provided at minimum running cost.

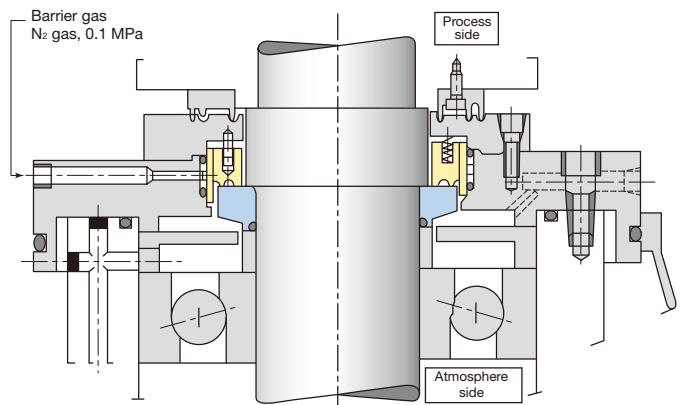
Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 80 max. | 0.05 max. |

PEC-2SAJ: Basic structure and materials



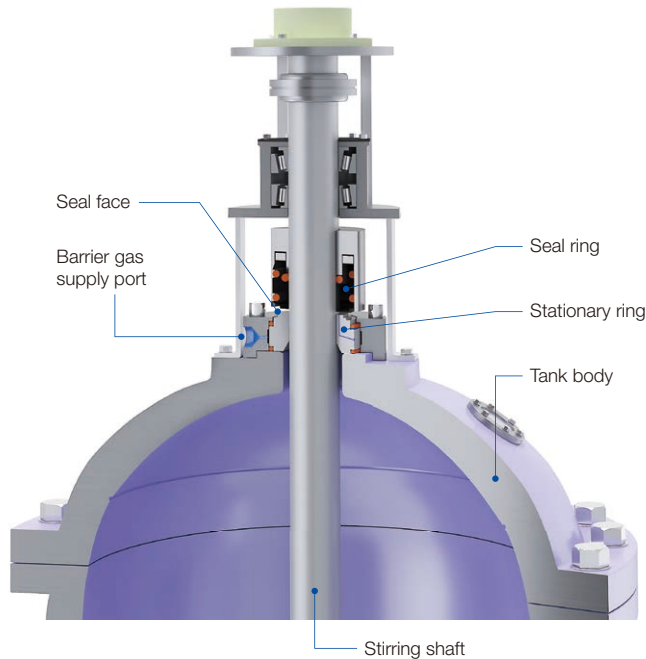
Application example of bottom installation for vertical powder grinding machine



Standard materials

| No. | Part name | Material | Qty |
|------|--------------------------|--------------------------------------|-----|
| 1 | Rotating ring | SUS316 or equiv. and ceramic coating | 1 |
| 2 | O-ring | FKM | 1 |
| 3 | Seal ring | Carbon | 1 |
| 4 | O-ring | FKM | 2 |
| 6 | Spring | Alloy 20 | 1S |
| 9 | Pin | SUS316 or equiv. | 1S |
| 31 | Sleeve | SUS316 or equiv. | 1 |
| 32 | O-ring | FKM | 1 |
| 33 | Stopper ring | SUS304 or equiv. | 1 |
| 38A | Set screw | SUS316 or equiv. | 1S |
| 38B | Set screw | SUS316 or equiv. | 1S |
| 50 | Seal case | SUS304 or equiv. | 1 |
| 51 | Sealing flange | SUS304 or equiv. | 1 |
| 52 | O-ring | FKM | 1 |
| 54-1 | Stud bolt | SUS304 or equiv. | 1S |
| 54-2 | Hexagon nut | SUS304 or equiv. | 1S |
| 54-3 | Spring washer | SUS304 or equiv. | 1S |
| 58-1 | Hexagon socket head bolt | SUS304 or equiv. | 1S |
| 58-2 | Spring washer | SUS304 or equiv. | 1S |

- Examples of applicable devices
- For various types of powder equipment, blowers, and upper seals for mixers
- Application image of vertical mixer



- This aerostatic type non-contact dry gas seal provides a stable gap of several μm to ten and several μm between the seal faces.
- The PEC-9RB adopts the rotary balanced type. It can be adopted as “non-metal PEC,” which is combined with a resin lined tank to prevent metal ions from leaching.

Application examples

Nanomaterials, functional materials, fine and specialty chemicals, and pharmaceuticals

Because the seal face has no contact, high-speed rotation can be supported. No wear debris is produced, so a high level of cleanliness can be achieved.

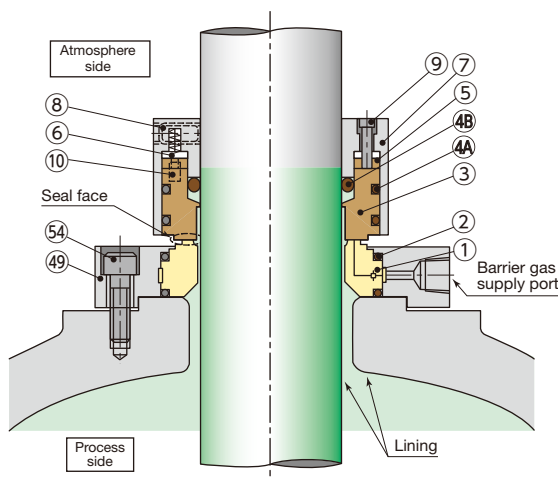
Bulk chemicals and steel

Flammable, volatile, and toxic gases can be sealed with a single seal structure.

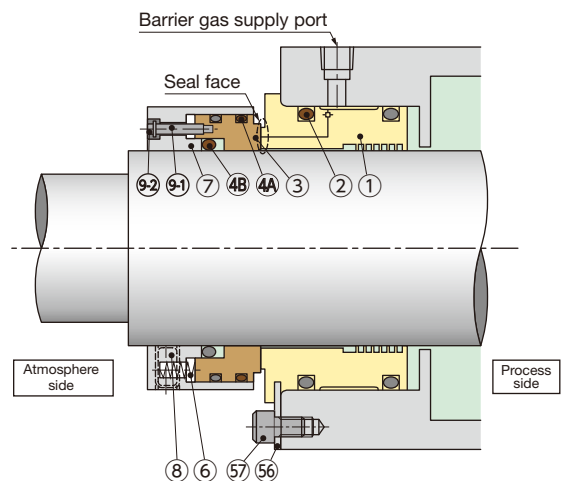
Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 20 max. | 0.2 max. |

PEC-9RBS (for lined cauldron mixers): Basic structure and materials



PEC-9RBS (for rotary valves): Basic structure and materials



Standard materials

| No. | Part name | Material | Qty |
|-----|--------------------------|------------------|-----|
| 1 | Stationary ring | Carbon | 1 |
| 2 | O-ring | FKM | 2 |
| 3 | Seal ring | Ceramic | 1 |
| 4A | O-ring | FKM | 2 |
| 4B | O-ring | FKM | 1 |
| 5 | Drive collar | SUS304 or equiv. | 1 |
| 6 | Spring | Alloy 20 | 1S |
| 7 | Spring retainer | SUS304 or equiv. | 1 |
| 8 | Set screw | SUS316 or equiv. | 1S |
| 9 | Drive pin | SUS316 or equiv. | 1S |
| 10 | Pin | SUS316 or equiv. | 1S |
| 49 | Flange | SUS304 or equiv. | 1 |
| 54 | Hexagon socket head bolt | SUS304 or equiv. | 1S |

Note: The materials shown above are based on the standard specifications.

Standard materials

| No. | Part name | Material | Qty |
|-----|--------------------------|--------------------------------------|-----|
| 1 | Stationary ring | SUS304 or equiv. (surface nitriding) | 1 |
| 2 | O-ring | FKM | 2 |
| 3 | Seal ring | SUS304 or equiv. and ceramic coating | 1 |
| 4A | O-ring | FKM | 2 |
| 4B | O-ring | FKM | 1 |
| 6 | Spring | Alloy 20 | 1S |
| 7 | Spring retainer | SUS304 or equiv. | 1 |
| 8 | Set screw | SUS316 or equiv. | 1S |
| 9-1 | Drive pin | SUS316 or equiv. | 1S |
| 9-2 | Snap ring | SUS304 or equiv. | 1S |
| 56 | Plate | SUS304 or equiv. | 2 |
| 57 | Hexagon socket head bolt | SUS304 or equiv. | 2 |

Note: The materials shown above are based on the standard specifications.

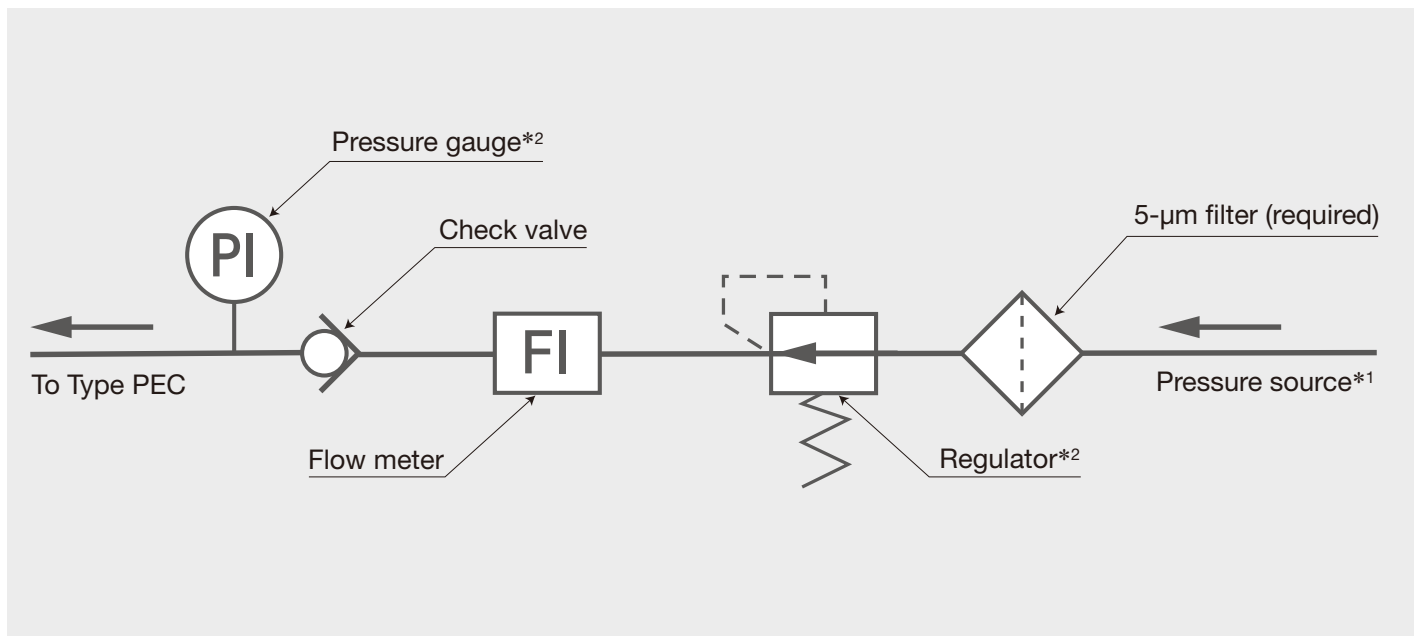
■ Guide to accessories and auxiliary devices

For Type PEC, the performance of the seal itself, as well as selection and management of accessories and auxiliary devices determines reliability, longevity, and other factors for the entire system.

We propose a barrier gas supply system that is optimized according to our past achievements.

Please consider this service in conjunction with our products.

Recommended barrier gas supply flow for Type PEC



*1 Pressure source must secure sufficient flow rates and must also be stable.

*2 Regulators and pressure gauges must be oil-free types.

As a total seal manufacturer, we have been continuing to resolve customers' issues with our wide array of sealing technologies.

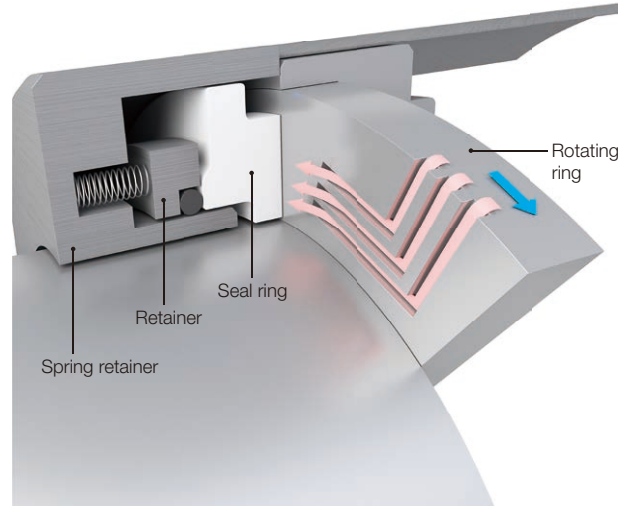
In the 1970s, as a seal manufacturer in Japan, we succeeded in making practical use of dry gas seal technology for the first time in Japan. We have been continuing daily to expand the deployment range of our technologies to blowers, as well as to liquid seals, containment seals, and other seals.

Aerodynamic type non-contact dry gas seal mechanism

When the shaft rotates, the grooves engraved on the rotating ring generate pressure (called "dynamic pressure") between the rotating ring and the seal ring.

This dynamic pressure keeps the seal ring floating by several μm. The amount of seal ring floating is as small as only several μm, making the amount of liquid leakage extremely small, at 1/1000 or less the degree in comparison with a labyrinth seal.

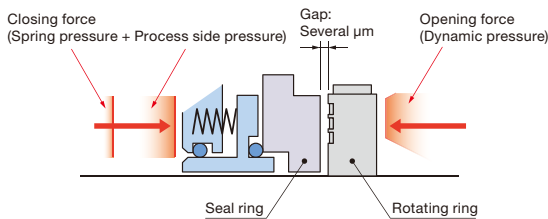
The seal face maintains a non-contact state during operation, minimizing motive power consumption, as well as providing various characteristics such as being lubricating oil free and having a long service life.



PILLAR original multi-groove design

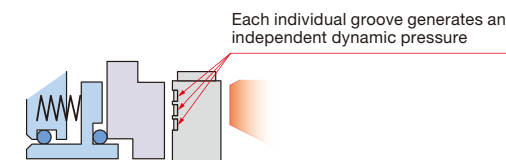
Automatic gap adjustment mechanism

While the dynamic pressure mechanism is in operation, the magnitude of dynamic pressure (opening force) instantly changes according to the gap width between the rotating ring and the seal ring. The gap width is always adjusted so that it approaches the design value, and the seal ring is continuously floated by several μm in a balanced state.



Advantages of multi-groove seal

The Type PPG PILLAR Phoenix Groove seal has multiple independent grooves that support bidirectional rotation. When the dynamic pressure mechanism is in operation, each individual groove generates an independent dynamic pressure and individual pressure distributions are formed. Compared to single-groove seals, multi-groove seals make dynamic pressure difficult to escape and provide advantages in terms of reliability and safety.



Gap Small (Closing force < Opening force)

When the seal gap becomes small, the dynamic pressure (opening force) cannot escape, pushing back the seal ring so that the seal gap reaches its design value.

Gap Large (Closing force > Opening force)

On the other hand, when the seal gap becomes large, the dynamic pressure (opening force) can escape to a significant degree, making the closing force relatively large. Therefore, the seal gap is balanced so that it becomes smaller.

Multi-groove (Type PPG) dry gas seal

Each individual groove adjusts the gap independently. (Can easily handle inclination of the sealing surface)

Single-groove (non-PILLAR) dry gas seal

Dynamic pressure escapes easily.

The dry gas seal is now recognized as the standard shaft sealing device for turbo-compressors. This technology and our experience can also be applied to shaft seals for devices other than turbo-compressors. We have a range of solutions that apply and expand this technology to various issues, including double seals for liquid, vertical mixer top seals, and containment seals.

Model notation

PPG3S

Basic structure
(1R, 3S, 4S, 6S, or 7R)

[Basic structure notation]

1R: Low-load rotary type seal

3S: High-load static type seal

4S: Medium-load general-purpose static type seal

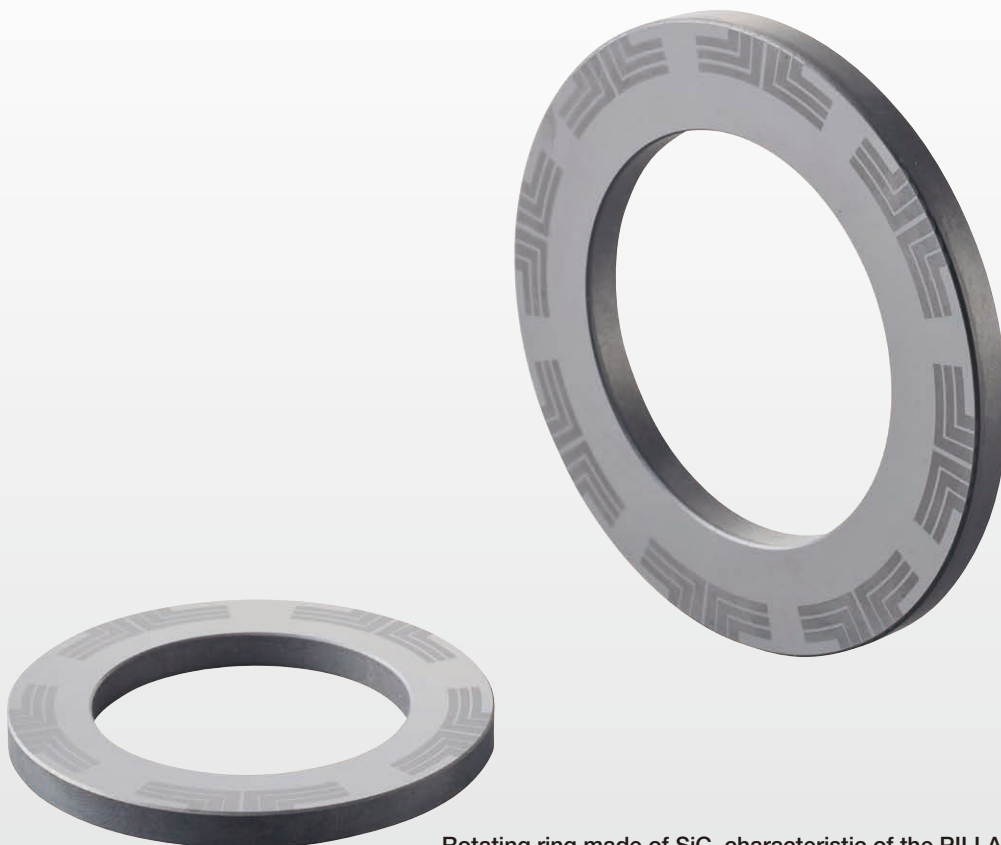
6S: Containment seal

7R: Low-load general-purpose rotary type seal (space-saving type)

Main seal models and scope of application

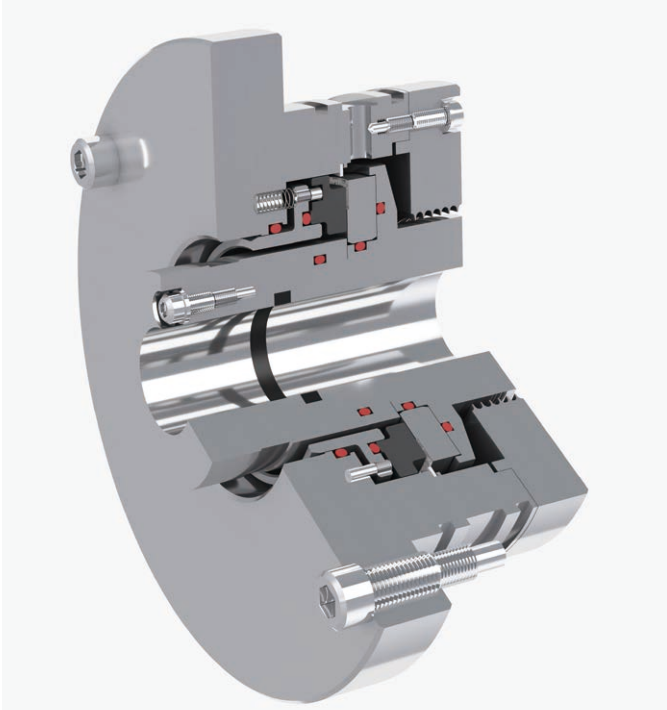
| Model name | Outline | Speed (m/s) | Pressure (MPaG) | Main applications |
|------------|---|-------------|-----------------|--|
| PPG3S | High-load static type seal | 150 max. | 10 max. | For compressors and blowers |
| PPG1R | Low-load rotary type seal | 20 max. | 1 max. | For general use, containment seals, and blowers |
| PPG7R | Low-load general-purpose rotary type seal (space-saving type) | 20 max. | 1 max. | For general use and containment seals |
| PPG4S | Medium-load general-purpose static type seal | 40 max. | 1.6 max. | For liquids, vertical mixer top seals, and blowers |
| PPG6S | Containment seal | 25 max. | *1 | For containment seals (outer seals) |

*1 This model can be operated as a containment seal under a pressure of 4.2 MPa for at least eight hours in the event of an emergency.



Rotating ring made of SiC, characteristic of the PILLAR Phoenix-Seal™

■ Examples of applicable devices
■ For compressors and blowers

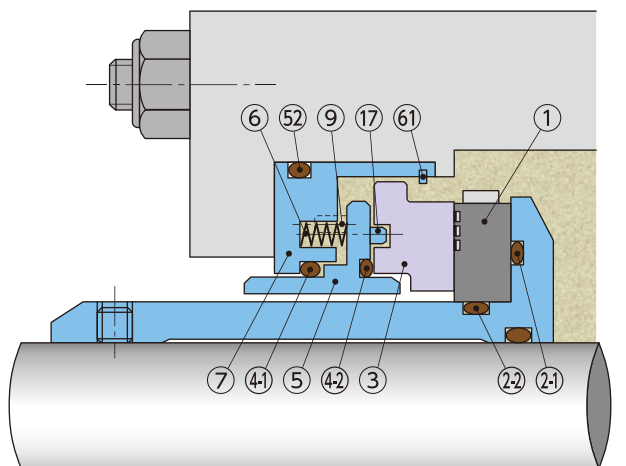


- This aerodynamic seal is provided with PILLAR-specific grooves on the seal face to make effective use of dynamic pressure through multiple barriers.
- This high-load static type dry gas seal is optimally designed for use in turbo-compressors.
- In addition to single seal arrangement, tandem seal arrangement and double seal arrangement are also available.

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 5 to 150 | 10 max. |

■ PPG3S: Basic structure and materials



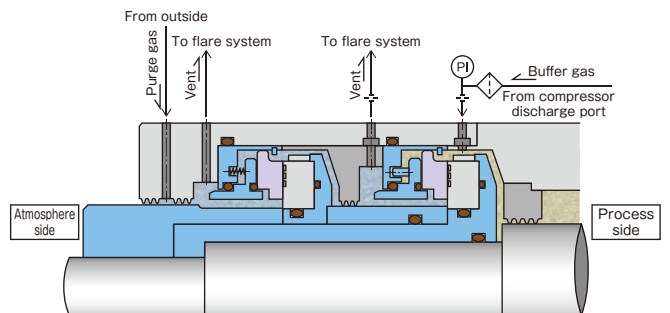
■ Standard materials

| No. | Part name | Material | Qty |
|-----|-----------------|------------------|-----|
| 1 | Rotating ring | SiC and titanium | 1 |
| 2-1 | O-ring | — | 1 |
| 2-2 | O-ring | — | 1 |
| 3 | Seal ring | Carbon | 1 |
| 4-1 | O-ring | — | 1 |
| 4-2 | O-ring | — | 1 |
| 5 | Retainer | SUS304 or equiv. | 1 |
| 6 | Spring | SUS304 or equiv. | 1S |
| 7 | Spring retainer | SUS304 or equiv. | 1 |
| 9 | Pin | SUS316 or equiv. | 1S |
| 17 | Pin | SUS316 or equiv. | 1S |
| 52 | O-ring | — | 1 |
| 61 | Snap ring | — | 1 |

■ Application examples of PPG3S

■ Tandem seal arrangement

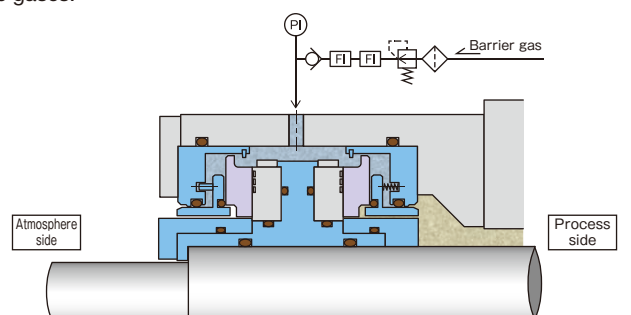
For compressors, the PPG3S is generally used as a tandem seal.



■ Double seal arrangement

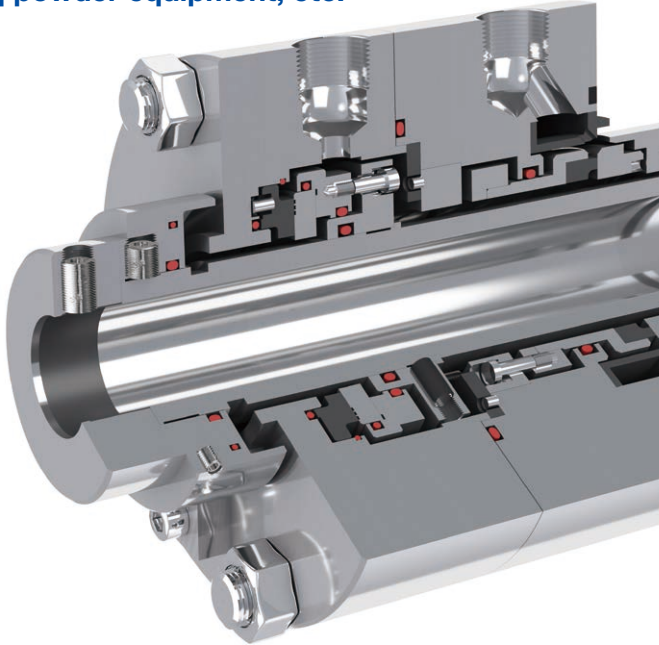
When toxic gases such as chlorine gas are not allowed to flow to the atmosphere side, the PPG3S is used as a double seal.

In particular, this arrangement is suitable for high-speed blowers for toxic gases.



Examples of applicable devices

For containment seals, blowers, powder equipment, etc.

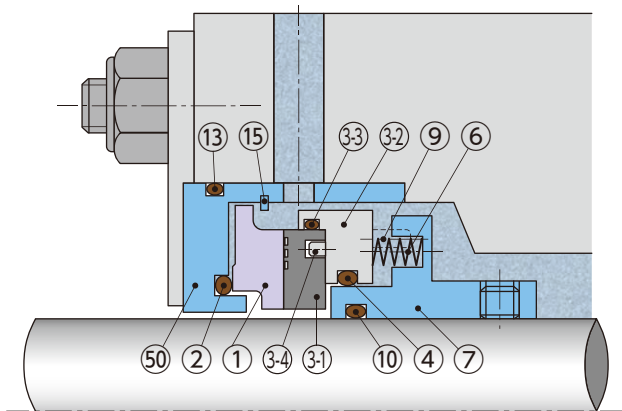


- This aerodynamic seal is provided with PILLAR-specific grooves on the seal face to make effective use of dynamic pressure through multiple barriers.
- A rotary type dry gas seal structure is adopted for simplicity and compactness.
- In addition to pressurized dual arrangement, this product can also be utilized as a containment seal.

Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 5 to 20 | 1 max. |

PPG1R: Basic structure and materials



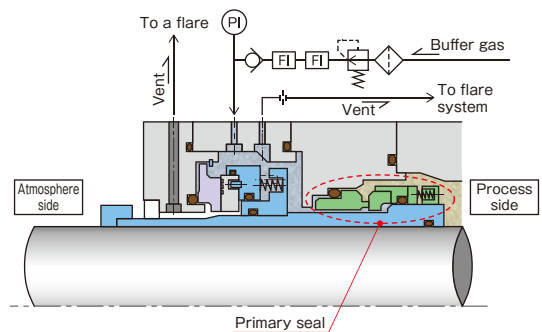
Standard materials

| No. | Part name | Material | Qty |
|-----|-----------------|------------------|-----|
| 1 | Stationary ring | Carbon | 1 |
| 2 | O-ring | — | 1 |
| 3-1 | Rotating ring | SiC | 1 |
| 3-2 | Retainer | SUS304 or equiv. | 1 |
| 3-3 | O-ring | — | 1 |
| 3-4 | Pin | SUS316 or equiv. | 1S |
| 4 | O-ring | — | 1 |
| 6 | Spring | SUS304 or equiv. | 1S |
| 7 | Spring retainer | SUS304 or equiv. | 1 |
| 9 | Drive pin | SUS304 or equiv. | 1S |
| 10 | O-ring | — | 1 |
| 13 | O-ring | — | 1 |
| 15 | Snap ring | SUS304 or equiv. | 1 |
| 50 | Seal case | SUS304 or equiv. | 1 |

Application examples of PPG1R

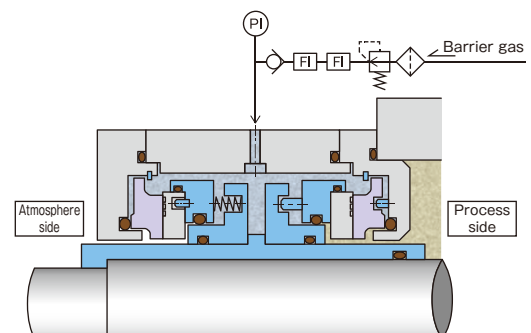
Containment seal

The rotary type dry gas seal can also be used as a containment seal. (For use in high-load areas, select Type PPG6S.)



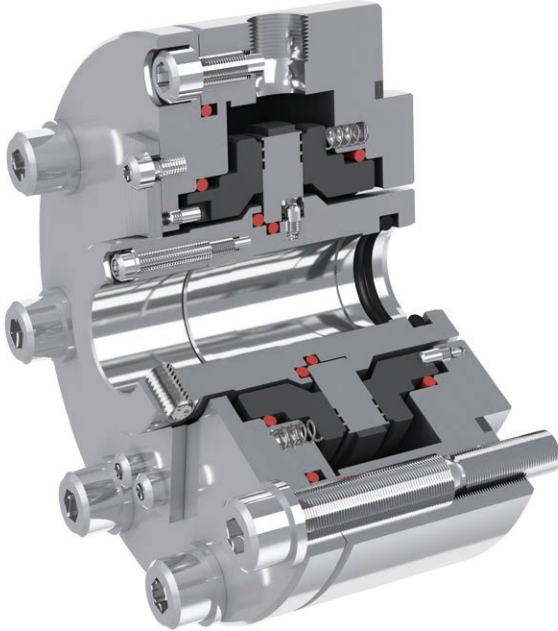
Double seal arrangement

If this product is used only under low PV conditions, the double seal arrangement can be applied to blowers or similar devices.



Examples of applicable devices

For pumps, blowers, and upper seals for vertical mixers

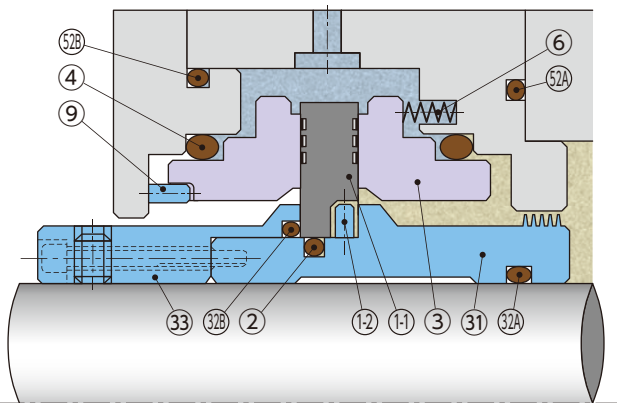


- This aerodynamic seal is provided with PILLAR-specific grooves on the seal face to make effective use of dynamic pressure through multiple barriers.
- This product employs a structure where grooves are arranged on both surfaces of the rotating ring. This results in a compact design.
- As a liquid seal for pumps and other devices, this product can be effectively applied to “high-viscosity fluid,” “slurry fluid,” and “polymerizable fluid,” sensitive to sliding heat.
- This product can be utilized as an upper seal for mixers.

Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 3 to 40 | 1.6 max. |

PPG4S: Basic structure and materials



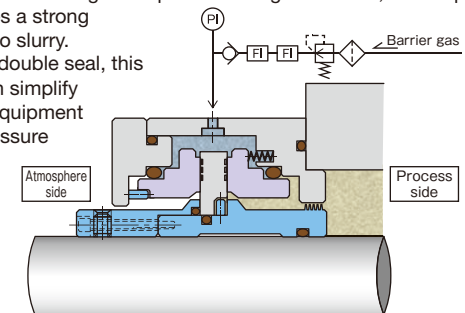
Standard materials

| No. | Part name | Material | Qty |
|-----|---------------|------------------|-----|
| 1-1 | Rotating ring | SiC | 1 |
| 1-2 | Pin | SUS304 or equiv. | 1 |
| 2 | O-ring | — | 1 |
| 3 | Seal ring | Carbon | 2 |
| 4 | O-ring | — | 2 |
| 6 | Spring | SUS304 or equiv. | 1S |
| 9 | Pin | SUS316 or equiv. | 1S |
| 31 | Sleeve | SUS304 or equiv. | 1 |
| 32A | O-ring | — | 1 |
| 32B | O-ring | — | 1 |
| 33 | Stopper ring | SUS304 or equiv. | 1 |
| 52A | O-ring | — | 1 |
| 52B | O-ring | — | 1 |

Pump seal

Sealing fluid with a dry gas seal provides a variety of advantages.

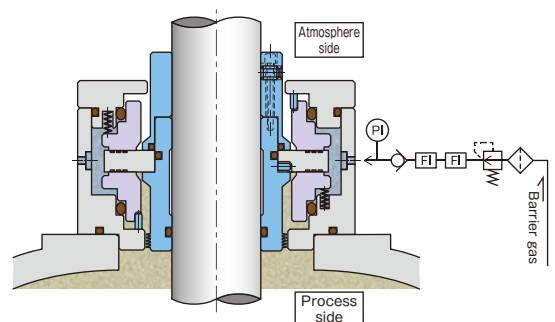
- The liquid contained can be completely sealed.
- Because the sealing face has no contact during operation, sliding heat can be suppressed. This product is suitable for liquids sensitive to heat. Moreover, the barrier gas keeps the sealing face clean, so this product also features a strong resistance to slurry.
- Despite its double seal, this product can simplify incidental equipment such as pressure units.



Upper seal for mixers

The compactly designed PPG4S (aneroid dual gas seal) can be used as a mixer top seal.

- Process gas is completely sealed with this seal unit.
- Expensive incidental equipment such as pressure units is not required.
- Because of the compact design, modification from gland packings is possible.

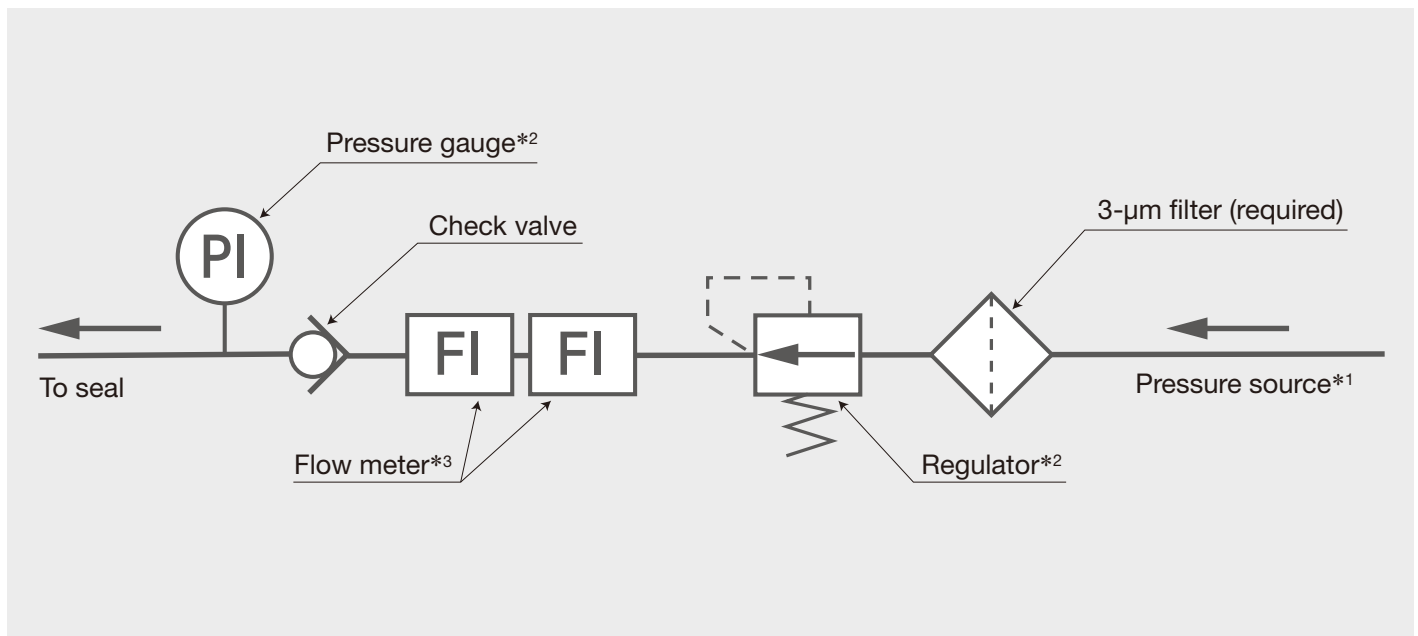


■ Guide to accessories and auxiliary devices

For dry gas seals, the performance of the seal itself, as well as selection and management of accessories and auxiliary devices determines reliability, longevity, and other factors for the entire system.

We propose a barrier gas supply system that is optimized according to our past achievements.

Recommended barrier gas supply flow for Type PPG



*1 Pressure source must secure sufficient flow rates and must also be stable.

*2 Regulators and pressure gauges must be oil-free types.

*3 For flow meters, we recommend a system that can measure a wide range of flow rates by using two flow meters with different measurement ranges in tandem.

Applying PILLAR's original aerodynamic type non-contact dry gas seal technology to containment seals

PILLAR Phoenix-Seal Type PPG6S

PPG6S seal technology

Containment seals cannot allow even a slight amount of gaseous fluid to leak from the inner seal and escape into the atmosphere, especially in the event of an emergency.

One of our solutions is horizontal deployment of our dry gas seal technology that we have cultivated through our past applications, such as compressors.

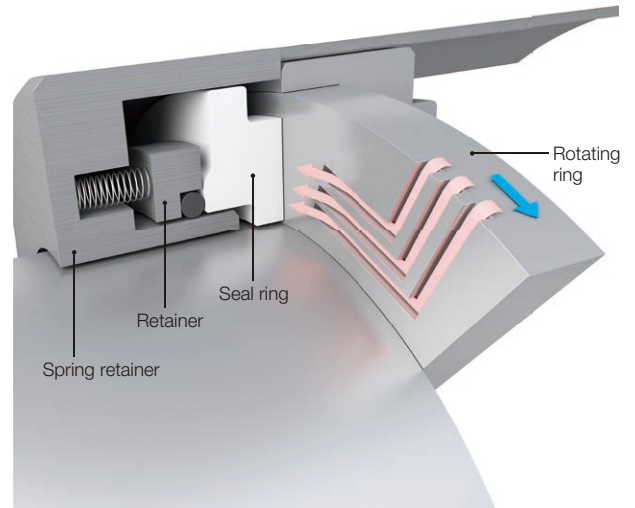
Aerodynamic type non-contact dry gas seal mechanism

When the shaft rotates, the grooves engraved on the rotating ring generate pressure (called "dynamic pressure") between the rotating ring and the seal ring.

This dynamic pressure keeps the seal ring floating by several μm .

The amount of seal ring floating is as small as only several μm , making the amount of liquid leakage extremely small, at 1/1000 or less the degree in comparison with a labyrinth seal.

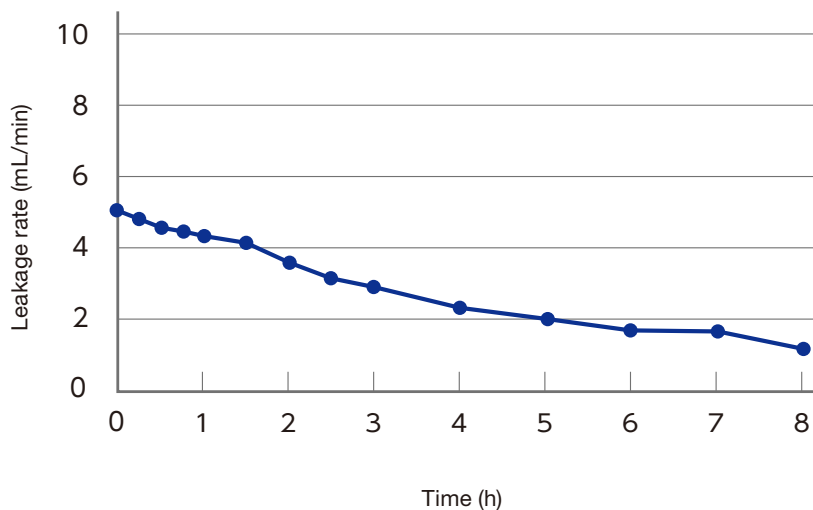
The seal face maintains a non-contact state during operation, minimizing motive power consumption, as well as providing various characteristics such as being lubricating oil free and having a long service life.



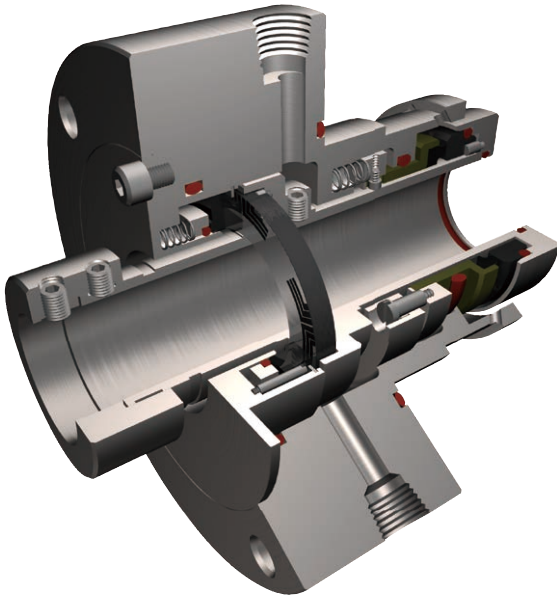
Maximum pressure test results of PPG6S

Testing conditions

| Size | Fluid | Pressure | Speed | Flow rate | Time |
|------|-------|----------|------------------------|-----------|------|
| O4B | Water | 4.2 MPaG | 3600 min^{-1} | 0 L/min | 8 h |



■ Example of applicable devices
■ For containment seals



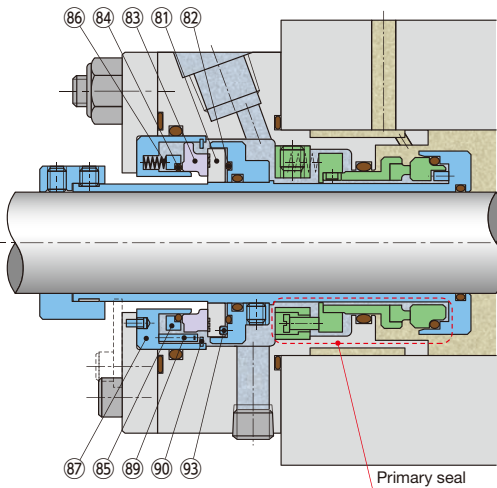
- This non-contact containment seal is designed to correspond with API 682 Seal Flush Plan 70s.
- This aerodynamic seal is provided with PILLAR-specific grooves on the seal face to make effective use of dynamic pressure through multiple barriers.
- This product is effective when leaked objects from the main seal are “vaporizable fluids.”

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 5 to 25 | *1 |

Note *1 This model can be operated as a containment seal under a pressure of 4.2 MPaA for at least eight hours in the event of an emergency.

■ PPG6S: Basic structure and materials



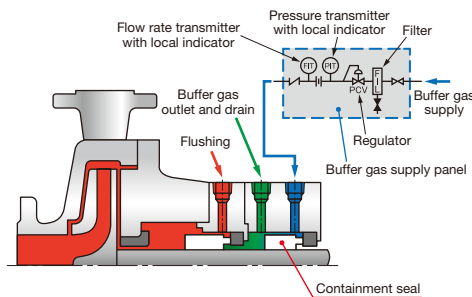
■ Standard materials

| No. | Part name | Material | Qty |
|-----|-----------------|------------------|-----|
| 81 | Rotating ring | SiC | 1 |
| 82 | O-ring | FKM | 1 |
| 83 | Seal ring | Carbon | 1 |
| 84 | O-ring | FKM | 1 |
| 85 | Retainer | SUS316 or equiv. | 1 |
| 86 | Spring | Alloy C-276 | 1S |
| 87 | Spring retainer | SUS316 or equiv. | 1 |
| 89 | Pin | SUS316 or equiv. | 1S |
| 90 | Snap ring | SUS316 or equiv. | 1 |
| 93 | Pin | SUS316 or equiv. | 1 |

■ API 682 PLAN 72+76

PLAN 72 and PLAN 76 are examples of API 682 Seal Flush Plan 70s.

PLAN 72



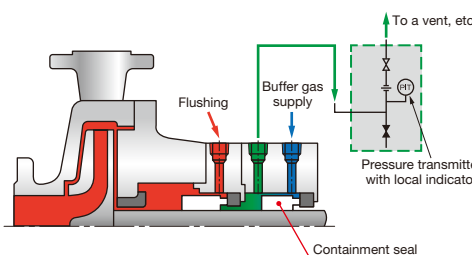
■ Description

- This is a buffer gas supply system for unpressurized tandem seals with a containment seal.
- This is used in combination with API 682 Seal Flush Plan 75 or 76.

■ Features

- Buffer gas is supplied to dilute leaked gas from the primary seal and minimize leakage into the atmosphere.
- Cooling the primary seal is separately required.

PLAN 76



■ Description

- This is a leakage detection system for unpressurized tandem seals with a containment seal.

■ Features

- This plan is used when the sealed liquid is a liquid that becomes gas at a normal temperature and under atmospheric pressure (such as LPG). Gas leaked from the primary seal is discharged to a flare system or similar system.
- When a large amount of gas leaks from the primary seal, the pressure changed by the orifice installed on the flare piping is detected with a pressure gauge or pressure transmitter.

RRG30 seal mechanism

This product is an API 682 Seal Flush Plan 70s containment seal that is always used under dry conditions.

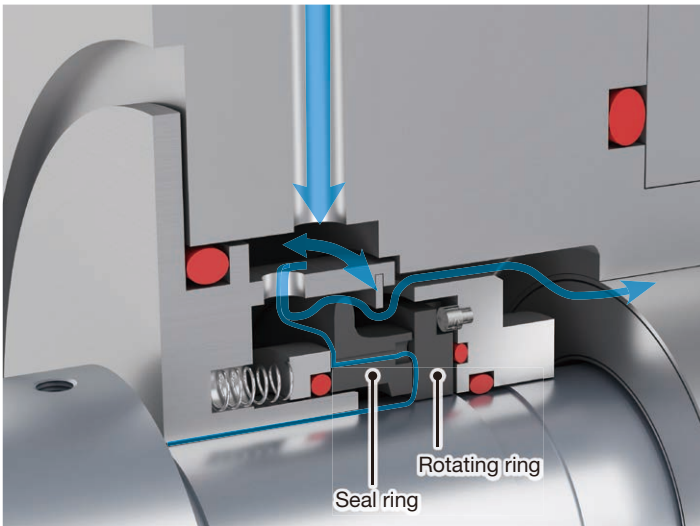
The extension of general dry running seal technologies cannot cope with such harsh conditions.

Type RRG30 is PILLAR's dry running type solution that satisfies the safety, reliability, and longevity expected by API 682.

Semi-floating double circular seal ring

Clean buffer gas supplied from the back of the seal ring reaches the seal face through the through-hole and circumferential groove in the seal ring. The buffer gas is then sent separately to the inner circumference (on the inner seal side) and outer circumference (on the atmospheric air side) on the seal face, causing the seal ring to enter a semi-floating state.

As a result, the surface pressure on the seal face becomes extremely small, making it possible to minimize sliding heat and wear.



PILLAR's original "semi-floating double circular seal ring"

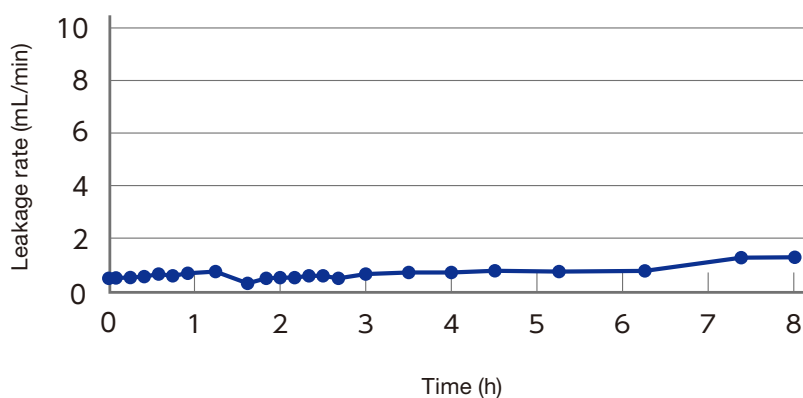
"Special carbon material" with strengthened dry sliding characteristics is used as a seal face material

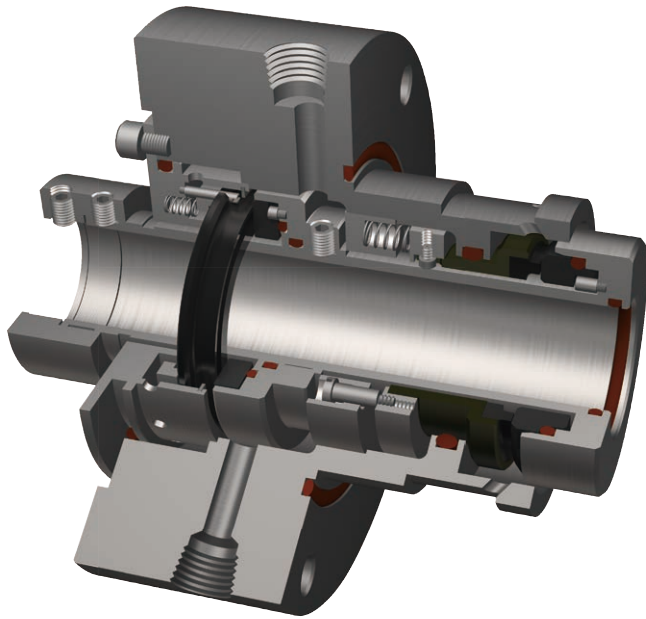
We can also handle specifications that do not supply buffer gas.

