Mechanical Seals

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TAKUMI Mechanical Seals

Application Catalog

PREFACE

A word about this catalogue. We have tried to make this catalogue as comprehensive and factual as possible. However, since the time of printing some of the information you'll fi nd here may have been updated. Also, some of the equipment shown or described through this catalogue may have been changed. Further, TAKUMI, reserves the right to make changes