Maximum pressure test results of RRG30

Testing conditions

| Size | Fluid | Pressure | Speed | Flow rate | Time |
|------|-------|----------|------------------------|-----------|------|
| 048 | Water | 4.2 MPaG | 3600 min ⁻¹ | 2 L/min | 8 h |





- This dry-contact containment seal is designed to correspond with API 682 Seal Flush Plan 70s.
- The seal face has double sliding surfaces to reduce load, using a special carbon. This product has a long service life even if it is used under dry conditions.
- This product allows the customer to select whether to supply buffer gas (Plan 72).
- This product is applicable even if leaked objects from the main seal are either vaporizable fluids or non-vaporizable fluids.

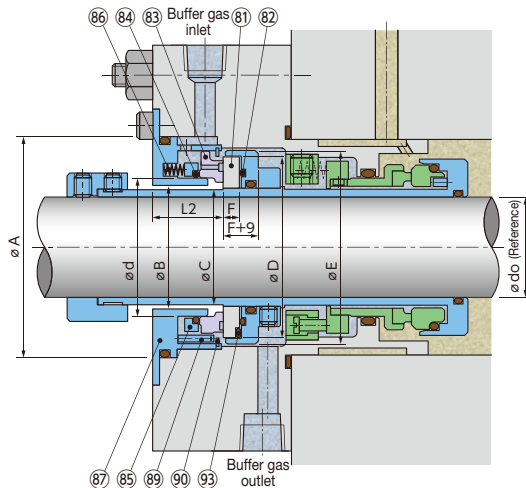
■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 21 max. | *1 |

Note: The nominal size is $\phi 30$ to $\phi 130$.

*1 This model can be operated as a containment seal under a pressure of 4.2 MPaA for at least eight hours in the event of an emergency.

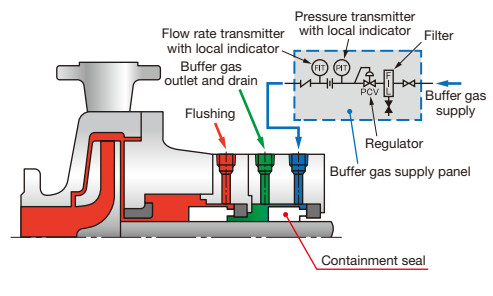
■ RRG30: Basic structure and materials



■ Standard materials

| No. | Part name | Material | Qty |
|-----|-----------------|------------------|-------|
| 81 | Rotating ring | SiC | 1 |
| 82 | O-ring | FKM | 1 |
| 83 | Seal ring | Carbon D4 | 1 |
| 84 | O-ring | FKM | 1 |
| 85 | Retainer | SUS316 or equiv. | 1 |
| 86 | Spring | Alloy C-276 | 1 set |
| 87 | Spring retainer | SUS316 or equiv. | 1 |
| 89 | Pin | SUS316 or equiv. | 4 |
| 90 | Snap ring | SUS316 or equiv. | 1 |
| 93 | Pin | SUS316 or equiv. | 1 |

■ PLAN 72



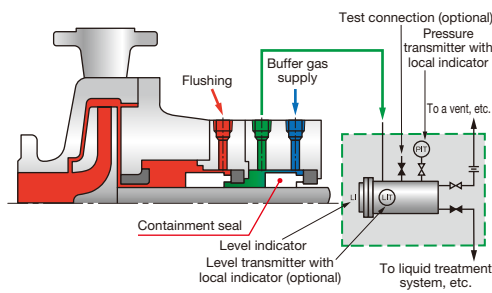
■ Description

- This is a buffer gas supply system for unpressurized tandem seals with a containment seal.
- This is used in combination with API 682 Seal Flush Plan 75 or 76.

■ Features

- Buffer gas is supplied to dilute leaked gas from the primary seal and minimize leakage into the atmosphere.
- Cooling the primary seal is separately required.

■ PLAN 75



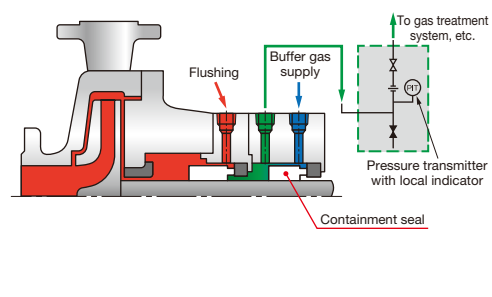
■ Description

- This is a leaked liquid collection system for unpressurized tandem seals with a containment seal.

■ Features

- This plan is used when the sealed liquid is a liquid at normal temperature and under atmospheric pressure. Leaked fluid is separated into gas and liquid components by the drain tank, liquid is collected, and gas is discharged to a flare system.
- When a large amount of liquid leaks from the primary seal, the pressure changed by the orifice installed on the flare piping is detected with a pressure gauge or pressure transmitter.

■ PLAN 76



■ Description

- This is a leakage detection system for unpressurized tandem seals with a containment seal.

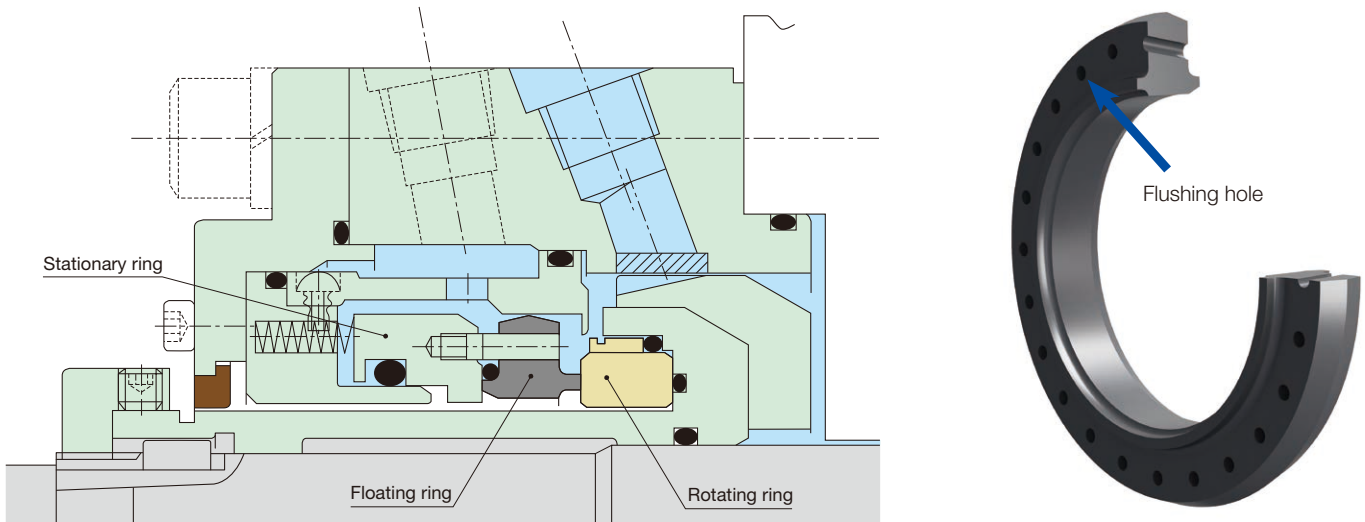
■ Features

- This plan is used when the sealed liquid is a liquid that becomes gas at a normal temperature and under atmospheric pressure (such as LPG). Gas leaked from the primary seal is discharged to a flare system or similar system.
- When a large amount of gas leaks from the primary seal, the pressure changed by the orifice installed on the flare piping is detected with a pressure gauge or pressure transmitter.

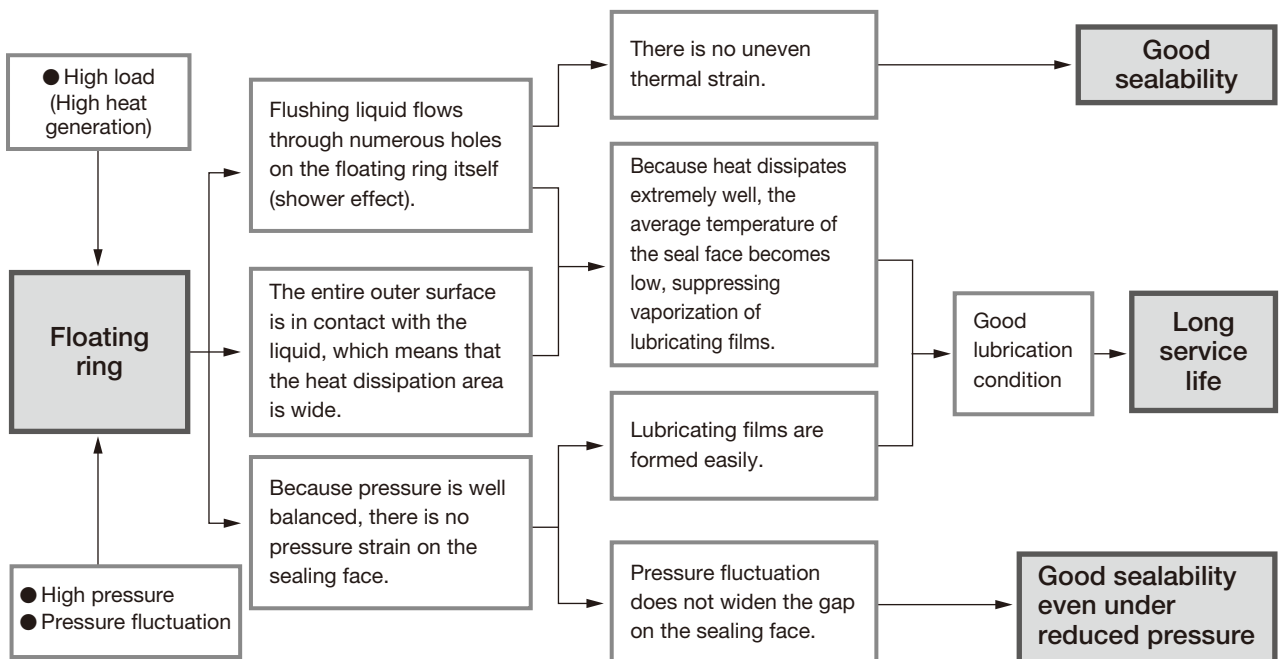
The floating ring type mechanical seal is a seal that has been developed to provide stable sealing performance under high-pressure, high-velocity conditions.

A large number of mechanical seals of this type have been delivered to important plants around the world. Main applications include boiler feed pumps for thermal power plants and high-pressure pumps for fertilizer plants, which are expected to increase in the future.

■ Structure



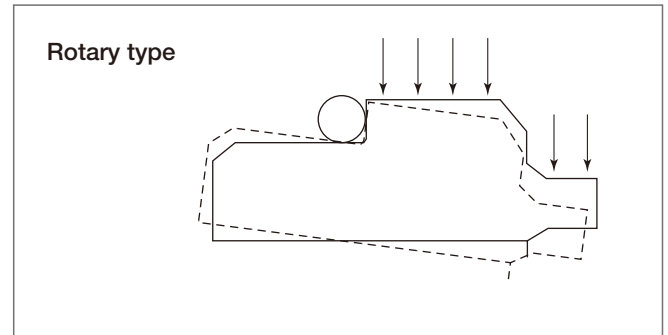
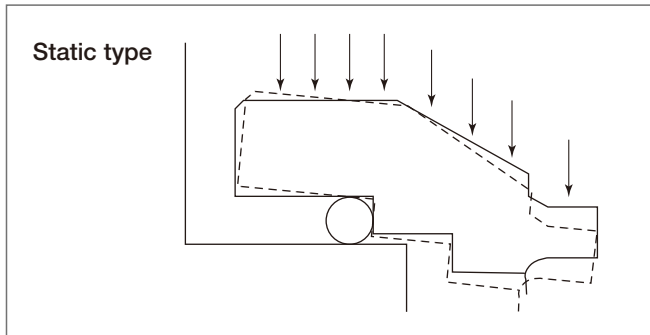
■ PILLAR floating ring type mechanical seal solutions



■ Features

■ Suitable design for high operating pressure

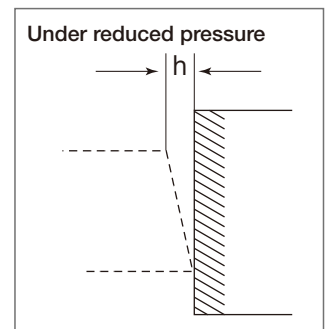
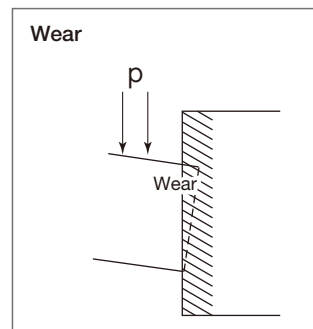
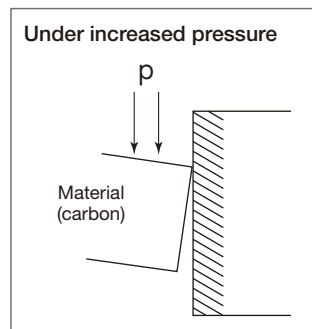
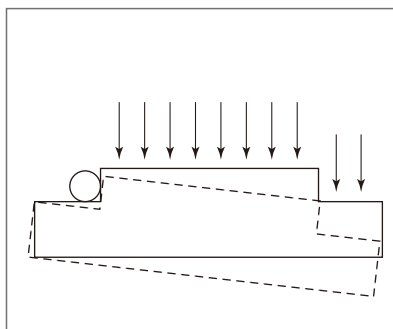
For general seals, the high-pressure fluid causes deformation of the seal face, creating a convexity of the outer diameter, as shown in the figure below. In this case, it is difficult to form a thin fluid film (lubricating film) between the seal faces due to the extreme contact of the outer diameter, resulting in poor lubrication, which can lead to a rough surface and premature wear of the carbon.



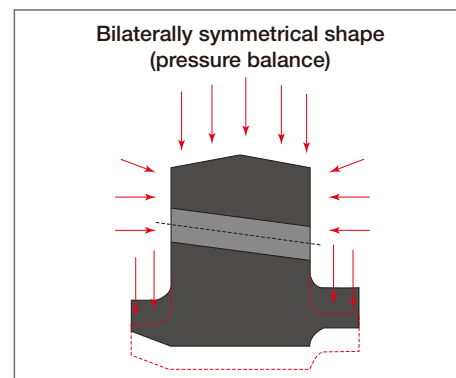
For floating ring type mechanical seals, the floating ring shape is almost bilaterally symmetrical and fluid pressure is used to keep pressure balance. Therefore, the seal does not cause pressure strain that would tilt the seal face (flatness is maintained) and lubricating films are formed stably.

■ Resistant to pressure fluctuation

For general seals, as mentioned above, the high-pressure fluid deforms the seal face so that it becomes convex in the outer diameter. Once the seal is worn out, upon pressure reduction, the deformation is relaxed and restored, resulting in a wedge-shaped gap on the outer diameter side of the seal face, which reduces sealing performance and increases the amount of leakage.

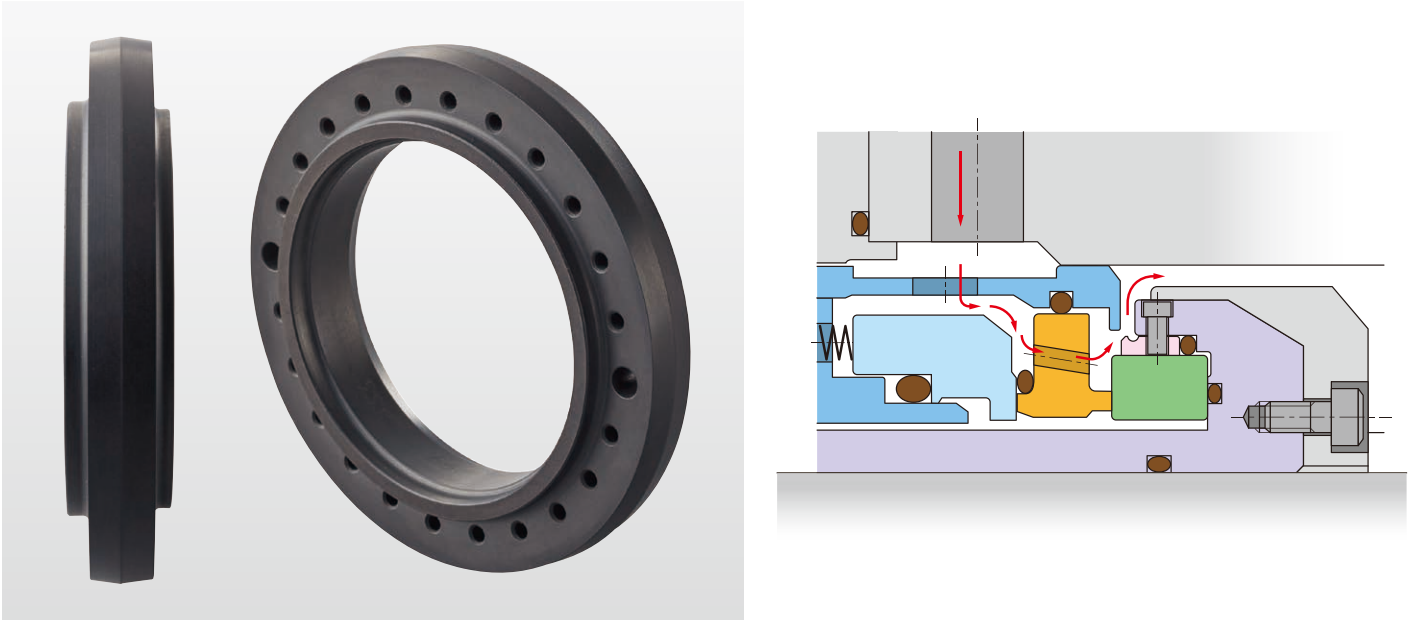


For floating rings, pressure balance hardly causes the fluid pressure to deform the outer surface of the seal face. Therefore, when the pressure decreases, no gap occurs on the seal face, allowing sealability to be maintained.



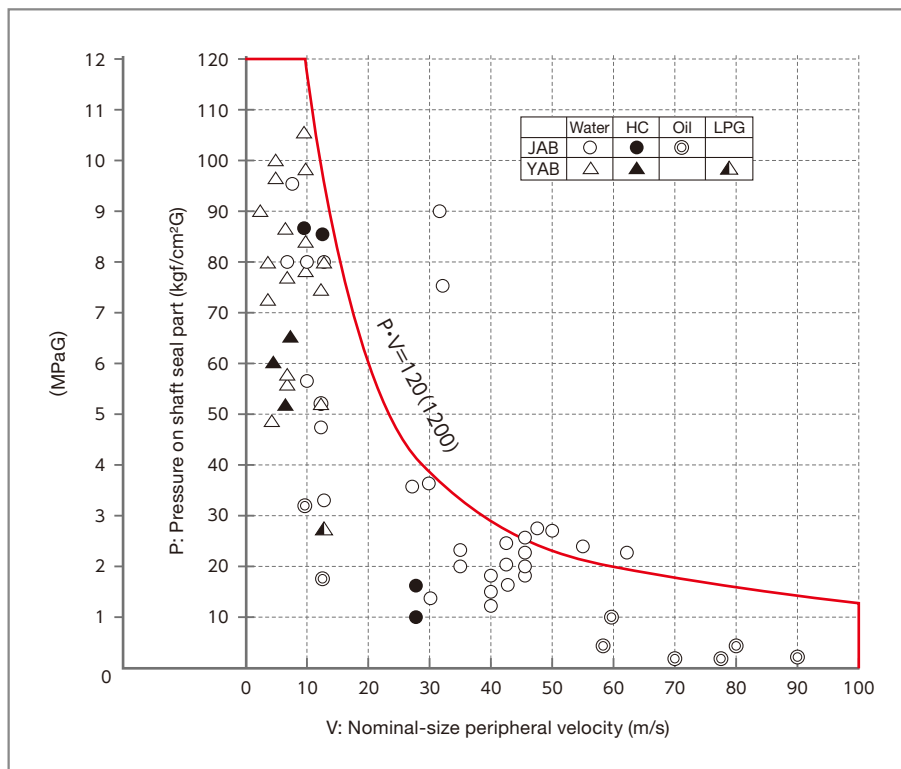
Suitable design for high load conditions

The floating ring has multiple holes through which flushing liquid flows to cool the floating ring itself effectively from inside. It also enables the seal face to be cooled evenly on the circumference, so that the lubrication condition of the seal face can be maintained in good condition. Therefore, stable sealing performance can be provided under high-pressure, high-velocity conditions.

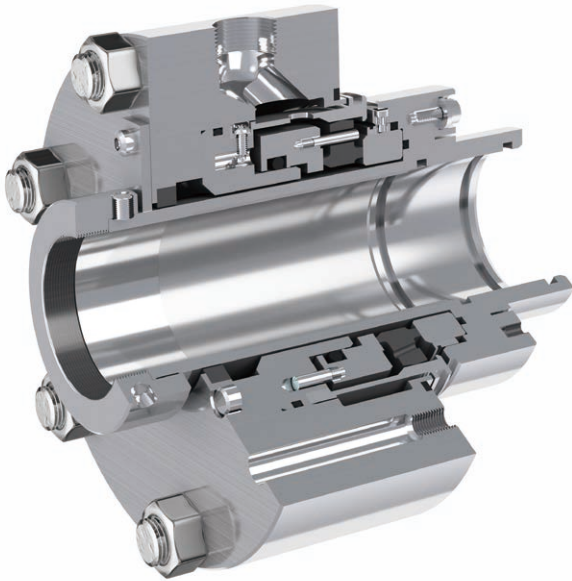


Supply records (extracts)

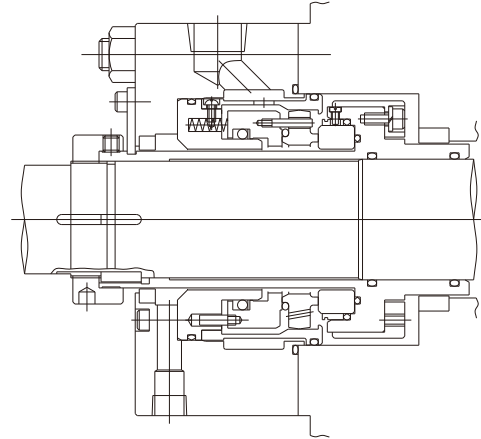
The floating ring type mechanical seal is a seal that is designed for use under high pressure, high speeds, and pressure fluctuation. It is mainly used in boiler water circulation pumps and boiler feed pumps for thermal power generation and private power generation, as well as reactor feed pumps, reactor water purification system circulation pumps, residual heat removal pumps, and other pumps for nuclear power generation.



Floating ring type mechanical seal (Static type)



- This seal is suitable for use under high load conditions. It provides stable sealability under high velocity, high pressure, and significant pressure fluctuation conditions.
- This product has a structure resistant to significant pressure fluctuations through the use of an almost bilaterally symmetrical floating ring made of carbon.
- Numerous flushing holes on the floating ring are designed to eliminate sliding heat effectively.
- This product adopts a static type structure to allow application under even higher load conditions.

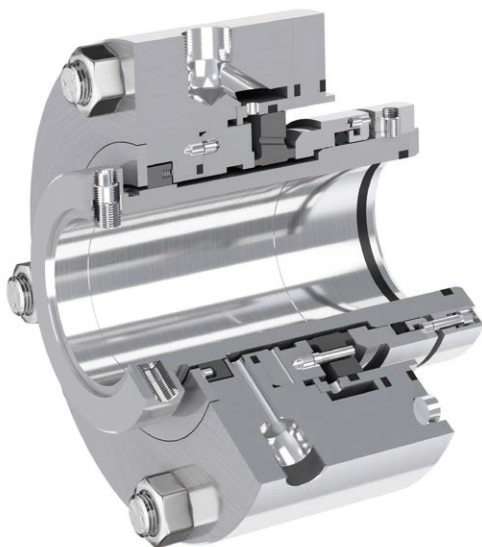


■ Specification conditions

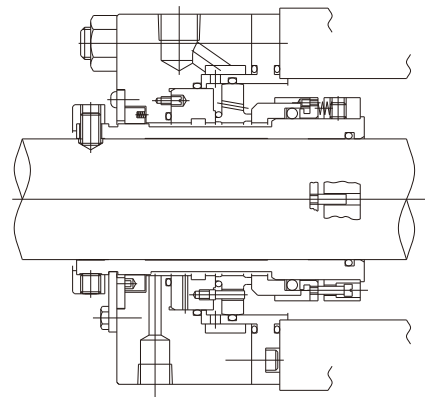
| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 80 max. | 10 max. |

Note: The nominal size is $\phi 50$ to $\phi 250$.

Floating ring type mechanical seal (Rotary type)



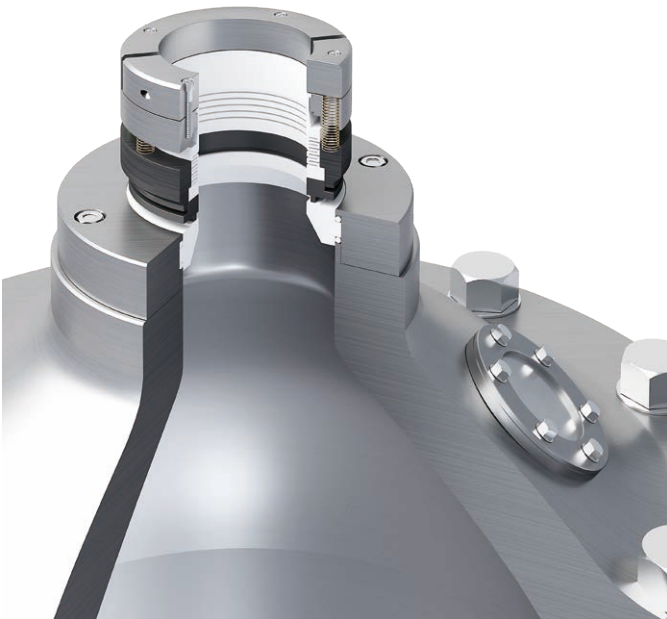
- This seal is suitable for use under high load conditions. It provides stable sealability under high pressure and significant pressure fluctuation conditions.
- This product has a structure resistant to significant pressure fluctuations through the use of an almost bilaterally symmetrical floating ring made of carbon.
- Numerous flushing holes on the floating ring are designed to eliminate sliding heat effectively.
- This product adopts a rotary type and compact structure.



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 20 max. | 10 max. |

Note: The nominal size is $\phi 35$ to $\phi 130$.



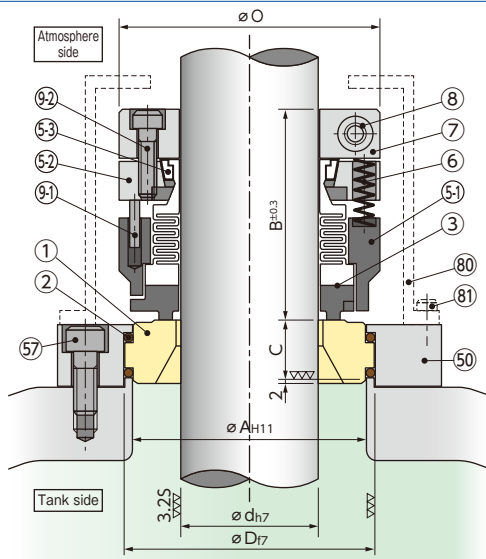
- This dry seal is best suited for sealing the shafts of vertical mixers.
- This dry-contact seal adopts “PTFE bellows” to provide excellent corrosion resistance.
- The wetted parts are made up of PTFE bellows and a stationary ring made of ceramic. Because no metal parts are in contact with canister gas, this product provides excellent corrosion resistance and effective measures to reduce contamination.
- No set screws are used to secure this product, so it can be used for lining tanks.
- Seal face materials can be selected according to the specifications.

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) |
|-------------|-----------------|------------------|
| 1.5 max. | FV to 0.5 | 0 to 175 *1 |

Note *1 For temperatures below 0°C or above 175°C, purge gas and flange jackets are required separately.

■ Basic structure and materials



Seal ring made of PTFE containing carbon fibers

■ Standard materials

| No. | Part name | Material | Qty |
|-----|--------------------------|----------------------------------|-----|
| 1 | Stationary ring | Ceramic | 1 |
| 2 | O-ring | PTFE containing glass fibers | 2 |
| 3 | Seal ring and bellows | PTFE containing filler, and PTFE | 1 |
| 5-1 | Spring retainer | PTFE containing carbon | 1 |
| 5-2 | Drive collar | SUS316 or equiv. | 1 |
| 5-3 | Adapter | SUS316 or equiv. | 1 |
| 6 | Spring | Alloy 20 | 1s |
| 7 | Stopper ring | SUS316 or equiv. | 1 |
| 8 | Hexagon socket head bolt | SUS316L or equiv. | 2 |
| 9-1 | Drive pin | SUS316 or equiv. | 1s |
| 9-2 | Hexagon socket head bolt | SUS316L or equiv. | 1s |

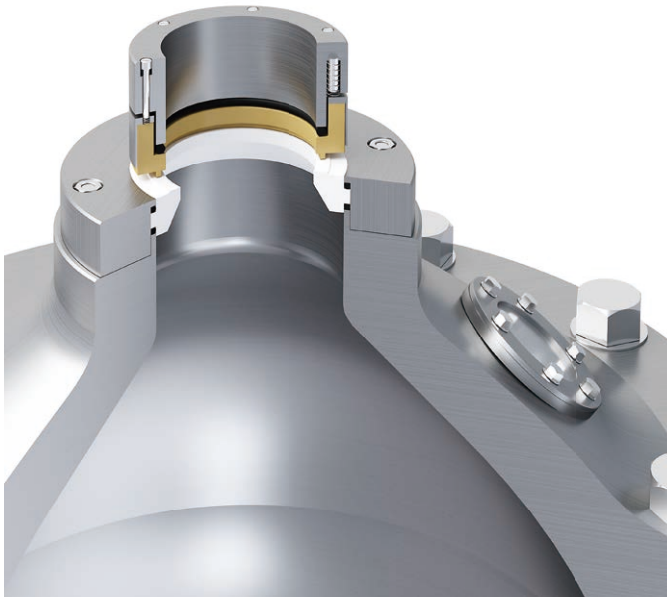
■ Optional parts

| No. | Part name | Material | Qty |
|-----|--------------------------|------------------|-----|
| 50 | Flange | SUS304 or equiv. | 1 |
| 57 | Hexagon socket head bolt | SUS304 or equiv. | 1s |
| 80 | Acrylic cover | Acryl | 1 |
| 81 | Hexagon socket head bolt | SUS304 or equiv. | 1s |



Seal ring made of PTFE containing special filler

Seal ring materials can be selected according to the specifications.
* The scope of application differs according to the material.



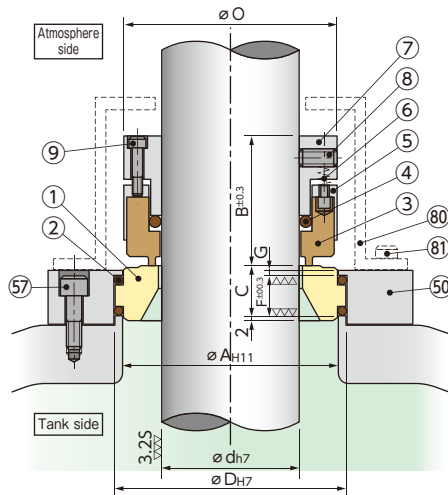
- This dry seal is best suited for sealing the shafts of vertical mixers.
- This product is a general-purpose dry-contact seal that uses a synthetic rubber O-ring as the shaft packing.
- PTFE containing filler and a stationary ring made of ceramic are adopted as the seal face materials. Because no metal parts are in contact with canister gas, this product provides excellent corrosion resistance and effective measures to reduce contamination.
- Seal face materials can be selected according to the specifications.

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) |
|-------------|-----------------|------------------|
| 1.5 max. | FV to 0.5 | 0 to 175 *1 |

Note *1 For temperatures below 0°C or above 175°C, purge gas and flange jackets are required separately.

■ Basic structure and materials



Seal ring made of PTFE containing special filler



Seal ring made of PTFE containing carbon fibers

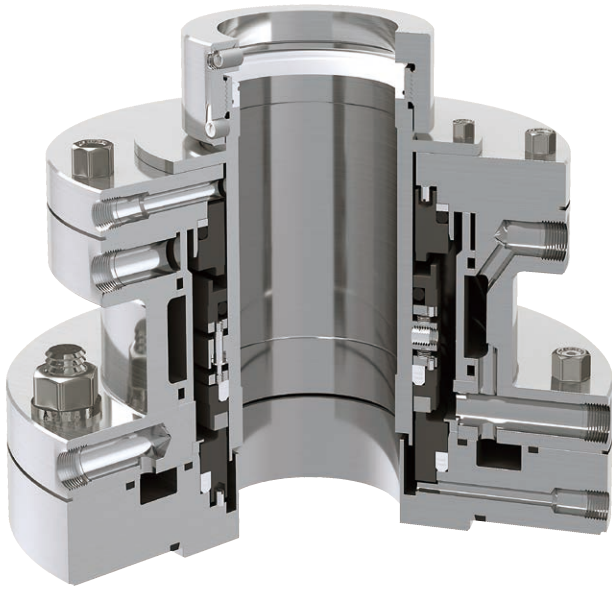
■ Standard materials

| No. | Part name | Material | Qty |
|-----|-----------------|------------------------|-----|
| 1 | Stationary ring | Ceramic | 1 |
| 2 | O-ring | — | 2 |
| 3 | Seal ring | PTFE containing filler | 1 |
| 4 | O-ring | — | 1 |
| 5 | Drive collar | SUS316 or equiv. | 1 |
| 6 | Spring | Alloy 20 | 1s |
| 7 | Spring retainer | SUS316 or equiv. | 1 |
| 8 | Set screw | SUS316 or equiv. | 1s |
| 9 | Drive pin | SUS316 or equiv. | 1s |

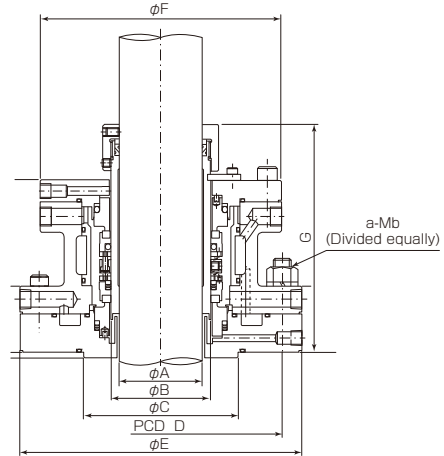
■ Optional parts

| No. | Part name | Material | Qty |
|-----|--------------------------|------------------|-----|
| 50 | Flange | SUS304 or equiv. | 1 |
| 57 | Hexagon socket head bolt | SUS304 or equiv. | 1s |
| 80 | Acrylic cover | Acryl | 1 |
| 81 | Hexagon socket head bolt | SUS304 or equiv. | 1s |

Seal ring materials can be selected according to the specifications.
* The scope of application differs according to the material.



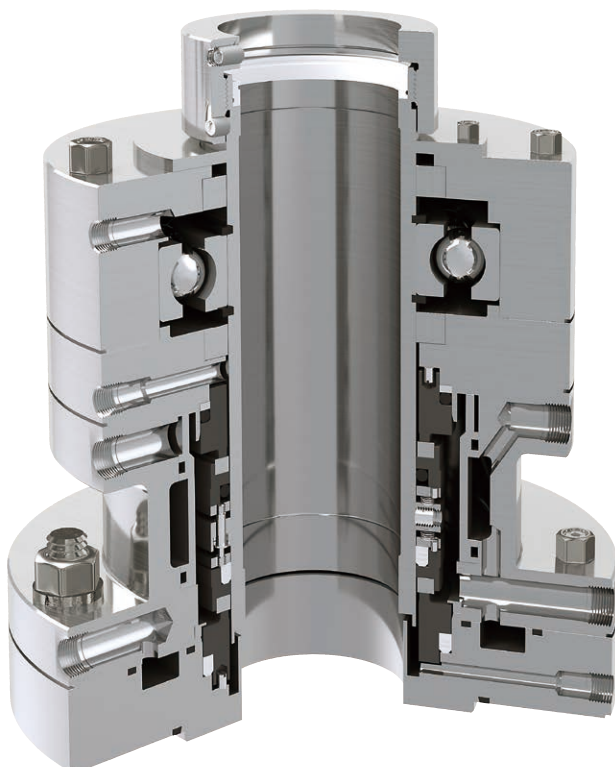
- This product is a rotary unbalanced type standard double seal for mixers. It is used for relatively low-pressure mixers.
- The mechanical seal unit is structured to have no bearings.
- A variety of customized designs can be provided according to the customer's specifications.



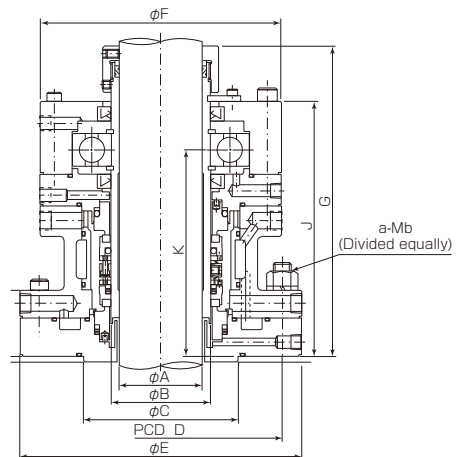
■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 2 max. | FV to 1 |

Note: For specifications other than those shown above, various customizations can also be provided. If you are interested in our customization services, please consult with us.



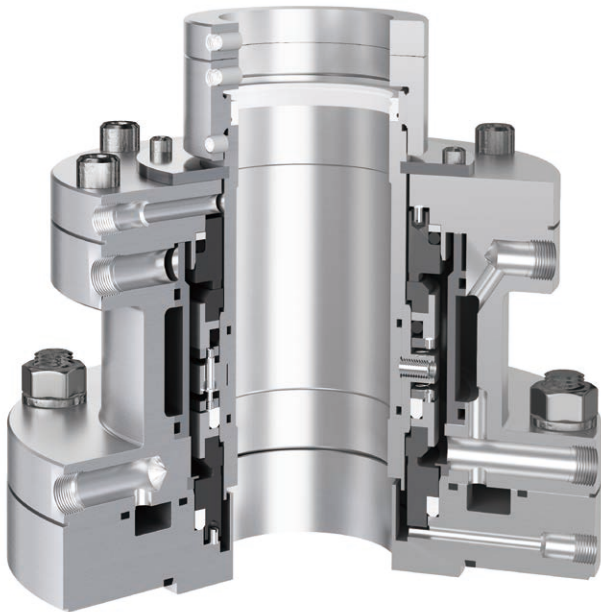
- This product is a rotary unbalanced type standard double seal for mixers. It is used for relatively low-pressure mixers.
- The mechanical seal unit is designed to have bearings.
- A variety of customized designs can be provided according to the customer's specifications.



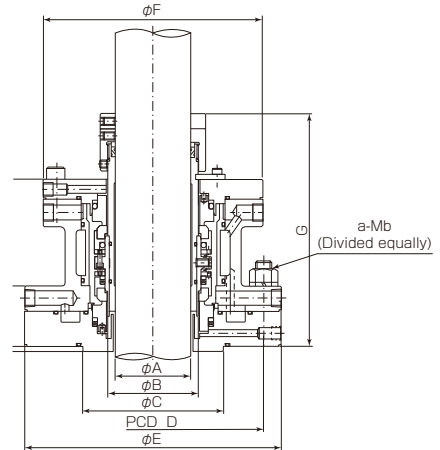
■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 2 max. | FV to 1 |

Note: For specifications other than those shown above, various customizations can also be provided. If you are interested in our customization services, please consult with us.



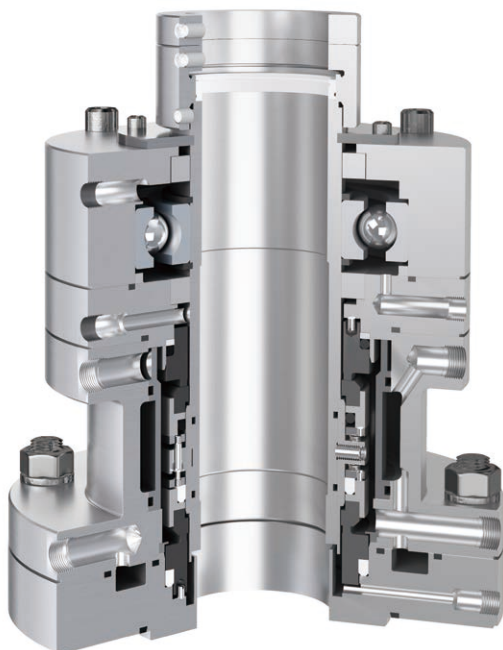
- This product is a rotary balanced type standard double seal for relatively high-pressure mixers.
- The mechanical seal unit is structured to have no bearings.
- A variety of customized designs can be provided according to the customer's specifications.



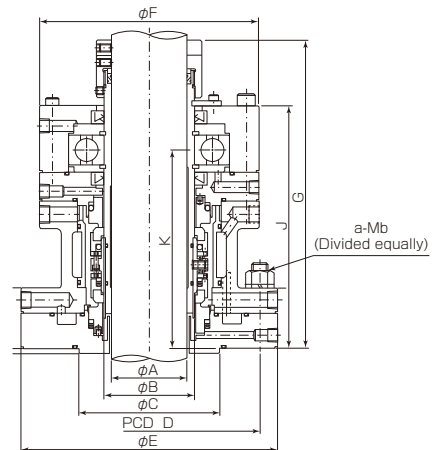
■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 2 max. | FV to 4 |

Note: For specifications other than those shown above, various customizations can also be provided. If you are interested in our customization services, please consult with us.



- This product is a rotary balanced type standard double seal for relatively high-pressure mixers.
- The mechanical seal unit is designed to have bearings.
- A variety of customized designs can be provided according to the customer's specifications.



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 2 max. | FV to 4 |

Note: For specifications other than those shown above, various customizations can also be provided. If you are interested in our customization services, please consult with us.

Highly reliable static type mechanical seal

Because the sleeve is integrally designed, it does not cause shaft wear and provides stable performance for a long time. Moreover, springs are externally mounted, which resolves leakage originating from seal ring operability deterioration.

Product series lineup applicable to various fluids and conditions

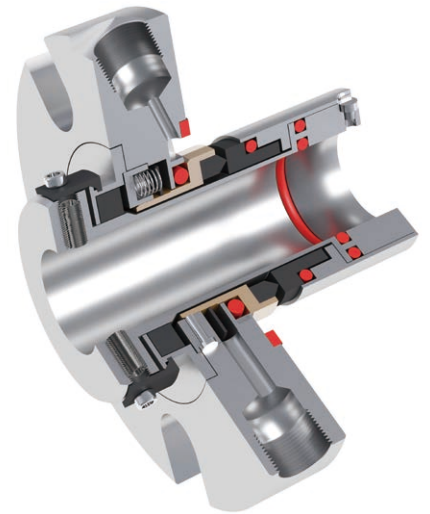
Focusing on “type GAKEM,” which employs a knife edge seal, we also have added “type GABE5,” which handles high pressure, “type GXKEM,” which handles high-concentration slurry, and a tandem seal type.

“Four-action installation” that requires no assembly experience

Mechanical seal installation can be completed with only four actions.

Best suited for replacement of gland packing

Gland follower bolts can be reused and our product design is applicable to standard pumps compliant with ISO and DIN standards.

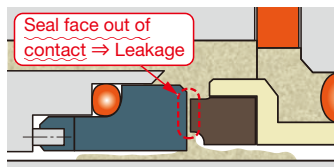


Features

Knife Edge technology * Incorporated in all models other than type GABE5

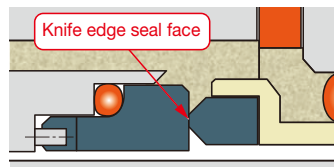
- Silicon carbide (SiC) is adopted as the seal face material. It provides excellent wear resistance and chemical resistance, and a long service life can also be expected.
- This product is particularly suitable for high-viscosity coagulable fluids that are difficult to maintain sealing performance.
- Because of small sliding heat and excellent cooling performance, this product can also be used without flushing, depending on the conditions.
- Because of little sliding resistance, this product features small energy loss.

Best suited for high-viscosity coagulable fluids



General mechanical seal

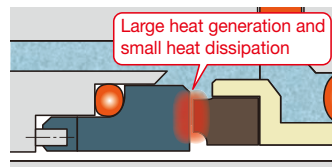
High-viscosity liquid gets caught or coagula are formed on the seal face, causing the sealing face to leave the shaft.



Knife edge seal

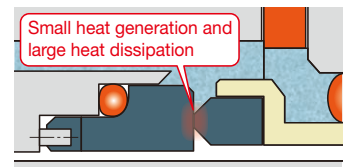
High surface pressure generated by the narrow face width prevents high-viscosity liquid from getting caught on the seal face, and cuts and eliminates coagula. The seal face hardly leaves the shaft, providing high sealability.

Small sliding heat and excellent cooling performance



General mechanical seal

Because the seal face is large and the amount of heat generated is large, if cooling is insufficient, lubricating film may be lost, resulting in seizure.

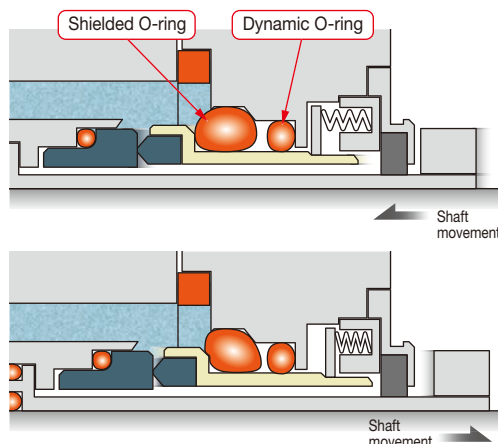


Knife edge seal

Because the seal face width is small, the amount of heat generated is small. Moreover, the heat dissipation area is large, providing excellent cooling performance.

Technology for resisting high-concentration slurry * Incorporated in type GXKEM

In addition to the general advantages of the knife edge seal, “type GXKEM” is additionally equipped with new mechanism “Shielded O-ring.” Cassette seals can now be applied to our services for even higher-concentration slurry.



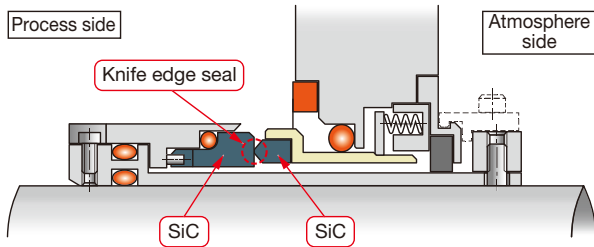
The type GXKEM “Shielded O-ring” is made of special soft rubber. This O-ring freely changes its shape by taking advantage of its flexibility and prevents slurry from intruding into the seal ring, while ensuring the followability of the seal ring.

PILLAR Cassette Seal lineup

“PILLAR Cassette Seal” with a number of features such as static type cartridges and easy installation. Focusing on “type GAKEM,” we provide various models and options that can be applied to a wide range of operating conditions.

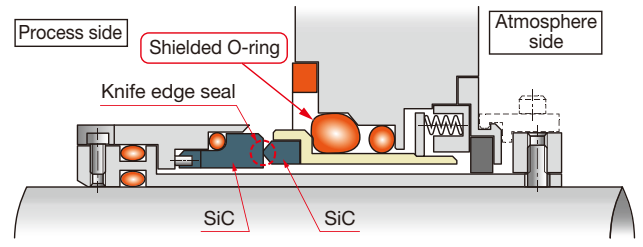
Standard knife edge seal Type GAKEM

The standard configuration of PILLAR Cassette Seal is SiC/SiC seal face materials and knife edge seal.



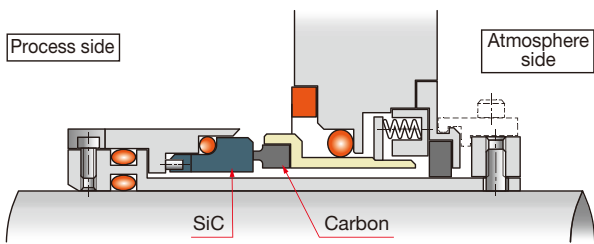
High-concentration slurry resistance type Type GXKEM

This type is equipped with a shielded O-ring to minimize the adverse effects of slurry on performance. It supports high-concentration slurry resistance specifications.



High-pressure resistance type Type GABE5

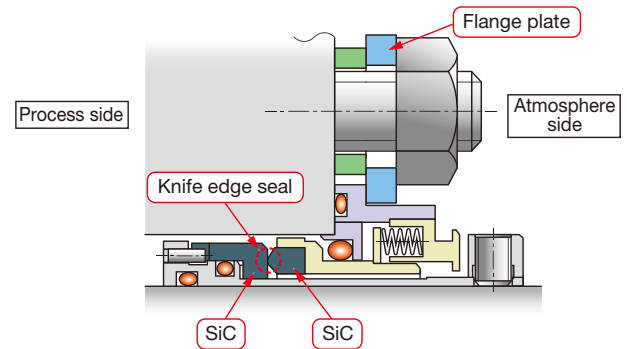
This type consists of general-purpose SiC and carbon seal face materials to resist a fluid pressure of up to 2.5 MPaG.



Flangeless cassette seal Type GAKPM

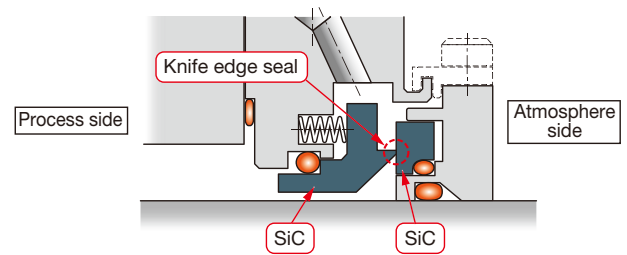
The applicable range of mating dimensions has been expanded by adopting a flange plate that allows the fixing method to be freely designed.

* The flange plate is optional.



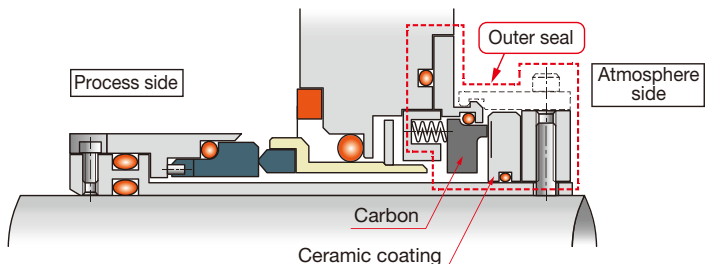
Outside static-type cartridge type seal Type GAKQM

Our original “knife edge seal” has been adopted to further expand the application range.



Tandem seal option Type FCURO

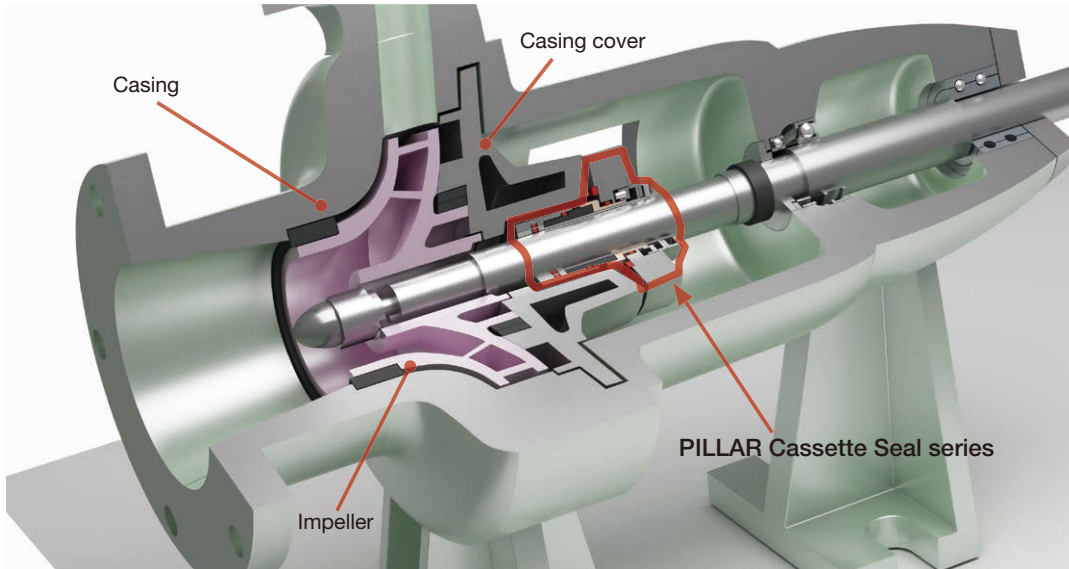
We also provide a lineup of products integrated with an outer seal that can be mounted on any PILLAR Cassette Seal products.



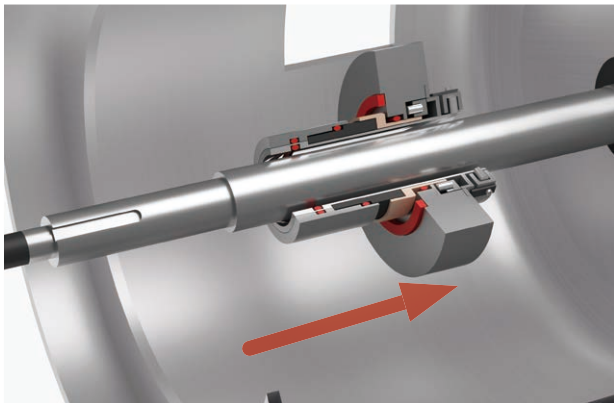
* Except for type GAKQM (outside cassette seal) and type GAKPM (flangeless cassette seal)

■ Easy installation with only four actions

“Compact design,” which allows bolt-on installation on pumps compliant with ISO and DIN standards, and “4-action installation,” which requires no dimension adjustment, can now be applied to a large number of pumps, and installation and replacement no longer require experience.

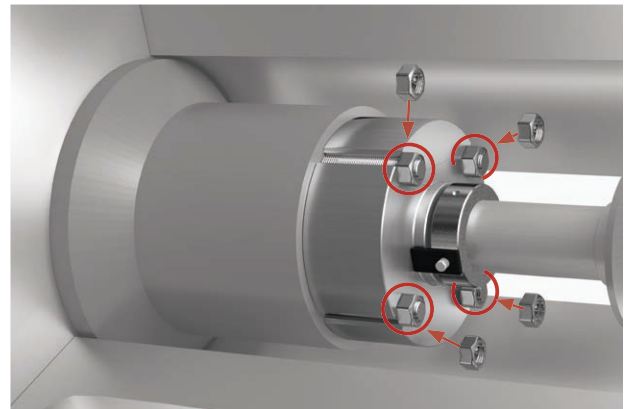


Action 1



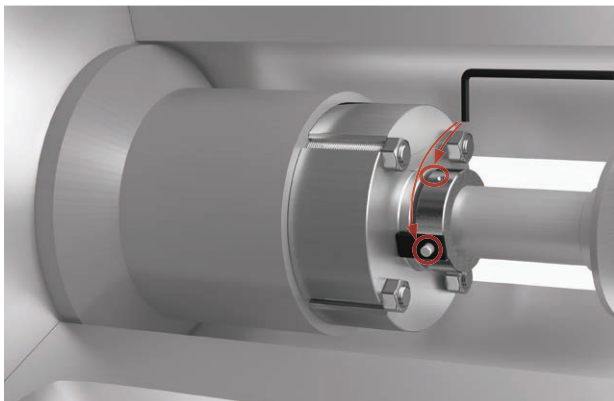
Insert the cassette seal assembly into the shaft of the pump from which the casing, impeller, and casing cover have been removed.

Action 2



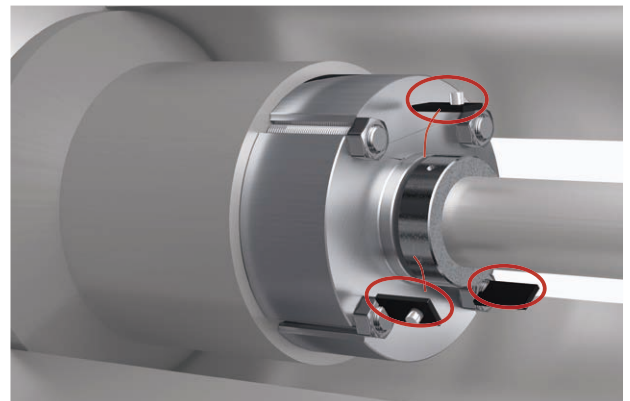
After reassembling the pump body, secure the cassette seal assembly with stuffing box unit bolts.

Action 3



Tighten all the set screws on the cassette seal to secure the parts on the rotation side of the seal onto the pump shaft.

Action 4



Remove the set plates that restrict the cassette seal to the specified mounting length when it is in the assembly state. This completes the mechanical seal installation work.

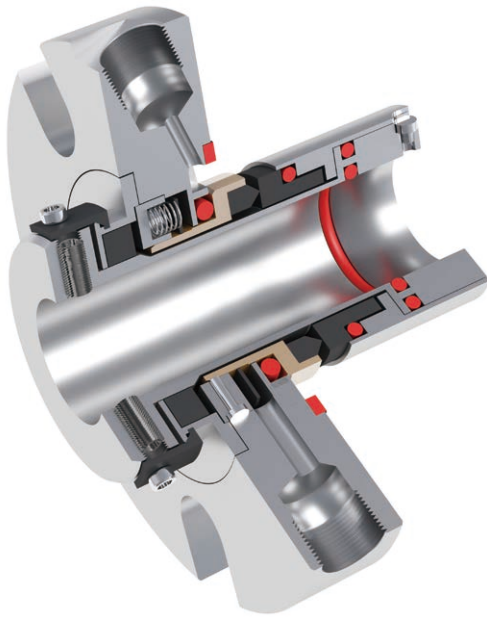
* The set plates are also required to remove the cassette seal.

MECHANICAL SEAL

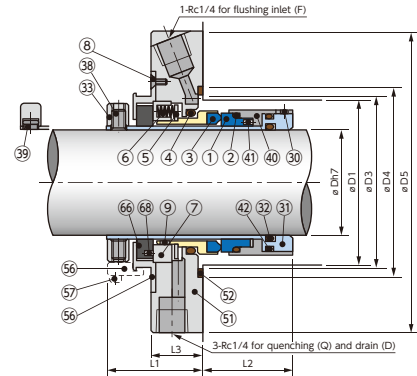
GAKEM

PILLAR CASSETTE SEAL™ (Standard type)

- Oil refinery/petrochemical
- Energy/environment
- Chemical
- Water supply and sewerage system
- Pump
- Mixer/low-speed rotary machine



- This product has the standard structure of PILLAR Cassette Seal.
- This product adopts SiC/SiC seal face materials and knife edge seal structure.



| No. | Part | Standard material | Qty | No. | Part | Standard material | Qty |
|-----|-----------------|-------------------|-----|-----|--------------------------|-------------------|-----|
| 1 | Rotating ring | SiC | 1 | 38 | Set screw | SUS316 or equiv. | 4 |
| 2 | O-ring | FKM | 1 | 39 | Pin | SUS304 or equiv. | 2 |
| 3 | Seal ring | SiC and titanium | 1 | 40 | Drive ring | SUS316 or equiv. | 1 |
| 4 | O-ring | FKM | 1 | 41 | Pin | SUS304 or equiv. | 1 |
| 5 | Plate | SUS304 or equiv. | 1 | 42 | O-ring | FKM | 1 |
| 6 | Spring | SUS316 or equiv. | 1s | 51 | Flange | SUS316 or equiv. | 1 |
| 7 | Spring retainer | SUS304 or equiv. | 1 | 52 | Gasket | FKM | 1 |
| 8 | Machine screw | SUS304 or equiv. | 4 | 55 | Adapter | SUS304 or equiv. | 1 |
| 9 | Pin | SUS304 or equiv. | 2 | 56 | Set plate | Carbon steel | 3 |
| 30 | Pin | SUS316 or equiv. | 1 | 57 | Hexagon socket head bolt | SUS304 or equiv. | 3 |
| 31 | Sleeve | SUS316 or equiv. | 1 | 66 | Throttle bushing | Carbon | 1 |
| 32 | O-ring | FKM | 1 | 68 | Pin | SUS304 or equiv. | 1 |
| 33 | Stopper ring | SUS304 or equiv. | 1 | | | | |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Slurry concentration (wt%) |
|-------------|-----------------|------------------|----------------------------|
| 20 max. | 1.0 | -20 to 150 | 10 max. |

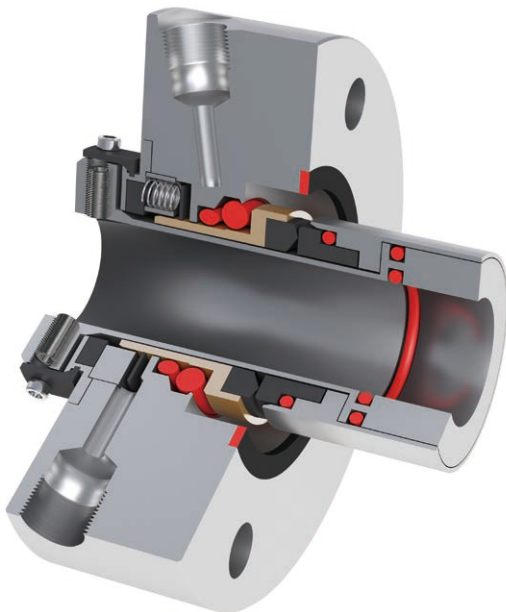
- Notes: 1) The maximum PV value is 10 MPaG-m/s.
 2) If the fluid temperature is below the boiling point (-20°C) of the fluid, we can consider non-flushing and non-quenching applications. (However, this depends on the liquid quality, pressure, and other factors.) If the fluid temperature is above the maximum temperature, an appropriate cooling system such as a flushing cooler is required.
 3) The operating temperature differs according to the O-ring material used.

MECHANICAL SEAL

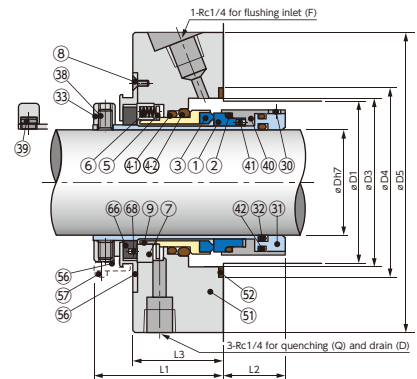
GXKEM

PILLAR CASSETTE SEAL™ (High-concentration slurry resistance type cassette seal)

- Oil refinery/petrochemical
- Energy/environment
- Chemical
- Water supply and sewerage system
- Pump
- Mixer/low-speed rotary machine



- High-concentration slurry resistance specification based on the technology for resisting high-concentration slurry
- This product adopts SiC/SiC seal face materials and knife edge seal structure.
- This type is equipped with a shielded O-ring to reduce the adverse effects of slurry on performance.



| No. | Part | Standard material | Qty | No. | Part | Standard material | Qty |
|-----|-----------------|-------------------|-----|-----|--------------------------|-------------------|-----|
| 1 | Rotating ring | SiC | 1 | 33 | Stopper ring | SUS304 or equiv. | 1 |
| 2 | O-ring | NBR | 1 | 38 | Set screw | SUS316 or equiv. | 4 |
| 3 | Seal ring | SiC and titanium | 1 | 39 | Pin | SUS304 or equiv. | 2 |
| 4-1 | O-ring | NBR | 1 | 40 | Drive ring | SUS316 or equiv. | 1 |
| 4-2 | Shielded O-ring | NBR | 1 | 41 | Pin | SUS304 or equiv. | 1 |
| 5 | Plate | SUS304 or equiv. | 1 | 42 | O-ring | NBR | 1 |
| 6 | Spring | SUS316 or equiv. | 1s | 51 | Flange | SUS316 or equiv. | 1 |
| 7 | Spring retainer | SUS304 or equiv. | 1 | 52 | Gasket | NBR | 1 |
| 8 | Machine screw | SUS304 or equiv. | 4 | 55 | Adapter | SUS304 or equiv. | 1 |
| 9 | Pin | SUS304 or equiv. | 2 | 56 | Set plate | Carbon steel | 3 |
| 30 | Pin | SUS316 or equiv. | 1 | 57 | Hexagon socket head bolt | SUS304 or equiv. | 3 |
| 31 | Sleeve | SUS316 or equiv. | 1 | 66 | Throttle bushing | Carbon | 1 |
| 32 | O-ring | NBR | 1 | 68 | Pin | SUS304 or equiv. | 1 |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Slurry concentration (wt%) |
|-------------|-----------------|------------------|----------------------------|
| 10 max. | 1.0 | -20 to 150 | 30 max. |

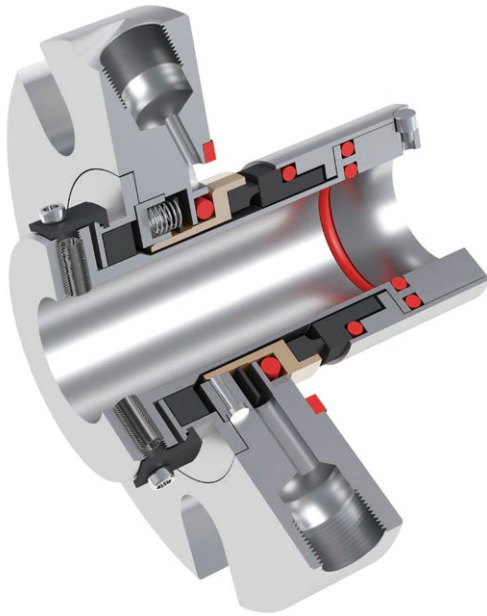
- Notes: 1) The maximum PV value is 6 MPaG-m/s.
 2) If the fluid temperature is below the boiling point (-40°C) of the fluid, we can consider non-flushing and non-quenching applications. (However, this depends on the liquid quality, pressure, and other factors.) If the fluid temperature is above the maximum temperature, an appropriate cooling system such as a flushing cooler is required.
 3) The operating temperature differs according to the O-ring material used. (The O-ring material can be selected from NBR, EPDM, silicone rubber, and fluoro rubber.)

MECHANICAL SEAL

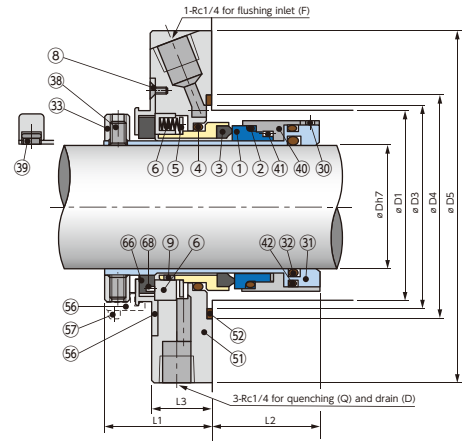
GABE5

PILLAR CASSETTE SEAL™ (High-pressure type cassette seal)

- Oil refinery/petrochemical
- Energy/environment
- Chemical
- Water supply and sewerage system
- Pump
- Mixer/low-speed rotary machine



- This cassette seal can handle a fluid pressure of up to 2.5 MPaG according to the combination of SiC and carbon seal face materials.
- This product adopts a static type structure. Shaft wear does not occur and an externally mounted spring system reduces the operability impediment caused by the fluid contained, which achieves long-term stable operation.



| No. | Part | Standard material | Qty | No. | Part | Standard material | Qty |
|-----|-----------------|---------------------|-------|-----|--------------------------|-------------------|-----|
| 1 | Rotating ring | SiC | 1 | 38 | Set screw | SCM435 or equiv. | 4 |
| 2 | O-ring | FKM | 1 | 39 | Pin | SUS304 or equiv. | 2 |
| 3 | Seal ring | Carbon and titanium | 1 | 40 | Drive ring | SUS316 or equiv. | 1 |
| 4 | O-ring | FKM | 1 | 41 | Pin | SUS304 or equiv. | 1 |
| 5 | Plate | SUS304 or equiv. | 1 | 42 | O-ring | FKM | 1 |
| 6 | Spring | SUS316 or equiv. | 1 set | 51 | Flange | SUS316 or equiv. | 1 |
| 7 | Spring retainer | SUS304 or equiv. | 1 | 52 | Gasket | FKM | 1 |
| 8 | Machine screw | SUS304 or equiv. | 4 | 55 | Adapter | SUS304 or equiv. | 1 |
| 9 | Pin | SUS304 or equiv. | 2 | 56 | Set plate | Carbon steel | 3 |
| 30 | Pin | SUS316 or equiv. | 1 | 57 | Hexagon socket head bolt | SUS304 or equiv. | 3 |
| 31 | Sleeve | SUS316 or equiv. | 1 | 66 | Throttle bushing | Carbon | 1 |
| 32 | O-ring | FKM | 1 | 68 | Pin | SUS304 or equiv. | 1 |
| 33 | Stopper ring | SUS304 or equiv. | 1 | | | | |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) |
|-------------|-----------------|------------------|
| 20 max. | 2.5 | -20 to 150 |

- Notes: 1) The maximum PV value is 25 MPaG-m/s.
 2) The operating temperature differs according to the O-ring material used.
 3) The maximum operating temperature is separately limited by the boiling point (-20°C) of the fluid. If the fluid temperature is above the maximum temperature, an appropriate cooling system such as a flushing cooler is required.

MECHANICAL SEAL

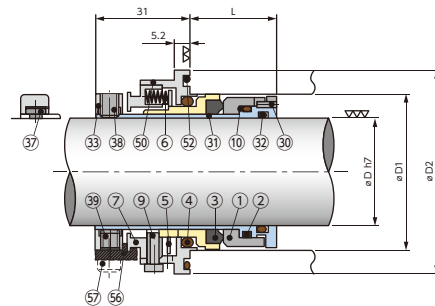
GAKPM

PILLAR CASSETTE SEAL™ (Flangeless cassette seal)

- Oil refinery/petrochemical
- Energy/environment
- Chemical
- Water supply and sewerage system
- Pump
- Mixer/low-speed rotary machine



- Cost reduction and space saving have been achieved by changing the fixed flange to a fixed plate.
- This product adopts SiC/SiC seal face materials and knife edge seal structure.



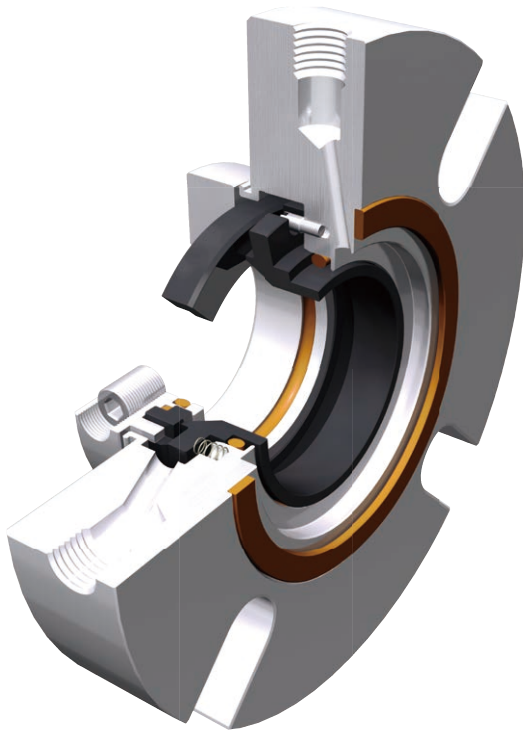
| No. | Product name | Standard material | Qty | No. | Product name | Standard material | Qty |
|-----|-----------------|------------------------------|-------|-----|--------------------------|-------------------|-----|
| 1 | Rotating ring | SiC | 1 | 31 | Sleeve | SUS316 or equiv. | 1 |
| 2 | O-ring | FKM | 1 | 32 | O-ring | FKM | 1 |
| 3 | Seal ring | SiC and titanium | 1 | 33 | Stopper ring | SUS304 or equiv. | 1 |
| 4 | O-ring | FKM | 1 | 37 | Pin | SUS304 or equiv. | 2 |
| 5 | Plate | SUS304 or equiv. | 1 | 38 | Set screw | SUS316 or equiv. | 2 |
| 6 | Spring | SUS316 or equiv. | 1 set | 39 | Set screw | SUS316 or equiv. | 2 |
| 7 | Spring retainer | SUS304 or equiv. | 1 | 50 | Casing | SUS316 or equiv. | 1 |
| 9 | Pin | SUS304 or equiv. | 1 set | 52 | O-ring | FKM | 1 |
| 10 | Seat | PIFE containing glass fibers | 1 | 56 | Set plate | Carbon steel | 3 |
| 30 | Pin | SUS316 or equiv. | 1 | 57 | Hexagon socket head bolt | SUS304 or equiv. | 3 |

■ Specification conditions

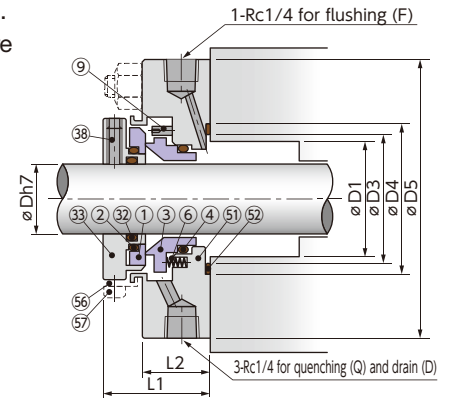
| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Slurry concentration (wt%) |
|-------------|-----------------|------------------|----------------------------|
| 10 max. | 0.6 | -20 to 150 | 10 max. |

- Notes: 1) The maximum PV value is 6 MPaG-m/s.
 2) If the fluid temperature is below the boiling point (-20°C) of the fluid, we can consider non-flushing and non-quenching applications. (However, this depends on the liquid quality, pressure, and other factors.)
 3) The operating temperature differs according to the O-ring material used.

PILLAR CASSETTE SEAL™ (Outside static-type cassette seal)



- This product employs an outside structure that achieves space saving.
- This product adopts SiC/SiC seal face materials and knife edge seal structure.
- Static type structure



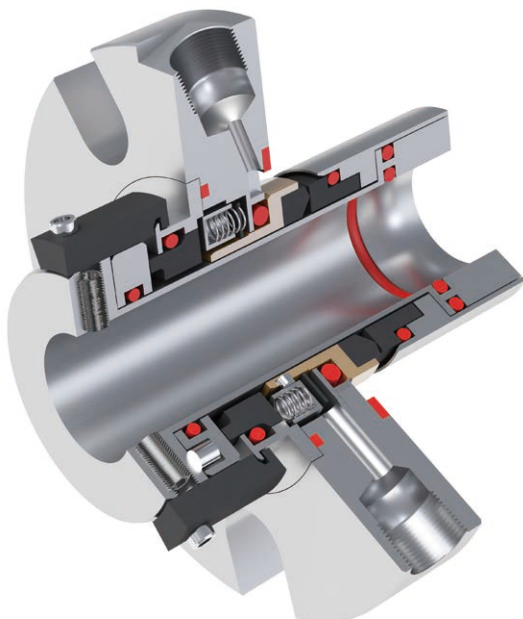
| No. | Part name | Standard material | Qty | No. | Part name | Standard material | Qty |
|-----|---------------|-------------------|-------|-----|--------------------------|------------------------|-------|
| 1 | Rotating ring | SiC | 1 | 33 | Stopper ring | SUS316 or equiv. | 1 |
| 2 | O-ring | FKM | 1 | 38 | Set screw | SUS316 or equiv. | 1 set |
| 3 | Seal ring | SiC | 1 | 51 | Flange | SUS316 or equiv. | 1 |
| 4 | O-ring | FKM | 1 | 52 | Gasket | PTFE containing filler | 1 |
| 6 | Spring | SUS316 or equiv. | 1 set | 56 | Set plate | Carbon steel | 1 set |
| 9 | Drive pin | SUS316 or equiv. | 1 set | 57 | Hexagon socket head bolt | SUS304 or equiv. | 1 set |
| 32 | O-ring | FKM | 1 | | | | |

■ Specification conditions

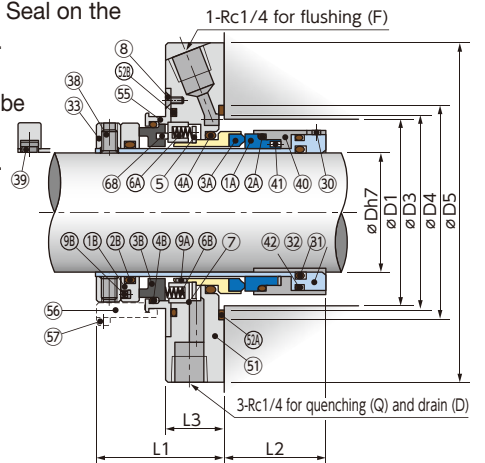
| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Slurry concentration (wt%) |
|-------------|-----------------|------------------|----------------------------|
| 15 max. | 0.8 | -20 to 150 | 5 max. |

- Notes: 1) The maximum PV value is 8 MPaG·m/s.
 2) If the fluid temperature is below the boiling point (-40°C) of the fluid, we can consider non-flushing and non-quenching applications. (However, this depends on the liquid quality, pressure, and other factors.) If the fluid temperature is above the maximum temperature, an appropriate cooling system such as a flushing cooler is required.
 3) The operating temperature differs according to the O-ring material used.

PILLAR CASSETTE SEAL™ (Tandem seal option)



- Tandem seal configuration can be achieved by arranging any PILLAR Cassette Seal on the atmosphere side.
- Tandem seal configuration can be achieved in a space saving way.



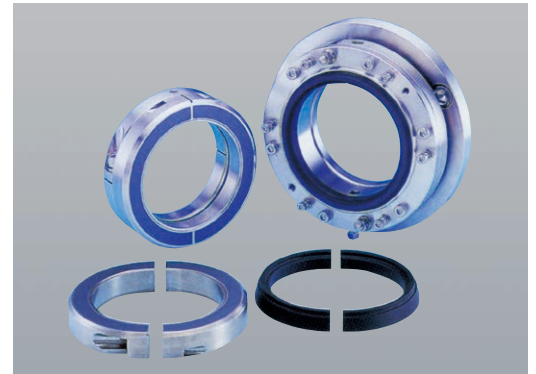
| No. | Part | Standard material | Qty | No. | Part | Standard material | Qty |
|-----|-----------------|------------------------------|-----|-----|--------------------------|-------------------|-----|
| 1A | Rotating ring | SiC | 1 | 31 | Sleeve | SUS316 or equiv. | 1 |
| 2A | O-ring | FKM | 1 | 32 | O-ring | FKM | 1 |
| 3A | Seal ring | SiC and titanium | 1 | 33 | Stopper ring | SUS304 or equiv. | 1 |
| 4A | O-ring | FKM | 1 | 38 | Set screw | SUS316 or equiv. | 4 |
| 5 | Plate | SUS304 or equiv. | 1 | 39 | Pin | SUS304 or equiv. | 2 |
| 6A | Spring | SUS316 or equiv. | 1s | 40 | Drive ring | SUS316 or equiv. | 1 |
| 7 | Spring retainer | SUS304 or equiv. | 1 | 41 | Pin | SUS304 or equiv. | 1 |
| 8 | Machine screw | SUS304 or equiv. | 4 | 42 | O-ring | FKM | 1 |
| 1B | Rotating ring | SUS316 or equiv. and ceramic | 1 | 51 | Flange | SUS316 or equiv. | 1 |
| 2B | O-ring | FKM | 2 | 52A | Gasket | FKM | 1 |
| 3B | Seal ring | Carbon | 2 | 52B | O-ring | FKM | 1 |
| 4B | O-ring | FKM | 2 | 55 | Adapter | SUS304 or equiv. | 1 |
| 6B | Spring | SUS316 or equiv. | 2 | 56 | Set plate | SUS304 or equiv. | 3 |
| 9A | Pin | SUS304 or equiv. | 2 | 57 | Hexagon socket head bolt | SUS304 or equiv. | 3 |
| 9B | Pin | SUS316 or equiv. | 2 | 68 | Pin | SUS304 or equiv. | 1 |
| 30 | Pin | SUS316 or equiv. | 1 | | | | |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 20 max. | 1.0 |

- Notes: 1) However, the box pressure must be greater than quenching pressure.
 2) The operating temperature differs according to the O-ring material used.

Pump dry running can be performed by adopting PILLAR ARI^{II} Seal™. This contributes to simplifying standby pump systems and shortening maintenance time.



■ Features

■ Dry running can be performed

The adoption of special carbon with excellent lubricity that PILLAR developed has made it possible to perform dry running for more than one hour.

■ Improved maintainability

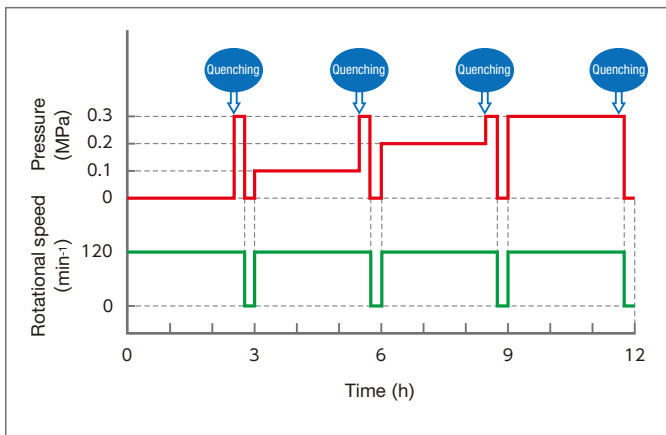
Replacement of mechanical seal parts has been made easier by dividing the sliding parts on the stationary side and parts on the rotation side that are replaced during maintenance into two sections.

■ Flushing system not required

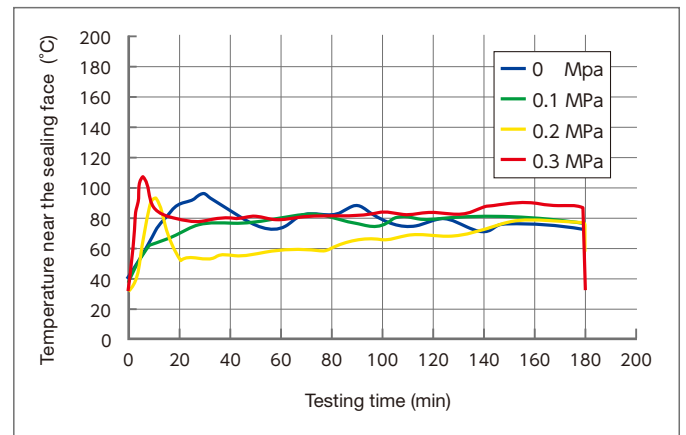
No seal water feed system is required because non-water feed operation can be performed during dry running, as well as during normal operation.

■ Mechanical seal performance verification testing

Operation mode Mechanical seal being tested: Model "ARI-D," size "φ141"



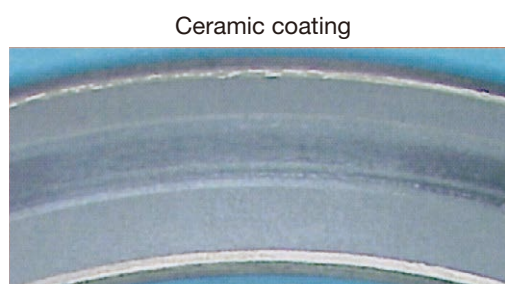
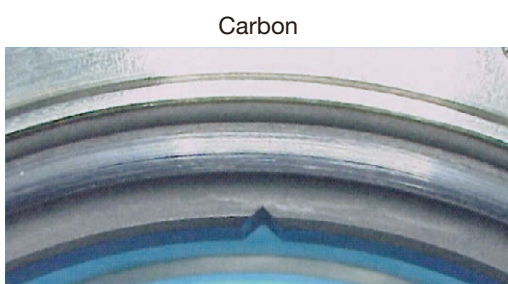
Seal face temperature during dry running



■ Test results

- The seal face temperature increase during dry running was extremely small.
- No problem occurred when dry running was switched to pumping operation.
- After operation, the seal face was in good condition.

■ Seal face condition after testing

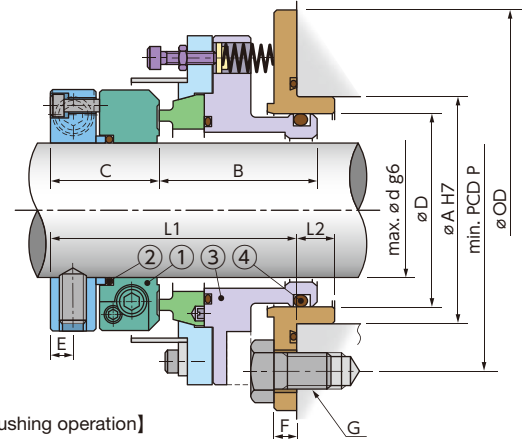
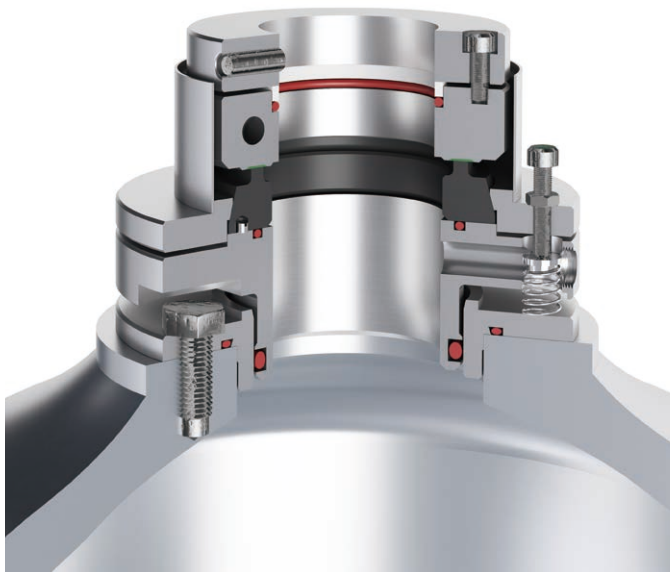


After 12-hour dry running, both seal faces had no damage.

Application examples

- Vertical-shaft standby pump
- Vertical-shaft pump for discharging sewage and rainwater
- Vertical-shaft pump for discharging river water

| No. | Part name | Standard material |
|------------------|----------------------------|------------------------------|
| 1 | Rotating ring (split type) | SUS316 or equiv. and ceramic |
| 2 | O-ring | FKM |
| 3 | Seal ring (split type) | Special carbon |
| 4 | O-ring | NBR |
| Other components | | SUS304 or equiv. |



[Non-flushing operation]

Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Slurry concentration (ppm) |
|-------------|-----------------|------------------|----------------------------|
| 12 max. | 0.5 | 80 | 2000 max. |

Notes: 1) The maximum PV value is 4 MPaG-m/s.
2) Applicable shaft diameter: ø30 to ø400

[Dry-running operation]

Specification conditions

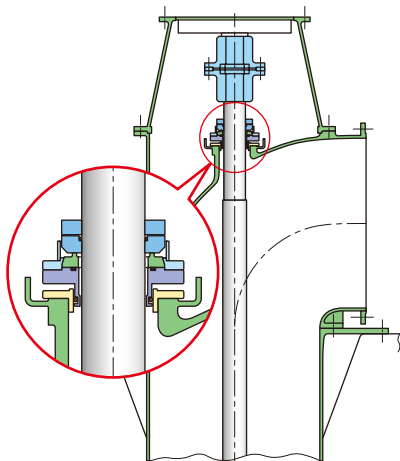
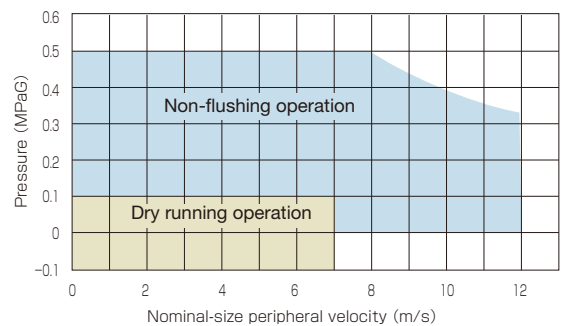
| Speed (m/s) | Pressure (MPaG) | Slurry concentration (ppm) |
|-------------|-----------------|----------------------------|
| 7 max. | 0.1 *1 | 2000 max. |

Note: Dry running can be performed for up to one hour.
*1 This product can also be used under continuous load conditions.

Performance

| Model | ARI ^{II} -D |
|--------------------------------------|---|
| Sealing materials | Ceramic coating (split) and carbon (split) |
| Applicable shaft diameter | ø30 to ø400 |
| Usage range (Non-flushing operation) | <ul style="list-style-type: none"> · Pressure: 0.5 MPa max. · Speed: 12 m/s max. · PV value: 4 MPa-m/s max. · Temperature: 80°C max. |
| Dry-running operation performance | <ul style="list-style-type: none"> · Dry running can be performed for up to one hour · Pressure: 0.1 MPa max. · Speed: 7 m/s max. · The product can also be used under continuous load conditions |
| Applicable water quality | Slurry: 2,000 ppm or less |

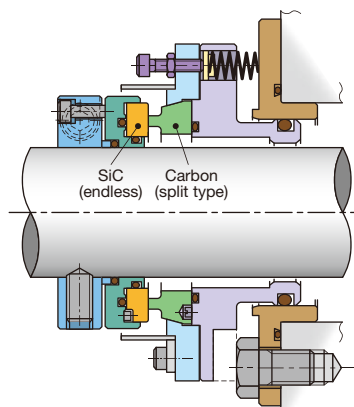
Scope of application for non-flushing operation (PV value)



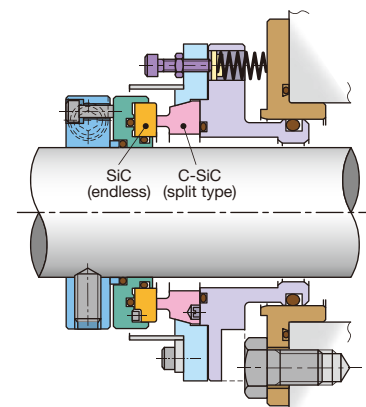
Dry-running (standby operation) resistant mechanical seal

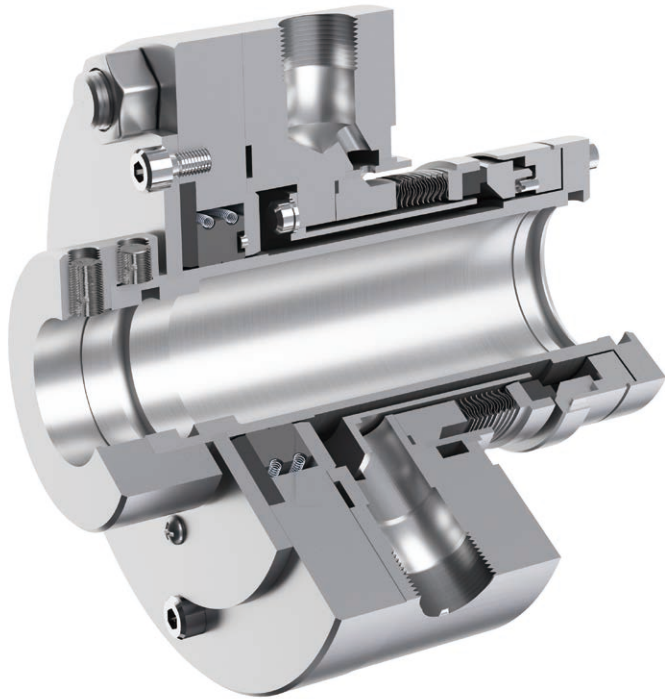
Applications

- Deep groundwater pump
A pump that generates boost pressure exceeding 0.5 MPa

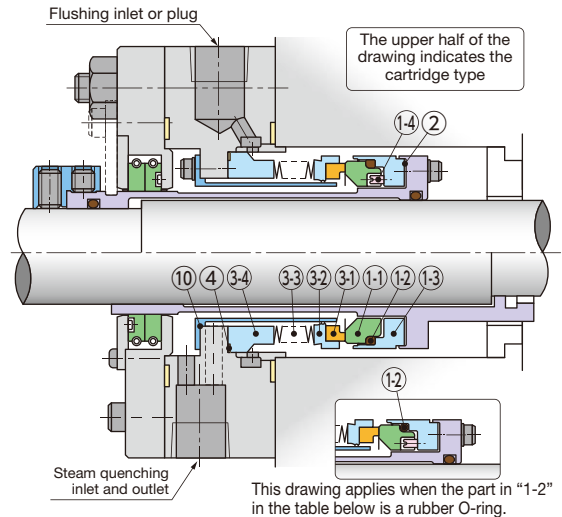


- Sludge pump
A pump that handles relatively high-concentration slurry





- Highly reliable double welded bellows with excellent pressure resistance and flexibility are adopted as a standard feature.
- A static type structure with a high tolerance to perpendicularity is adopted as a standard feature.
- A structure that prevents damage to bellows is used.



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) |
|-------------|-----------------|------------------|
| 60 max. | 3 *1 | 450 max. |

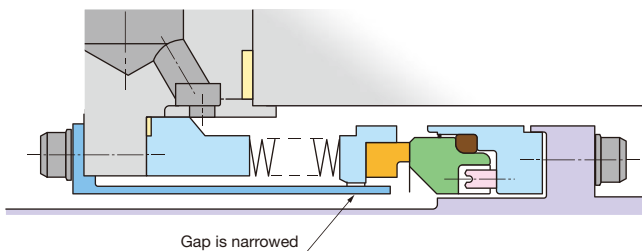
Note: The nominal size is $\phi 39$ to $\phi 136$.
 *1 The maximum operating pressure differs according to the nominal-size peripheral velocity.

| No. | Part name | Standard material | Qty | No. | Part name | Standard material | Qty |
|-----|---------------|-------------------------|-----|-----|-----------|--------------------|-----|
| 1-1 | Rotating ring | SIC | 1 | 3-1 | Seal ring | Carbon | 1 |
| 1-2 | Gasket O-ring | PILLARFOIL P/#6610 FFKM | 1 | 3-2 | Retainer | Special alloy | 1 |
| 1-3 | Drive ring | SUS316 or equiv. | 1 | 3-3 | Bellows | Inconel | 1 |
| 1-4 | Pin | SUS316 or equiv. | 1 | 3-4 | Adapter | SUS316 or equiv. | 1 |
| 2 | Gasket | PILLARFOIL P/#6633 | 1 | 4 | Gasket | PILLARFOIL P/#6633 | 1 |
| | | | | 10 | Baffle | SUS304 or equiv. | 1 |

■ Highest-standard Inconel double bellows adopted as a standard feature

Welded metal bellows employ Inconel with excellent corrosion resistance and mechanical strength as a standard feature and can be applied to a wide range of temperatures.

■ High-performance bellows seal
 Preventing resonance

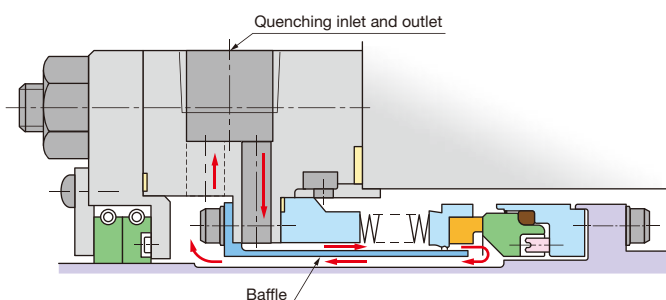


If the lubrication condition of the seal face is poor, friction force fluctuation (stick slip) will occur, which may cause the bellows to resonate due to torsional vibration or swinging vibration of the seal ring.



Stable sealability and increased longevity are expected by narrowing the gap in the radial direction between the baffle and the seal ring to prevent the seal ring from vibrating.

■ Preventing torsion caused by coagulated liquid stuck on the sealing face



The liquid between the seal faces may coagulate and get stuck during standby, which may cause excessive torsion at the time of startup.

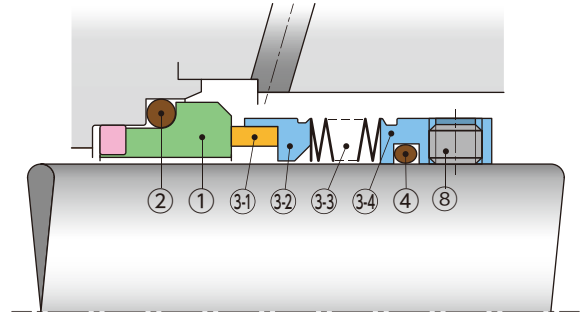


The effects of steam quenching are enhanced by extending the baffle to the vicinity of the seal face.

- Enhancing the effects of thermal insulation during standby resolves the problem with liquid coagulation on the seal face and prevents torsion caused by excessive torque at the time of startup.
- Enhancing the cooling effects improves the lubrication condition of the seal face.
- Enhancing the cleaning effects prevents coagulation and buildup of slightly leaked liquid.

Bellows Pack™ (Rotary-type welded metal bellows seal)

- This rotary-type metal bellows seal can also be mounted on pumps compliant with ISO and DIN standards.
- This product adopts Inconel as the bellows material, which enables the product to be used with a wide range of fluids.

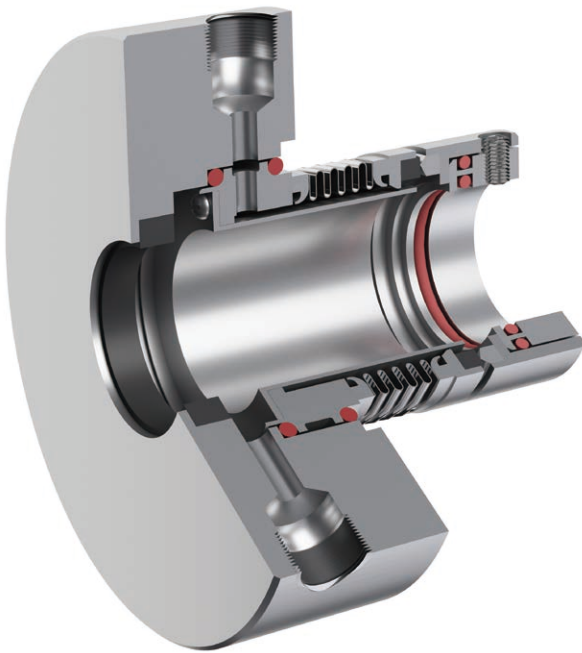


| No. | Part name | Standard material | Qty |
|-----|---------------|-------------------|-----|
| 1 | Floating seat | SiC | 1 |
| 2 | O-ring | FKM | 1 |
| 3-1 | Seal ring | Carbon | 1 |
| 3-2 | Retainer | Inconel | 1 |
| 3-3 | Bellows | Inconel | 1 |
| 3-4 | Adapter | SUS316L | 1 |
| 4 | O-ring | FKM | 1 |
| 8 | Set screw | SUS316L | 3 |

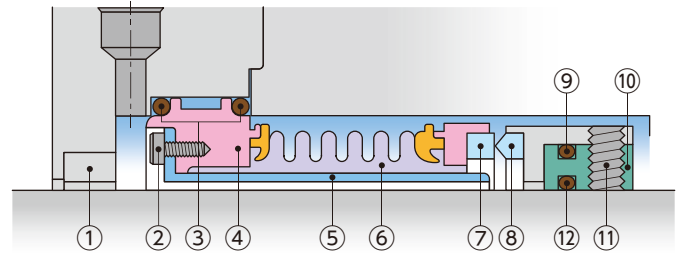
■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) | Maximum viscosity (mPa·s) | Slurry concentration (wt%) |
|-------------|-----------------|------------------|---------------------------|----------------------------|
| 25 | 2 *1 | -50 to 180 | 500 | 0.5 |

*1 The maximum operating pressure differs according to the nominal-size peripheral velocity.



- This product has a sharp knife edge seal surface to cut and eliminate high-viscosity, coagulable, and adhesive liquids. It provides stable sealing performance.
- This product adopts molded metal bellows with a unique balancing mechanism. The seal surface is only subject to an elastic load from the bellows, which enables the product to constantly provide stable performance in terms of pressure.



| Part number | Part name | Standard material | Qty | Part number | Part name | Standard material | Qty |
|-------------|--------------------------|-------------------|-------|-------------|---------------|-------------------|-----|
| 1 | Bushing | Carbon | 1 | 7 | Seal ring | Cemented carbide | 1 |
| 2 | Hexagon socket head bolt | SUS304 or equiv. | 1 set | 8 | Rotating ring | Cemented carbide | 1 |
| 3 | O-ring | FKM | 2 | 9 | O-ring | FKM | 1 |
| 4 | Bellows adapter | SUS316 or equiv. | 1 | 10 | Stopper ring | SUS316 or equiv. | 1 |
| 5 | Baffle | SUS304 or equiv. | 1 | 11 | Set screw | SUS316 or equiv. | 2 |
| 6 | Bellows | SUS316 or equiv. | 1 | 12 | O-ring | FKM | 1 |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | Temperature (°C) |
|-------------|-----------------|------------------|
| 20 max. | 1 | -40 to 150 |

Note: The nominal size is $\phi 29$ to $\phi 116$.

High-viscosity, coagulable, and adhesive fluid seal

Best suited for high-viscosity, coagulable fluids

The seal face has a sharp knife edge shape to increase the surface pressure, which prevents high-viscosity, coagulable fluid from becoming trapped on the seal face and also enables the sharp knife edge face to cut and eliminate coagula generated near the seal face.

Little affect from thermal distortion and pressure distortion

The seal face width is extremely small compared with that of normal mechanical seals, which can eliminate thermal strain and pressure strain in the radial direction, resulting in no liquid leakage caused by strain.

Excellent cooling characteristics

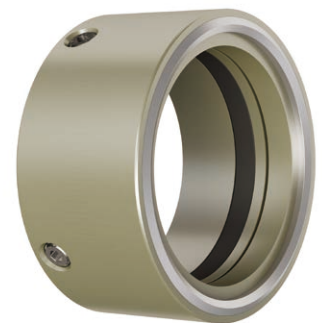
The sharp knife edge face means that the seal face area is extremely small. Compared with normal mechanical seals, this product features less heat generation and excellent cooling effects.

High-flexibility structure

This product employs molded metal bellows, resulting in excellent followability, compared with normal mechanical seals. There is no liquid leakage caused by stick following failure.

Sharp knife edge shape

This product can seal viscous liquid, coagulable liquid, and adhesive liquid, all of which are the most difficult to seal. The sharp knife edge cuts coagula generated between the seal faces.



Excellent hydrodynamic balance

Because of its unique balancing mechanism, the seal face is influenced very little by fluid pressure and is only subject to an elastic load from the bellows, which makes the product constantly stable in terms of pressure.



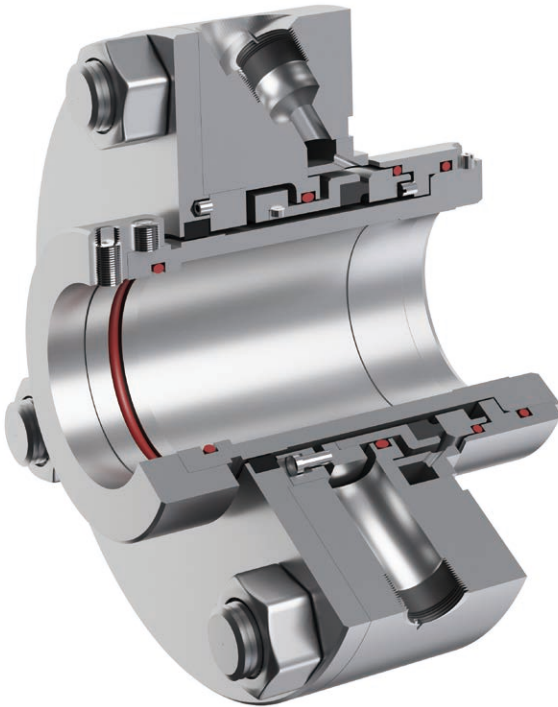
* Schematic illustration of pressure balance

Applicable fluids

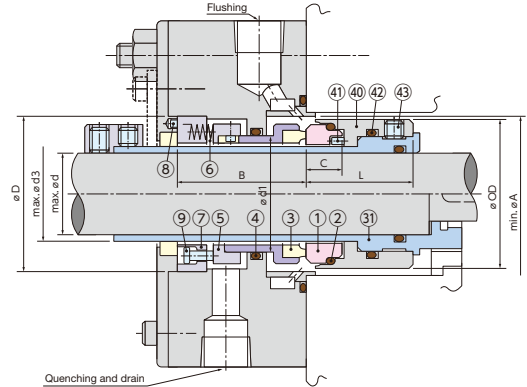
This product is best suited for fluids that are difficult for conventional structures to seal.

Monomer, polymer, nylon, white liquor, green liquor, black liquor, animal and vegetable oils, molasses, milk, chocolate, electrodeposition coating, various types of paint, tar, SBR Latex, ABR Latex, polymerizable fluid, cornstarch, food, soy sauce, etc.

Static-type mechanical seal (Standard type)



- This product is a standard static-type mechanical seal with a compact design.
- Equipped with a spring on the atmospheric side, this product provides stable sealing performance that enables the seal ring to follow even high peripheral velocity, high viscosity fluids easily.
- Any misalignment in the perpendicularity of the stuffing box end face is absorbed by a spring, thereby enabling the seal face to maintain perpendicularity relative to the shaft center and retain stable sealing performance.



| No. | Part name | Standard material | Qty | No. | Part name | Standard material | Qty |
|-----|-----------------|-------------------------------|-------|-----|------------|-------------------|-------|
| 1 | Rotating ring | SIC | 1 | 8 | Pin | SUS316 | 1 |
| 2 | O-ring | FKM | 1 | 9 | Pin | SUS316 | 1 set |
| 3 | Seal ring | Carbon "C2" and titanium | 1 | 31 | Sleeve | SUS304 | 1 |
| * 3 | Seal ring | Cemented carbide and titanium | 1 | 40 | Drive ring | SUS304 | 1 |
| 4 | O-ring | FKM | 1 | 41 | Pin | SUS316 | 1 |
| 5 | Collar | SUS316 | 1 | 42 | O-ring | FKM | 1 |
| 6 | Spring | Alloy 20 | 1 set | 43 | Set screw | SUS316 | 3 |
| 7 | Spring retainer | SUS316 | 1 | | | | |

■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 40 | 4 *1 |

*1 For Type GHK (with knife edge sliding surfaces), the maximum operating pressure is 1 MPaG.

Advantages of static type seals

■ Stable even at high peripheral velocity

Because the seal ring and spring are located on the stationary side, this seal is not affected by centrifugal force even at high peripheral velocity, enabling the seal ring to follow the shaft easily, resulting in stable sealing performance.

■ Maintaining perpendicularity

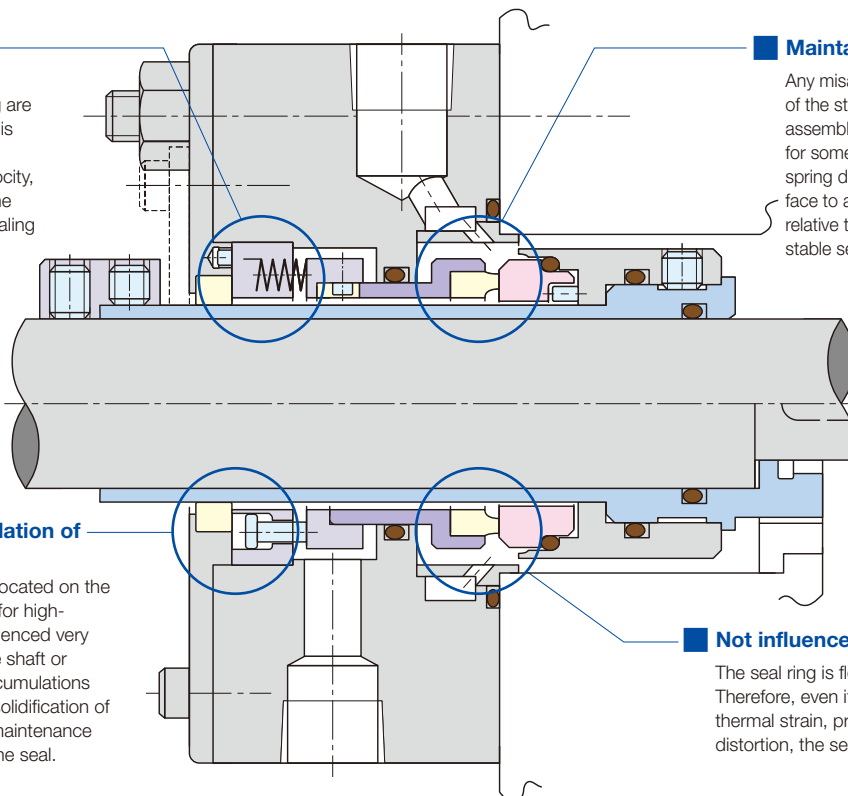
Any misalignment in the perpendicularity of the stuffing box end face due to assembly errors, aging, or pipe stress or for some other reason is absorbed by spring deflection, thereby enabling the seal face to always maintain perpendicularity relative to the shaft center, resulting in stable sealing performance.

■ Helps preventing accumulation of leaked fluid

The secondary seal (packing) is located on the seal cover side. Therefore, even for high-temperature fluid, the seal is influenced very little by heat conduction from the shaft or sleeve. This helps preventing accumulations caused by the carbonization or solidification of leaked fluids and ensures easy maintenance and consistent performance of the seal.

■ Not influenced by strain

The seal ring is floated from the seal cover. Therefore, even if the seal cover is subjected to thermal strain, pressure strain, or tightening distortion, the seal surface will not be affected.



MECHANICAL SEAL

AAU/ABU/AAB/ABB

Rotary-type multi-spring mechanical seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump

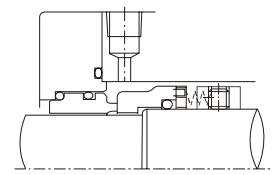
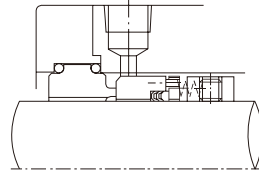


- This product is a general-purpose rotary type seal.
- This product adopts a multi-spring system that can provide stable performance for a wide range of applications.

[Basic structure]

Type AAU/ABU unbalanced type seal

Type AAB/ABB balanced type seal



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | |
|-------------|-----------------|-----|
| 20 | AAU/ABU | 1.3 |
| 20 | AAB/ABB | 3.5 |

MECHANICAL SEAL

AEU/AFU/AEB/AFB

ISO-compliant dimensions applied rotary-type multi-spring mechanical seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump

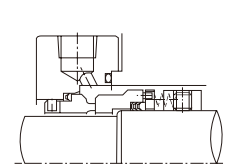
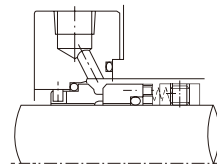


- This seal is designed for application to pumps compliant with ISO and ANSI standards.
- This product adopts a multi-spring system that can provide stable performance for a wide range of applications.

[Basic structure]

Type AEU/AFU unbalanced type seal

Type AEB/AFB balanced type seal



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | |
|-------------|-----------------|-----|
| 20 | AEU/AFU | 1.3 |
| 20 | AEB/AFB | 3 |

MECHANICAL SEAL

PEU/PFU/PEB/PFB

Rotary-type one-coil spring mechanical seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump

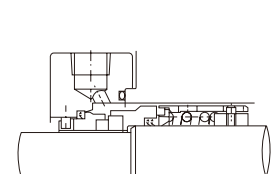
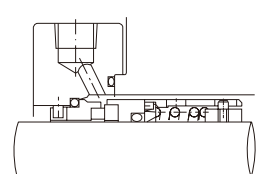


- This one-coil spring seal has strong resistance to corrosion and slurry.
- This product adopts a clutch mechanism to transfer running torque from the seal.

[Basic structure]

Type PEU/PFU unbalanced type seal

Type PEB/PFB balanced type seal



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) | |
|-------------|-----------------|-----|
| 15 | PAU/PBU | 1.3 |
| 15 | PAB/PBB | 3 |

MECHANICAL SEAL

TEL8M

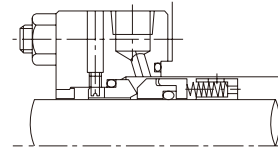
PILLAR SiC_x seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump



- This product can be used for fluids containing acid, alkaline solutions, and fine particles, as well as a wide range of other fluids.
- This multi-spring type mechanical seal adopts SiC alone as the seal ring, contains radial grooves in the drive collar and spring retainer, and possesses a function for discharging fine particles.
- * A lineup of carbon seal rings (with flat faces) is available for additional options.

[Basic structure]



■ Specification conditions

| Type | Speed (m/s) | Pressure (MPaG) | |
|--------------------|-------------|-----------------|-----|
| TEL8M (Knife edge) | 10 | SiC + SiC | 0.5 |
| TEU80 (Carbon) | 10 | SiC + carbon | 0.8 |

Note: The size is $\Phi 20$ to $\Phi 55$.

MECHANICAL SEAL

CEU/CFU

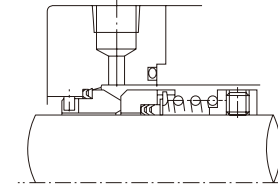
ISO-compliant dimensions applied rotary-type multi-spring mechanical seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump



- This product is designed for application to ISO-compliant pumps.
- This one-coil spring seal adopts SiC as a seal face material.

[Basic structure]



■ Specification conditions

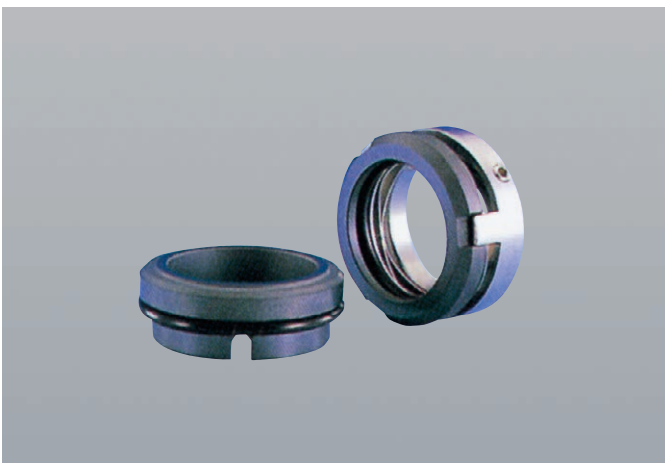
| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 15 | 0.9 |

MECHANICAL SEAL

VEU/VFU

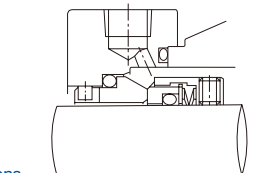
ISO-compliant dimensions applied rotary-type leaf spring mechanical seal

- Oil refinery/ petrochemical
- Energy/ environment
- Chemical
- Water supply and sewerage system
- Pump



- This product is designed for application to ISO-compliant pumps.
- This product adopts a leaf spring as the spring and is designed so that the length in the axial direction is short.
- This seal is advantageous for food processing as little fluid remains in the seal.

[Basic structure]



■ Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 15 | 0.9 |

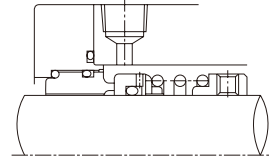
One-coil spring mechanical seal for ships

Marine equipment Water supply and sewerage system Pump



- This seal is officially adopted as model US-1 by the Japan Ship Machinery and Equipment Association (JSMEA).
- This product adopts a one-coil spring that is affected very little by corrosion (electrolytic corrosion) and slurry.
- The O-ring for the shaft on the rotating ring has holes that prevent the rotating ring from failing to follow the shaft due to clogging.
- This product can be used for pumps for use in cooling water systems (industrial water, wastewater, and seawater) in any industry.

[Basic structure]



Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 15 | 1 |

Note: The nominal size is $\phi 20$ to $\phi 130$.

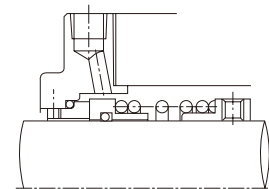
One-coil spring mechanical seal for ships

Marine equipment Water supply and sewerage system Pump



- This seal is adopted as model US-2 by the Japan Ship Machinery and Equipment Association (JSMEA).
- This product adopts a one-coil spring that is affected very little by corrosion (electrolytic corrosion) and slurry.
- This product can also be used in any industry other than marine equipment.
- We also provide a lineup of inch-based seals (US-3).

[Basic structure]



Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 15 | 1 |

Note: The nominal size is $\phi 20$ to $\phi 140$.

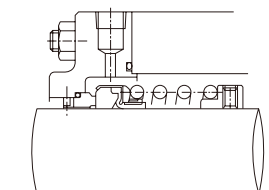
One-coil spring mechanical seal for ships

Marine equipment Water supply and sewerage system Pump



- This product is an improved version of the seals used for marine equipment.
- This product adopts rubber bellows to reduce shaft packing followability problems.
- This product adopts a one-coil spring that is affected very little by corrosion (electrolytic corrosion) and slurry.
- This product can also be used in any industry other than marine equipment.

[Basic structure]



Specification conditions

| Speed (m/s) | Pressure (MPaG) |
|-------------|-----------------|
| 15 | 1 |

Note: The nominal size is $\phi 20$ to $\phi 120$.

MEMO

A series of horizontal dotted lines for writing, spanning the width of the page.

Rotary union for semiconductor and LCD manufacturing equipment

- The flow channel for wetted parts is made of polyetheretherketone (PEEK), taking metal contamination into account.
- The seal face is made of silicon carbide (SiC), which features excellent chemical resistance and slurry resistance.
- This product can be used in a wide range of pressures, from negative pressure to positive pressure.
- This product is certainly subject to oil-free treatment. Moreover, the entire process from cleaning through to assembly and packaging (clean packing) is consistently implemented in cleanrooms.

What is a rotary union?

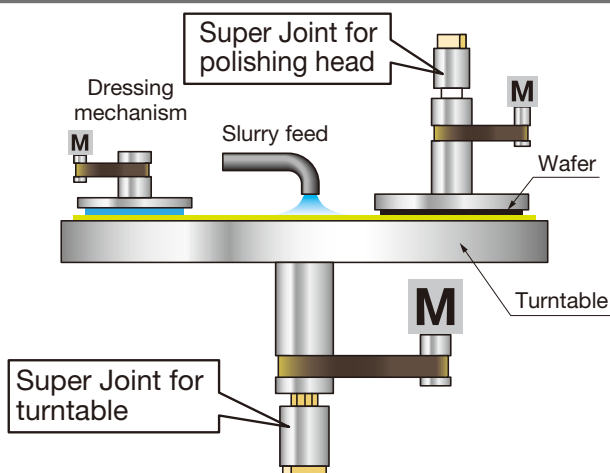
The rotary union is a rotating device that transfers various fluids flowing through fixed pipes to rotating bodies.

The rotary union consists of a shaft section that revolves together with the rotating body and a housing section that connects the union from the fixed pipe. It is internally equipped with bearings, rotation seals, and other components.



Application

Application example of CMP apparatus (schematic)



PILLAR SUPER JOINT is a functional part indispensable for semiconductor/LCD manufacturing equipment that does not only supply liquid but also uses a rotating pressure head (typically CMP apparatus).

Main applications

- Air supply for cooling water and wafer pressurization
- Vacuum supply for wafer suction
- Purified water and slurry liquid supply for water faucet
- Cooling water feed to turntable

PILLAR SUPER JOINT™ (Mechanical seal for rotary unions)



- This product adopts a balanced type sealing mechanism for positive and negative pressures. It maintains stable sealability.
- This product adopts a seal face material that is made of SiC solid and provides excellent slurry resistance and sealing performance.

■ Applicable fluids

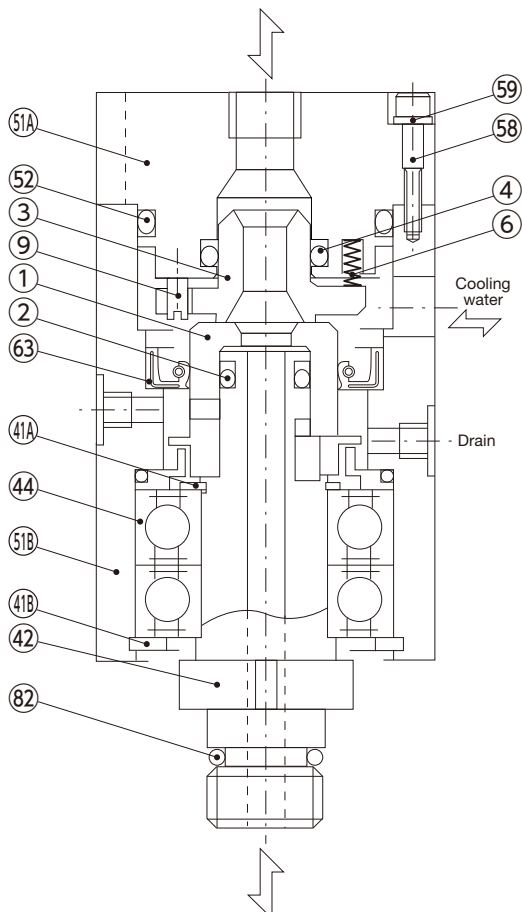
■ Compressed air and vacuum

■ Ultrapure water, CMP slurry, etc.

■ Specification conditions

| Pressure (MPaG) | Speed (min ⁻¹) |
|-----------------|----------------------------|
| FV to 1 | 0 to 1,000 |

■ PSJ: Basic structure and materials



■ Standard materials

| No. | Part name | Standard material | Qty |
|-----|--------------------------|-------------------|-------|
| 1 | Rotating ring | SiC | 1 |
| 2 | O-ring | FKM | 1 |
| 3 | Stationary ring | SiC | 1 |
| 4 | O-ring | FKM | 1 |
| 6 | Spring | SUS316 or equiv. | 1 set |
| 9 | Pin | SUS316 or equiv. | 1 set |
| 41A | Snap ring | SUS304 or equiv. | 1 |
| 41B | Snap ring | SUS304 or equiv. | 1 |
| 42 | Shaft | PEEK | 1 |
| 44 | Bearing | SUS440C | 2 |
| 51A | Flange | PEEK | 1 |
| 51B | Flange | SUS316 or equiv. | 1 |
| 52 | O-ring | FKM | 1 |
| 58 | Hexagon socket head bolt | SUS304 or equiv. | 4 |
| 59 | Spring washer | SUS304 or equiv. | 4 |
| 63 | Oil seal | NBR/SUS304 | 1 |
| 82 | O-ring | FKM | 1 |

This is just an example of the single port type. We can provide a variety of designs according to the operating conditions, such as a multi-port type, a large flow rate type and a compact type using resin seals. For details, please contact us.

Unique structure without shaft wear

Unlike gland packings, this product has a structure that does not slide on the shaft or sleeve, which means that there is no damage to the devices mounted.

Compact design and easy maintenance

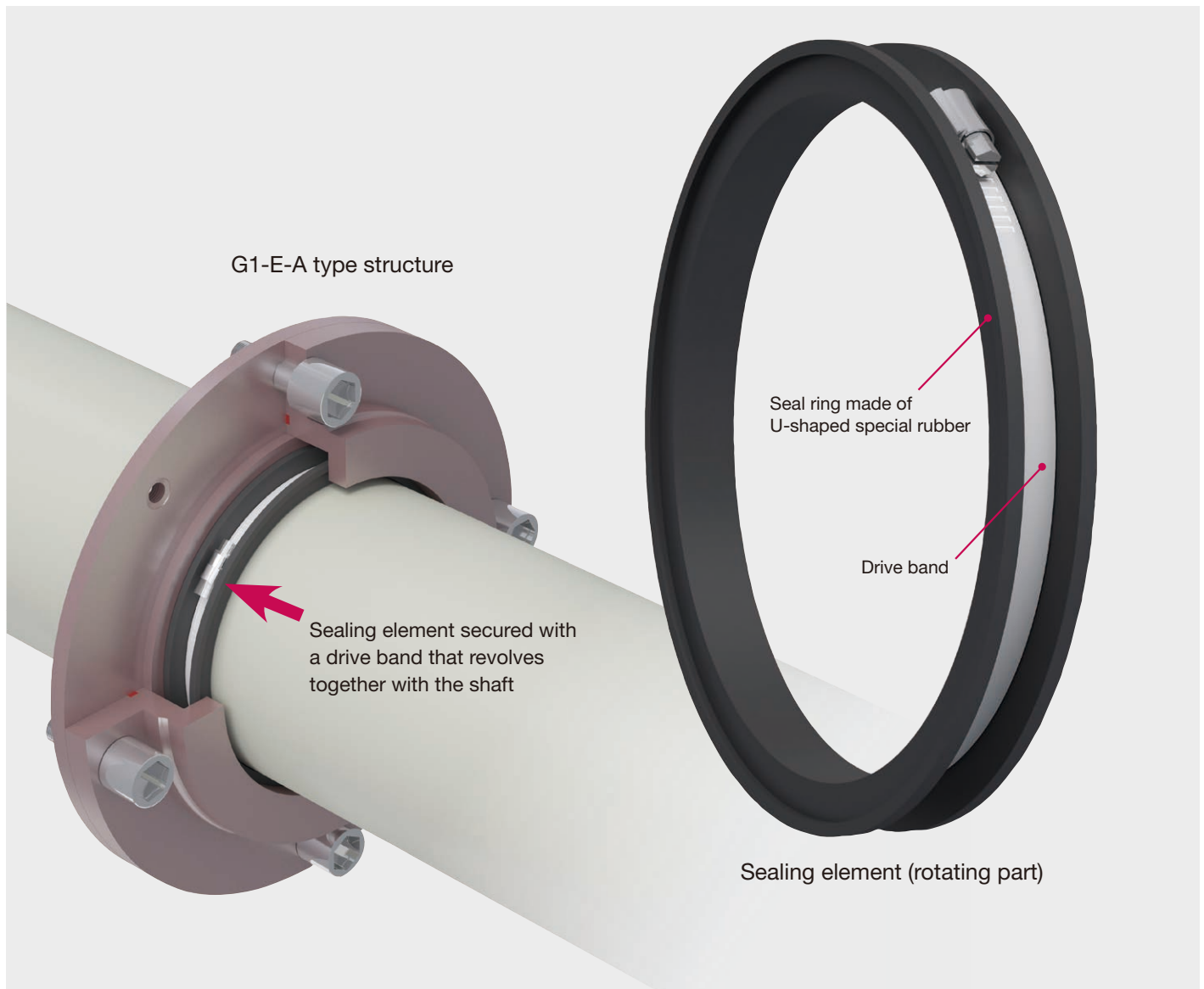
The seal unit itself is compact and can therefore be mounted on various devices. The sealing element, which is a sliding part, can be cut and replaced, which makes maintenance easy.

Excellent shaft followability

The sealing element is made of flexible special rubber. Because of its highly flexible structure, the sealing element can cope with shaft misalignment and shaft runout.

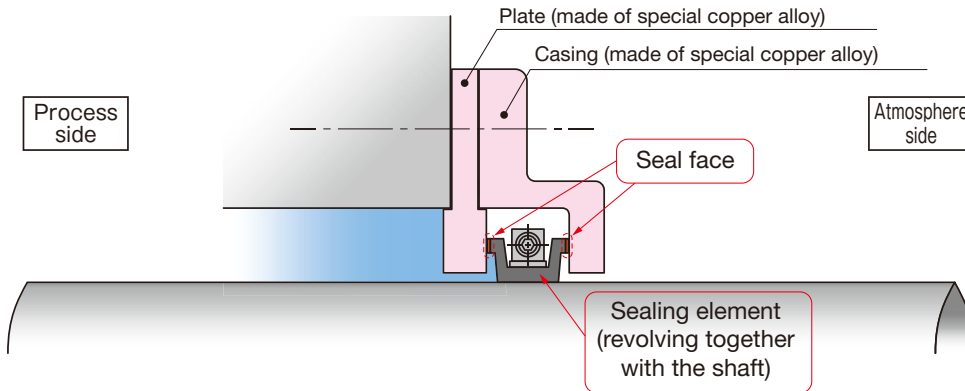
Product series lineup

We provide products optimally designed for each individual application, such as “G1-FL” for flocculators and “G1-PRS” for rudder stocks.



Basic configuration

The PILLAR G1 series seal employs a simple design that consists of a sealing element that revolves together with the shaft and a structural material on the stationary side that is made of special copper alloy.



Specification conditions

Fluids: Clear water, seawater, river water, sewage, etc.

Equipment: Flocculators, rudder stocks, sink rolls, stern tubes, etc. (shaft sealing portions)

| Temperature | Pressure | Speed | Allowable shaft runout |
|--------------|----------------|---------------|---|
| -10 to +60°C | 0.2 MPaG (max) | 6 m/sec (max) | 2 mm (max) in the axial direction, 4 mm (max) in the radial direction |

Note: The above specifications may differ according to the combined conditions in actual operation. Therefore, if you are considering use of this product, please consult with us beforehand.

Features

● Coping with shaft misalignment



The sealing element revolves together with the shaft and the structure ensures sufficient followability, enabling this product to maintain good sealing performance even under significant shaft misalignment conditions.

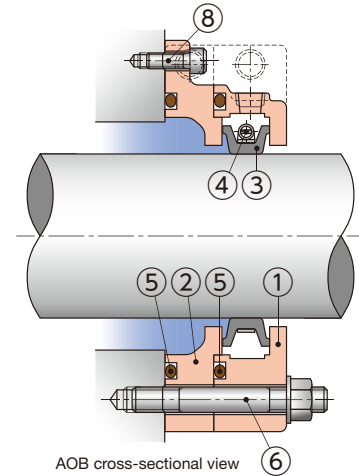
● Coping with shaft runout



The displacement corresponding to shaft runout is absorbed by the sealing element flexibly changing its shape. Therefore, even if this product is mounted on a device that causes relatively large shaft runout, its sealability will be ensured.



- This product series is optimized for flocculators that are often used in water purification plants and sewage treatment plants.
- This product can be split into individual components. Each component can be replaced or maintained while they are on the shaft.



| No. | Part | Standard material | Qty | Remarks |
|-----|--------------------------|----------------------|----------|------------|
| 1 | Casing | Special copper alloy | 1 s | Split type |
| 2 | Plate | Special copper alloy | 1 s | Split type |
| 3 | Seal ring | Special rubber | 1 | |
| 4 | Drive band | SUS | 1 | |
| 5 | O-ring | NBR | 2 | |
| 6 | Stud bolt, etc. | SUS304 or equiv. | 4 or 6 s | |
| 7 | Reamer bolt, etc. | SUS304 or equiv. | 4 s | |
| 8 | Hexagon socket head bolt | SUS304 or equiv. | 2 | |

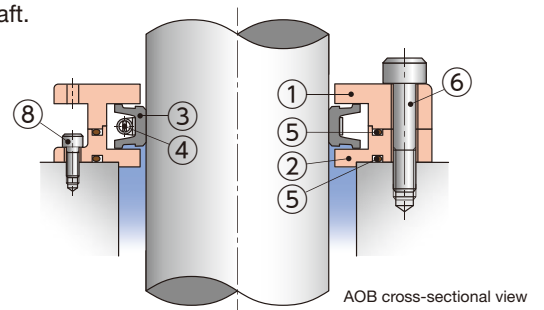
■ Specification conditions

| Speed (m/sec) | Pressure (MPaG) |
|---------------|-----------------|
| 6 | 0.2 |

Applicable shaft diameter: $\phi 60$ to $\phi 250$



- This product series is customized for rudder stocks used for ships.
- This product can be split into individual components. Each component can be replaced or maintained while they are on the shaft.



| No. | Part | Standard material | Qty | Remarks |
|-----|--------------------------|----------------------|-----------|------------|
| 1 | Casing | Special copper alloy | 1 s | Split type |
| 2 | Plate | Special copper alloy | 1 s | Split type |
| 3 | Seal ring | Special rubber | 1 | |
| 4 | Drive band | SUS | 1 | |
| 5 | O-ring | NBR | 2 | |
| 6 | Hexagon socket head bolt | SUS304 or equiv. | 4 to 12 s | |
| 7 | Reamer bolt, etc. | SUS304 or equiv. | 4 s | |
| 8 | Hexagon socket head bolt | SUS304 or equiv. | 2 | |

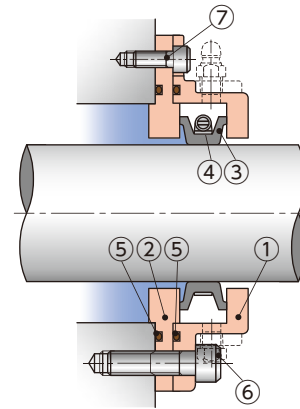
■ Specification conditions

| Pressure (MPaG) |
|-----------------|
| 0.2 |

Applicable shaft diameter: $\phi 80$ to $\phi 990$



- All components are of endless structure general-purpose type, the number of components is fewer, and the cost of this product is low.



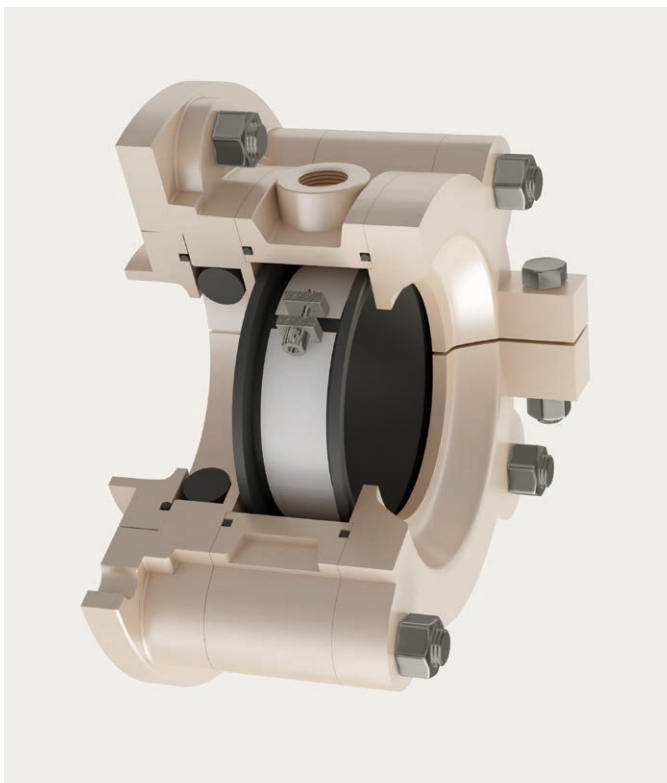
AOB cross-sectional view

| No. | Part | Standard material | Qty | Remarks |
|-----|--------------------------|----------------------|---------|---------|
| 1 | Casing | Special copper alloy | 1 | Endless |
| 2 | Plate | Special copper alloy | 1 | Endless |
| 3 | Seal ring | Special rubber | 1 | |
| 4 | Drive band | SUS | 1 | |
| 5 | O-ring | NBR | 2 | |
| 6 | Hexagon socket head bolt | SUS304 or equiv. | 4 to 16 | |
| 7 | Hexagon socket head bolt | SUS304 or equiv. | 2 | |

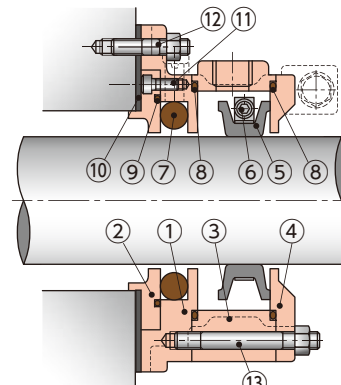
■ Specification conditions

| Speed (m/sec) | Pressure (MPaG) |
|---------------|-----------------|
| 6 | 0.2 |

Applicable shaft diameter: $\phi 50$ to $\phi 450$



- This product is designed specially for the stern tubes of ships.
- This product has a structure that is equipped with an emergency sealing mechanism.



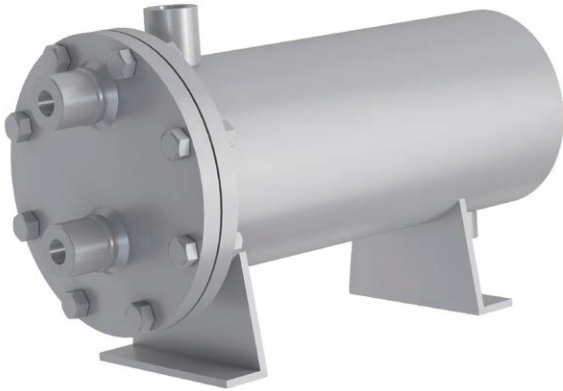
AOB cross-sectional view

| No. | Part | Standard material | Qty | Remarks | No. | Part | Standard material | Qty | Remarks |
|-----|----------------|----------------------|-----|------------|-----|--------------------------|-------------------|-----|---------|
| 1 | Mounting ring | Special copper alloy | 1 | Endless | 8 | O-ring | NBR | 2 | |
| 2 | Adapter | Special copper alloy | 1 | Endless | 9 | O-ring | NBR | 1 | |
| 3 | Casing | Special copper alloy | 1 | Endless | 10 | Gasket | Soft cut gasket | 1 | |
| 4 | Plate | Special copper alloy | 1 s | Split type | 11 | Hexagon socket head bolt | SUS316 or equiv. | 6 | |
| 5 | Seal ring | Special rubber | 1 | | 12 | Stud bolt, etc. | SUS304 or equiv. | 6 | |
| 6 | Drive band | SUS | 1 | | 13 | Stud bolt, etc. | SUS304 or equiv. | 4 | |
| 7 | Emergency seal | Special rubber | 1 | | 14 | Reamer bolt, etc. | SUS304 or equiv. | 2 s | |

■ Specification conditions

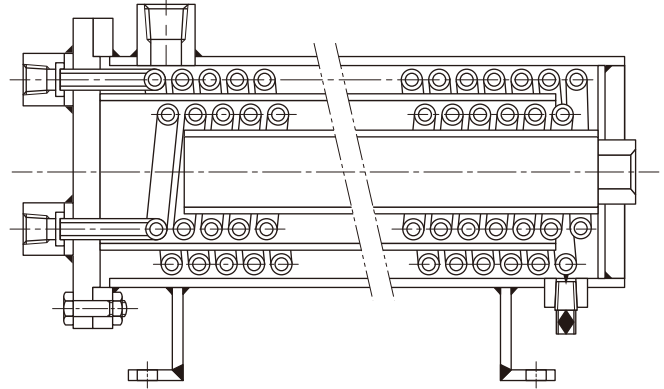
| Speed (m/sec) | Pressure (MPaG) |
|---------------|-----------------|
| 6 | 0.12 |

Applicable shaft diameter: $\phi 65$ to $\phi 450$

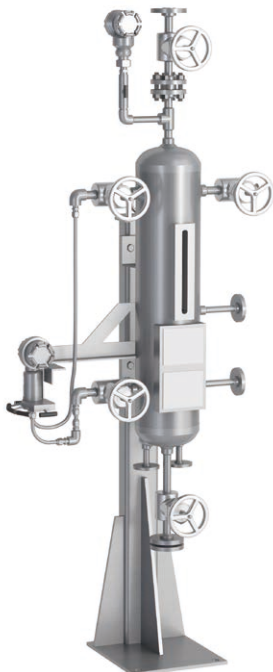


- For high-temperature fluid, this product is mounted in the flushing line to protect the mechanical seal.
- Various heat exchanger tube types (in terms of materials and sizes) are provided so that they can be applied to each kind of fluid.
- We can provide products that conform to the High Pressure Gas Safety Act and ASME standards.

[Basic structure]

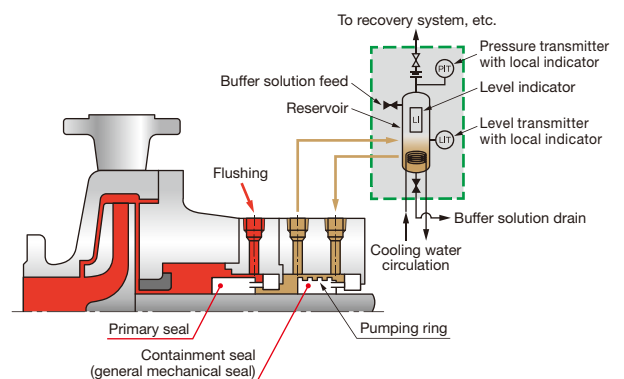


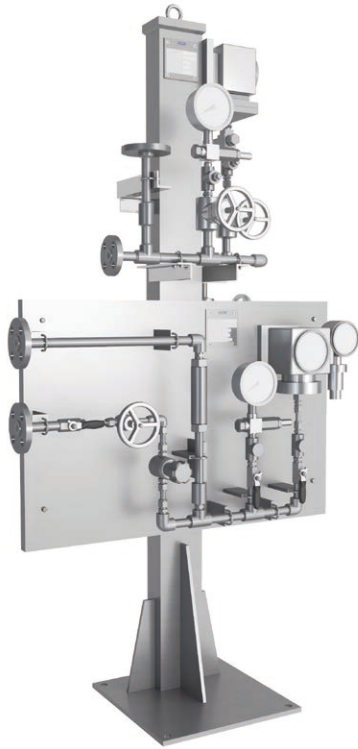
| Type | Heat transfer area |
|-------|---------------------|
| HE-5S | 0.25 m ² |
| HE-5A | 0.4 m ² |
| HE-5B | 0.6 m ² |
| HE-5C | 0.8 m ² |



- This reservoir is installed when tandem seals for API Plan 52 are adopted.
- We can provide products that conform to the High Pressure Gas Safety Act and ASME standards.
- We can provide a variety of instrumentation devices to be installed.

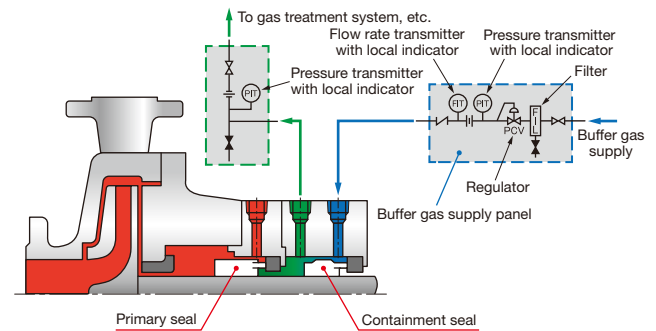
PLAN 52





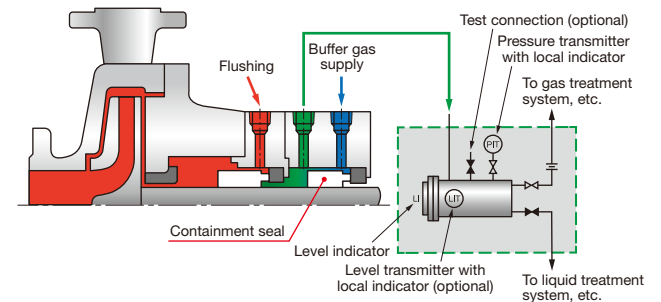
- This auxiliary pipe is installed when containment seals for API Plan 72 or 76 are adopted.
 - This product can be unitized by installing a nitrogen purging pipe (for API Plan 72) or flare connection pipe (for API Plan 76) on a stay.*1
 - We can provide a variety of instrumentation devices to be installed.
 - For API Plan 76 gas lines, we can provide products that conform to the High Pressure Gas Safety Act.
- *1 For API Plans 72 and 76, we can also panelize our products or deliver individual instrumentation devices separately.

PLAN 72/76



- This drain tank unit is installed when containment seals for API Plan 75 are adopted.
- We can provide a variety of instrumentation devices to be installed.

PLAN 75



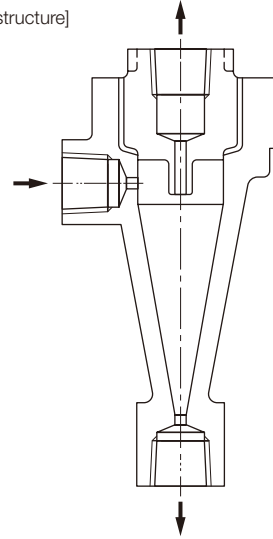
Cyclone separator

Cyclone separator

- This product is mounted in the flushing line leading to the stuffing box to protect the mechanical seal from solids.
- Flushing fluid is injected into the conical body of this product and centrifugal force is applied with gyrating motion to separate and discharge solid particles.



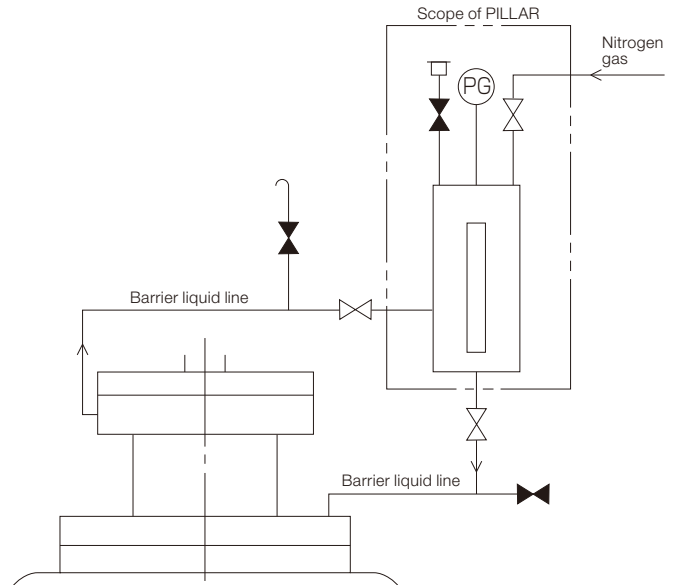
[Basic structure]



Pressure tank



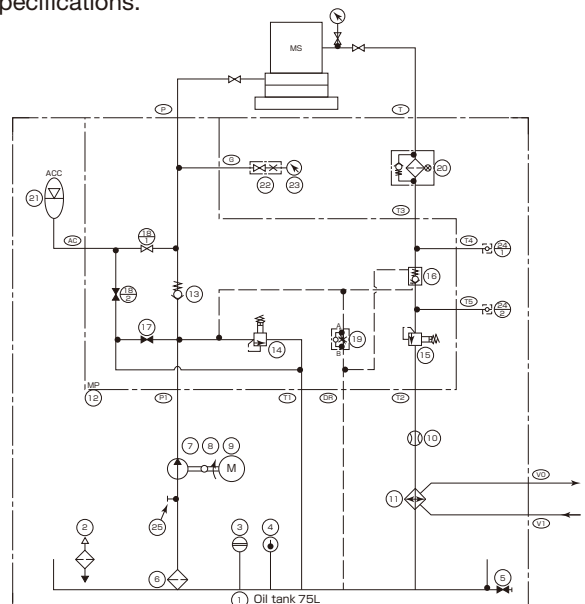
- This product is a double-sealed confined liquid pressure tank that is mainly used for mixers.
- We can also provide products that conform to the High Pressure Gas Safety Act, as well as products that incorporate cooling coils.



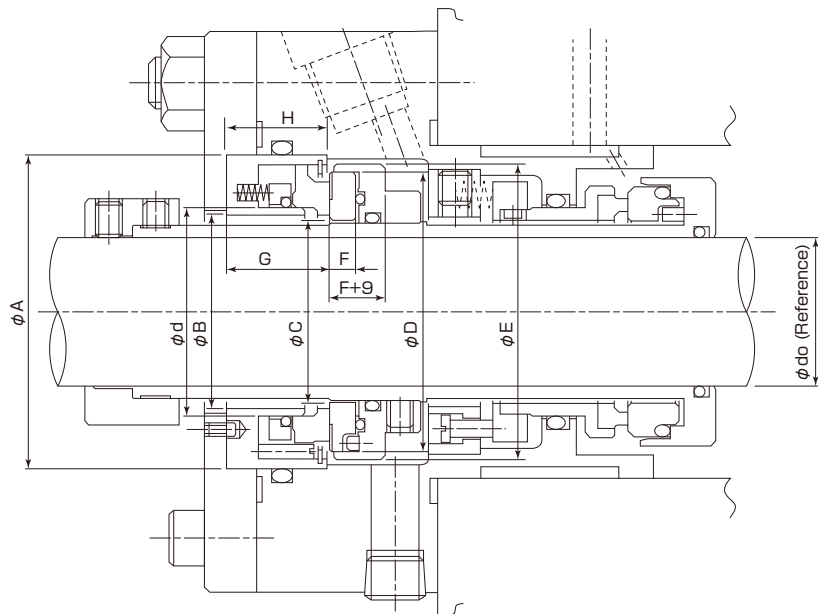
Pressure unit



- This product is a double-sealed confined liquid circulation device that is used for mixers, pumps, blowers, and other devices.
- For pressurization methods, we can support the tank pressurization method using nitrogen gas, as well as the pump pressurization method.
- We can customize the tank capacity, required pressure, and required flow rate according to the customer's specifications.



Basic structure diagram

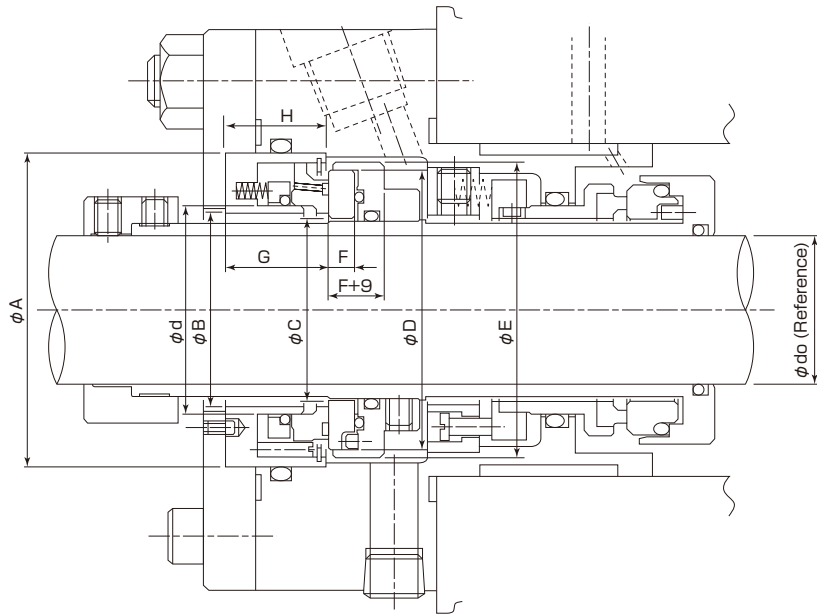


Size table

(Unit: mm)

| ϕd | ϕdO | ϕA | ϕB | ϕC | ϕD | ϕE | F | G | H |
|----------|-----------|----------|----------|----------|----------|----------|----|------|------|
| 30 | 20 | 53 | 27 | 26 | 46 | 50 | 6 | 25.5 | 25 |
| 35 | 25 | 58 | 32 | 31 | 51 | 55 | 6 | 25.5 | 25 |
| 43 | 30 | 66 | 40 | 36 | 56 | 60 | 6 | 25.5 | 25 |
| 48 | 38 | 72 | 45 | 44 | 64 | 68 | 6 | 25.5 | 25 |
| 51 | 40 | 75 | 48 | 46 | 66 | 70 | 6 | 25.5 | 25 |
| 56 | 45 | 80 | 53 | 51 | 71 | 75 | 8 | 25.5 | 25 |
| 60 | 50 | 84 | 57 | 56 | 76 | 80 | 8 | 25.5 | 25 |
| 65 | 55 | 89 | 62 | 61 | 81 | 85 | 8 | 25.5 | 25 |
| 70 | 59 | 94 | 67 | 66 | 86 | 90 | 8 | 25.5 | 25 |
| 76 | 63 | 100 | 73 | 71 | 91 | 95 | 8 | 25.5 | 25 |
| 80 | 66 | 107 | 76 | 76 | 98 | 102 | 10 | 28 | 27.5 |
| 86 | 71 | 113 | 82 | 81 | 103 | 107 | 10 | 28 | 27.5 |
| 90 | 76 | 117 | 86 | 86 | 108 | 112 | 10 | 28 | 27.5 |
| 95 | 81 | 122 | 91 | 91 | 113 | 117 | 10 | 28 | 27.5 |
| 100 | 86 | 129 | 96 | 95 | 121 | 125 | 10 | 28 | 27.5 |
| 105 | 91 | 134 | 101 | 100 | 126 | 130 | 10 | 28 | 27.5 |
| 110 | 96 | 139 | 106 | 105 | 131 | 135 | 10 | 28 | 27.5 |
| 115 | 101 | 144 | 111 | 110 | 136 | 140 | 10 | 28 | 27.5 |
| 121 | 106 | 150 | 117 | 115 | 141 | 145 | 10 | 28 | 27.5 |
| 125 | 111 | 154 | 121 | 120 | 146 | 150 | 10 | 28 | 27.5 |
| 130 | 116 | 159 | 126 | 125 | 151 | 155 | 10 | 28 | 27.5 |

■ Basic structure diagram

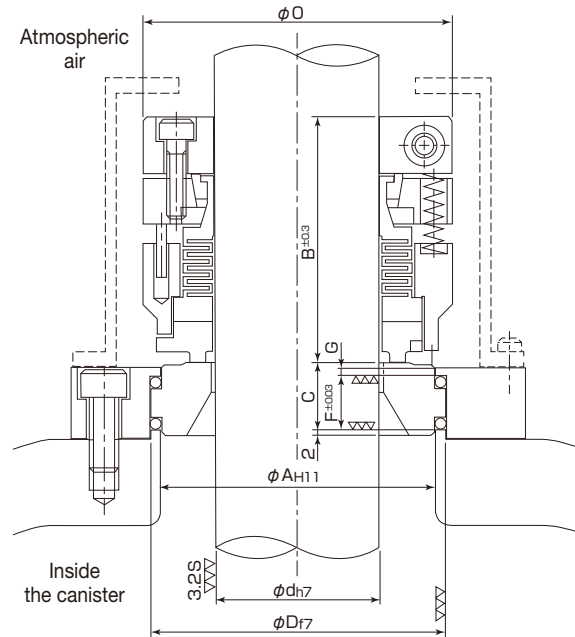


■ Size table

(Unit: mm)

| ϕd | $\phi d0$ | ϕA | ϕB | ϕC | ϕD | ϕE | F | G | H |
|----------|-----------|----------|----------|----------|----------|----------|----|------|----|
| 30 | 18 | 53 | 27 | 26 | 46 | 50 | 6 | 25.5 | 25 |
| 35 | 20 | 58 | 32 | 31 | 51 | 55 | // | // | // |
| 43 | 25 | 66 | 40 | 36 | 56 | 60 | // | // | // |
| 48 | 30 | 72 | 45 | 44 | 64 | 68 | // | // | // |
| 51 | 38 | 75 | 48 | 46 | 66 | 70 | // | // | // |
| 56 | 40 | 82 | 53 | 51 | 71 | 75 | 8 | // | // |
| 60 | 47 | 84 | 57 | 56 | 76 | 80 | // | // | // |
| 65 | 50 | 89 | 62 | 61 | 81 | 85 | // | // | // |
| 70 | 55 | 94 | 67 | 66 | 86 | 90 | // | // | // |
| 76 | 60 | 100 | 73 | 71 | 91 | 95 | // | // | // |
| 80 | 63 | 107 | 76 | 76 | 98 | 102 | 10 | 28 | 27 |
| 86 | 66 | 113 | 82 | 81 | 103 | 107 | // | // | // |
| 90 | 71 | 117 | 86 | 86 | 108 | 112 | // | // | // |
| 95 | 76 | 122 | 91 | 91 | 113 | 117 | // | // | // |
| 100 | 80 | 129 | 96 | 95 | 121 | 125 | // | // | // |
| 105 | 86 | 134 | 101 | 100 | 126 | 130 | // | // | // |
| 111 | 90 | 139 | 107 | 105 | 131 | 135 | // | // | // |
| 115 | 96 | 144 | 111 | 110 | 136 | 140 | // | // | // |
| 121 | 101 | 150 | 117 | 115 | 141 | 145 | // | // | // |
| 125 | 106 | 154 | 121 | 120 | 146 | 150 | // | // | // |
| 130 | 110 | 159 | 126 | 125 | 151 | 155 | // | // | // |

Basic structure diagram

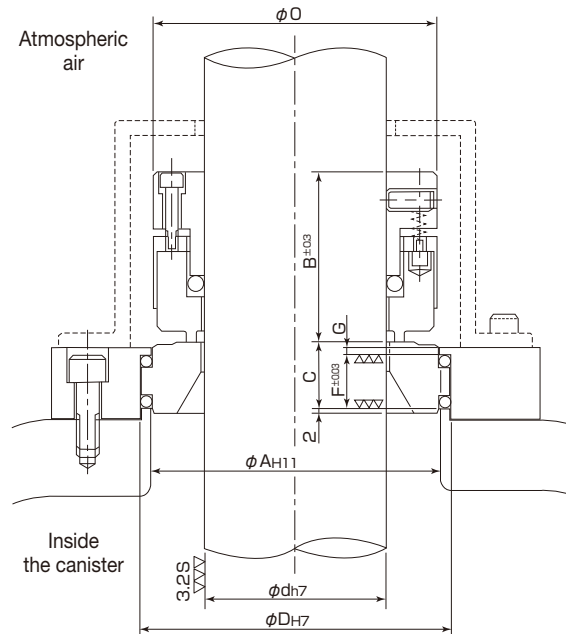


Size table

(Unit: mm)

| Shaft diameter ϕd | ϕA | B | C | ϕD | F | G | ϕO |
|----------------------------|----------|----|----|----------|----|---|----------|
| 20 | 44 | 52 | 22 | 50.5 | 16 | 3 | 54 |
| 25 | 50 | 52 | 22 | 56.5 | 16 | 3 | 57 |
| 30 | 55 | 54 | 24 | 61.5 | 18 | 3 | 63.5 |
| 35 | 60 | 54 | 24 | 66.5 | 18 | 3 | 66.5 |
| 40 | 65 | 60 | 25 | 71.5 | 18 | 4 | 76 |
| 45 | 70 | 60 | 25 | 76.5 | 18 | 4 | 79.5 |
| 50 | 76 | 60 | 26 | 82.5 | 18 | 5 | 85.5 |
| 55 | 80 | 60 | 26 | 86.5 | 18 | 5 | 89 |
| 60 | 89 | 66 | 26 | 95.5 | 18 | 5 | 106.5 |
| 65 | 94 | 66 | 27 | 100.5 | 18 | 6 | 109.5 |
| 70 | 99 | 66 | 27 | 105.5 | 18 | 6 | 116 |
| 75 | 105 | 66 | 27 | 111.5 | 18 | 6 | 122 |
| 80 | 109 | 70 | 27 | 115.5 | 18 | 6 | 133.5 |
| 85 | 114 | 70 | 27 | 120.5 | 18 | 6 | 139.5 |
| 90 | 119 | 70 | 27 | 125.5 | 18 | 6 | 143 |
| 95 | 124 | 70 | 27 | 130.5 | 18 | 6 | 149 |
| 100 | 129 | 70 | 27 | 135.5 | 18 | 6 | 152.5 |
| 105 | 140 | 70 | 29 | 146.5 | 20 | 6 | 157.5 |
| 110 | 145 | 70 | 29 | 151.5 | 20 | 6 | 162.5 |
| 115 | 150 | 70 | 29 | 156.5 | 20 | 6 | 167.5 |
| 120 | 155 | 70 | 29 | 161.5 | 20 | 6 | 172.5 |
| 125 | 160 | 70 | 29 | 166.5 | 20 | 6 | 177.5 |
| 130 | 167 | 70 | 29 | 173.5 | 20 | 6 | 182.5 |
| 135 | 172 | 80 | 38 | 182.5 | 28 | 7 | 192.5 |
| 140 | 177 | 80 | 38 | 187.5 | 28 | 7 | 197.5 |
| 145 | 182 | 80 | 38 | 192.5 | 28 | 7 | 202.5 |
| 150 | 187 | 80 | 38 | 197.5 | 28 | 7 | 207.5 |

Basic structure diagram

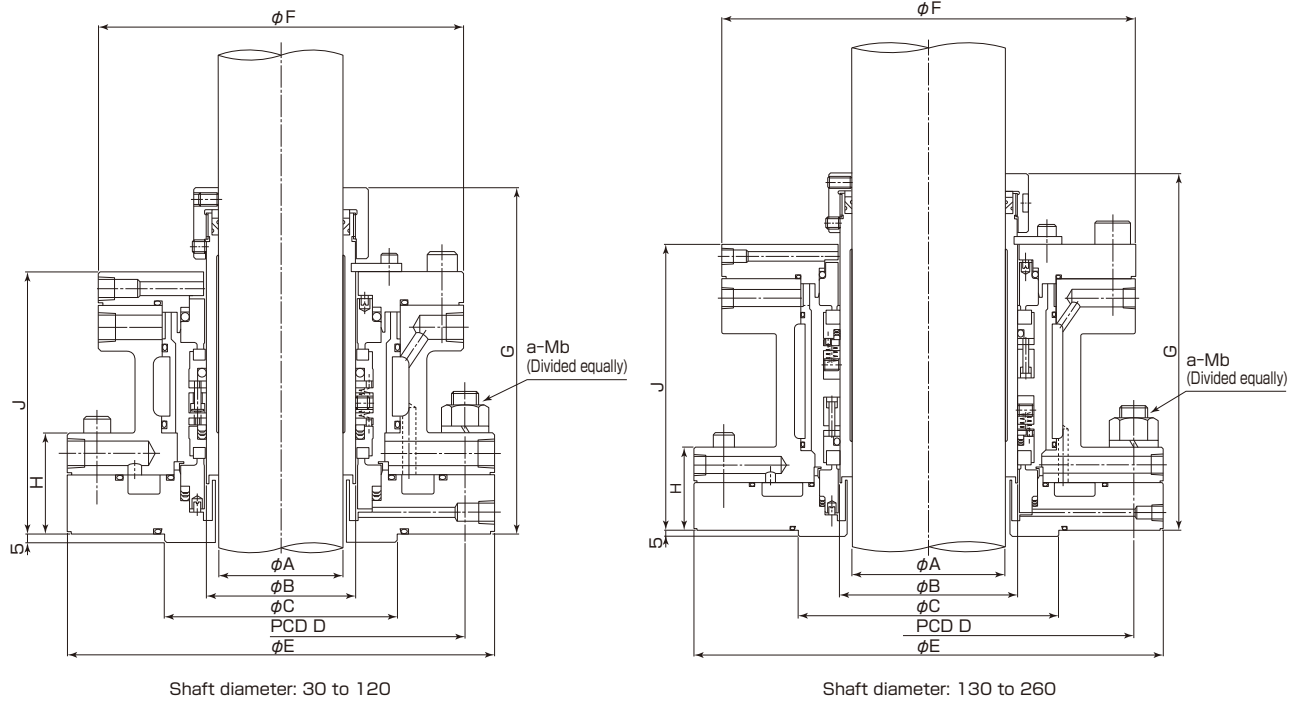


Size table

(Unit: mm)

| Shaft diameter ϕd | ϕA | B | C | ϕD | F | G | ϕO |
|----------------------------|----------|----|----|----------|----|---|----------|
| 20 | 44 | 43 | 22 | 50.5 | 16 | 3 | 43 |
| 25 | 50 | 43 | 22 | 56.5 | 16 | 3 | 48 |
| 28 | 55 | 43 | 22 | 61.5 | 16 | 3 | 51 |
| 30 | 55 | 43 | 24 | 61.5 | 18 | 3 | 53 |
| 35 | 60 | 43 | 24 | 66.5 | 18 | 3 | 59 |
| 40 | 65 | 48 | 25 | 71.5 | 18 | 4 | 64 |
| 45 | 70 | 48 | 25 | 76.5 | 18 | 4 | 69 |
| 50 | 76 | 48 | 26 | 82.5 | 18 | 5 | 74 |
| 55 | 80 | 48 | 26 | 86.5 | 18 | 5 | 79 |
| 60 | 89 | 48 | 26 | 95.5 | 18 | 5 | 88 |
| 65 | 94 | 48 | 27 | 100.5 | 18 | 6 | 93 |
| 70 | 99 | 48 | 27 | 105.5 | 18 | 6 | 98 |
| 75 | 105 | 48 | 27 | 111.5 | 18 | 6 | 103 |
| 80 | 109 | 48 | 27 | 115.5 | 18 | 6 | 108 |
| 85 | 114 | 48 | 27 | 120.5 | 18 | 6 | 113 |
| 90 | 119 | 48 | 27 | 125.5 | 18 | 6 | 118 |
| 95 | 124 | 48 | 27 | 130.5 | 18 | 6 | 123 |
| 100 | 129 | 48 | 27 | 135.5 | 18 | 6 | 128 |
| 105 | 140 | 53 | 29 | 146.5 | 20 | 6 | 138 |
| 110 | 145 | 53 | 29 | 151.5 | 20 | 6 | 143 |
| 115 | 150 | 53 | 29 | 156.5 | 20 | 6 | 148 |
| 120 | 155 | 53 | 29 | 161.5 | 20 | 6 | 153 |
| 125 | 160 | 53 | 29 | 166.5 | 20 | 6 | 158 |
| 130 | 167 | 53 | 29 | 173.5 | 20 | 6 | 166 |
| 135 | 172 | 58 | 38 | 182.5 | 28 | 7 | 171 |
| 140 | 177 | 58 | 38 | 187.5 | 28 | 7 | 176 |
| 145 | 182 | 58 | 38 | 192.5 | 28 | 7 | 181 |
| 150 | 187 | 58 | 38 | 197.5 | 28 | 7 | 186 |

Basic structure diagram

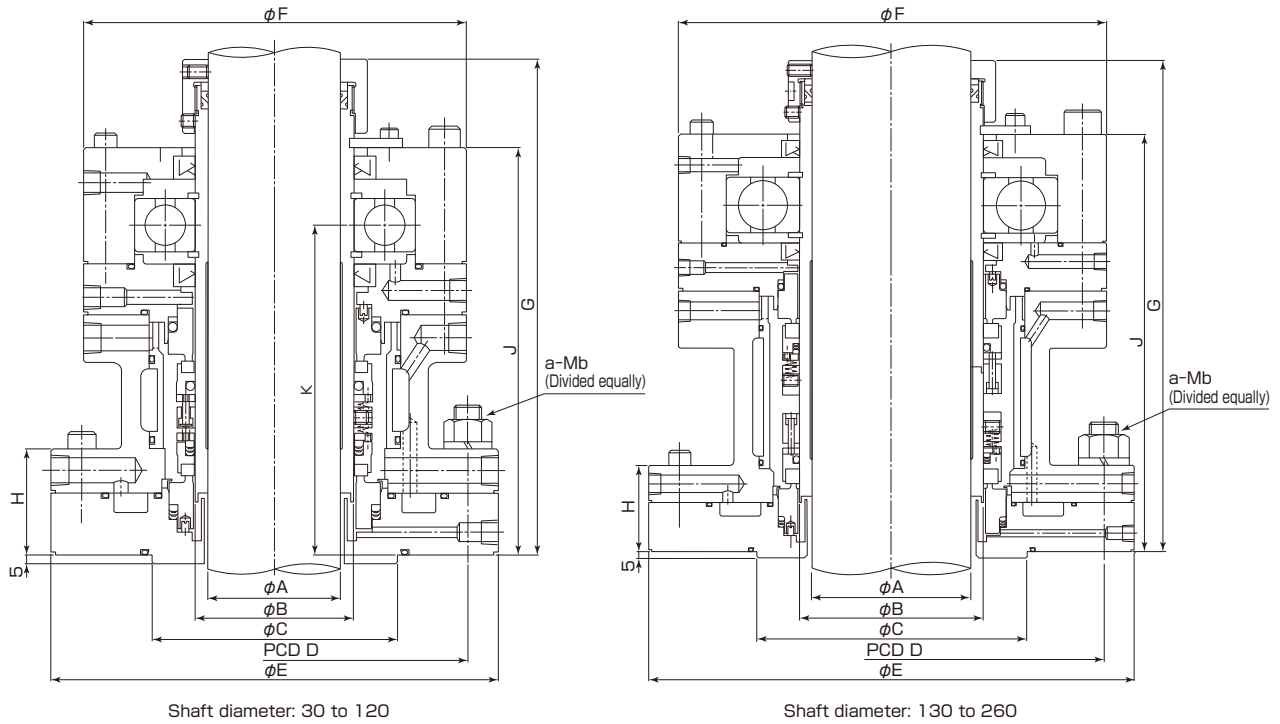


Size table

(Unit: mm)

| Shaft diameter ΦA h6 | Nominal size ΦB | ΦC H8 | PCD D | ΦE | ΦF | G | H | J | a-Mb |
|-------------------------|--------------------|----------|-------|-----|-----|-----|----|-----|--------|
| 30 | 45 | 80 | 155 | 190 | 155 | 204 | 60 | 154 | 8-M16 |
| 35 | 50 | 90 | 175 | 210 | 158 | 204 | 60 | 154 | 8-M16 |
| 40 | 55 | 90 | 175 | 210 | 163 | 204 | 60 | 154 | 8-M16 |
| 45 | 60 | 100 | 185 | 220 | 178 | 205 | 60 | 155 | 8-M16 |
| 50 | 65 | 100 | 185 | 220 | 188 | 205 | 60 | 155 | 8-M16 |
| 55 | 70 | 120 | 200 | 235 | 193 | 205 | 60 | 155 | 8-M16 |
| 60 | 75 | 120 | 200 | 235 | 198 | 205 | 60 | 155 | 8-M16 |
| 65 | 80 | 130 | 210 | 245 | 203 | 205 | 60 | 155 | 8-M16 |
| 70 | 85 | 140 | 220 | 255 | 208 | 205 | 60 | 155 | 8-M16 |
| 75 | 90 | 140 | 220 | 255 | 218 | 205 | 60 | 155 | 8-M16 |
| 80 | 95 | 150 | 245 | 285 | 238 | 205 | 60 | 155 | 8-M20 |
| 85 | 100 | 150 | 245 | 285 | 243 | 205 | 60 | 155 | 8-M20 |
| 90 | 105 | 160 | 260 | 300 | 258 | 215 | 60 | 165 | 8-M20 |
| 95 | 110 | 160 | 260 | 300 | 263 | 215 | 60 | 165 | 8-M20 |
| 105 | 120 | 170 | 270 | 310 | 283 | 215 | 60 | 165 | 12-M20 |
| 115 | 130 | 190 | 280 | 320 | 298 | 215 | 60 | 165 | 12-M20 |
| 120 | 140 | 200 | 315 | 355 | 328 | 250 | 70 | 200 | 12-M20 |
| 130 | 150 | 220 | 345 | 395 | 348 | 300 | 70 | 240 | 12-M24 |
| 140 | 160 | 230 | 355 | 405 | 368 | 300 | 70 | 240 | 12-M24 |
| 150 | 170 | 240 | 365 | 415 | 390 | 315 | 70 | 255 | 12-M24 |
| 160 | 180 | 250 | 375 | 425 | 408 | 315 | 70 | 255 | 12-M24 |
| 170 | 190 | 260 | 390 | 440 | 418 | 315 | 70 | 255 | 12-M24 |
| 180 | 200 | 320 | 425 | 475 | 438 | 315 | 70 | 255 | 12-M24 |
| 190 | 210 | 330 | 435 | 485 | 485 | 335 | 90 | 275 | 12-M24 |
| 200 | 220 | 350 | 460 | 510 | 485 | 335 | 90 | 275 | 12-M24 |
| 210 | 230 | 360 | 480 | 530 | 528 | 345 | 90 | 285 | 12-M24 |
| 220 | 240 | 370 | 505 | 565 | 528 | 345 | 90 | 285 | 16-M27 |
| 230 | 250 | 380 | 515 | 575 | 573 | 355 | 90 | 295 | 16-M27 |
| 240 | 260 | 400 | 550 | 610 | 573 | 380 | 90 | 310 | 16-M27 |
| 250 | 270 | 410 | 560 | 620 | 593 | 380 | 90 | 310 | 16-M27 |
| 260 | 280 | 410 | 560 | 620 | 593 | 380 | 90 | 310 | 16-M27 |

Basic structure diagram

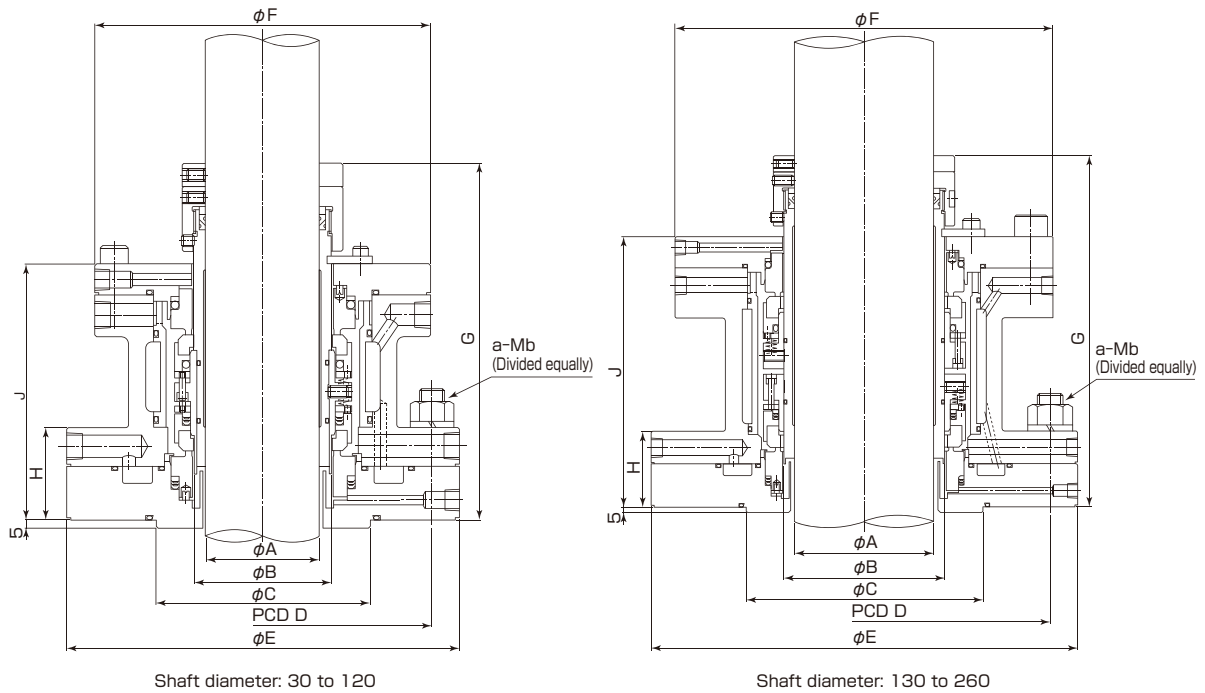


Size table

(Unit: mm)

| Shaft diameter ϕA h6 | Nominal size ϕB | ϕC H8 | PCD D | ϕE | ϕF | G | H | J | K | Bearing No. | a-Mb |
|-------------------------------|--------------------------|----------------|-------|----------|----------|-----|----|-----|-----|----------------|--------|
| 30 | 45 | 80 | 155 | 190 | 155 | 266 | 60 | 216 | 180 | #6209 | 8-M16 |
| 35 | 50 | 90 | 175 | 210 | 158 | 267 | 60 | 217 | 181 | #6210 | 8-M16 |
| 40 | 55 | 90 | 175 | 210 | 163 | 268 | 60 | 218 | 182 | #6211 | 8-M16 |
| 45 | 60 | 100 | 185 | 220 | 178 | 272 | 60 | 222 | 182 | #6212 | 8-M16 |
| 50 | 65 | 100 | 185 | 220 | 188 | 273 | 60 | 223 | 183 | #6213 | 8-M16 |
| 55 | 70 | 120 | 200 | 235 | 193 | 274 | 60 | 224 | 183 | #6214 | 8-M16 |
| 60 | 75 | 120 | 200 | 235 | 198 | 275 | 60 | 225 | 184 | #6215 | 8-M16 |
| 65 | 80 | 130 | 210 | 245 | 203 | 276 | 60 | 226 | 184 | #6216 | 8-M16 |
| 70 | 85 | 140 | 220 | 255 | 208 | 279 | 60 | 229 | 186 | #6217 | 8-M16 |
| 75 | 90 | 140 | 220 | 255 | 218 | 281 | 60 | 231 | 187 | #6218 | 8-M16 |
| 80 | 95 | 150 | 245 | 285 | 238 | 284 | 60 | 234 | 188 | #6219 | 8-M20 |
| 85 | 100 | 150 | 245 | 285 | 243 | 286 | 60 | 236 | 189 | #6220 | 8-M20 |
| 90 | 105 | 160 | 260 | 300 | 258 | 305 | 60 | 255 | 206 | #6221 | 8-M20 |
| 95 | 110 | 160 | 260 | 300 | 263 | 307 | 60 | 257 | 207 | #6222 | 8-M20 |
| 105 | 120 | 170 | 270 | 310 | 283 | 309 | 60 | 259 | 208 | #6224 | 12-M20 |
| 115 | 130 | 190 | 280 | 320 | 298 | 309 | 60 | 259 | 208 | #6226 | 12-M20 |
| 120 | 140 | 200 | 315 | 355 | 328 | 341 | 70 | 291 | 239 | #6228 | 12-M20 |
| 130 | 150 | 220 | 345 | 395 | 348 | 398 | 70 | 338 | 281 | #6230 | 12-M24 |
| 140 | 160 | 230 | 355 | 405 | 368 | 405 | 70 | 345 | 282 | #6232 | 12-M24 |
| 150 | 170 | 240 | 365 | 415 | 390 | 423 | 70 | 363 | 299 | #6234 | 12-M24 |
| 160 | 180 | 250 | 375 | 425 | 408 | 423 | 70 | 363 | 300 | #6236 | 12-M24 |
| 170 | 190 | 260 | 390 | 440 | 418 | 430 | 70 | 370 | 301 | #6238 | 12-M24 |
| 180 | 200 | 320 | 425 | 475 | 438 | 432 | 70 | 372 | 302 | #6240 | 12-M24 |
| 190 | 210 | 330 | 435 | 485 | 485 | 470 | 90 | 410 | 338 | #6244 | 12-M24 |
| 200 | 220 | 350 | 460 | 510 | 485 | 470 | 90 | 410 | 338 | #6244 | 12-M24 |
| 210 | 230 | 360 | 480 | 530 | 528 | 480 | 90 | 420 | 348 | #6248 | 12-M24 |
| 220 | 240 | 370 | 505 | 565 | 528 | 480 | 90 | 420 | 348 | #6248 | 16-M27 |
| 230 | 250 | 380 | 515 | 575 | 573 | 540 | 90 | 470 | 390 | #6252 | 16-M27 |
| 240 | 260 | 400 | 550 | 610 | 573 | 540 | 90 | 470 | 390 | #6252 | 16-M27 |
| 250 | 270 | 410 | 560 | 620 | 593 | 550 | 90 | 480 | 410 | #6256 | 16-M27 |
| 260 | 280 | 410 | 560 | 620 | 593 | 550 | 90 | 480 | 410 | #6256 | 16-M27 |

Basic structure diagram

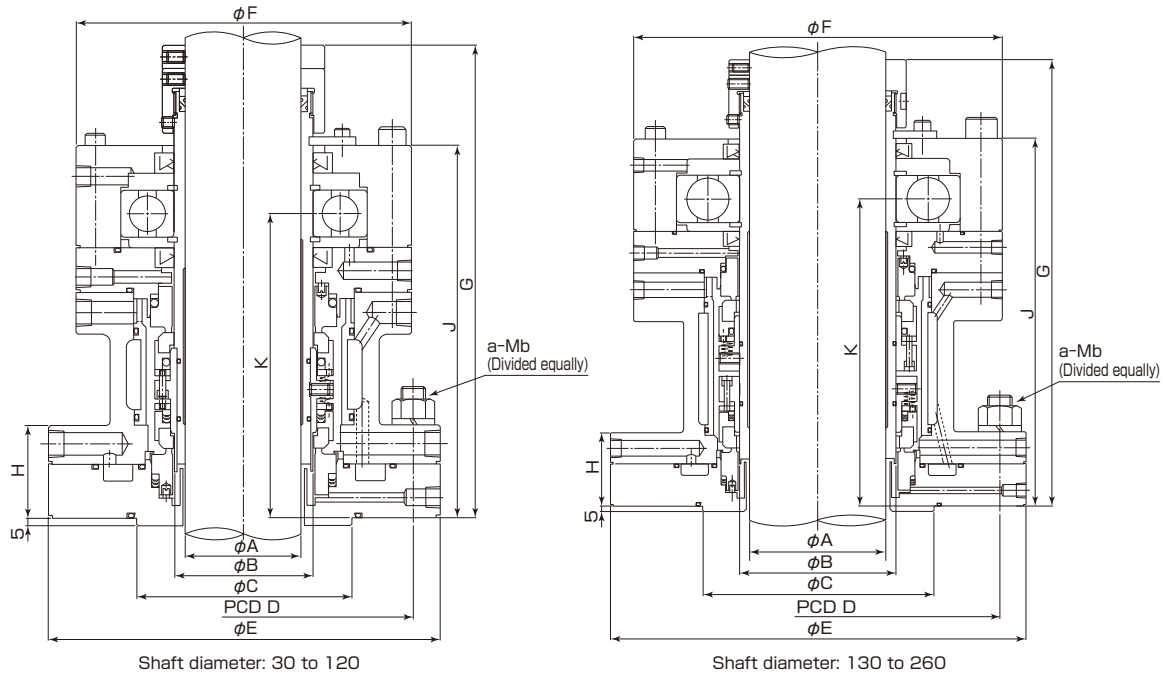


Size table

(Unit: mm)

| Shaft diameter ΦA h6 | Nominal size ΦB | ΦC H8 | PCD D | ΦE | ΦF | G | H | J | a-Mb |
|-------------------------------|--------------------------|----------------|-------|----------|----------|-----|----|-----|--------|
| 30 | 50 | 80 | 155 | 190 | 155 | 228 | 60 | 163 | 8-M16 |
| 35 | 55 | 90 | 175 | 210 | 158 | 228 | 60 | 163 | 8-M16 |
| 40 | 60 | 90 | 175 | 210 | 163 | 228 | 60 | 163 | 8-M16 |
| 45 | 65 | 100 | 185 | 220 | 178 | 228 | 60 | 163 | 8-M16 |
| 50 | 70 | 100 | 185 | 220 | 188 | 230 | 60 | 165 | 8-M16 |
| 55 | 75 | 120 | 200 | 235 | 193 | 230 | 60 | 165 | 8-M16 |
| 60 | 80 | 120 | 200 | 235 | 198 | 230 | 60 | 165 | 8-M16 |
| 65 | 85 | 130 | 210 | 245 | 203 | 230 | 60 | 165 | 8-M16 |
| 70 | 90 | 140 | 220 | 255 | 208 | 230 | 60 | 165 | 8-M16 |
| 75 | 95 | 140 | 220 | 255 | 218 | 230 | 60 | 165 | 8-M16 |
| 80 | 100 | 150 | 245 | 285 | 238 | 230 | 60 | 165 | 8-M20 |
| 85 | 105 | 150 | 245 | 285 | 243 | 237 | 60 | 172 | 8-M20 |
| 90 | 110 | 160 | 260 | 300 | 258 | 240 | 60 | 175 | 8-M20 |
| 95 | 115 | 160 | 260 | 300 | 263 | 240 | 60 | 175 | 8-M20 |
| 105 | 125 | 170 | 270 | 310 | 283 | 240 | 60 | 175 | 12-M20 |
| 115 | 135 | 190 | 280 | 320 | 298 | 274 | 60 | 209 | 12-M20 |
| 120 | 145 | 200 | 315 | 355 | 328 | 274 | 70 | 209 | 12-M20 |
| 130 | 160 | 220 | 345 | 395 | 348 | 325 | 70 | 250 | 12-M24 |
| 140 | 170 | 230 | 355 | 405 | 368 | 339 | 70 | 264 | 12-M24 |
| 150 | 180 | 240 | 365 | 415 | 390 | 340 | 70 | 265 | 12-M24 |
| 160 | 190 | 250 | 375 | 425 | 408 | 340 | 70 | 265 | 12-M24 |
| 170 | 200 | 260 | 390 | 440 | 418 | 340 | 70 | 265 | 12-M24 |
| 180 | 210 | 320 | 425 | 475 | 438 | 350 | 70 | 275 | 12-M24 |
| 190 | 220 | 330 | 435 | 485 | 485 | 360 | 90 | 285 | 12-M24 |
| 200 | 230 | 350 | 460 | 510 | 485 | 366 | 90 | 291 | 12-M24 |
| 210 | 240 | 360 | 480 | 530 | 528 | 370 | 90 | 295 | 12-M24 |
| 220 | 250 | 370 | 505 | 565 | 528 | 370 | 90 | 295 | 16-M27 |
| 230 | 260 | 380 | 515 | 575 | 573 | 380 | 90 | 305 | 16-M27 |
| 240 | 270 | 400 | 550 | 610 | 573 | 405 | 90 | 320 | 16-M27 |
| 250 | 280 | 410 | 560 | 620 | 593 | 405 | 90 | 320 | 16-M27 |
| 260 | 290 | 410 | 560 | 620 | 593 | 405 | 90 | 320 | 16-M27 |

Basic structure diagram

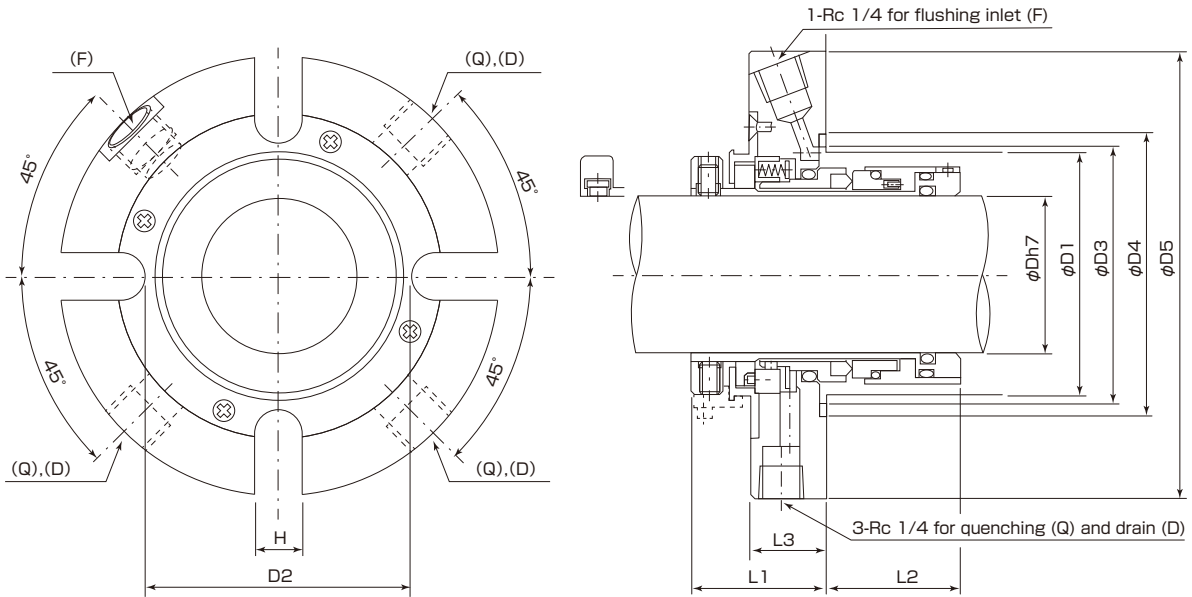


Size table

(Unit: mm)

| Shaft diameter ΦA h6 | Nominal size ΦB | ΦC H8 | PCD D | ΦE | ΦF | G | H | J | K | Bearing No. | a-Mb |
|-------------------------------|--------------------------|----------------|-------|----------|----------|-----|----|-----|-----|----------------|--------|
| 30 | 50 | 80 | 155 | 190 | 155 | 289 | 60 | 224 | 188 | #6209 | 8-M16 |
| 35 | 55 | 90 | 175 | 210 | 158 | 290 | 60 | 225 | 189 | #6210 | 8-M16 |
| 40 | 60 | 90 | 175 | 210 | 163 | 291 | 60 | 226 | 190 | #6211 | 8-M16 |
| 45 | 65 | 100 | 185 | 220 | 178 | 295 | 60 | 230 | 190 | #6212 | 8-M16 |
| 50 | 70 | 100 | 185 | 220 | 188 | 298 | 60 | 233 | 193 | #6213 | 8-M16 |
| 55 | 75 | 120 | 200 | 235 | 193 | 299 | 60 | 234 | 193 | #6214 | 8-M16 |
| 60 | 80 | 120 | 200 | 235 | 198 | 300 | 60 | 235 | 194 | #6215 | 8-M16 |
| 65 | 85 | 130 | 210 | 245 | 203 | 301 | 60 | 236 | 194 | #6216 | 8-M16 |
| 70 | 90 | 140 | 220 | 255 | 208 | 304 | 60 | 239 | 196 | #6217 | 8-M16 |
| 75 | 95 | 140 | 220 | 255 | 218 | 306 | 60 | 241 | 197 | #6218 | 8-M16 |
| 80 | 100 | 150 | 245 | 285 | 238 | 309 | 60 | 244 | 198 | #6219 | 8-M20 |
| 85 | 105 | 150 | 245 | 285 | 243 | 318 | 60 | 253 | 206 | #6220 | 8-M20 |
| 90 | 110 | 160 | 260 | 300 | 258 | 330 | 60 | 265 | 216 | #6221 | 8-M20 |
| 95 | 115 | 160 | 260 | 300 | 263 | 332 | 60 | 267 | 217 | #6222 | 8-M20 |
| 105 | 125 | 170 | 270 | 310 | 283 | 334 | 60 | 269 | 218 | #6224 | 12-M20 |
| 115 | 135 | 190 | 280 | 320 | 298 | 363 | 60 | 298 | 247 | #6226 | 12-M20 |
| 120 | 145 | 200 | 315 | 355 | 328 | 365 | 70 | 300 | 248 | #6228 | 12-M20 |
| 130 | 160 | 220 | 345 | 395 | 348 | 423 | 70 | 348 | 291 | #6230 | 12-M24 |
| 140 | 170 | 230 | 355 | 405 | 368 | 443 | 70 | 368 | 306 | #6232 | 12-M24 |
| 150 | 180 | 240 | 365 | 415 | 390 | 448 | 70 | 373 | 309 | #6234 | 12-M24 |
| 160 | 190 | 250 | 375 | 425 | 408 | 448 | 70 | 373 | 309 | #6236 | 12-M24 |
| 170 | 200 | 260 | 390 | 440 | 418 | 455 | 70 | 380 | 311 | #6238 | 12-M24 |
| 180 | 210 | 320 | 425 | 475 | 438 | 466 | 70 | 391 | 322 | #6240 | 12-M24 |
| 190 | 220 | 330 | 435 | 485 | 485 | 495 | 90 | 420 | 348 | #6244 | 12-M24 |
| 200 | 230 | 350 | 460 | 510 | 485 | 495 | 90 | 420 | 348 | #6244 | 12-M24 |
| 210 | 240 | 360 | 480 | 530 | 528 | 505 | 90 | 430 | 358 | #6248 | 12-M24 |
| 220 | 250 | 370 | 505 | 565 | 528 | 505 | 90 | 430 | 358 | #6248 | 16-M27 |
| 230 | 260 | 380 | 515 | 575 | 573 | 555 | 90 | 480 | 380 | #6252 | 16-M27 |
| 240 | 270 | 400 | 550 | 610 | 573 | 555 | 90 | 480 | 380 | #6252 | 16-M27 |
| 250 | 280 | 410 | 560 | 620 | 593 | 570 | 90 | 495 | 400 | #6256 | 16-M27 |
| 260 | 290 | 410 | 560 | 620 | 593 | 570 | 90 | 495 | 400 | #6256 | 16-M27 |

Basic structure diagram

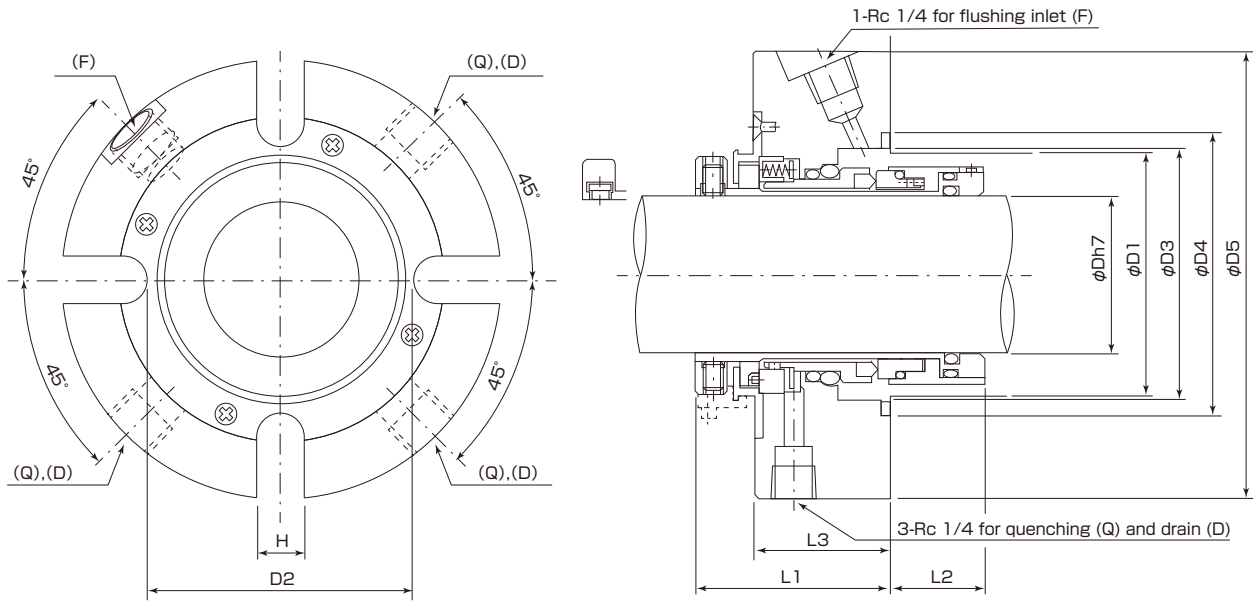


Size table

(Unit: mm)

| Nominal size | ΦD (Shaft diameter) | ΦD1 | | D2 | ΦD3 | ΦD4 | ΦD5 | L1 | L2 | L3 | H |
|--------------|------------------------|-------|-------|-----|-----|-----|-----|----|----|----|----|
| | | (min) | (max) | | | | | | | | |
| 020 | 20 | 36 | 48 | 56 | 46 | 54 | 98 | 35 | 35 | 21 | 12 |
| 025 | 25 | 41 | 53 | 61 | 51 | 59 | 105 | 35 | 35 | 21 | 12 |
| 028 | 28 | 44 | 56 | 64 | 54 | 62 | 108 | 35 | 35 | 21 | 12 |
| 030 | 30 | 46 | 58 | 66 | 56 | 64 | 108 | 35 | 35 | 21 | 12 |
| 032 | 32 | 48 | 60 | 68 | 58 | 66 | 115 | 35 | 35 | 21 | 14 |
| 035 | 35 | 51 | 63 | 71 | 61 | 69 | 115 | 35 | 35 | 21 | 14 |
| 038 | 38 | 57 | 66 | 76 | 66 | 74 | 125 | 38 | 39 | 22 | 14 |
| 040 | 40 | 59 | 68 | 78 | 68 | 76 | 125 | 38 | 39 | 22 | 14 |
| 042 | 42 | 61 | 70 | 80 | 70 | 78 | 128 | 38 | 39 | 22 | 14 |
| 045 | 45 | 64 | 73 | 83 | 73 | 81 | 128 | 38 | 39 | 22 | 14 |
| 048 | 48 | 67 | 76 | 86 | 76 | 84 | 135 | 38 | 39 | 22 | 16 |
| 050 | 50 | 69 | 78 | 88 | 78 | 86 | 135 | 38 | 39 | 22 | 18 |
| 055 | 55 | 74 | 83 | 93 | 83 | 91 | 158 | 38 | 39 | 22 | 18 |
| 060 | 60 | 79 | 88 | 98 | 88 | 96 | 164 | 38 | 39 | 22 | 18 |
| 065 | 65 | 87 | 94 | 108 | 94 | 105 | 168 | 43 | 43 | 24 | 18 |
| 070 | 70 | 92 | 99 | 113 | 99 | 110 | 178 | 43 | 43 | 24 | 18 |
| 075 | 75 | 99 | 108 | 122 | 105 | 119 | 198 | 45 | 43 | 24 | 22 |
| 080 | 80 | 105 | 113 | 128 | 110 | 124 | 198 | 45 | 43 | 24 | 22 |
| 085 | 85 | 110 | 118 | 133 | 115 | 129 | 208 | 45 | 43 | 24 | 22 |
| 090 | 90 | 115 | 123 | 138 | 120 | 134 | 208 | 45 | 43 | 24 | 22 |
| 095 | 95 | 120 | 128 | 143 | 125 | 139 | 218 | 45 | 43 | 24 | 22 |
| 100 | 100 | 125 | 133 | 148 | 130 | 144 | 218 | 45 | 43 | 24 | 22 |

Basic structure diagram

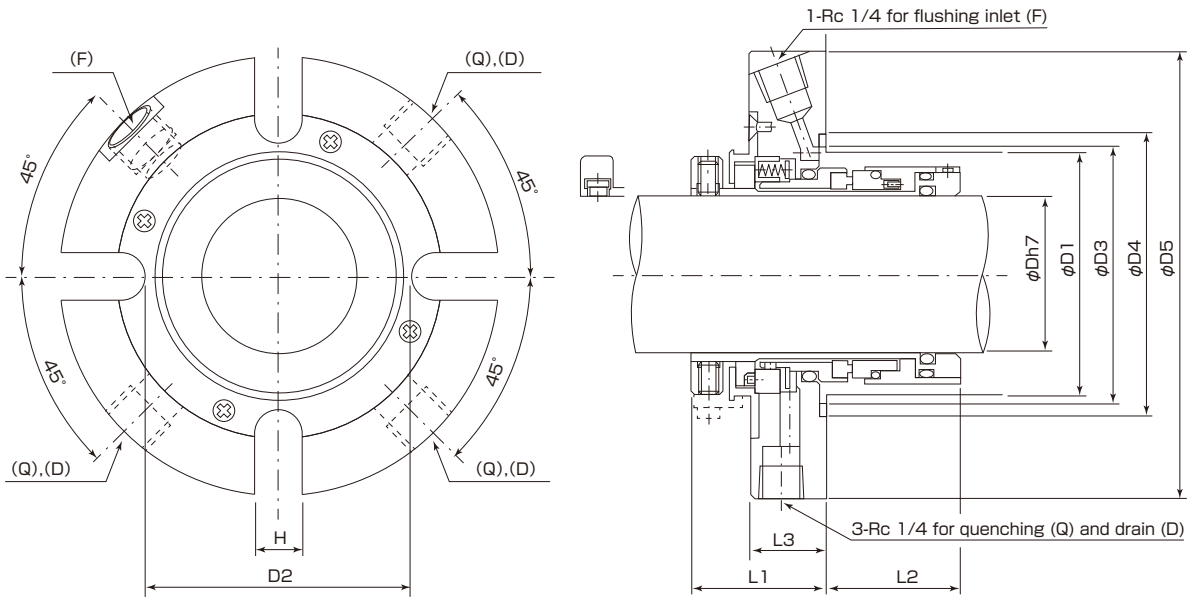


Size table

(Unit: mm)

| Nominal size | ϕD (Shaft diameter) | $\phi D1$ | | D2 | $\phi D3$ | $\phi D4$ | $\phi D5$ | L1 | L2 | L3 | H |
|--------------|------------------------------|-----------|-------|----|-----------|-----------|-----------|----|----|----|----|
| | | (min) | (max) | | | | | | | | |
| 020 | 20 | 36 | 48 | 56 | 46 | 54 | 98 | 49 | 25 | 35 | 12 |
| 025 | 25 | 41 | 53 | 61 | 51 | 59 | 105 | 49 | 25 | 35 | 12 |
| 028 | 28 | 44 | 56 | 64 | 54 | 62 | 108 | 49 | 25 | 35 | 12 |
| 030 | 30 | 46 | 58 | 66 | 56 | 64 | 108 | 49 | 25 | 35 | 12 |
| 032 | 32 | 48 | 60 | 68 | 58 | 66 | 115 | 49 | 25 | 35 | 14 |
| 035 | 35 | 51 | 63 | 71 | 61 | 69 | 115 | 49 | 25 | 35 | 14 |
| 038 | 38 | 57 | 66 | 76 | 66 | 74 | 125 | 53 | 28 | 37 | 14 |
| 040 | 40 | 59 | 68 | 78 | 68 | 76 | 125 | 53 | 28 | 37 | 14 |
| 042 | 42 | 61 | 70 | 80 | 70 | 78 | 128 | 53 | 28 | 37 | 14 |
| 045 | 45 | 64 | 73 | 83 | 73 | 81 | 128 | 53 | 28 | 37 | 14 |
| 048 | 48 | 67 | 76 | 86 | 76 | 84 | 135 | 53 | 28 | 37 | 16 |
| 050 | 50 | 69 | 78 | 88 | 78 | 86 | 135 | 53 | 28 | 37 | 18 |
| 055 | 55 | 74 | 83 | 93 | 83 | 91 | 158 | 53 | 28 | 37 | 18 |
| 060 | 60 | 79 | 88 | 98 | 88 | 96 | 164 | 53 | 28 | 37 | 18 |

Basic structure diagram

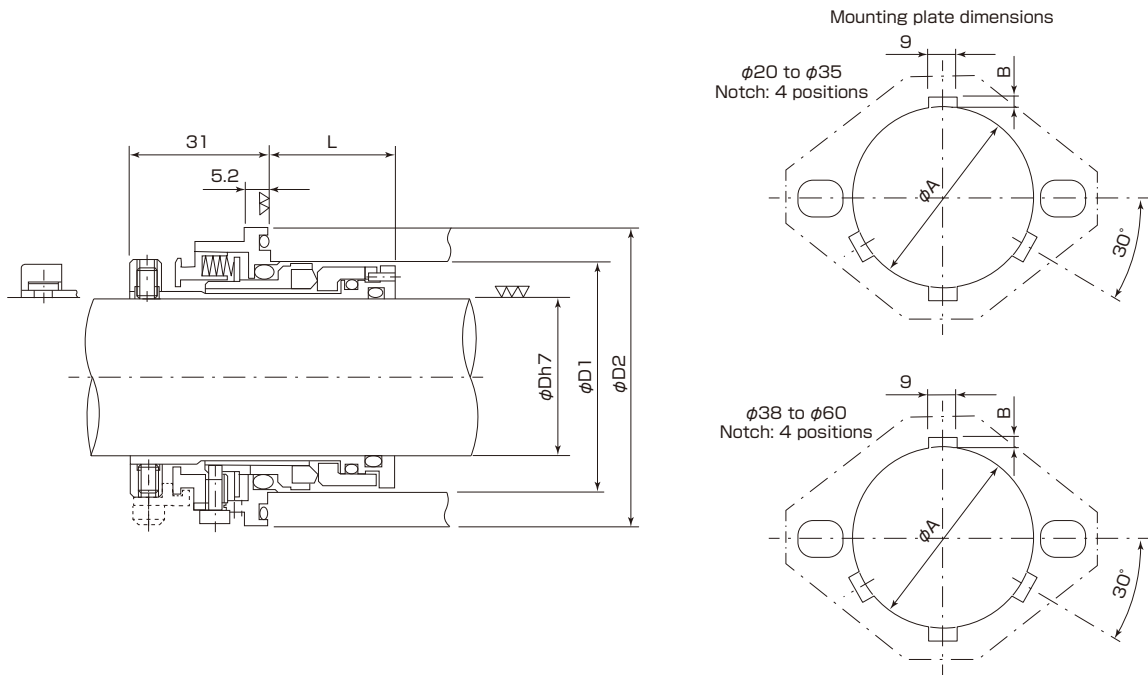


Size table

(Unit: mm)

| Nominal size | ΦD (Shaft diameter) | ΦD1 | | D2 | ΦD3 | ΦD4 | ΦD5 | L1 | L2 | L3 | H |
|--------------|------------------------|-------|-------|-----|-----|-----|-----|----|----|----|----|
| | | (min) | (max) | | | | | | | | |
| 020 | 20 | 36 | 48 | 56 | 46 | 54 | 98 | 35 | 35 | 21 | 12 |
| 025 | 25 | 41 | 53 | 61 | 51 | 59 | 105 | 35 | 35 | 21 | 12 |
| 028 | 28 | 44 | 56 | 64 | 54 | 62 | 108 | 35 | 35 | 21 | 12 |
| 030 | 30 | 46 | 58 | 66 | 56 | 64 | 108 | 35 | 35 | 21 | 12 |
| 032 | 32 | 48 | 60 | 68 | 58 | 66 | 115 | 35 | 35 | 21 | 14 |
| 035 | 35 | 51 | 63 | 71 | 61 | 69 | 115 | 35 | 35 | 21 | 14 |
| 038 | 38 | 57 | 66 | 76 | 66 | 74 | 125 | 38 | 39 | 22 | 14 |
| 040 | 40 | 59 | 68 | 78 | 68 | 76 | 125 | 38 | 39 | 22 | 14 |
| 042 | 42 | 61 | 70 | 80 | 70 | 78 | 128 | 38 | 39 | 22 | 14 |
| 045 | 45 | 64 | 73 | 83 | 73 | 81 | 128 | 38 | 39 | 22 | 14 |
| 048 | 48 | 67 | 76 | 86 | 76 | 84 | 135 | 38 | 39 | 22 | 16 |
| 050 | 50 | 69 | 78 | 88 | 78 | 86 | 135 | 38 | 39 | 22 | 18 |
| 055 | 55 | 74 | 83 | 93 | 83 | 91 | 158 | 38 | 39 | 22 | 18 |
| 060 | 60 | 79 | 88 | 98 | 88 | 96 | 164 | 38 | 39 | 22 | 18 |
| 065 | 65 | 87 | 94 | 108 | 94 | 105 | 168 | 43 | 43 | 24 | 18 |
| 070 | 70 | 92 | 99 | 113 | 99 | 110 | 178 | 43 | 43 | 24 | 18 |
| 075 | 75 | 99 | 108 | 122 | 105 | 119 | 198 | 45 | 43 | 24 | 22 |
| 080 | 80 | 105 | 113 | 128 | 110 | 124 | 198 | 45 | 43 | 24 | 22 |
| 085 | 85 | 110 | 118 | 133 | 115 | 129 | 208 | 45 | 43 | 24 | 22 |
| 090 | 90 | 115 | 123 | 138 | 120 | 134 | 208 | 45 | 43 | 24 | 22 |
| 095 | 95 | 120 | 128 | 143 | 125 | 139 | 218 | 45 | 43 | 24 | 22 |
| 100 | 100 | 125 | 133 | 148 | 130 | 144 | 218 | 45 | 43 | 24 | 22 |

Basic structure diagram

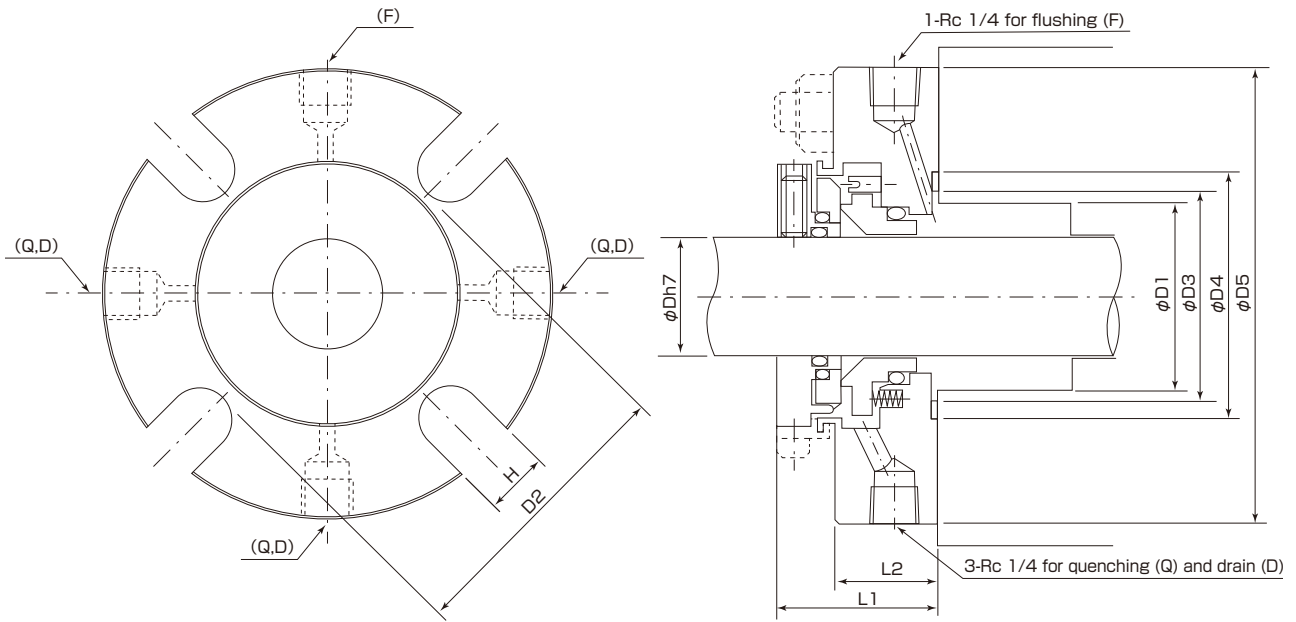


Size table

(Unit: mm)

| D (Shaft diameter) | D1 Min. | D2 | L | Reference: Mounting bolt PCD (min.) | | | | | | Plate size | |
|-----------------------|------------|----|----|-------------------------------------|-----|-----|--------------------------|-----|-----|------------|-----|
| | | | | Hexagon head bolt | | | Hexagon socket head bolt | | | A | B |
| | | | | M8 | M10 | M12 | M8 | M10 | M12 | | |
| 20 | 36 | 51 | 28 | 61 | 66 | 68 | 60 | 62 | 64 | 45 | 4.5 |
| 25 | 41 | 56 | ↑ | 66 | 71 | 73 | 65 | 67 | 69 | 50 | ↑ |
| 28 | 44 | 59 | ↑ | 69 | 74 | 76 | 68 | 70 | 72 | 53 | ↑ |
| 30 | 46 | 61 | ↑ | 71 | 76 | 78 | 70 | 72 | 74 | 55 | ↑ |
| 32 | 48 | 63 | ↑ | 73 | 78 | 80 | 72 | 74 | 76 | 57 | ↑ |
| 35 | 51 | 66 | ↑ | 76 | 81 | 83 | 75 | 77 | 79 | 60 | ↑ |
| 38 | 57 | 73 | 31 | 82 | 87 | 89 | 82 | 84 | 86 | 66.5 | 3.5 |
| 40 | 59 | 75 | ↑ | 84 | 89 | 91 | 84 | 86 | 88 | 68.5 | ↑ |
| 42 | 61 | 77 | ↑ | 86 | 91 | 93 | 86 | 88 | 90 | 70.5 | ↑ |
| 45 | 64 | 80 | ↑ | 89 | 94 | 96 | 89 | 91 | 93 | 73.5 | ↑ |
| 48 | 67 | 83 | ↑ | 92 | 97 | 99 | 92 | 94 | 96 | 76.5 | ↑ |
| 50 | 69 | 85 | ↑ | 94 | 99 | 101 | 94 | 96 | 98 | 78.5 | ↑ |
| 55 | 74 | 90 | ↑ | 99 | 104 | 106 | 99 | 101 | 103 | 83.5 | ↑ |
| 60 | 79 | 95 | ↑ | 104 | 109 | 111 | 104 | 106 | 108 | 88.5 | ↑ |

Basic structure diagram

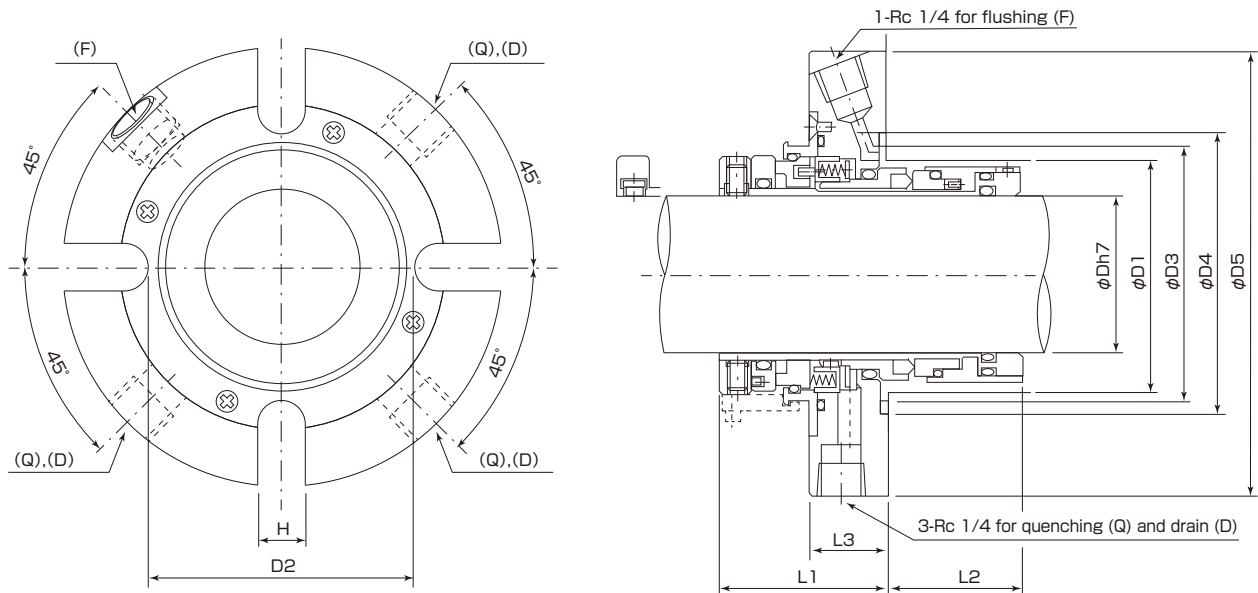


Size table

(Unit: mm)

| D (Shaft diameter) | D1 (min.) | D1 (max.) | D2 | D3 | D4 | D5 | L1 | L2 | H | Reference: Bolt PCD (min.) | | |
|-----------------------|-----------|-----------|-----|-----|-----|-----|----|----|----|----------------------------|-------------------|--------------------------|
| | | | | | | | | | | Bolt size | Hexagon head bolt | Hexagon socket head bolt |
| 020 | 36 | 48 | 56 | 46 | 54 | 98 | 35 | 21 | 12 | 4-M10 | 74 | 70 |
| 025 | 41 | 53 | 61 | 51 | 59 | 105 | 35 | 21 | 12 | 4-M10 | 79 | 75 |
| 028 | 44 | 56 | 64 | 54 | 62 | 108 | 35 | 21 | 12 | 4-M10 | 82 | 78 |
| 030 | 46 | 58 | 66 | 56 | 64 | 108 | 35 | 21 | 12 | 4-M10 | 84 | 80 |
| 032 | 48 | 60 | 68 | 58 | 66 | 115 | 35 | 21 | 14 | 4-M12 | 88 | 84 |
| 035 | 51 | 63 | 71 | 61 | 69 | 115 | 35 | 21 | 14 | 4-M12 | 91 | 87 |
| 038 | 57 | 66 | 76 | 66 | 74 | 125 | 38 | 24 | 14 | 4-M12 | 96 | 92 |
| 040 | 59 | 68 | 78 | 68 | 76 | 125 | 38 | 24 | 14 | 4-M12 | 98 | 94 |
| 042 | 61 | 70 | 80 | 70 | 78 | 128 | 38 | 24 | 14 | 4-M12 | 100 | 96 |
| 045 | 64 | 73 | 83 | 73 | 81 | 128 | 38 | 24 | 14 | 4-M12 | 104 | 100 |
| 048 | 67 | 76 | 86 | 76 | 84 | 135 | 38 | 24 | 16 | 4-M14 | 110 | 105 |
| 050 | 69 | 78 | 88 | 78 | 86 | 135 | 38 | 24 | 18 | 4-M16 | 114 | 110 |
| 055 | 74 | 83 | 93 | 83 | 91 | 158 | 38 | 24 | 18 | 4-M16 | 120 | 116 |
| 060 | 79 | 88 | 98 | 88 | 96 | 164 | 38 | 24 | 18 | 4-M16 | 124 | 120 |
| 065 | 87 | 94 | 108 | 94 | 105 | 168 | 43 | 27 | 18 | 4-M16 | 132 | 128 |
| 070 | 92 | 99 | 113 | 99 | 110 | 178 | 43 | 27 | 18 | 4-M16 | 137 | 133 |
| 075 | 99 | 108 | 122 | 105 | 119 | 198 | 45 | 29 | 22 | 4-M20 | 151 | 146 |
| 080 | 105 | 113 | 128 | 110 | 124 | 198 | 45 | 29 | 22 | 4-M20 | 156 | 151 |
| 085 | 110 | 118 | 133 | 115 | 129 | 208 | 45 | 29 | 22 | 4-M20 | 161 | 156 |
| 090 | 115 | 123 | 138 | 120 | 134 | 208 | 45 | 29 | 22 | 4-M20 | 166 | 161 |
| 095 | 120 | 128 | 143 | 125 | 139 | 218 | 45 | 29 | 22 | 4-M20 | 171 | 166 |
| 100 | 125 | 133 | 148 | 130 | 144 | 218 | 45 | 29 | 22 | 4-M20 | 176 | 171 |

Basic structure diagram



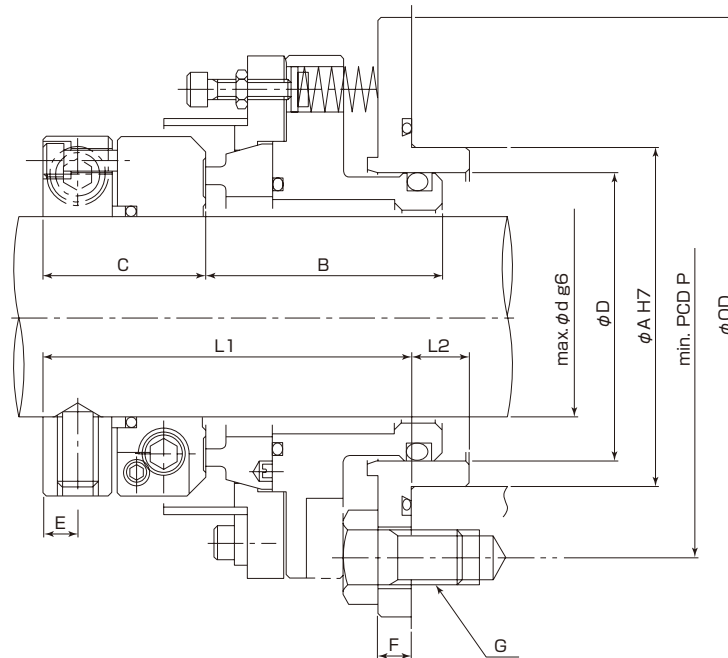
Note: This diagram shows a tandem seal of Cassette Seal "type GAKEM" as an example.

Size table

(Unit: mm)

| Nominal size | ϕD (Shaft diameter) | $\phi D1$ | | $D2$ | $\phi D3$ | $\phi D4$ | $\phi D5$ | $L1$ | $L2$ | $L3$ | H |
|--------------|------------------------------|-----------|-------|------|-----------|-----------|-----------|------|------|------|-----|
| | | (min) | (max) | | | | | | | | |
| 020 | 20 | 36 | 48 | 56 | 46 | 54 | 98 | 45 | 35 | 21 | 12 |
| 025 | 25 | 41 | 53 | 61 | 51 | 59 | 105 | 45 | 35 | 21 | 12 |
| 028 | 28 | 44 | 56 | 64 | 54 | 62 | 108 | 45 | 35 | 21 | 12 |
| 030 | 30 | 46 | 58 | 66 | 56 | 64 | 108 | 45 | 35 | 21 | 12 |
| 032 | 32 | 48 | 60 | 68 | 58 | 66 | 115 | 45 | 35 | 21 | 14 |
| 035 | 35 | 51 | 63 | 71 | 61 | 69 | 115 | 45 | 35 | 21 | 14 |
| 038 | 38 | 57 | 66 | 76 | 66 | 74 | 125 | 51 | 39 | 22 | 14 |
| 040 | 40 | 59 | 68 | 78 | 68 | 76 | 125 | 51 | 39 | 22 | 14 |
| 042 | 42 | 61 | 70 | 80 | 70 | 78 | 128 | 51 | 39 | 22 | 14 |
| 045 | 45 | 64 | 73 | 83 | 73 | 81 | 128 | 51 | 39 | 22 | 14 |
| 048 | 48 | 67 | 76 | 86 | 76 | 84 | 135 | 51 | 39 | 22 | 16 |
| 050 | 50 | 69 | 78 | 88 | 78 | 86 | 135 | 51 | 39 | 22 | 18 |
| 055 | 55 | 74 | 83 | 93 | 83 | 91 | 158 | 51 | 39 | 22 | 18 |
| 060 | 60 | 79 | 88 | 98 | 88 | 96 | 164 | 51 | 39 | 22 | 18 |
| 065 | 65 | 87 | 94 | 108 | 94 | 105 | 168 | 57 | 43 | 24 | 18 |
| 070 | 70 | 92 | 99 | 113 | 99 | 110 | 178 | 57 | 43 | 24 | 18 |
| 075 | 75 | 99 | 108 | 122 | 105 | 119 | 198 | 60 | 43 | 24 | 22 |
| 080 | 80 | 105 | 113 | 128 | 110 | 124 | 198 | 60 | 43 | 24 | 22 |

Basic structure diagram

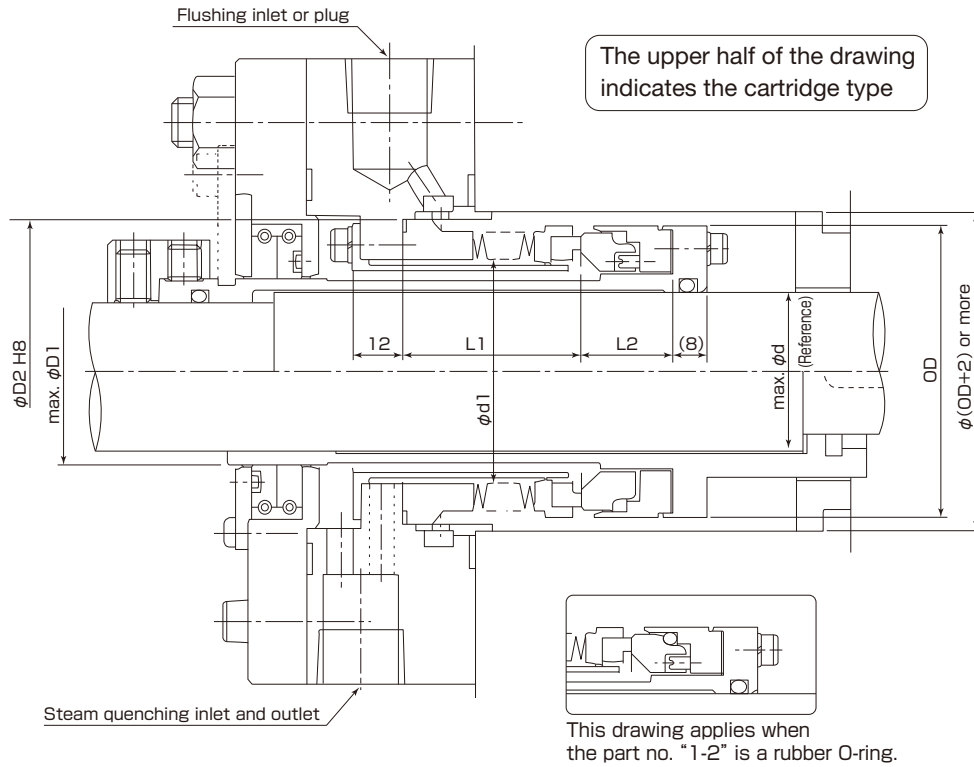


Size table

(Unit: mm)

| ϕd g6 max. | ϕD | ϕA H7 min. | B | C | E | F | G | L1 | L2 | PCD P min. | ϕOD min. |
|------------------|----------|------------------|-----|----|-----|----|-----|-----|----|------------|----------------|
| 33 | 51 | 65 | 67 | 43 | 8.5 | 8 | M12 | 100 | 15 | 100 | 125 |
| 40 | 58 | 75 | 67 | 43 | 8.5 | 8 | M12 | 100 | 15 | 110 | 132 |
| 46 | 64 | 80 | 67 | 43 | 8.5 | 8 | M12 | 100 | 15 | 115 | 138 |
| 50 | 71 | 85 | 70 | 43 | 8.5 | 8 | M12 | 100 | 15 | 120 | 143 |
| 55 | 76 | 90 | 70 | 43 | 8.5 | 8 | M12 | 100 | 15 | 125 | 148 |
| 60 | 81 | 95 | 70 | 43 | 8.5 | 8 | M12 | 100 | 15 | 130 | 153 |
| 65 | 86 | 100 | 72 | 43 | 8.5 | 8 | M12 | 102 | 15 | 135 | 158 |
| 70 | 91 | 105 | 72 | 48 | 10 | 8 | M12 | 107 | 15 | 140 | 165 |
| 80 | 101 | 115 | 72 | 48 | 10 | 8 | M12 | 107 | 15 | 150 | 175 |
| 90 | 111 | 125 | 73 | 48 | 10 | 10 | M16 | 109 | 15 | 165 | 195 |
| 100 | 121 | 135 | 73 | 48 | 10 | 10 | M16 | 109 | 15 | 175 | 205 |
| 110 | 131 | 145 | 73 | 48 | 10 | 10 | M16 | 109 | 15 | 185 | 215 |
| 120 | 141 | 155 | 73 | 48 | 10 | 10 | M16 | 109 | 15 | 195 | 225 |
| 130 | 151 | 165 | 78 | 53 | 11 | 10 | M16 | 119 | 15 | 205 | 238 |
| 140 | 161 | 175 | 78 | 53 | 11 | 10 | M16 | 119 | 15 | 215 | 248 |
| 150 | 171 | 185 | 78 | 53 | 11 | 10 | M16 | 119 | 15 | 225 | 258 |
| 160 | 181 | 195 | 78 | 53 | 11 | 10 | M16 | 119 | 15 | 235 | 268 |
| 170 | 196 | 210 | 90 | 65 | 15 | 14 | M20 | 142 | 20 | 260 | 298 |
| 185 | 211 | 225 | 90 | 65 | 15 | 14 | M20 | 142 | 20 | 275 | 313 |
| 200 | 226 | 240 | 90 | 65 | 15 | 14 | M20 | 142 | 20 | 290 | 328 |
| 215 | 241 | 255 | 90 | 65 | 15 | 14 | M20 | 142 | 20 | 305 | 338 |
| 230 | 256 | 270 | 90 | 65 | 15 | 14 | M20 | 142 | 20 | 320 | 358 |
| 240 | 271 | 285 | 105 | 75 | 18 | 14 | M24 | 167 | 20 | 340 | 388 |
| 250 | 286 | 300 | 105 | 75 | 18 | 14 | M24 | 167 | 20 | 355 | 398 |
| 260 | 301 | 315 | 105 | 75 | 18 | 14 | M24 | 167 | 20 | 370 | 408 |

Basic structure diagram

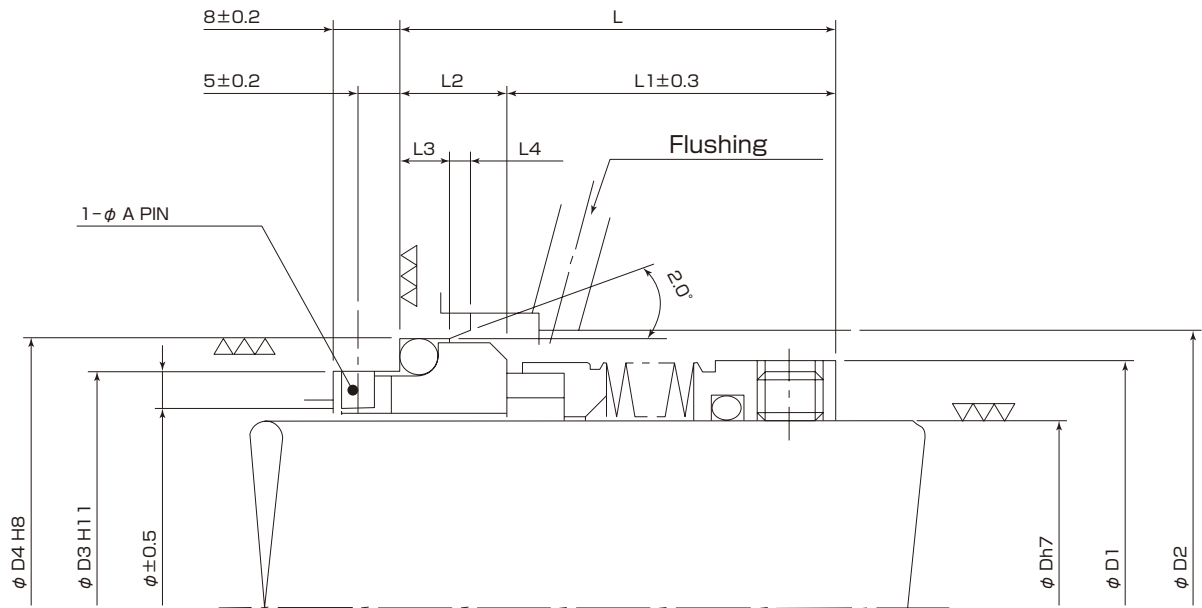


Size table

(Unit: mm)

| d1 | d | D1 | D2 | L1 | L2 | OD |
|-----|------|-----|-----|----|------|-------|
| 039 | 24.5 | 32 | 58 | 40 | 22 | 55 |
| 043 | 28.5 | 36 | 62 | 42 | 22 | 59 |
| 049 | 34.5 | 42 | 68 | 42 | 22 | 65 |
| 053 | 38.5 | 46 | 72 | 42 | 22 | 69 |
| 061 | 46.5 | 53 | 80 | 42 | 22 | 77 |
| 069 | 54 | 61 | 90 | 47 | 25.5 | 87 |
| 076 | 61 | 68 | 97 | 48 | 25.5 | 94 |
| 086 | 71 | 78 | 107 | 48 | 25.5 | 106 |
| 096 | 79 | 87 | 117 | 48 | 25.5 | 116 |
| 106 | 89 | 97 | 127 | 48 | 25.5 | 126 |
| 116 | 97 | 106 | 139 | 55 | 29.5 | 136.5 |
| 136 | 117 | 126 | 159 | 55 | 29.5 | 156.5 |

Basic structure diagram

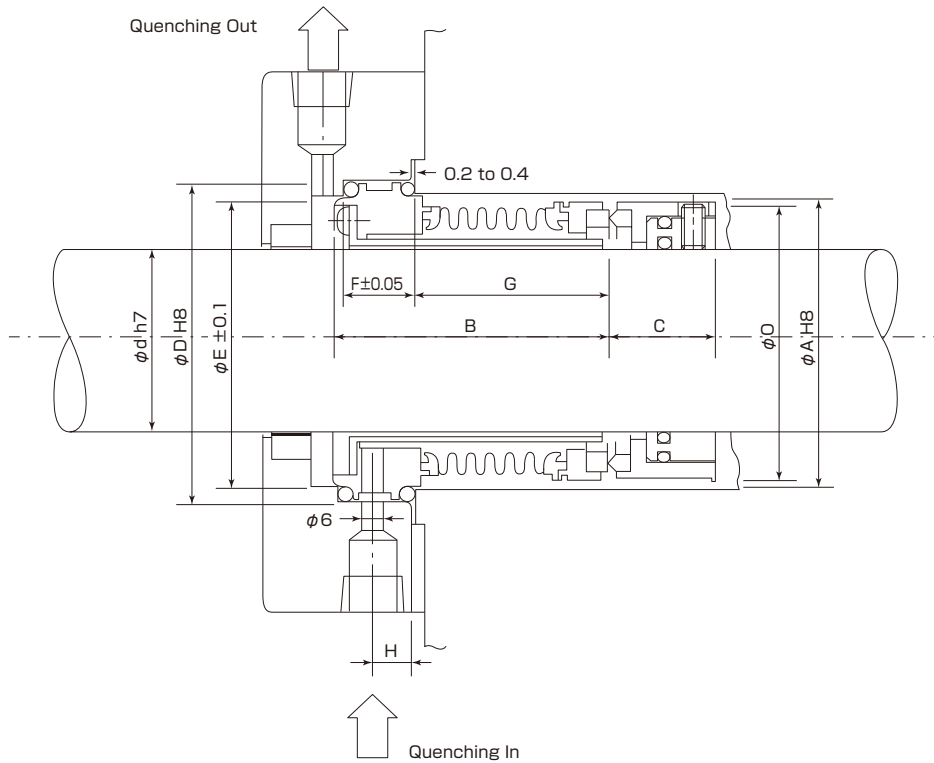


Size table

(Unit: mm)

| D SIZE | D1 | D2 | D3 | D4 | L | L1 | L2 | L3 | L4 | A | B |
|--------|-----|-----|-----|-----|------|------|------|----|-----|----|-----|
| 20 | 33 | 36 | 29 | 35 | 37.5 | 27.5 | 10 | 5 | 2 | 3 | 3.5 |
| 25 | 39 | 41 | 34 | 40 | 40 | 30 | // | // | // | // | // |
| 30 | 44 | 46 | 39 | 45 | 42.5 | 32.5 | // | // | // | // | // |
| 35 | 49 | 51 | 44 | 50 | 42.5 | 32.5 | // | // | // | // | // |
| 40 | 54 | 60 | 51 | 58 | 45 | 34 | 11 | 6 | // | 4 | 4 |
| 45 | 59 | 63 | 56 | 63 | 45 | 34 | // | // | // | // | 4.5 |
| 50 | 64 | 70 | 62 | 70 | 47.5 | 34.5 | 13 | // | 2.5 | // | // |
| 55 | 69 | 75 | 67 | 75 | 47.5 | 34.5 | // | // | // | // | 5 |
| 60 | 74 | 80 | 72 | 80 | 52 | 39 | // | // | // | // | // |
| 65 | 79 | 89 | 77 | 85 | 52 | 39 | // | // | // | // | // |
| 70 | 86 | 92 | 83 | 92 | 56 | 41 | 15 | 7 | // | // | // |
| 75 | 91 | 100 | 88 | 97 | 56 | 41 | // | // | // | // | // |
| 80 | 97 | 103 | 95 | 105 | 58.5 | 43 | 15.5 | // | 3 | // | 6 |
| 85 | 102 | 110 | 100 | 110 | 58.5 | 43 | // | // | // | // | // |
| 90 | 107 | 113 | 105 | 115 | 61.5 | 46 | // | // | // | // | // |
| 95 | 112 | 119 | 110 | 120 | 61.5 | 46 | // | // | // | // | // |
| 100 | 117 | 126 | 115 | 125 | 61.5 | 46 | // | // | // | // | // |

Basic structure diagram



Size table

(Unit: mm)

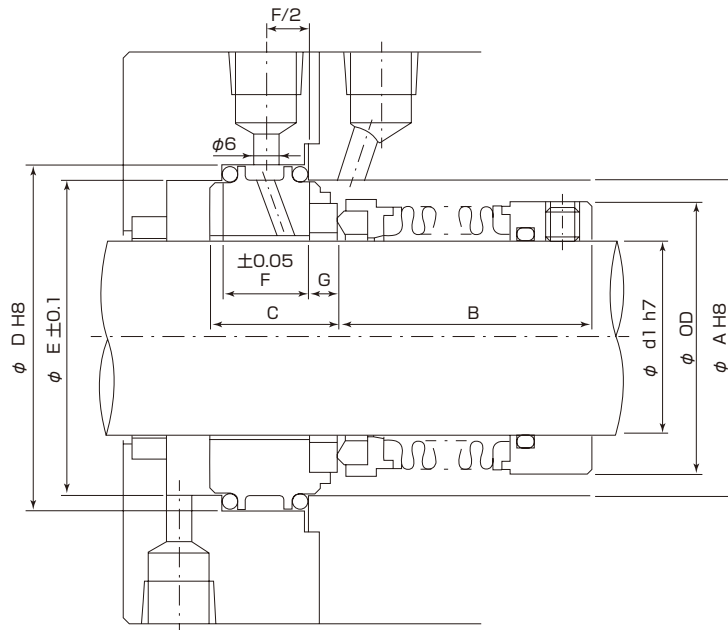
| Shaft dia $\phi d, h7$ | | | | ϕA | B | C | ϕD | ϕE | F | G | H | ϕO |
|------------------------|-----|----------|-------|----------|-----------|------------|----------|----------|----|----|---|----------|
| Standard dia | | Max. dia | H8 | H8 | ± 0.1 | ± 0.05 | | | | | | |
| 20 | 22 | | 23.5 | 44 | 53 | 26 | 50.5 | 44.2 | 16 | 34 | 8 | 42 |
| 25 | | | 26.5 | 48 | 54 | ↑ | 54.5 | 48.2 | 18 | ↑ | 9 | 46 |
| 28 | 30 | | 31.5 | 56 | 61 | ↑ | 62.5 | 56.2 | ↑ | 41 | ↑ | 54 |
| 32 | 35 | | 36.5 | 59 | ↑ | 28 | 65.5 | 59.2 | ↑ | ↑ | ↑ | 57 |
| 38 | 40 | | 41.0 | 66 | ↑ | 30 | 72.5 | 66.2 | ↑ | ↑ | ↑ | 64 |
| 42 | 45 | | 45.0 | 69 | ↑ | ↑ | 75.5 | 69.2 | ↑ | ↑ | ↑ | 67 |
| 48 | 50 | 52 | 53.0 | 79 | 66 | ↑ | 85.5 | 79.2 | ↑ | 46 | ↑ | 77 |
| 55 | 58 | 60 | 61.0 | 86 | ↑ | 35 | 92.5 | 86.2 | ↑ | ↑ | ↑ | 84 |
| 62 | 65 | 68 | 68.0 | 94 | ↑ | ↑ | 100.5 | 94.2 | ↑ | ↑ | ↑ | 92 |
| 70 | 75 | | 76.0 | 105 | 69 | ↑ | 111.5 | 105.2 | ↑ | 49 | ↑ | 102 |
| 80 | 85 | | 86.0 | 116 | ↑ | ↑ | 122.5 | 116.2 | ↑ | ↑ | ↑ | 113 |
| 90 | 95 | | 96.0 | 128 | 71 | ↑ | 134.5 | 128.2 | ↑ | 51 | ↑ | 125 |
| 100 | 105 | | 106.0 | 138 | ↑ | ↑ | 144.5 | 138.2 | ↑ | ↑ | ↑ | 135 |

*MS-31903-1

Basic structure diagram

Combination of standard
seal face materials

WC + WC

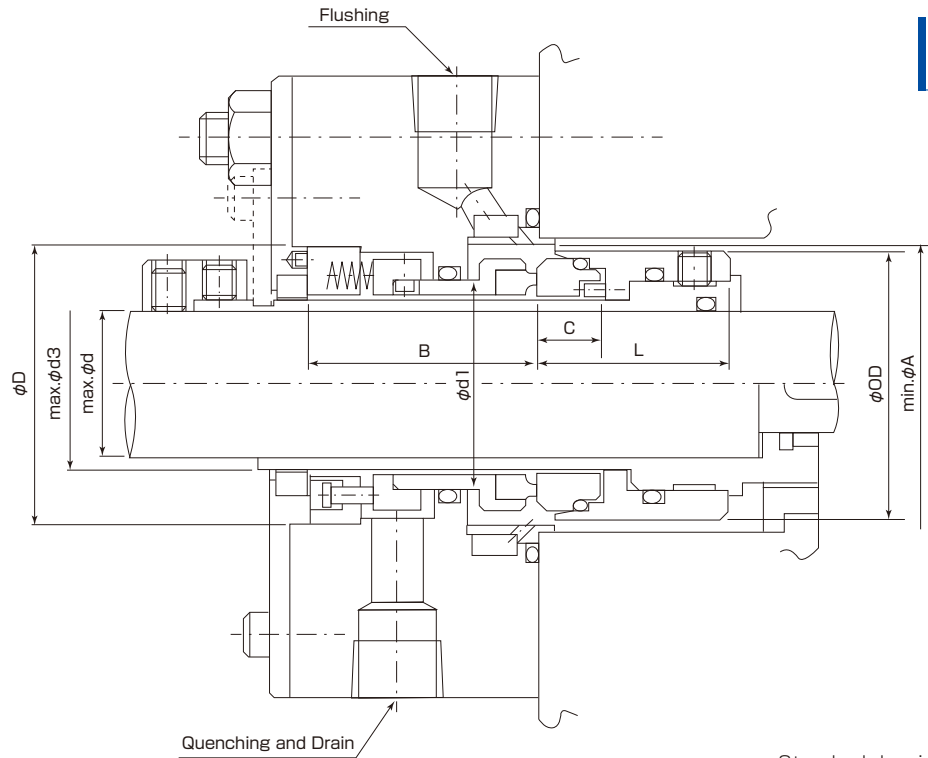


Size table

(Unit: mm)

| Nominal size | ϕd_1 | ϕA | B | C | ϕD | ϕE | F | G | ϕOD |
|--------------|-------------|----------|----|----|----------|----------|----|---|-----------|
| 020 | 20 | 40 | 46 | 24 | 46.5 | 40.2 | 16 | 5 | 36 |
| 022 | 22 | 42 | " | " | 48.5 | 42.2 | " | " | 38 |
| 025 | 25 | 44 | " | " | 50.5 | 44.2 | " | " | 42 |
| 028 | 28 | 47 | " | " | 53.5 | 47.2 | " | " | 44 |
| 030 | 30 | 50 | " | 26 | 56.5 | 50.2 | 18 | 6 | 47 |
| 032 | 32 | 51 | " | " | 57.5 | 51.2 | " | " | " |
| 035 | 35 | 55 | 54 | " | 61.5 | 55.2 | " | " | 53 |
| 038 | 38 | 58 | " | " | 64.5 | 58.2 | " | " | 54 |
| 040 | 40 | 60 | " | " | 66.5 | 60.2 | " | " | 57 |
| 042 | 42 | 63 | " | " | 69.5 | 63.2 | " | " | 58 |
| 045 | 45 | 65 | 57 | " | 71.5 | 65.2 | " | " | 63 |
| 048 | 48 | 69 | 58 | " | 75.5 | 69.2 | " | " | 64 |
| 050 | 50 | 70 | " | " | 76.5 | 70.2 | " | " | 67 |
| 052 | 52 | 74 | " | " | 80.5 | 74.2 | " | " | 68 |
| 055,058 | 55,58 | 79 | 63 | " | 85.5 | 79.2 | " | " | 77 |
| 059 | 59 | 83 | " | 28 | 89.5 | 83.2 | " | 7 | " |
| 060,062 | 60,62 | 86 | " | " | 92.5 | 86.2 | " | " | 84 |
| 065 | 65 | 89 | " | " | 95.5 | 89.2 | " | " | " |
| 067 | 67 | 92 | " | " | 98.5 | 92.2 | " | " | " |
| 070 | 70 | 93 | " | " | 99.5 | 93.2 | " | " | 91 |
| 072 | 72 | 95 | " | " | 101.5 | 95.2 | " | " | 92 |
| 074 | 74 | 98 | " | " | 104.5 | 98.2 | " | " | " |
| 075,080,082 | 75,80,82 | 105 | 66 | " | 111.5 | 105.2 | " | " | 102 |
| 084 | 84 | 108 | " | " | 114.5 | 108.2 | " | " | " |
| 085,090 | 85,90 | 114 | " | " | 120.5 | 114.2 | " | " | 112 |
| 094 | 94 | 118 | " | " | 124.5 | 118.2 | " | " | " |
| 095,100,104 | 95,100,104 | 128 | 68 | " | 134.5 | 128.2 | " | " | 124 |
| 105,110,114 | 105,110,114 | 138 | " | " | 144.5 | 138.2 | " | " | 134 |

Basic structure diagram



The upper half of the drawing indicates the cartridge type

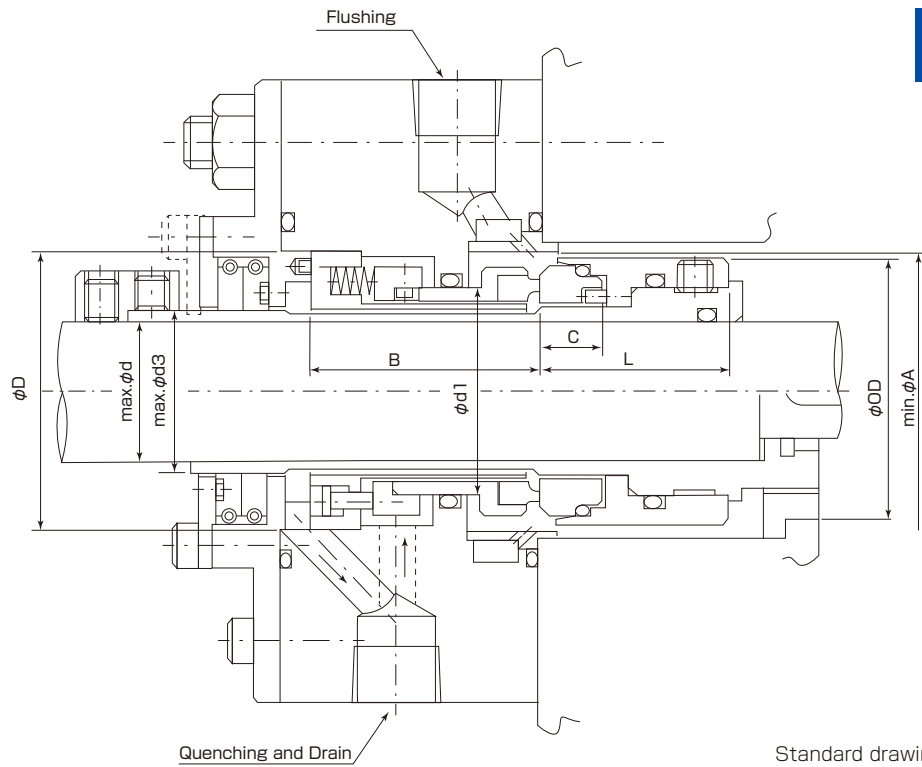
Standard drawing number: MSX-3663-3S

Size table

(Unit: mm)

| Nominal size $\triangle\triangle\triangle$ | d | d1 | d3 | D | OD | A | B | C | L |
|---|-----|-----|-----|-----|-----|-----|----|----|----|
| 030 | 17 | 30 | 21 | 45 | 43 | 45 | 54 | 15 | 45 |
| 032 | 19 | 32 | 23 | 47 | 45 | 47 | // | // | // |
| 035 | 22 | 35 | 26 | 50 | 48 | 51 | // | // | // |
| 038 | 25 | 38 | 29 | 53 | 51 | 54 | // | // | // |
| 040 | 27 | 40 | 31 | 55 | 53 | 56 | // | // | // |
| 042 | 29 | 42 | 33 | 57 | 56 | 59 | // | // | // |
| 045 | 32 | 45 | 36 | 60 | 59 | 62 | // | // | // |
| 048 | 35 | 48 | 39 | 63 | 62 | 65 | // | // | // |
| 050 | 37 | 50 | 41 | 65 | 64 | 67 | // | // | // |
| 052 | 39 | 52 | 43 | 67 | 66 | 69 | // | // | // |
| 054 | 41 | 54 | 45 | 69 | 68 | 71 | // | // | // |
| 057 | 44 | 57 | 48 | 72 | 71 | 74 | // | // | // |
| 060 | 47 | 60 | 51 | 76 | 76 | 79 | // | // | // |
| 063 | 50 | 63 | 54 | 79 | 79 | 82 | // | // | // |
| 067 | 54 | 67 | 58 | 83 | 83 | 86 | // | // | // |
| 070 | 57 | 70 | 61 | 86 | 86 | 89 | // | // | // |
| 076 | 62 | 76 | 67 | 92 | 92 | 95 | // | // | // |
| 082 | 68 | 82 | 73 | 98 | 98 | 101 | // | // | // |
| 086 | 72 | 86 | 77 | 102 | 102 | 105 | // | // | // |
| 092 | 78 | 92 | 83 | 108 | 108 | 111 | // | // | // |
| 095 | 81 | 95 | 86 | 111 | 111 | 114 | // | // | // |
| 101 | 87 | 101 | 92 | 117 | 117 | 120 | // | // | // |
| 105 | 89 | 105 | 94 | 121 | 121 | 124 | 60 | // | // |
| 110 | 94 | 110 | 99 | 126 | 126 | 129 | // | // | // |
| 115 | 99 | 115 | 104 | 131 | 131 | 134 | // | // | // |
| 120 | 104 | 120 | 109 | 136 | 136 | 139 | // | // | // |
| 125 | 109 | 125 | 114 | 141 | 141 | 144 | // | // | // |
| 130 | 114 | 130 | 119 | 146 | 146 | 149 | // | // | // |

Basic structure diagram



Standard drawing number: MSX-3663-2S

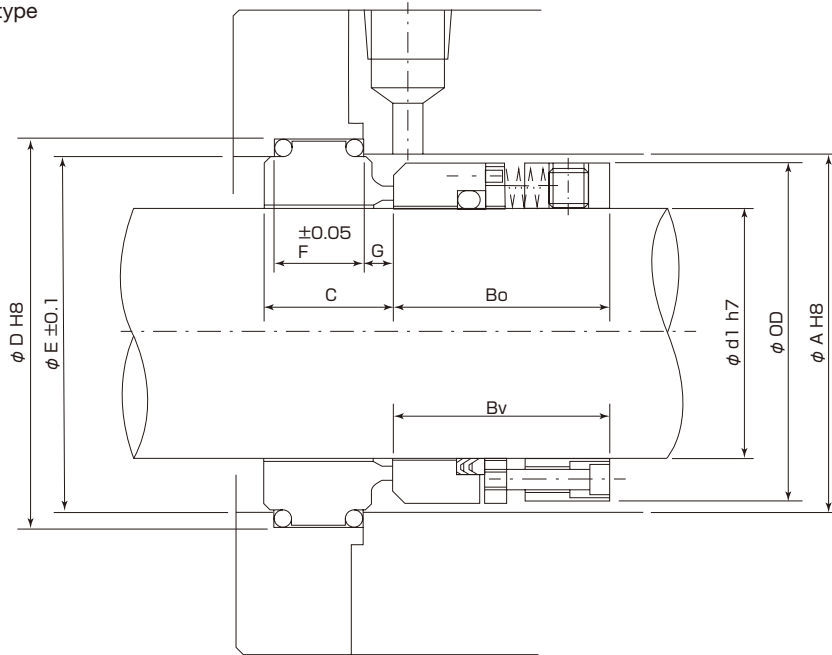
Size table

(Unit: mm)

| Nominal size △△△ | d | d1 | d3 | D | OD | A | B | C | L |
|---------------------|-----|-----|-----|-----|-----|-----|----|----|----|
| 030 | 16 | 30 | 20 | 45 | 43 | 45 | 54 | 15 | 45 |
| 032 | 18 | 32 | 22 | 47 | 45 | 47 | // | // | // |
| 035 | 21 | 35 | 25 | 50 | 48 | 51 | // | // | // |
| 038 | 24 | 38 | 28 | 53 | 51 | 54 | // | // | // |
| 040 | 26 | 40 | 30 | 55 | 53 | 56 | // | // | // |
| 042 | 28 | 42 | 32 | 57 | 56 | 59 | // | // | // |
| 045 | 31 | 45 | 35 | 60 | 59 | 62 | // | // | // |
| 048 | 33 | 48 | 37 | 63 | 62 | 65 | // | // | // |
| 050 | 35 | 50 | 39 | 65 | 64 | 67 | // | // | // |
| 052 | 37 | 52 | 41 | 67 | 66 | 69 | // | // | // |
| 054 | 39 | 54 | 43 | 69 | 68 | 71 | // | // | // |
| 057 | 42 | 57 | 46 | 72 | 71 | 74 | // | // | // |
| 060 | 45 | 60 | 49 | 76 | 76 | 79 | // | // | // |
| 063 | 48 | 63 | 52 | 79 | 79 | 82 | // | // | // |
| 067 | 52 | 67 | 56 | 83 | 83 | 86 | // | // | // |
| 070 | 55 | 70 | 59 | 86 | 86 | 89 | // | // | // |
| 076 | 61 | 76 | 65 | 92 | 92 | 95 | // | // | // |
| 082 | 67 | 82 | 71 | 98 | 98 | 101 | // | // | // |
| 086 | 71 | 86 | 75 | 102 | 102 | 105 | // | // | // |
| 092 | 77 | 92 | 81 | 108 | 108 | 111 | // | // | // |
| 095 | 80 | 95 | 84 | 111 | 111 | 114 | // | // | // |
| 101 | 86 | 101 | 90 | 117 | 117 | 120 | // | // | // |
| 105 | 86 | 105 | 91 | 121 | 121 | 124 | 60 | // | // |
| 110 | 91 | 110 | 96 | 126 | 126 | 129 | // | // | // |
| 115 | 96 | 115 | 101 | 131 | 131 | 134 | // | // | // |
| 120 | 101 | 120 | 106 | 136 | 136 | 139 | // | // | // |
| 125 | 106 | 125 | 111 | 141 | 141 | 144 | // | // | // |
| 130 | 111 | 130 | 116 | 146 | 146 | 149 | // | // | // |

Basic structure diagram

AAU1 * (formerly A1): O-ring type
 ABU1 * (formerly B1): V-ring type



Combination of standard seal face materials

Carbon + SiC
 Carbon + WC
 Carbon + Cr₂O₃
 SiC + SiC
 WC + WC

Note: Only the difference between AAU1* and ABU1* is the lengths of Bo and Bv.

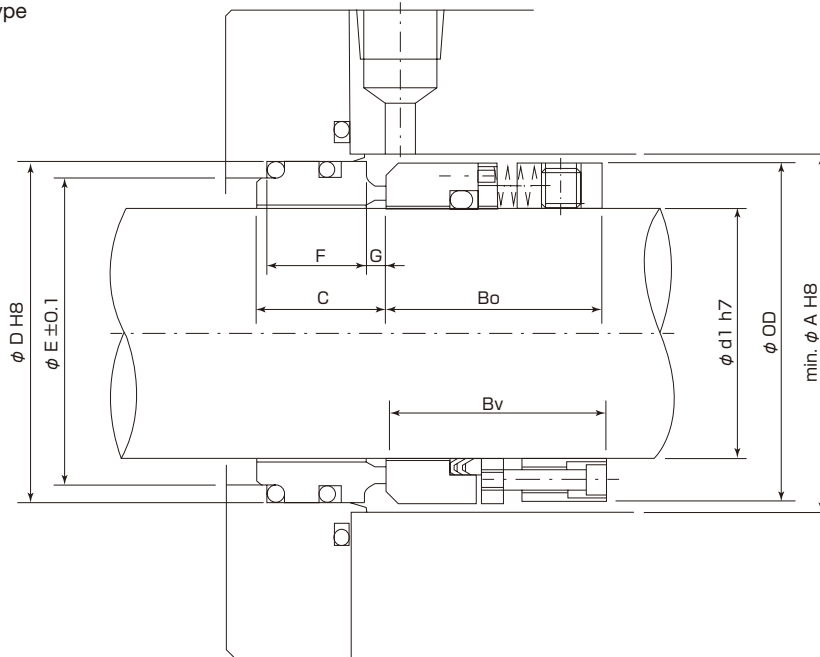
Size table

(Unit: mm)

| Nominal size | ϕd_1 | ϕA | B_o | B_v | C | ϕD | ϕE | F | G | ϕOD |
|--------------|------------|----------|-------|-------|-----|----------|----------|-----|-----|-----------|
| 020 | 20 | 40 | 39 | 40 | 24 | 46.5 | 40.2 | 16 | 5 | 37 |
| 022 | 22 | 42 | // | // | // | 48.5 | 42.2 | // | // | 39 |
| 025 | 25 | 44 | // | // | // | 50.5 | 44.2 | // | // | 42 |
| 028 | 28 | 47 | // | // | // | 53.5 | 47.2 | // | // | 45 |
| 030 | 30 | 50 | // | // | 26 | 56.5 | 50.2 | 18 | 6 | 47 |
| 032 | 32 | 51 | // | // | // | 57.5 | 51.2 | // | // | 49 |
| 035 | 35 | 55 | // | // | // | 61.5 | 55.2 | // | // | 53 |
| 038 | 38 | 58 | 42 | 43 | // | 64.5 | 58.2 | // | // | 56 |
| 040 | 40 | 60 | // | // | // | 66.5 | 60.2 | // | // | 58 |
| 042 | 42 | 63 | // | // | // | 69.5 | 63.2 | // | // | 60 |
| 045 | 45 | 65 | // | // | // | 71.5 | 65.2 | // | // | 63 |
| 048 | 48 | 69 | // | // | // | 75.5 | 69.2 | // | // | 66 |
| 050 | 50 | 70 | // | // | // | 76.5 | 70.2 | // | // | 68 |
| 052 | 52 | 74 | // | // | // | 80.5 | 74.2 | // | // | 70 |
| 055 | 55 | 76 | // | // | // | 82.5 | 76.2 | // | // | 73 |
| 058 | 58 | 79 | // | // | // | 85.5 | 79.2 | // | // | 76 |
| 060 | 60 | 83 | // | // | 28 | 89.5 | 83.2 | // | 7 | 81 |
| 062 | 62 | 86 | // | // | // | 92.5 | 86.2 | // | // | 83 |
| 065 | 65 | 89 | // | // | // | 95.5 | 89.2 | // | // | 86 |
| 068 | 68 | 92 | // | // | // | 98.5 | 92.2 | // | // | 89 |
| 070 | 70 | 93 | 44 | 45 | // | 99.5 | 93.2 | // | // | 91 |
| 075 | 75 | 98 | // | // | // | 104.5 | 98.2 | // | // | 96 |
| 080 | 80 | 105 | // | // | // | 111.5 | 105.2 | // | // | 101 |
| 085 | 85 | 108 | // | // | // | 114.5 | 108.2 | // | // | 106 |
| 090 | 90 | 114 | // | // | // | 120.5 | 114.2 | // | // | 111 |
| 095 | 95 | 118 | // | // | // | 124.5 | 118.2 | // | // | 116 |
| 100 | 100 | 123 | // | // | // | 129.5 | 123.2 | // | // | 121 |
| 105 | 105 | 135 | 48 | 49 | 30 | 141.5 | 135.2 | 20 | // | 131 |
| 110 | 110 | 140 | // | // | // | 146.5 | 140.2 | // | // | 136 |
| 115 | 115 | 145 | // | // | // | 151.5 | 145.2 | // | // | 141 |
| 120 | 120 | 150 | // | // | // | 156.5 | 150.2 | // | // | 146 |
| 125 | 125 | 155 | // | // | // | 161.5 | 155.2 | // | // | 151 |
| 130 | 130 | 160 | // | // | // | 166.5 | 160.2 | // | // | 156 |

Basic structure diagram

AAU30 (formerly A3): O-ring type
ABU30 (formerly B3): V-ring type



Combination of standard seal face materials

Carbon + SiC
Carbon + WC
Carbon + Cr₂O₃

Note: Only the difference between AAU30 and ABU30 is the lengths of B_o and B_v .

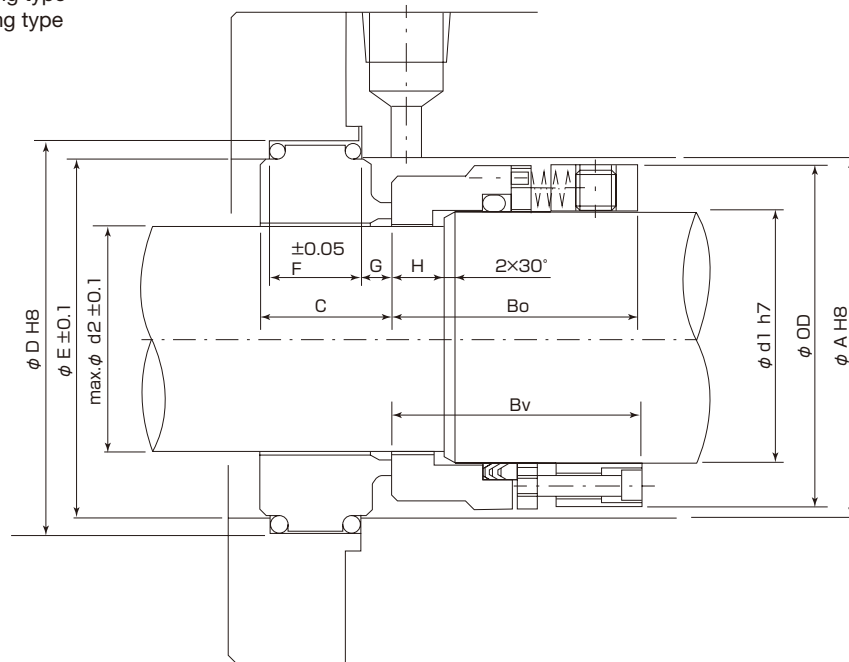
Size table

(Unit: mm)

| Nominal size | ϕd_1 | ϕA | B_o | B_v | C | ϕD | ϕE | F | G | ϕOD |
|--------------|------------|----------|-------|-------|-----|----------|----------|-----|-----|-----------|
| 020 | 20 | 40 | 39 | 40 | 24 | 37 | 31 | 20 | 3 | 37 |
| 022 | 22 | 42 | // | // | // | 39 | 33 | // | // | 39 |
| 025 | 25 | 44 | // | // | // | 40 | 34 | // | // | 42 |
| 028 | 28 | 47 | // | // | // | 44 | 38 | // | // | 45 |
| 030 | 30 | 50 | // | // | 26 | 47 | 41 | // | 4 | 47 |
| 032 | 32 | 51 | // | // | // | 48 | 42 | // | // | 49 |
| 035 | 35 | 55 | // | // | // | 51 | 45 | // | // | 53 |
| 038 | 38 | 58 | 42 | 43 | // | 54 | 48 | // | // | 56 |
| 040 | 40 | 60 | // | // | // | 57 | 51 | // | // | 58 |
| 042 | 42 | 63 | // | // | // | 60.5 | 54.5 | // | // | 60 |
| 045 | 45 | 65 | // | // | // | 61 | 55 | // | // | 63 |
| 048 | 48 | 69 | // | // | // | 64 | 58 | // | // | 66 |
| 050 | 50 | 70 | // | // | // | 67 | 61 | // | // | 68 |
| 052 | 52 | 74 | // | // | // | 70 | 64 | // | // | 70 |
| 055 | 55 | 76 | // | // | // | 73 | 67 | // | // | 73 |
| 058 | 58 | 79 | // | // | // | 76 | 70 | // | // | 76 |
| 060 | 60 | 83 | // | // | 28 | 80 | 74 | 22 | // | 81 |
| 062 | 62 | 86 | // | // | // | 83 | 77 | // | // | 83 |
| 065 | 65 | 89 | // | // | // | 86 | 80 | // | // | 86 |
| 068 | 68 | 92 | // | // | // | 89 | 83 | // | // | 89 |
| 070 | 70 | 93 | 44 | 45 | // | 89 | 83 | // | // | 91 |
| 075 | 75 | 98 | // | // | // | 95 | 89 | // | // | 96 |
| 080 | 80 | 105 | // | // | // | 99 | 93 | // | // | 101 |
| 085 | 85 | 108 | // | // | // | 105 | 99 | // | // | 106 |
| 090 | 90 | 114 | // | // | // | 111 | 105 | // | // | 111 |
| 095 | 95 | 118 | // | // | // | 114 | 108 | // | // | 116 |
| 100 | 100 | 123 | // | // | // | 118 | 112 | // | // | 121 |
| 105 | 105 | 135 | 48 | 49 | 30 | 132 | 126 | 24 | // | 131 |
| 110 | 110 | 140 | // | // | // | 137 | 131 | // | // | 136 |
| 115 | 115 | 145 | // | // | // | 140 | 134 | // | // | 141 |
| 120 | 120 | 150 | // | // | // | 147 | 141 | // | // | 146 |
| 125 | 125 | 155 | // | // | // | 150 | 144 | // | // | 151 |
| 130 | 130 | 160 | // | // | // | 156 | 150 | // | // | 156 |

Basic structure diagram

AAB1* (formerly AB1): O-ring type
 ABB1* (formerly BB1): V-ring type



Combination of standard seal face materials

Carbon + SiC
 Carbon + WC
 Carbon + Cr₂O₃
 SiC + SiC
 WC + WC

Note: Only the difference between AAB1* and ABB1* is the lengths of B_o and B_v .

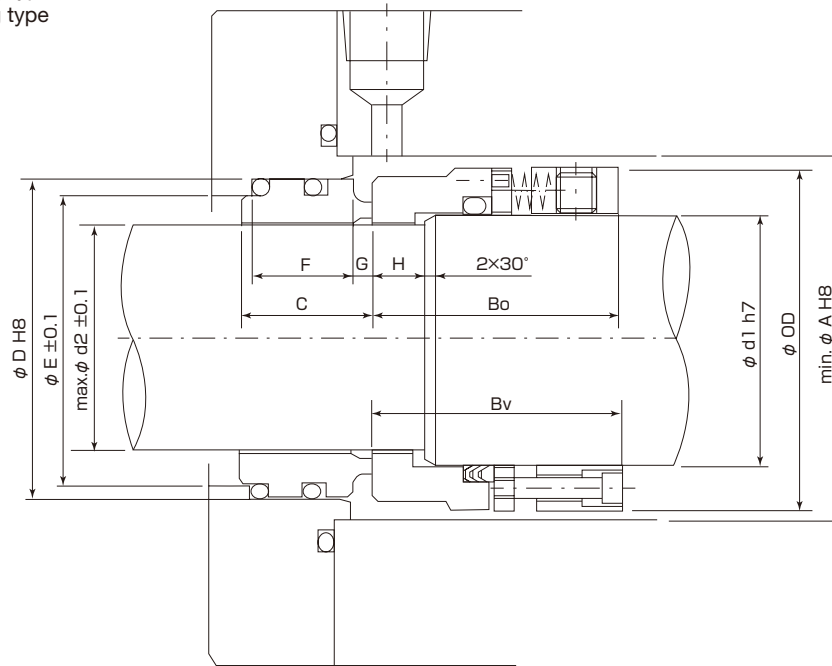
Size table

(Unit: mm)

| Nominal size | ϕd_1 | ϕd_2 | ϕA | B_o | B_v | C | ϕD | ϕE | F | G | H | ϕOD |
|--------------|------------|------------|----------|-------|-------|----|----------|----------|----|----|----|-----------|
| 020 | 20 | 15 | 40 | 44 | 45 | 24 | 46.5 | 40.2 | 16 | 5 | 8 | 37 |
| 022 | 22 | 17 | 42 | // | // | // | 48.5 | 42.2 | // | // | // | 39 |
| 025 | 25 | 20 | 44 | // | // | // | 50.5 | 44.2 | // | // | // | 42 |
| 028 | 28 | 23 | 47 | // | // | // | 53.5 | 47.2 | // | // | // | 45 |
| 030 | 30 | 25 | 50 | // | // | 26 | 56.5 | 50.2 | 18 | 6 | // | 47 |
| 032 | 32 | 27 | 51 | // | // | // | 57.5 | 51.2 | // | // | // | 49 |
| 035 | 35 | 30 | 55 | // | // | // | 61.5 | 55.2 | // | // | // | 53 |
| 038 | 38 | 33 | 58 | 47 | 48 | // | 64.5 | 58.2 | // | // | 10 | 56 |
| 040 | 40 | 35 | 60 | // | // | // | 66.5 | 60.2 | // | // | // | 58 |
| 042 | 42 | 37 | 63 | // | // | // | 69.5 | 63.2 | // | // | // | 60 |
| 045 | 45 | 40 | 65 | // | // | // | 71.5 | 65.2 | // | // | // | 63 |
| 048 | 48 | 43 | 69 | // | // | // | 75.5 | 69.2 | // | // | // | 66 |
| 050 | 50 | 45 | 70 | // | // | // | 76.5 | 70.2 | // | // | // | 68 |
| 052 | 52 | 47 | 74 | // | // | // | 80.5 | 74.2 | // | // | // | 70 |
| 055 | 55 | 50 | 76 | // | // | // | 82.5 | 76.2 | // | // | // | 73 |
| 058 | 58 | 53 | 79 | // | // | // | 85.5 | 79.2 | // | // | // | 76 |
| 060 | 60 | 55 | 83 | // | // | 28 | 89.5 | 83.2 | // | 7 | // | 81 |
| 062 | 62 | 57 | 86 | // | // | // | 92.5 | 86.2 | // | // | // | 83 |
| 065 | 65 | 60 | 89 | // | // | // | 95.5 | 89.2 | // | // | // | 86 |
| 068 | 68 | 63 | 92 | // | // | // | 98.5 | 92.2 | // | // | // | 89 |
| 070 | 70 | 65 | 93 | 49 | 50 | // | 99.5 | 93.2 | // | // | // | 91 |
| 075 | 75 | 70 | 98 | // | // | // | 104.5 | 98.2 | // | // | // | 96 |
| 080 | 80 | 75 | 105 | // | // | // | 111.5 | 105.2 | // | // | // | 101 |
| 085 | 85 | 80 | 108 | // | // | // | 114.5 | 108.2 | // | // | // | 106 |
| 090 | 90 | 85 | 114 | // | // | // | 120.5 | 114.2 | // | // | // | 111 |
| 095 | 95 | 90 | 118 | // | // | // | 124.5 | 118.2 | // | // | // | 116 |
| 100 | 100 | 95 | 123 | // | // | // | 129.5 | 123.2 | // | // | // | 121 |
| 105 | 105 | 100 | 135 | 53 | 54 | 30 | 141.5 | 135.2 | 20 | // | 12 | 131 |
| 110 | 110 | 105 | 140 | // | // | // | 146.5 | 140.2 | // | // | // | 136 |
| 115 | 115 | 110 | 145 | // | // | // | 151.5 | 145.2 | // | // | // | 141 |
| 120 | 120 | 115 | 150 | // | // | // | 156.5 | 150.2 | // | // | // | 146 |
| 125 | 125 | 120 | 155 | // | // | // | 161.5 | 155.2 | // | // | // | 151 |
| 130 | 130 | 125 | 160 | // | // | // | 166.5 | 160.2 | // | // | // | 156 |

Basic structure diagram

AAB30 (formerly AB3): O-ring type
 ABB30 (formerly BB3): V-ring type



Combination of standard seal face materials

Carbon + SiC
 Carbon + WC
 Carbon + Cr₂O₃

Note: Only the difference between AAB30 and ABB30 is the lengths of B₀ and B_v.

Size table

(Unit: mm)

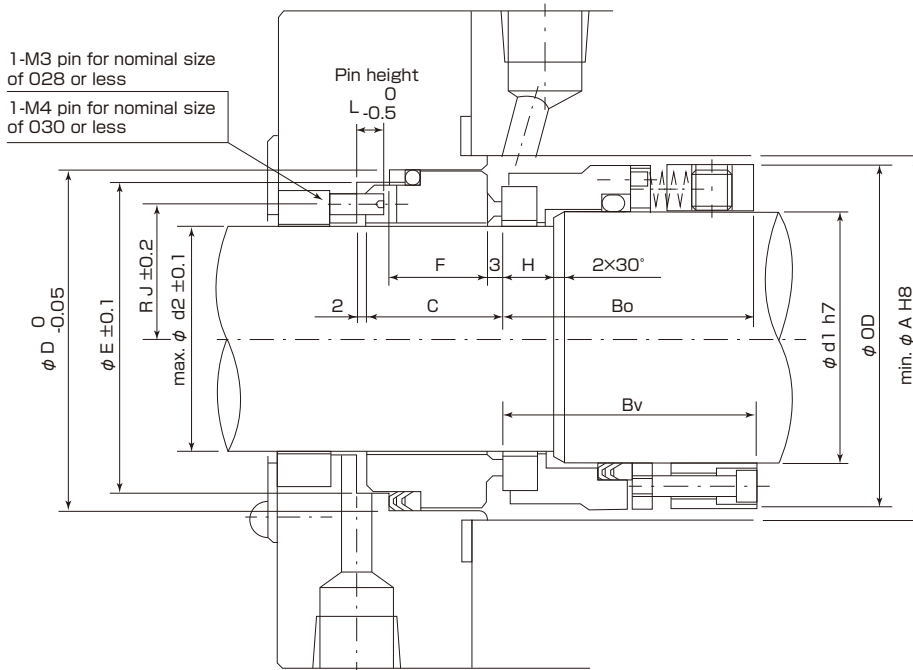
| Nominal size | Φd ₁ | Φd ₂ | ΦA | B ₀ | B _v | C | ΦD | ΦE | F | G | H | ΦOD |
|--------------|-----------------|-----------------|-----|----------------|----------------|----|-----|-----|----|---|----|-----|
| 020 | 20 | 15 | 40 | 44 | 45 | 24 | 35 | 29 | 20 | 3 | 8 | 37 |
| 022 | 22 | 17 | 42 | 44 | 45 | 24 | 37 | 31 | 20 | 3 | 8 | 39 |
| 025 | 25 | 20 | 44 | 44 | 45 | 24 | 39 | 33 | 20 | 3 | 8 | 42 |
| 028 | 28 | 23 | 47 | 44 | 45 | 24 | 42 | 36 | 20 | 3 | 8 | 45 |
| 030 | 30 | 25 | 50 | 44 | 45 | 26 | 44 | 38 | 20 | 4 | 8 | 47 |
| 032 | 32 | 27 | 51 | 44 | 45 | 26 | 46 | 40 | 20 | 4 | 8 | 49 |
| 035 | 35 | 30 | 55 | 44 | 45 | 26 | 48 | 42 | 20 | 4 | 8 | 53 |
| 038 | 38 | 33 | 58 | 47 | 48 | 26 | 51 | 45 | 20 | 4 | 10 | 56 |
| 040 | 40 | 35 | 60 | 47 | 48 | 26 | 54 | 48 | 20 | 4 | 10 | 58 |
| 042 | 42 | 37 | 63 | 47 | 48 | 26 | 57 | 51 | 20 | 4 | 10 | 60 |
| 045 | 45 | 40 | 65 | 47 | 48 | 26 | 57 | 51 | 20 | 4 | 10 | 63 |
| 048 | 48 | 43 | 69 | 47 | 48 | 26 | 61 | 55 | 20 | 4 | 10 | 66 |
| 050 | 50 | 45 | 70 | 47 | 48 | 26 | 61 | 55 | 20 | 4 | 10 | 68 |
| 052 | 52 | 47 | 74 | 47 | 48 | 26 | 67 | 61 | 20 | 4 | 10 | 70 |
| 055 | 55 | 50 | 76 | 47 | 48 | 26 | 67 | 61 | 20 | 4 | 10 | 73 |
| 058 | 58 | 53 | 79 | 47 | 48 | 26 | 73 | 67 | 20 | 4 | 10 | 76 |
| 060 | 60 | 55 | 83 | 49 | 50 | 28 | 73 | 67 | 22 | 4 | 10 | 81 |
| 062 | 62 | 57 | 86 | 49 | 50 | 28 | 80 | 74 | 22 | 4 | 10 | 83 |
| 065 | 65 | 60 | 89 | 49 | 50 | 28 | 80 | 74 | 22 | 4 | 10 | 86 |
| 068 | 68 | 63 | 92 | 49 | 50 | 28 | 86 | 80 | 22 | 4 | 10 | 89 |
| 070 | 70 | 65 | 93 | 49 | 50 | 28 | 86 | 80 | 22 | 4 | 10 | 91 |
| 075 | 75 | 70 | 98 | 49 | 50 | 28 | 89 | 83 | 22 | 4 | 10 | 96 |
| 080 | 80 | 75 | 105 | 49 | 50 | 28 | 95 | 89 | 22 | 4 | 10 | 101 |
| 085 | 85 | 80 | 108 | 49 | 50 | 28 | 99 | 93 | 22 | 4 | 10 | 106 |
| 090 | 90 | 85 | 114 | 49 | 50 | 28 | 105 | 99 | 22 | 4 | 10 | 111 |
| 095 | 95 | 90 | 118 | 49 | 50 | 28 | 111 | 105 | 22 | 4 | 10 | 116 |
| 100 | 100 | 95 | 123 | 49 | 50 | 28 | 114 | 108 | 22 | 4 | 10 | 121 |
| 105 | 105 | 100 | 135 | 53 | 54 | 30 | 128 | 122 | 24 | 4 | 12 | 131 |
| 110 | 110 | 105 | 140 | 53 | 54 | 30 | 132 | 126 | 24 | 4 | 12 | 136 |
| 115 | 115 | 110 | 145 | 53 | 54 | 30 | 137 | 131 | 24 | 4 | 12 | 141 |
| 120 | 120 | 115 | 150 | 53 | 54 | 30 | 140 | 134 | 24 | 4 | 12 | 146 |
| 125 | 125 | 120 | 155 | 53 | 54 | 30 | 147 | 141 | 24 | 4 | 12 | 151 |
| 130 | 130 | 125 | 160 | 53 | 54 | 30 | 150 | 144 | 24 | 4 | 12 | 156 |

Basic structure diagram

AAB8* (formerly AB81): O-ring type
 ABB8* (formerly BB81): V-ring type

Combination of standard seal face materials

- Carbon + SiC
- Carbon + WC
- Carbon + Cr₂O₃
- SiC + SiC
- WC + WC



Note: Only the difference between AAB8* and ABB8* is the lengths of Bo and Bv.

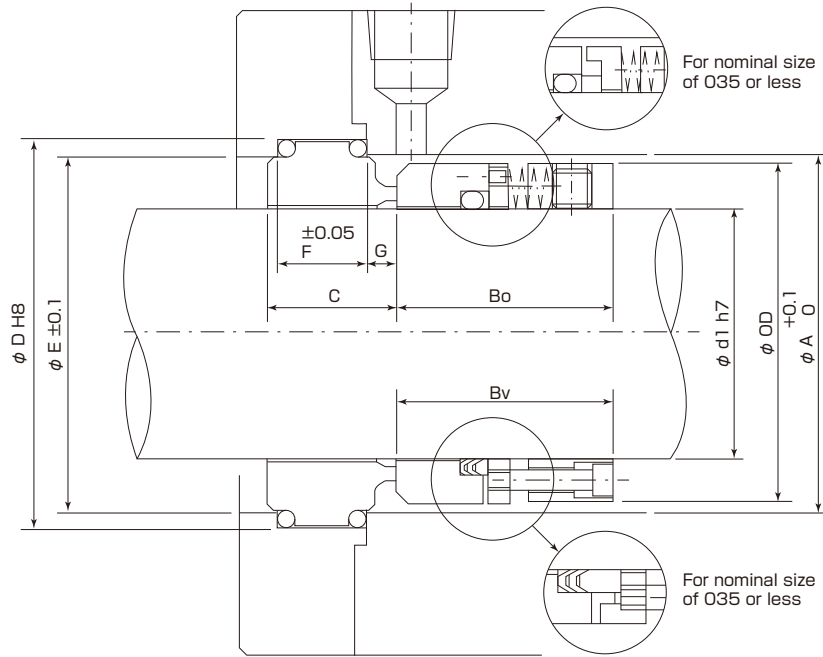
Size table

(Unit: mm)

| Nominal size | $\phi d1$ | $\phi d2$ | ϕA | B_o | B_v | C | ϕD | ϕE | F | H | RJ | L | ϕOD |
|--------------|-----------|-----------|----------|-------|-------|----|----------|----------|----|----|------|----|-----------|
| 020 | 20 | 15 | 40 | 44 | 45 | 24 | 36.3 | 30.4 | 18 | 8 | 11.5 | 5 | 37 |
| 022 | 22 | 17 | 42 | // | // | // | 38.3 | 32.4 | // | // | 12.5 | // | 39 |
| 025 | 25 | 20 | 45 | // | // | // | 42.2 | 35.4 | // | // | 14.0 | // | 42 |
| 028 | 28 | 23 | 48 | // | // | // | 45.2 | 38.4 | // | // | 15.5 | // | 45 |
| 030 | 30 | 25 | 50 | // | // | 26 | 47.2 | 40.4 | 19 | // | 16.5 | 6 | 47 |
| 032 | 32 | 27 | 52 | // | // | // | 49.2 | 42.4 | // | // | 17.5 | // | 49 |
| 035 | 35 | 30 | 55 | // | // | // | 52.2 | 45.4 | // | // | 19.0 | // | 53 |
| 038 | 38 | 33 | 58 | 47 | 48 | // | 55.2 | 48.4 | // | 10 | 20.5 | // | 56 |
| 040 | 40 | 35 | 60 | // | // | // | 57.2 | 50.4 | // | // | 21.5 | // | 58 |
| 042 | 42 | 37 | 63 | // | // | // | 59.2 | 52.4 | // | // | 22.5 | // | 60 |
| 045 | 45 | 40 | 65 | // | // | // | 62.2 | 55.4 | // | // | 24.0 | // | 63 |
| 048 | 48 | 43 | 69 | // | // | // | 65.2 | 58.4 | // | // | 25.5 | // | 66 |
| 050 | 50 | 45 | 74 | // | // | // | 70.6 | 60.4 | // | // | 26.5 | // | 68 |
| 052 | 52 | 47 | 76 | // | // | // | 72.6 | 62.4 | // | // | 27.5 | // | 70 |
| 055 | 55 | 50 | 79 | // | // | // | 75.6 | 65.4 | // | // | 29.0 | // | 73 |
| 058 | 58 | 53 | 82 | // | // | // | 78.6 | 68.4 | // | // | 30.5 | // | 76 |
| 060 | 60 | 55 | 84 | // | // | 28 | 80.6 | 70.4 | 20 | // | 31.5 | 7 | 81 |
| 062 | 62 | 57 | 89 | // | // | // | 85.6 | 75.4 | // | // | 34.0 | // | 83 |
| 065 | 65 | 60 | 89 | // | // | // | 85.6 | 75.4 | // | // | // | // | 86 |
| 068 | 68 | 63 | 94 | // | // | // | 90.6 | 80.4 | // | // | 36.5 | // | 89 |
| 070 | 70 | 65 | 94 | 49 | 50 | // | 90.6 | 80.4 | // | // | // | // | 91 |
| 075 | 75 | 70 | 99 | // | // | // | 95.6 | 85.4 | // | // | 39.0 | // | 96 |
| 080 | 80 | 75 | 105 | // | // | // | 100.6 | 90.4 | // | // | 41.5 | // | 101 |
| 085 | 85 | 80 | 109 | // | // | // | 105.6 | 95.4 | // | // | 44.0 | // | 106 |
| 090 | 90 | 85 | 114 | // | // | // | 110.6 | 100.4 | // | // | 46.5 | // | 111 |
| 095 | 95 | 90 | 119 | // | // | // | 115.6 | 105.4 | // | // | 49.0 | // | 116 |
| 100 | 100 | 95 | 124 | // | // | // | 120.6 | 110.4 | // | // | 51.5 | // | 121 |
| 105 | 105 | 100 | 135 | 53 | 54 | 30 | 130.6 | 120.4 | 22 | 12 | 55.0 | // | 131 |
| 110 | 110 | 105 | 140 | // | // | // | 135.6 | 125.4 | // | // | 57.5 | // | 136 |
| 115 | 115 | 110 | 145 | // | // | // | 140.6 | 130.4 | // | // | 60.0 | // | 141 |
| 120 | 115 | 113 | 150 | // | // | // | 145.6 | 135.4 | // | // | 62.5 | // | 146 |
| 125 | 125 | 118 | 155 | // | // | // | 150.6 | 140.4 | // | // | 65.0 | // | 151 |
| 130 | 130 | 123 | 160 | // | // | // | 155.6 | 145.4 | // | // | 67.5 | // | 156 |

Basic structure diagram

AEU1*: O-ring type
AFU1*: V-ring type



Combination of standard seal face materials

- Carbon + SiC
- Carbon + WC
- Carbon + Cr₂O₃
- SiC + SiC
- WC + WC

- Notes: 1) Only the difference between AEU1* and AFU1* is the lengths of Bo and Bv.
- 2) For nominal size above 100, please use AAU1* or ABU1*.
- 3) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.
- 4) For nominal sizes of 038 or greater, rotary parts are the same as those of AAU and ABU.

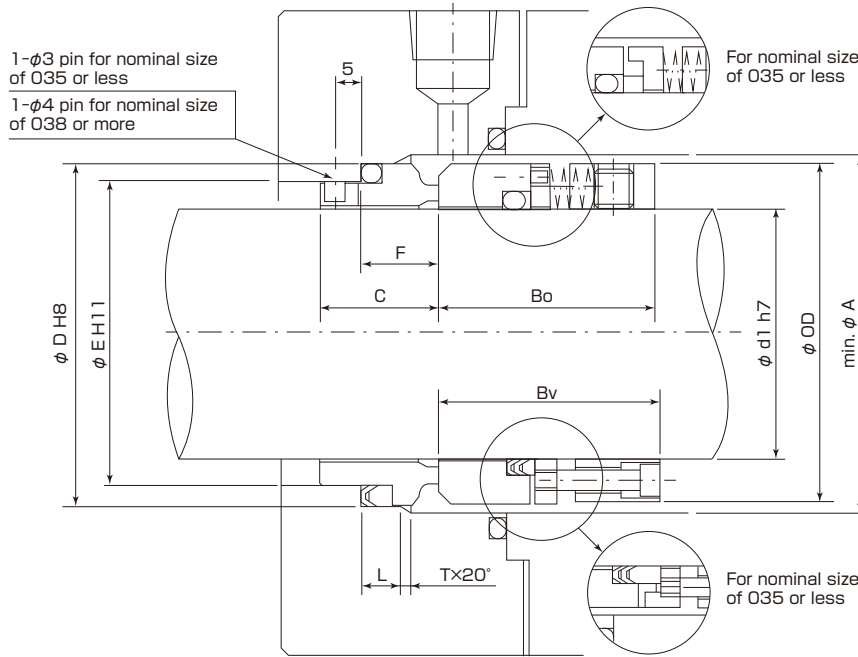
Size table

(Unit: mm)

| Nominal size | Φd ₁ | ΦA | Bo | Bv | C | ΦD | ΦE | F | G | ΦOD |
|--------------|-----------------|-----|----|----|----|-----|-----|----|----|-----|
| ● 018 | 18 | 34 | 40 | 41 | 24 | 40 | 34 | 18 | 4 | 32 |
| ● 020 | 20 | 36 | // | // | // | 42 | 36 | // | // | 34 |
| ● 022 | 22 | 38 | // | // | // | 44 | 38 | // | // | 36 |
| ● 024 | 24 | 40 | // | // | // | 46 | 40 | // | // | 38 |
| ● 025 | 25 | 41 | // | // | // | 47 | 41 | // | // | 39 |
| ● 028 | 28 | 44 | // | // | // | 50 | 44 | // | // | 42 |
| ● 030 | 30 | 46 | // | // | // | 52 | 46 | // | // | 44 |
| ● 032 | 32 | 48 | // | // | // | 54 | 48 | // | // | 46 |
| ● 033 | 33 | 49 | // | // | // | 55 | 49 | // | // | 47 |
| ● 035 | 35 | 51 | // | // | // | 57 | 51 | // | // | 49 |
| ● 038 | 38 | 58 | 42 | 43 | // | 64 | 58 | // | // | 56 |
| ● 040 | 40 | 60 | // | // | // | 66 | 60 | // | // | 58 |
| ● 042 | 42 | 62 | // | // | // | 68 | 62 | // | // | 60 |
| ● 043 | 43 | 63 | // | // | // | 69 | 63 | // | // | 61 |
| ● 045 | 45 | 65 | // | // | // | 71 | 65 | // | // | 63 |
| ● 048 | 48 | 68 | // | // | // | 74 | 68 | // | // | 66 |
| ● 050 | 50 | 70 | // | // | 26 | 76 | 70 | 20 | // | 68 |
| ● 052 | 52 | 72 | // | // | // | 78 | 72 | // | // | 70 |
| ● 053 | 53 | 73 | // | // | // | 79 | 73 | // | // | 71 |
| ● 055 | 55 | 75 | // | // | // | 81 | 75 | // | // | 73 |
| ● 058 | 58 | 83 | // | // | 27 | 89 | 83 | // | 5 | 76 |
| ● 060 | 60 | 85 | // | // | // | 91 | 85 | // | // | 81 |
| ● 062 | 62 | 87 | // | // | // | 93 | 87 | // | // | 83 |
| ● 063 | 63 | 88 | // | // | // | 94 | 88 | // | // | 84 |
| ● 065 | 65 | 90 | // | // | // | 96 | 90 | // | // | 86 |
| ● 068 | 68 | 93 | // | // | // | 99 | 93 | // | // | 89 |
| ● 070 | 70 | 95 | 44 | 45 | // | 101 | 95 | // | // | 91 |
| ● 075 | 75 | 104 | // | // | // | 110 | 104 | // | // | 96 |
| ● 080 | 80 | 109 | // | // | // | 115 | 109 | // | // | 101 |
| ● 085 | 85 | 114 | // | // | // | 120 | 114 | // | // | 106 |
| ● 090 | 90 | 119 | // | // | // | 125 | 119 | // | // | 111 |
| ● 095 | 95 | 124 | // | // | // | 130 | 124 | // | // | 116 |
| ● 100 | 100 | 129 | // | // | // | 135 | 129 | // | // | 121 |

Basic structure diagram

AEU8*: O-ring type
AFU8*: V-ring type



Combination of standard seal face materials

- Carbon + SiC
- Carbon + WC
- Carbon + Cr₂O₃
- SiC + SiC
- WC + WC

- Notes: 1) Only the difference between AEU8* and AFU8* is the lengths of Bo and Bv.
2) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.
3) For nominal sizes of 038 or greater, rotary parts are the same as those of AAU and ABU.

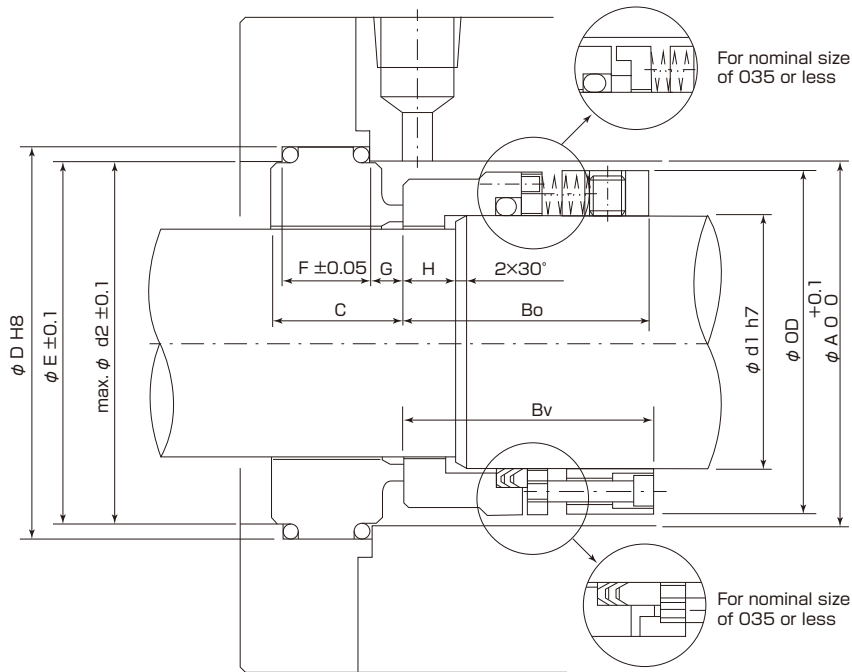
Size table

(Unit: mm)

| Nominal size | φd ₁ | φA | Bo | Bv | C | φD | φE | F | L | T | φOD |
|--------------|-----------------|-----|----|----|----|-----|-----|----|---|-----|-----|
| • 018 | 18 | 34 | 40 | 41 | 20 | 33 | 27 | 12 | 5 | 2.0 | 32 |
| • 020 | 20 | 36 | 40 | 41 | 20 | 35 | 29 | 12 | 5 | 2.0 | 34 |
| • 022 | 22 | 38 | 40 | 41 | 20 | 37 | 31 | 12 | 5 | 2.0 | 36 |
| • 024 | 24 | 40 | 40 | 41 | 20 | 39 | 33 | 12 | 5 | 2.0 | 38 |
| • 025 | 25 | 41 | 40 | 41 | 20 | 40 | 34 | 12 | 5 | 2.0 | 39 |
| • 028 | 28 | 44 | 40 | 41 | 20 | 43 | 37 | 12 | 5 | 2.0 | 42 |
| • 030 | 30 | 46 | 40 | 41 | 20 | 45 | 39 | 12 | 5 | 2.0 | 44 |
| • 032 | 32 | 48 | 40 | 41 | 20 | 48 | 42 | 12 | 5 | 2.0 | 46 |
| • 033 | 33 | 49 | 40 | 41 | 20 | 48 | 42 | 12 | 5 | 2.0 | 47 |
| • 035 | 35 | 51 | 40 | 41 | 20 | 50 | 44 | 12 | 5 | 2.0 | 49 |
| • 038 | 38 | 58 | 42 | 43 | 21 | 56 | 49 | 13 | 6 | 2.5 | 56 |
| • 040 | 40 | 60 | 42 | 43 | 21 | 58 | 51 | 13 | 6 | 2.5 | 58 |
| 042 | 42 | 62 | 42 | 43 | 21 | 61 | 54 | 13 | 6 | 2.5 | 60 |
| • 043 | 43 | 63 | 42 | 43 | 21 | 61 | 54 | 13 | 6 | 2.5 | 61 |
| • 045 | 45 | 65 | 42 | 43 | 21 | 63 | 56 | 13 | 6 | 2.5 | 63 |
| • 048 | 48 | 68 | 42 | 43 | 21 | 66 | 59 | 13 | 6 | 2.5 | 66 |
| • 050 | 50 | 70 | 44 | 45 | 23 | 70 | 62 | 15 | 7 | 2.5 | 68 |
| 052 | 52 | 73 | 44 | 45 | 23 | 73 | 65 | 15 | 7 | 2.5 | 70 |
| • 053 | 53 | 73 | 44 | 45 | 23 | 73 | 65 | 15 | 7 | 2.5 | 71 |
| • 055 | 55 | 75 | 44 | 45 | 23 | 75 | 67 | 15 | 7 | 2.5 | 73 |
| • 058 | 58 | 78 | 44 | 45 | 23 | 78 | 70 | 15 | 7 | 2.5 | 76 |
| • 060 | 60 | 83 | 44 | 45 | 23 | 80 | 72 | 15 | 7 | 2.5 | 81 |
| 062 | 62 | 85 | 44 | 45 | 23 | 83 | 75 | 15 | 7 | 2.5 | 83 |
| • 063 | 63 | 86 | 44 | 45 | 23 | 83 | 75 | 15 | 7 | 2.5 | 84 |
| • 065 | 65 | 88 | 44 | 45 | 23 | 85 | 77 | 15 | 7 | 2.5 | 86 |
| • 068 | 68 | 91 | 44 | 45 | 26 | 90 | 81 | 18 | 7 | 2.5 | 89 |
| • 070 | 70 | 93 | 44 | 45 | 26 | 92 | 83 | 18 | 7 | 2.5 | 91 |
| 075 | 75 | 98 | 44 | 45 | 26 | 97 | 88 | 18 | 7 | 2.5 | 96 |
| 080 | 80 | 105 | 44 | 45 | 26 | 105 | 95 | 18 | 7 | 2.5 | 101 |
| 085 | 85 | 110 | 44 | 45 | 26 | 110 | 100 | 18 | 7 | 2.5 | 106 |
| 090 | 90 | 115 | 44 | 45 | 26 | 115 | 105 | 18 | 7 | 2.5 | 111 |
| 095 | 95 | 120 | 44 | 45 | 26 | 120 | 110 | 18 | 7 | 2.5 | 116 |
| 100 | 100 | 125 | 44 | 45 | 26 | 125 | 115 | 18 | 7 | 2.5 | 121 |

Basic structure diagram

AEB1*: O-ring type
AFB1*: V-ring type



Combination of standard seal face materials

- Carbon + SiC
- Carbon + WC
- Carbon + Cr_2O_3
- SiC + SiC
- WC + WC

- Notes: 1) Only the difference between AEB1* and AFB1* is the lengths of B_o and B_v .
 2) For nominal size above 105, please use AAB1* or ABB1*.
 3) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.
 4) For nominal sizes of 038 or greater, rotary parts are the same as those of AAB and ABB.

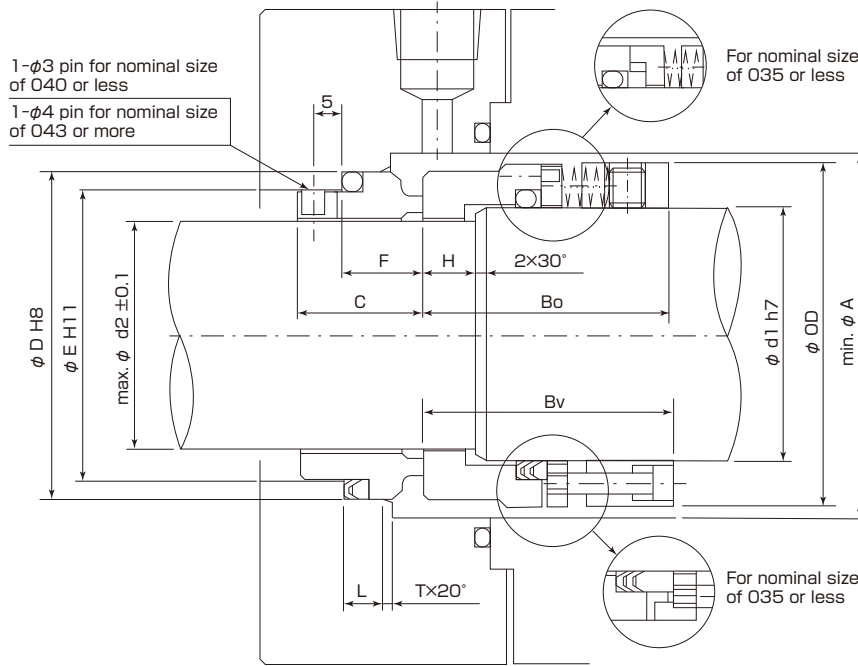
Size table

(Unit: mm)

| Nominal size | ϕd_1 | ϕd_2 | ϕA | B_o | B_v | C | ϕD | ϕE | F | G | H | ϕOD |
|--------------|------------|------------|----------|-------|-------|-----|----------|----------|-----|-----|-----|-----------|
| 020 | 20 | 16 | 36 | 45 | 46 | 24 | 42 | 36 | 18 | 4 | 8 | 34 |
| ● 022 | 22 | 18 | 38 | // | // | // | 44 | 38 | // | // | // | 36 |
| ● 024 | 24 | 20 | 40 | // | // | // | 46 | 40 | // | // | // | 38 |
| ● 026 | 26 | 22 | 42 | // | // | // | 48 | 42 | // | // | // | 40 |
| ● 028 | 28 | 24 | 44 | // | // | // | 50 | 44 | // | // | // | 42 |
| ● 030 | 30 | 25 | 46 | // | // | // | 52 | 46 | // | // | // | 44 |
| ● 033 | 33 | 28 | 49 | // | // | // | 55 | 49 | // | // | // | 47 |
| ● 035 | 35 | 30 | 51 | // | // | // | 57 | 51 | // | // | // | 49 |
| ● 038 | 38 | 33 | 58 | 47 | 48 | // | 64 | 58 | // | // | // | 56 |
| ● 040 | 40 | 35 | 60 | // | // | // | 66 | 60 | // | // | // | 58 |
| ● 043 | 43 | 38 | 63 | // | // | // | 69 | 63 | // | // | 10 | 61 |
| ● 045 | 45 | 40 | 65 | // | // | // | 71 | 65 | // | // | // | 63 |
| ● 048 | 48 | 43 | 68 | // | // | // | 74 | 68 | // | // | // | 66 |
| ● 050 | 50 | 45 | 70 | // | // | 26 | 76 | 70 | 20 | // | // | 68 |
| ● 053 | 53 | 48 | 73 | // | // | // | 79 | 73 | // | // | // | 71 |
| ● 055 | 55 | 50 | 75 | // | // | // | 81 | 75 | // | // | // | 73 |
| ● 058 | 58 | 53 | 83 | // | // | 27 | 89 | 83 | // | 5 | // | 76 |
| ● 060 | 60 | 55 | 85 | // | // | // | 91 | 85 | // | // | // | 81 |
| ● 063 | 63 | 58 | 88 | // | // | // | 94 | 88 | // | // | // | 84 |
| ● 065 | 65 | 60 | 90 | // | // | // | 96 | 90 | // | // | // | 86 |
| ● 068 | 68 | 63 | 93 | // | // | // | 99 | 93 | // | // | // | 89 |
| ● 070 | 70 | 65 | 95 | 49 | 50 | // | 101 | 95 | // | // | // | 91 |
| ● 075 | 75 | 70 | 104 | // | // | // | 110 | 104 | // | // | // | 96 |
| 080 | 80 | 75 | 109 | // | // | // | 115 | 109 | // | // | // | 101 |
| 085 | 85 | 80 | 114 | // | // | // | 120 | 114 | // | // | // | 106 |
| 090 | 90 | 85 | 119 | // | // | // | 125 | 119 | // | // | // | 111 |
| 095 | 95 | 90 | 124 | // | // | // | 130 | 124 | // | // | // | 116 |
| 100 | 100 | 95 | 129 | // | // | // | 135 | 129 | // | // | // | 121 |
| 105 | 105 | 100 | 134 | 53 | 54 | // | 140 | 134 | 53 | 54 | // | 131 |

Basic structure diagram

AEB8*: O-ring type
AFB8*: V-ring type



Combination of standard seal face materials

- Carbon + SiC
- Carbon + WC
- Carbon + Cr₂O₃
- SiC + SiC
- WC + WC

- Notes: 1) Only the difference between AEB8* and AFB8* is the lengths of Bo and Bv.
 2) For nominal size above 105, please use AAB8* or ABB8*.
 3) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.
 4) For nominal sizes of 038 or greater, rotary parts are the same as those of AAB and ABB.

Size table

(Unit: mm)

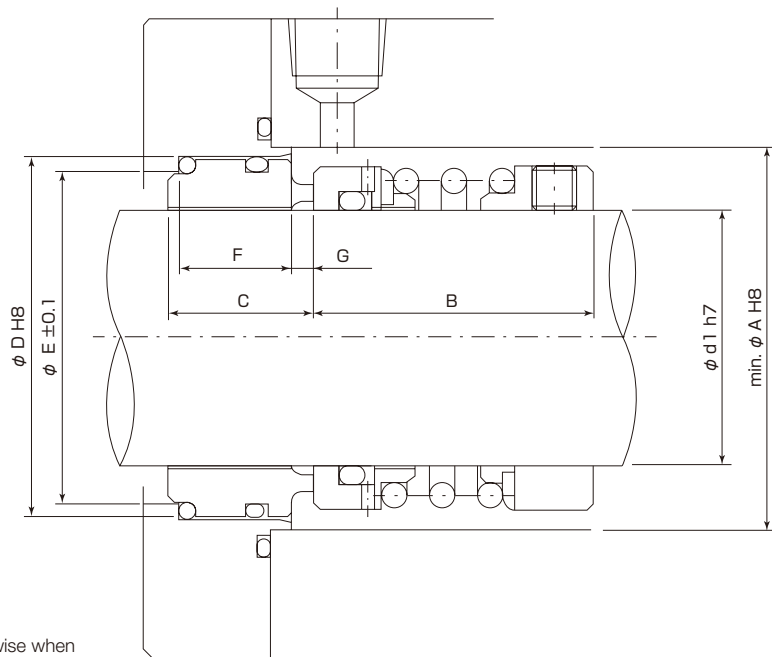
| Nominal size | $\phi d1$ | $\phi d2$ | ϕA | B_o | B_v | C | ϕD | ϕE | F | L | T | H | ϕOD |
|--------------|-----------|-----------|----------|-------|-------|-----|----------|----------|-----|-----|-----|-----|-----------|
| ● 022 | 22 | 18 | 38 | 45 | 46 | 20 | 33 | 27 | 12 | 5 | 2 | 8 | 36 |
| ● 024 | 24 | 20 | 40 | ● | ● | ● | 35 | 29 | ● | ● | ● | ● | 38 |
| ● 026 | 26 | 22 | 42 | ● | ● | ● | 37 | 31 | ● | ● | ● | ● | 40 |
| ● 028 | 28 | 24 | 44 | ● | ● | ● | 39 | 33 | ● | ● | ● | ● | 42 |
| ● 030 | 30 | 25 | 46 | ● | ● | ● | 40 | 34 | ● | ● | ● | ● | 44 |
| ● 033 | 33 | 28 | 49 | ● | ● | ● | 43 | 37 | ● | ● | ● | ● | 47 |
| ● 035 | 35 | 30 | 51 | ● | ● | ● | 45 | 39 | ● | ● | ● | ● | 49 |
| ● 038 | 38 | 33 | 58 | 47 | 48 | ● | 48 | 42 | ● | ● | ● | ● | 56 |
| ● 040 | 40 | 35 | 60 | ● | ● | ● | 50 | 44 | ● | ● | ● | ● | 58 |
| ● 043 | 43 | 38 | 63 | ● | ● | 21 | 56 | 49 | 13 | 6 | ● | 10 | 61 |
| ● 045 | 45 | 40 | 65 | ● | ● | ● | 58 | 51 | ● | ● | ● | ● | 63 |
| ● 048 | 48 | 43 | 68 | ● | ● | ● | 61 | 54 | ● | ● | ● | ● | 66 |
| ● 050 | 50 | 45 | 70 | ● | ● | ● | 63 | 56 | ● | ● | ● | ● | 68 |
| ● 053 | 53 | 48 | 73 | ● | ● | ● | 66 | 59 | ● | ● | ● | ● | 71 |
| ● 055 | 55 | 50 | 75 | ● | ● | 23 | 70 | 62 | 15 | ● | 2.5 | ● | 73 |
| ● 058 | 58 | 53 | 78 | ● | ● | ● | 73 | 65 | ● | ● | ● | ● | 76 |
| ● 060 | 60 | 55 | 83 | ● | ● | ● | 75 | 67 | ● | ● | ● | ● | 81 |
| ● 063 | 63 | 58 | 86 | ● | ● | ● | 78 | 70 | ● | ● | ● | ● | 84 |
| ● 065 | 65 | 60 | 88 | ● | ● | ● | 80 | 72 | ● | ● | ● | ● | 86 |
| ● 068 | 68 | 63 | 91 | ● | ● | ● | 83 | 75 | ● | ● | ● | ● | 89 |
| ● 070 | 70 | 65 | 93 | 49 | 50 | ● | 85 | 77 | ● | ● | ● | ● | 91 |
| ● 075 | 75 | 70 | 98 | ● | ● | 26 | 92 | 83 | 18 | 7 | ● | ● | 96 |
| 080 | 80 | 75 | 103 | ● | ● | ● | 97 | 88 | ● | ● | ● | ● | 101 |
| 085 | 85 | 80 | 108 | ● | ● | ● | 105 | 95 | ● | ● | 3 | ● | 106 |
| 090 | 90 | 85 | 113 | ● | ● | ● | 110 | 100 | ● | ● | ● | ● | 111 |
| 095 | 95 | 90 | 118 | ● | ● | ● | 115 | 105 | ● | ● | ● | ● | 116 |
| 100 | 100 | 95 | 123 | ● | ● | ● | 120 | 110 | ● | ● | ● | ● | 121 |
| 105 | 105 | 100 | 134 | 53 | 54 | ● | 125 | 115 | ● | ● | ● | ● | 131 |

Basic structure diagram

Rotary type one-coil spring seal
(JSMEA standard type US-1)

Combination of standard
seal face materials

Carbon + Cr₂O₃



Note: The standard model rotates clockwise when viewed from the flange side. If you prefer counterclockwise rotation, please specify so when placing an order.

Size table

(Unit: mm)

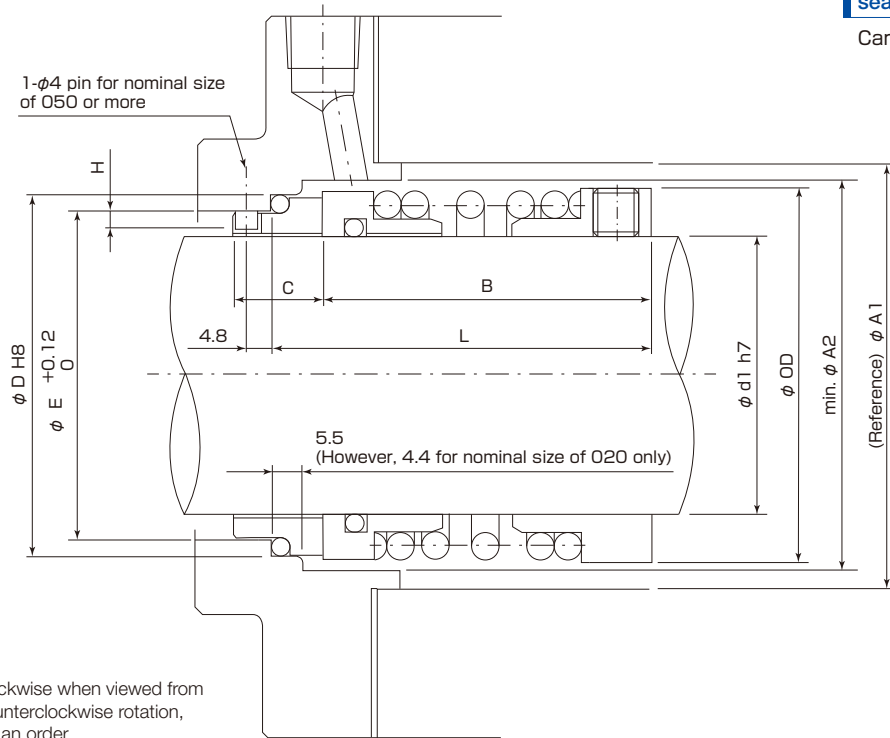
| Nominal size | Φd ₁ | ΦA | B | C | ΦD | ΦE | F | G |
|--------------|-----------------|-----|----|----|------|------|----|----|
| 020 | 20 | 40 | 38 | 24 | 37 | 31 | 20 | 3 |
| 022 | 22 | 42 | // | // | 39 | 33 | // | // |
| 025 | 25 | 45 | // | // | 40 | 34 | // | // |
| 028 | 28 | 48 | 40 | // | 44 | 38 | // | // |
| 030 | 30 | 53 | // | 26 | 47 | 41 | // | 4 |
| 032 | 32 | 55 | // | // | 48 | 42 | // | // |
| 035 | 35 | 58 | // | // | 51 | 45 | // | // |
| 038 | 38 | 62 | 45 | // | 54 | 48 | // | // |
| 040 | 40 | 64 | // | // | 57 | 51 | // | // |
| 042 | 42 | 66 | 50 | // | 60.5 | 54.5 | // | // |
| 045 | 45 | 69 | // | // | 61 | 55 | // | // |
| 048 | 48 | 72 | 55 | // | 64 | 58 | // | // |
| 050 | 50 | 75 | // | // | 67 | 61 | // | // |
| 052 | 52 | 77 | 58 | // | 70 | 64 | // | // |
| 055 | 55 | 80 | // | // | 73 | 67 | // | // |
| 058 | 58 | 83 | // | // | 76 | 70 | // | // |
| 060 | 60 | 85 | 60 | 28 | 80 | 74 | 22 | // |
| 062 | 62 | 87 | // | // | 83 | 77 | // | // |
| 065 | 65 | 90 | 62 | // | 86 | 80 | // | // |
| 068 | 68 | 93 | // | // | 89 | 83 | // | // |
| 070 | 70 | 95 | 65 | // | 89 | 83 | // | // |
| 075 | 75 | 100 | // | // | 95 | 89 | // | // |
| 080 | 80 | 110 | 70 | // | 99 | 93 | // | // |
| 085 | 85 | 115 | // | // | 105 | 99 | // | // |
| 090 | 90 | 120 | // | // | 111 | 105 | // | // |
| 095 | 95 | 130 | 75 | // | 114 | 108 | // | // |
| 100 | 100 | 135 | // | // | 118 | 112 | // | // |
| 105 | 105 | 140 | // | 30 | 132 | 126 | 24 | // |
| 110 | 110 | 145 | 80 | // | 137 | 131 | // | // |
| 115 | 115 | 150 | // | // | 140 | 134 | // | // |
| 120 | 120 | 160 | 85 | // | 147 | 141 | // | // |
| 125 | 125 | 165 | // | // | 150 | 144 | // | // |
| 130 | 130 | 170 | // | // | 156 | 150 | // | // |

Basic structure diagram

Rotary type one-coil spring seal
(JSMEA standard type US-2)

Combination of standard
seal face materials

Carbon + Cr₂O₃



Note: The standard model rotates clockwise when viewed from the flange side. If you prefer counterclockwise rotation, please specify so when placing an order.

Size table

(Unit: mm)

| Nominal size | Φd_1 | ΦA_1 | ΦA_2 | B | C | ΦD | ΦE | H | L | ΦOD |
|--------------|------------|------------|------------|------|------|----------|----------|-----|--------|-----------|
| 020 | 20 | 40 | 37 | 37.3 | 11.0 | 33.32 | 29.06 | — | 44.45 | 34.5 |
| 025 | 25 | 46 | 43 | 40.0 | 12.0 | 39.67 | 33.83 | — | 49.21 | 41.0 |
| 030 | 30 | 51 | 48 | 41.6 | // | 44.45 | 38.61 | — | 50.80 | 45.5 |
| 035 | 35 | 56 | 53 | 48.0 | // | 49.20 | 43.46 | — | 57.15 | 50.0 |
| 040 | 40 | 61 | 58 | 48.0 | // | 53.97 | 48.13 | — | 57.15 | 55.0 |
| 045 | 45 | 65 | 62 | 48.0 | // | 58.72 | 52.98 | — | 57.15 | 60.0 |
| 050 | 50 | 72 | 69 | 59.1 | 16.0 | 65.07 | 59.33 | 4.2 | 68.26 | 66.0 |
| 055 | 55 | 76 | 73 | 60.7 | // | 69.85 | 64.01 | // | 69.85 | 71.0 |
| 060 | 60 | 84 | 81 | 63.8 | // | 76.20 | 70.36 | // | 73.02 | 77.0 |
| 065 | 65 | 89 | 86 | 67.0 | // | 80.97 | 75.21 | // | 76.20 | 82.0 |
| 070 | 70 | 93 | 91 | 67.0 | // | 85.72 | 79.88 | // | 76.20 | 87.0 |
| 075 | 75 | 100 | 97 | 71.8 | // | 90.47 | 84.73 | // | 80.96 | 91.5 |
| 080 | 80 | 105 | 102 | 78.1 | // | 98.42 | 92.58 | 5.4 | 87.31 | 99.5 |
| 085 | 85 | 111 | 108 | 78.1 | // | 104.77 | 98.93 | // | 87.31 | 105.5 |
| 090 | 90 | 118 | 115 | 78.1 | // | 109.52 | 103.78 | // | 87.31 | 110.5 |
| 095 | 95 | 122 | 119 | 82.9 | // | 114.30 | 108.46 | // | 92.07 | 115.5 |
| 100 | 100 | 127 | 124 | 82.9 | // | 119.07 | 113.31 | // | 92.07 | 120.0 |
| 105 | 105 | 135 | 132 | 89.2 | // | 127.00 | 121.16 | 6.6 | 98.42 | 128.0 |
| 110 | 110 | 140 | 137 | 89.2 | // | 131.77 | 126.01 | // | 98.42 | 133.0 |
| 115 | 115 | 145 | 142 | 89.2 | // | 136.52 | 130.68 | // | 98.42 | 137.5 |
| 120 | 120 | 150 | 147 | 95.5 | // | 142.87 | 137.03 | // | 104.72 | 144.0 |

Basic structure diagram

Rotary unbalanced type one-coil spring seal

CEU80: O-ring type

CFU80: V-ring type

Rotary unbalanced type one-coil spring knife edge seal

(ISO-compliant dimensions

applied product)

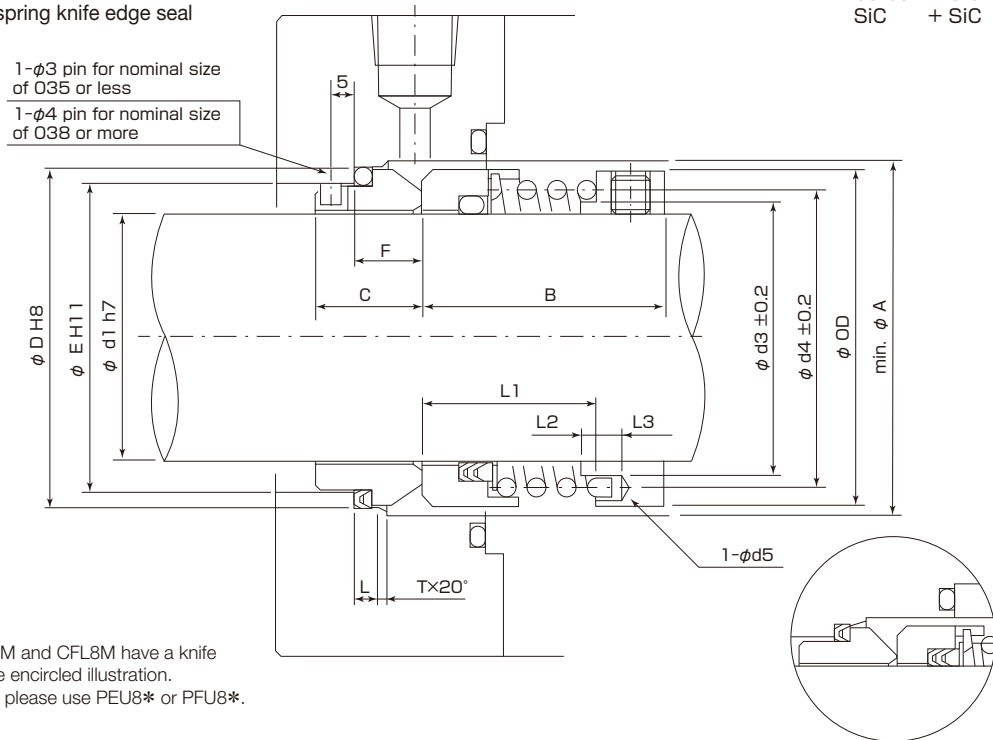
CEL8M: O-ring type

CFL8M: V-ring type

Combination of standard seal face materials

Carbon + SiC

SiC + SiC



Notes: 1) The sliding portions of CEL8M and CFL8M have a knife edge shape, as shown in the encircled illustration.

2) For nominal size above 055, please use PEU8* or PFU8*.

Size table

(Unit: mm)

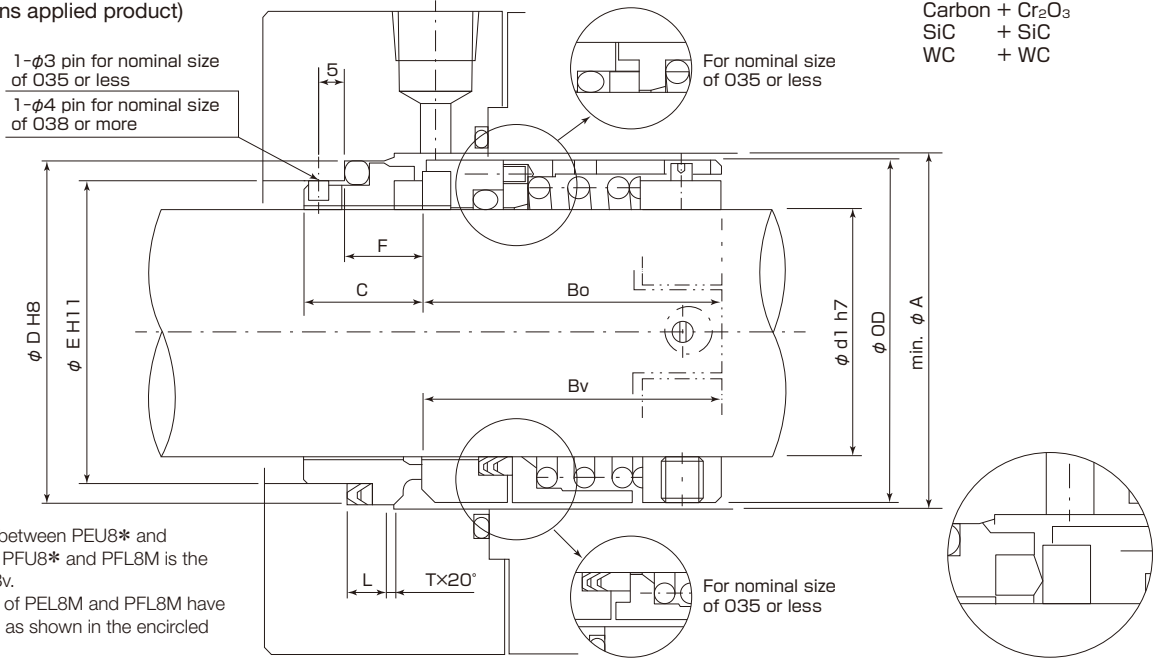
| Nominal size | $\phi d1$ | ϕA | B | C | ϕD | ϕE | F | L | T | $\phi d3$ | $\phi d4$ | $\phi d5$ | L1 | L2 | L3 | ϕOD |
|--------------|-----------|----------|----|----|----------|----------|----|----|-----|-----------|-----------|-----------|----|-----|----|-----------|
| 018 | 18 | 34 | 30 | 20 | 33 | 27 | 12 | 5 | 2 | 22.7 | 25.2 | 2.5 | 22 | 3.0 | 4 | 32 |
| 020 | 20 | 36 | // | // | 35 | 29 | // | // | // | 24.1 | 26.9 | 2.8 | // | 3.5 | // | 34 |
| 022 | 22 | 38 | // | // | 37 | 31 | // | // | // | 26.1 | 28.9 | // | // | // | // | 36 |
| 024 | 24 | 40 | 33 | // | 39 | 33 | // | // | // | 27.7 | 30.7 | 3.0 | 25 | // | // | 38 |
| 025 | 25 | 41 | // | // | 40 | 34 | // | // | // | 28.7 | 31.7 | // | // | // | // | 39 |
| 028 | 28 | 44 | 34 | // | 43 | 37 | // | // | // | 30.7 | 34.2 | 3.5 | 26 | 4.5 | // | 42 |
| 030 | 30 | 46 | // | // | 45 | 39 | // | // | // | 32.7 | 36.2 | // | // | // | // | 44 |
| 032 | 32 | 48 | 36 | // | 48 | 42 | // | // | // | 34.7 | 38.2 | // | // | // | // | 46 |
| 033 | 33 | 49 | // | // | 48 | 42 | // | // | // | 36.7 | 40.2 | // | // | // | // | 47 |
| 035 | 35 | 51 | // | // | 50 | 44 | // | // | // | 37.7 | 41.2 | // | // | // | // | 49 |
| 038 | 38 | 58 | 42 | 21 | 56 | 49 | 13 | 6 | // | 42.7 | 46.7 | 4.0 | 30 | 5.0 | // | 56 |
| 040 | 40 | 60 | // | // | 58 | 51 | // | // | // | 44.7 | 48.7 | // | // | // | // | 58 |
| 042 | 42 | 63 | 44 | // | 61 | 54 | // | // | // | 46.6 | 51.1 | 4.5 | 32 | 6.0 | // | 61 |
| 043 | 43 | 63 | // | // | 61 | 54 | // | // | // | // | // | // | // | // | // | 61 |
| 045 | 45 | 65 | // | // | 63 | 56 | // | // | // | 48.6 | 53.1 | // | // | // | // | 63 |
| 050 | 50 | 70 | 46 | 23 | 70 | 62 | 15 | // | 2.5 | 53.0 | 58.0 | 5.0 | 34 | 6.5 | 6 | 68 |
| 055 | 55 | 75 | 48 | // | 75 | 67 | // | // | // | 57.0 | 62.5 | 5.5 | 36 | 7.0 | // | 73 |

Basic structure diagram

Rotary unbalanced type one-coil spring seal (Clutch type)
 PEU8* (formerly 2PK): O-ring type, PFU8* (formerly 2PF): V-ring type
 Rotary unbalanced type one-coil spring knife edge seal (Clutch type)
 PEL8M: O-ring type, PFL8M: V-ring type
 (ISO-compliant dimensions applied product)

Combination of standard seal face materials

Carbon + SiC
 Carbon + WC
 Carbon + Cr₂O₃
 SiC + SiC
 WC + WC



- Notes: 1) Only the difference between PEU8* and PEL8M or between PFU8* and PFL8M is the lengths of B_o and B_v .
- 2) The sliding portions of PEL8M and PFL8M have a knife edge shape, as shown in the encircled illustration.
- 3) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.

Size table

(Unit: mm)

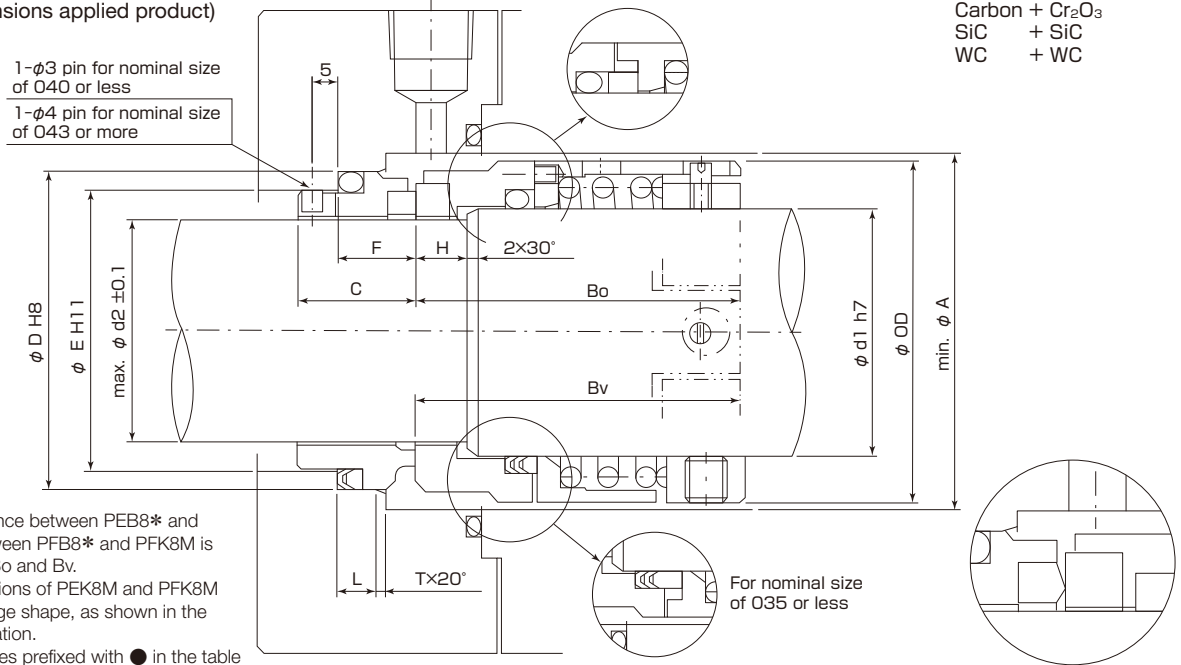
| Nominal size | ϕd_1 | ϕA | B_o | B_v | C | ϕD | ϕE | F | L | T | ϕOD |
|--------------|------------|----------|-------|-------|-----|----------|----------|-----|-----|-----|-----------|
| ● 020 | 20 | 36 | 45 | 46 | 20 | 35 | 29 | 12 | 5 | 2.0 | 34 |
| ● 022 | 22 | 38 | 47 | 47 | 20 | 37 | 31 | 12 | 5 | 2.0 | 36 |
| ● 024 | 24 | 40 | 47 | 48 | 20 | 39 | 33 | 12 | 5 | 2.0 | 38 |
| ● 025 | 25 | 41 | 47 | 48 | 20 | 40 | 34 | 12 | 5 | 2.0 | 39 |
| ● 028 | 28 | 44 | 47 | 48 | 20 | 43 | 37 | 12 | 5 | 2.0 | 42 |
| ● 030 | 30 | 46 | 47 | 48 | 20 | 45 | 39 | 12 | 5 | 2.0 | 44 |
| ● 032 | 32 | 48 | 50 | 51 | 20 | 48 | 42 | 12 | 5 | 2.0 | 46 |
| ● 033 | 33 | 49 | 47 | 48 | 20 | 49 | 43 | 12 | 5 | 2.0 | 47 |
| ● 035 | 35 | 51 | 47 | 48 | 20 | 50 | 44 | 12 | 5 | 2.0 | 49 |
| ● 038 | 38 | 58 | 53 | 54 | 21 | 56 | 49 | 13 | 6 | 2.5 | 56 |
| ● 040 | 40 | 60 | 55 | 56 | 21 | 58 | 51 | 13 | 6 | 2.5 | 58 |
| ● 043 | 43 | 63 | 57 | 58 | 21 | 61 | 54 | 13 | 6 | 2.5 | 61 |
| ● 045 | 45 | 65 | 57 | 58 | 21 | 63 | 56 | 13 | 6 | 2.5 | 63 |
| ● 048 | 48 | 68 | 57 | 58 | 21 | 66 | 59 | 13 | 6 | 2.5 | 66 |
| ● 050 | 50 | 70 | 57 | 58 | 23 | 70 | 62 | 15 | 7 | 2.5 | 68 |
| ● 053 | 53 | 73 | 61 | 62 | 23 | 73 | 65 | 15 | 7 | 2.5 | 71 |
| ● 055 | 55 | 75 | 61 | 62 | 23 | 75 | 67 | 15 | 7 | 2.5 | 73 |
| ● 058 | 58 | 78 | 61 | 62 | 23 | 78 | 70 | 15 | 7 | 2.5 | 76 |
| ● 060 | 60 | 83 | 62 | 63 | 23 | 80 | 72 | 15 | 7 | 2.5 | 84 |
| ● 063 | 65 | 86 | 62 | 63 | 23 | 83 | 75 | 15 | 7 | 2.5 | 86 |
| ● 065 | 65 | 88 | 62 | 63 | 23 | 85 | 77 | 15 | 7 | 2.5 | 86 |
| ● 068 | 68 | 91 | 64 | 65 | 26 | 90 | 81 | 18 | 7 | 2.5 | 89 |
| ● 070 | 70 | 93 | 64 | 65 | 26 | 92 | 83 | 18 | 7 | 2.5 | 91 |
| 075 | 75 | 98 | 69 | 70 | 26 | 97 | 88 | 18 | 7 | 2.5 | 96 |
| 080 | 80 | 105 | 71 | 72 | 26 | 105 | 95 | 18 | 7 | 3.0 | 101 |
| 085 | 85 | 110 | 71 | 72 | 26 | 110 | 100 | 18 | 7 | 3.0 | 106 |
| 090 | 90 | 115 | 71 | 72 | 26 | 115 | 105 | 18 | 7 | 3.0 | 111 |
| 095 | 95 | 120 | 71 | 72 | 26 | 120 | 110 | 18 | 7 | 3.0 | 116 |
| 100 | 100 | 125 | 71 | 72 | 26 | 125 | 115 | 18 | 7 | 3.0 | 121 |

Basic structure diagram

Rotary balanced type one-coil spring seal (Clutch type)
 PEB8 * (formerly 2PKB): O-ring type, PFB8 * (formerly 2PFB): V-ring type
 Rotary balanced type one-coil spring knife edge seal (Clutch type)
 PEK8M: O-ring type, PFK8M: V-ring type
 (ISO-compliant dimensions applied product)

Combination of standard seal face materials

Carbon + SiC
 Carbon + WC
 Carbon + Cr₂O₃
 SiC + SiC
 WC + WC



- Notes: 1) Only the difference between PEB8* and PEK8M or between PFB8* and PFK8M is the lengths of B_o and B_v .
- 2) The sliding portions of PEK8M and PFK8M have a knife edge shape, as shown in the encircled illustration.
- 3) The nominal sizes prefixed with ● in the table below can be applied to ISO dimension series.

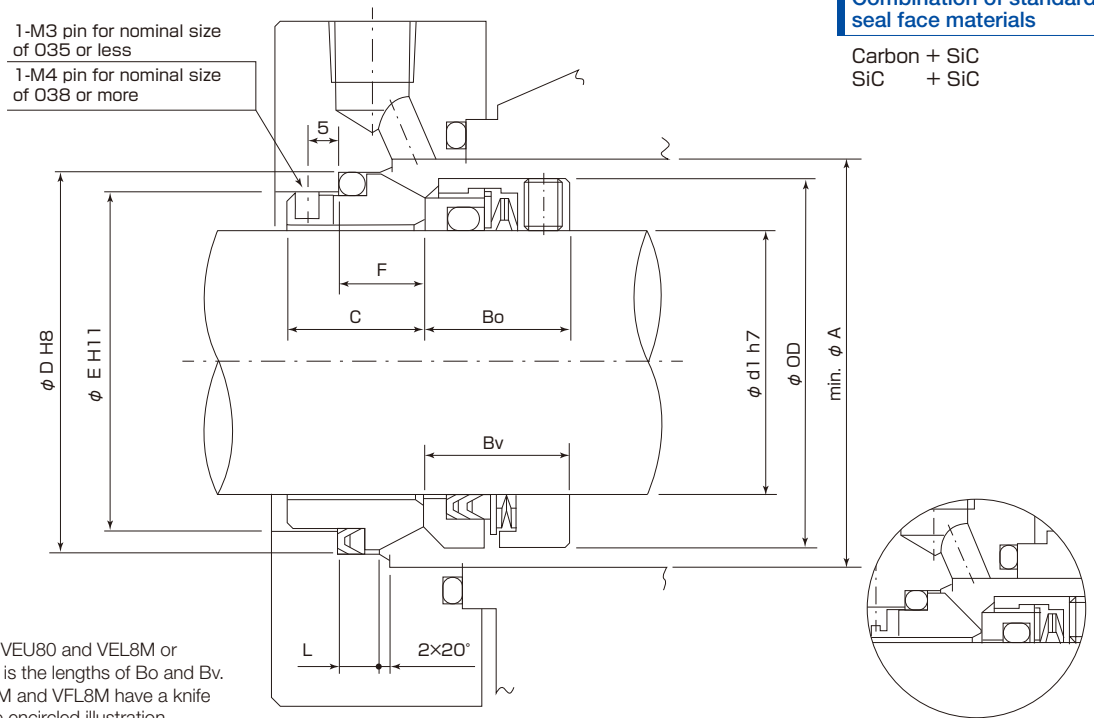
Size table

(Unit: mm)

| Nominal size | $\phi d1$ | $\phi d2$ | ϕA | B_o | B_v | C | ϕD | ϕE | F | H | L | T | ϕOD |
|--------------|-----------|-----------|----------|-------|-------|----|----------|----------|----|----|----|-----|-----------|
| ● 022 | 22 | 18 | 38 | 50 | 51 | 20 | 33 | 27 | 12 | 8 | 5 | 2.0 | 36 |
| ● 024 | 24 | 20 | 40 | 52 | 53 | // | 35 | 29 | // | // | // | // | 38 |
| ● 026 | 26 | 22 | 42 | // | // | // | 37 | 31 | // | // | // | // | 40 |
| ● 028 | 28 | 24 | 44 | // | // | // | 39 | 33 | // | // | // | // | 42 |
| ● 030 | 30 | 25 | 46 | // | // | // | 40 | 34 | // | // | // | // | 44 |
| ● 033 | 33 | 28 | 49 | 55 | 56 | // | 43 | 37 | // | // | // | // | 47 |
| ● 035 | 35 | 30 | 51 | // | // | // | 45 | 39 | // | // | // | // | 49 |
| ● 038 | 38 | 33 | 58 | 58 | 59 | // | 48 | 42 | // | // | // | // | 56 |
| ● 040 | 40 | 35 | 60 | 60 | 61 | // | 50 | 44 | // | // | // | // | 58 |
| ● 043 | 43 | 38 | 63 | 62 | 63 | 21 | 56 | 49 | 13 | 10 | 6 | // | 61 |
| ● 045 | 45 | 40 | 65 | // | // | // | 58 | 51 | // | // | // | // | 63 |
| ● 048 | 48 | 43 | 68 | // | // | // | 61 | 54 | // | // | // | // | 66 |
| ● 050 | 50 | 45 | 70 | // | // | // | 63 | 56 | // | // | // | // | 68 |
| ● 053 | 53 | 48 | 73 | 66 | 67 | // | 66 | 59 | // | // | // | // | 71 |
| ● 055 | 55 | 50 | 75 | // | // | 23 | 70 | 62 | 15 | // | // | 2.5 | 73 |
| ● 058 | 58 | 53 | 78 | // | // | // | 73 | 65 | // | // | // | // | 76 |
| ● 060 | 60 | 55 | 83 | 67 | 68 | // | 75 | 67 | // | // | // | // | 81 |
| ● 063 | 63 | 58 | 86 | // | // | // | 78 | 70 | // | // | // | // | 84 |
| ● 065 | 65 | 60 | 88 | // | // | // | 80 | 72 | // | // | // | // | 86 |
| ● 068 | 68 | 63 | 91 | 69 | 70 | // | 83 | 75 | // | // | // | // | 89 |
| ● 070 | 70 | 65 | 93 | // | // | // | 85 | 77 | // | // | // | // | 91 |
| ● 075 | 75 | 70 | 98 | 74 | 75 | 26 | 92 | 83 | 18 | // | 7 | // | 96 |
| 080 | 80 | 75 | 103 | // | // | // | 97 | 88 | // | // | // | // | 101 |
| 085 | 85 | 80 | 108 | // | // | // | 105 | 95 | // | // | // | 3.0 | 106 |
| 090 | 90 | 85 | 113 | 76 | 77 | // | 110 | 100 | // | // | // | // | 111 |
| 095 | 95 | 90 | 118 | // | // | // | 115 | 105 | // | // | // | // | 116 |
| 100 | 100 | 95 | 123 | // | // | // | 120 | 110 | // | // | // | // | 121 |

Basic structure diagram

Rotary unbalanced type leaf spring seal
 VEU80: O-ring type
 VFU80: V-ring type
 Rotary unbalanced type leaf spring knife edge seal
 VEL8M: O-ring type
 VFL8M: V-ring type
 (ISO-compliant dimensions applied product)



Size table

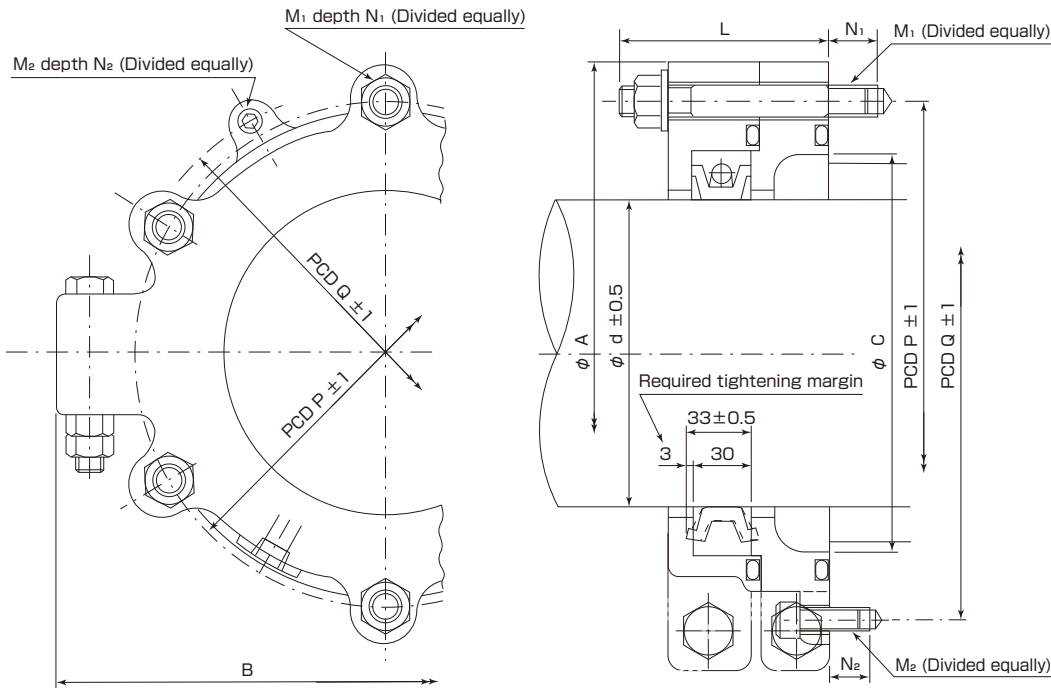
(Unit: mm)

| Nominal size | Φd ₁ | ΦA | B ₀ | B _v | C | ΦD | ΦE | F | L | ΦOD |
|--------------|-----------------|----|----------------|----------------|----|----|----|----|----|-----|
| 018 | 18 | 34 | 18 | 19 | 20 | 33 | 27 | 12 | 5 | 32 |
| 020 | 20 | 36 | 19 | 20 | // | 35 | 29 | // | // | 34 |
| 022 | 22 | 38 | // | // | // | 37 | 31 | // | // | 36 |
| 024 | 24 | 40 | 20 | 21 | // | 39 | 33 | // | // | 38 |
| 025 | 25 | 41 | // | // | // | 40 | 34 | // | // | 39 |
| 028 | 28 | 44 | // | // | // | 43 | 37 | // | // | 42 |
| 030 | 30 | 46 | // | // | // | 45 | 39 | // | // | 44 |
| 032 | 32 | 48 | 21 | 22 | // | 48 | 42 | // | // | 46 |
| 033 | 33 | 49 | // | // | // | 48 | 42 | // | // | 47 |
| 035 | 35 | 51 | // | // | // | 50 | 44 | // | // | 49 |
| 038 | 38 | 58 | 22 | 23 | 21 | 56 | 49 | 13 | 6 | 54 |
| 040 | 40 | 60 | // | // | // | 58 | 51 | // | // | 56 |
| 042 | 42 | 63 | // | // | // | 61 | 54 | // | // | 58 |
| 043 | 43 | 63 | // | // | // | 61 | 54 | // | // | 59 |
| 045 | 45 | 65 | // | // | // | 63 | 56 | // | // | 61 |

Basic structure diagram

Combination of standard seal face materials

Synthetic rubber + BC



Size table

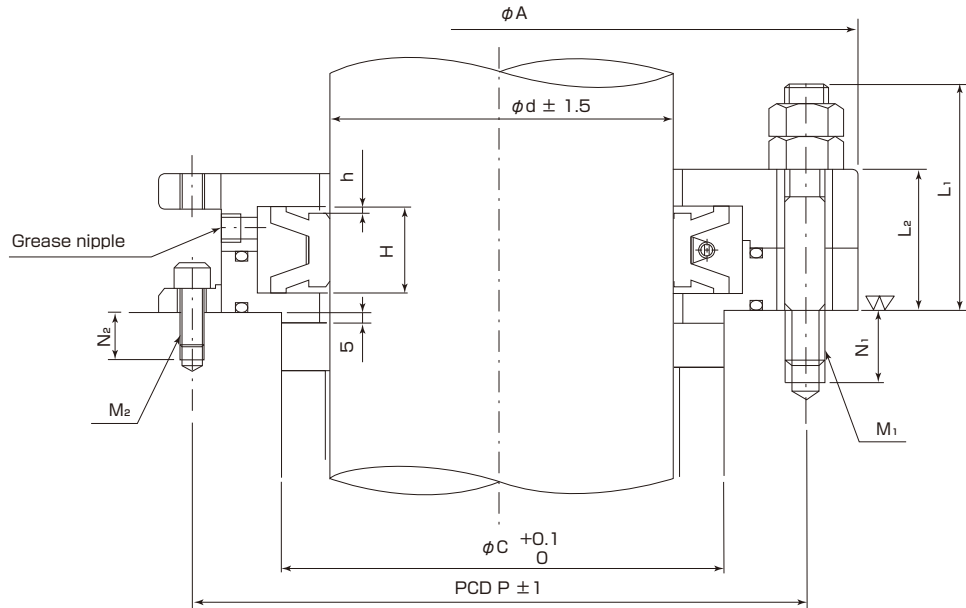
(Unit: mm)

| φd | φA | B | φC | M ₁ | N ₁ | M ₂ | N ₂ | L | P | Q |
|-----------|-----|-----|-----|----------------|----------------|----------------|----------------|-----|-----|-----|
| 50<d≤60 | 185 | 205 | 106 | 4-M12 | 20 | 2-M8 | 15 | 90 | 155 | 165 |
| 60<d≤70 | 195 | 210 | 116 | // | // | // | // | // | 165 | 175 |
| 70<d≤80 | 205 | 215 | 126 | // | // | // | // | // | 175 | 185 |
| 80<d≤90 | 215 | 220 | 136 | // | // | // | // | // | 185 | 195 |
| 90<d≤100 | 240 | 235 | 146 | 4-M16 | 25 | 2-M10 | 20 | 100 | 200 | 215 |
| 100<d≤110 | 250 | 245 | 156 | // | // | // | // | // | 210 | 225 |
| 110<d≤120 | 260 | 255 | 166 | // | // | // | // | // | 220 | 235 |
| 120<d≤130 | 270 | 260 | 176 | // | // | // | // | // | 230 | 245 |
| 130<d≤140 | 280 | 270 | 186 | // | // | // | // | // | 240 | 255 |
| 140<d≤150 | 290 | 280 | 196 | // | // | // | // | // | 250 | 265 |
| 150<d≤160 | 300 | 350 | 206 | 6-M16 | // | // | // | // | 260 | 275 |
| 160<d≤170 | 310 | 360 | 216 | // | // | // | // | // | 270 | 285 |
| 170<d≤180 | 320 | 370 | 226 | // | // | // | // | // | 280 | 295 |
| 180<d≤190 | 330 | 380 | 236 | // | // | // | // | // | 290 | 305 |
| 190<d≤200 | 340 | 385 | 246 | // | // | // | // | // | 300 | 315 |
| 200<d≤210 | 350 | 395 | 256 | // | // | // | // | // | 310 | 325 |
| 210<d≤220 | 360 | 400 | 266 | // | // | // | // | // | 320 | 335 |
| 220<d≤230 | 385 | 420 | 276 | 6-M20 | 35 | 2-M12 | // | 110 | 335 | 350 |
| 230<d≤240 | 395 | 430 | 286 | // | // | // | // | // | 345 | 360 |
| 240<d≤250 | 405 | 440 | 296 | // | // | // | // | // | 355 | 370 |

Combination of standard seal face materials

Synthetic rubber + BC

Basic structure diagram



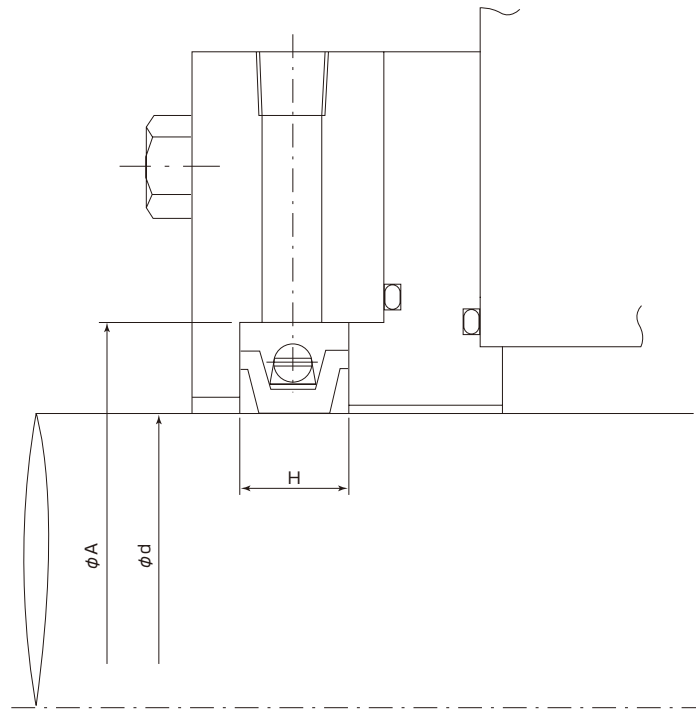
Note: "φC" size can be changed. If your preferred size differs from the size shown in the table below, please consult with us.

Size table

(Unit: mm)

| ϕd | ϕA | B | ϕC | H | L_1 | L_2 | M_1 | N_1 | M_2 | N_2 | P | h |
|-----------|----------|------|----------|----|-------|-------|--------|-------|-------|-------|------|-----|
| 90<d≤100 | 250 | 240 | 140 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 210 | 2.5 |
| 100<d≤110 | 260 | 250 | 150 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 220 | 2.5 |
| 110<d≤120 | 270 | 260 | 160 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 230 | 2.5 |
| 120<d≤130 | 280 | 270 | 170 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 240 | 2.5 |
| 130<d≤140 | 290 | 280 | 180 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 250 | 2.5 |
| 140<d≤150 | 300 | 290 | 190 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 260 | 2.5 |
| 150<d≤160 | 310 | 300 | 200 | 35 | 100 | 60 | 4-M16 | 30 | 2-M10 | 20 | 270 | 2.5 |
| 160<d≤170 | 320 | 340 | 210 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 280 | 2.5 |
| 170<d≤180 | 330 | 350 | 220 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 290 | 2.5 |
| 180<d≤190 | 340 | 360 | 230 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 300 | 2.5 |
| 190<d≤200 | 350 | 370 | 240 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 310 | 2.5 |
| 200<d≤210 | 360 | 380 | 250 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 320 | 2.5 |
| 210<d≤220 | 370 | 390 | 260 | 35 | 100 | 60 | 6-M16 | 30 | 2-M10 | 20 | 330 | 2.5 |
| 220<d≤240 | 420 | 455 | 290 | 40 | 115 | 70 | 6-M20 | 40 | 2-M12 | 20 | 370 | 3 |
| 240<d≤260 | 440 | 475 | 310 | 40 | 115 | 70 | 6-M20 | 40 | 2-M12 | 20 | 390 | 3 |
| 260<d≤280 | 460 | 495 | 330 | 40 | 115 | 70 | 6-M20 | 40 | 2-M12 | 20 | 410 | 3 |
| 280<d≤300 | 480 | 515 | 350 | 40 | 115 | 70 | 6-M20 | 40 | 2-M12 | 20 | 430 | 3 |
| 300<d≤320 | 500 | 535 | 370 | 40 | 115 | 70 | 6-M20 | 40 | 2-M12 | 20 | 450 | 3 |
| 320<d≤340 | 520 | 560 | 390 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 470 | 3 |
| 340<d≤360 | 540 | 580 | 410 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 490 | 3 |
| 360<d≤380 | 560 | 600 | 430 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 510 | 3 |
| 380<d≤400 | 580 | 620 | 450 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 530 | 3 |
| 400<d≤425 | 605 | 645 | 475 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 555 | 3 |
| 425<d≤450 | 630 | 670 | 500 | 40 | 115 | 70 | 8-M20 | 45 | 2-M12 | 20 | 580 | 3 |
| 450<d≤480 | 720 | 780 | 540 | 60 | 140 | 95 | 8-M24 | 45 | 2-M16 | 25 | 660 | 3 |
| 480<d≤510 | 750 | 810 | 570 | 60 | 140 | 95 | 8-M24 | 45 | 2-M16 | 25 | 690 | 3 |
| 510<d≤540 | 780 | 840 | 600 | 60 | 140 | 95 | 8-M24 | 45 | 2-M16 | 25 | 720 | 3 |
| 540<d≤570 | 810 | 870 | 630 | 60 | 140 | 95 | 8-M24 | 45 | 2-M16 | 25 | 750 | 3 |
| 570<d≤600 | 840 | 920 | 660 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 780 | 3 |
| 600<d≤630 | 870 | 950 | 690 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 810 | 3 |
| 630<d≤660 | 900 | 980 | 720 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 840 | 3 |
| 660<d≤690 | 930 | 1010 | 750 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 870 | 3 |
| 690<d≤720 | 960 | 1040 | 780 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 900 | 3 |
| 720<d≤750 | 990 | 1070 | 810 | 60 | 140 | 95 | 12-M24 | 55 | 2-M16 | 25 | 930 | 3 |
| 750<d≤780 | 1040 | 1120 | 850 | 60 | 175 | 115 | 12-M30 | 55 | 6-M20 | 30 | 970 | 3 |
| 780<d≤810 | 1070 | 1150 | 880 | 60 | 175 | 115 | 12-M30 | 55 | 6-M20 | 30 | 1000 | 3 |
| 810<d≤840 | 1100 | 1180 | 910 | 60 | 175 | 115 | 12-M30 | 55 | 6-M20 | 30 | 1030 | 3 |
| 840<d≤870 | 1130 | 1210 | 940 | 60 | 175 | 115 | 12-M30 | 55 | 6-M20 | 30 | 1060 | 3 |
| 870<d≤900 | 1160 | 1240 | 970 | 60 | 175 | 115 | 12-M30 | 55 | 6-M20 | 30 | 1090 | 3 |
| 900<d≤930 | 1190 | 1280 | 1000 | 60 | 175 | 115 | 16-M30 | 55 | 6-M20 | 30 | 1120 | 3 |
| 930<d≤960 | 1220 | 1310 | 1030 | 60 | 175 | 115 | 16-M30 | 55 | 6-M20 | 30 | 1150 | 3 |
| 960<d≤990 | 1250 | 1340 | 1060 | 60 | 175 | 115 | 16-M30 | 55 | 6-M20 | 30 | 1180 | 3 |

Basic structure diagram



Combination of standard seal face materials

- Synthetic rubber + BC
- Synthetic rubber + SUS304
- Synthetic rubber + Cr₂O₃

Size table

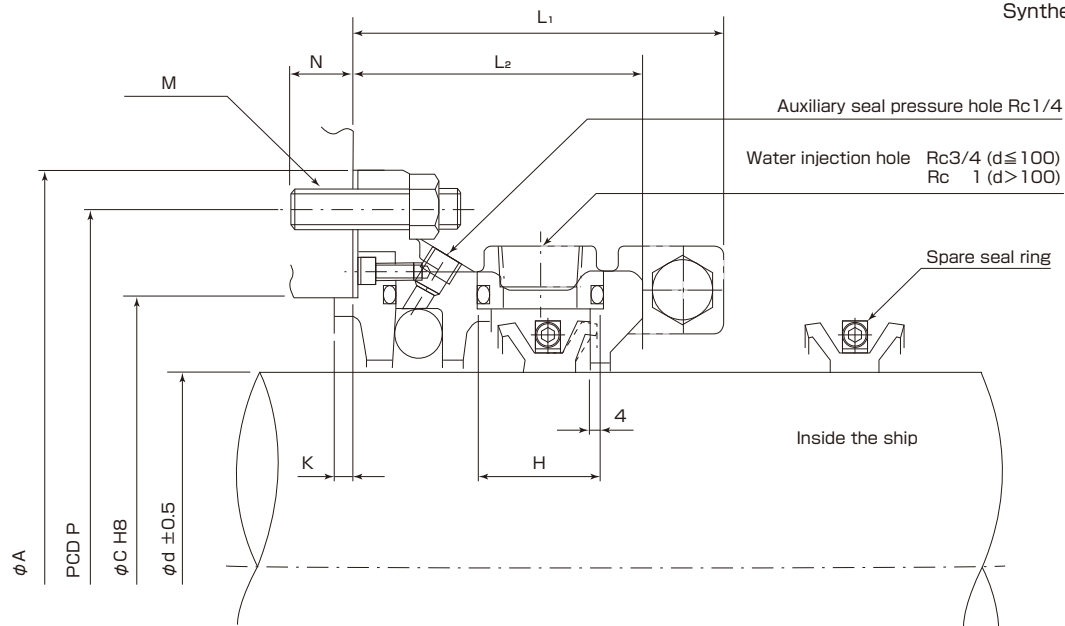
(Unit: mm)

| ϕd | H | ϕA |
|----------------------|----|----------|
| $30 \leq d \leq 250$ | 30 | (d+50) |
| $250 < d \leq 450$ | 35 | (d+60) |

Combination of standard seal face materials

Synthetic rubber + BC

Basic structure diagram



Note: "φC" size can be changed. If your preferred size differs from the size shown in the table below, please consult with us.

Size table

(Unit: mm)

| $\phi d \leq$ | ϕA | ϕC | H | K | L_1 | L_2 | M | N | P |
|---------------------------------|----------|----------|------|------|-------|-------|-------|----|-----|
| 65$\phi d \leq 70$ | 190 | 100 | 46.5 | 5 | 113 | 90 | 6-M10 | 15 | 165 |
| 70$\phi d \leq 75$ | 195 | 105 | " | " | " | " | " | " | 170 |
| 75$\phi d \leq 80$ | 200 | 110 | " | " | " | " | " | " | 175 |
| 80$\phi d \leq 90$ | 210 | 120 | " | " | " | " | " | " | 185 |
| 90$\phi d \leq 100$ | 220 | 130 | " | " | " | " | " | " | 195 |
| 100$\phi d \leq 110$ | 250 | 155 | 47 | " | 127 | 102 | 6-M12 | 20 | 220 |
| 110$\phi d \leq 120$ | 260 | 165 | " | " | " | " | " | " | 230 |
| 120$\phi d \leq 130$ | 270 | 175 | " | " | " | " | " | " | 240 |
| 130$\phi d \leq 140$ | 280 | 185 | " | " | " | " | " | " | 250 |
| 140$\phi d \leq 150$ | 290 | 195 | " | " | " | " | " | " | 260 |
| 150$\phi d \leq 160$ | 300 | 205 | " | " | " | " | " | " | 270 |
| 160$\phi d \leq 170$ | 330 | 230 | 49 | 7.5 | 148 | 116 | 8-M16 | 25 | 300 |
| 170$\phi d \leq 180$ | 340 | 240 | " | " | " | " | " | " | 310 |
| 180$\phi d \leq 200$ | 360 | 260 | " | " | " | " | " | " | 330 |
| 200$\phi d \leq 220$ | 380 | 280 | " | " | " | " | " | " | 350 |
| 220$\phi d \leq 240$ | 400 | 300 | " | " | " | " | " | " | 370 |
| 240$\phi d \leq 260$ | 460 | 340 | 56 | 10 | 176 | 136 | 8-M20 | 35 | 420 |
| 260$\phi d \leq 280$ | 480 | 360 | " | " | " | " | " | " | 440 |
| 280$\phi d \leq 300$ | 500 | 380 | " | " | " | " | " | " | 460 |
| 300$\phi d \leq 320$ | 520 | 400 | " | " | " | " | " | " | 480 |
| 320$\phi d \leq 340$ | 540 | 420 | " | " | " | " | " | " | 500 |
| 340$\phi d \leq 360$ | 590 | 460 | 57.5 | 12.5 | 190 | 145 | 8-M24 | 40 | 535 |
| 360$\phi d \leq 380$ | 610 | 480 | " | " | " | " | " | " | 555 |
| 380$\phi d \leq 400$ | 630 | 500 | " | " | " | " | " | " | 575 |
| 400$\phi d \leq 425$ | 655 | 525 | " | " | " | " | " | " | 600 |
| 425$\phi d \leq 450$ | 680 | 550 | " | " | " | " | " | " | 625 |



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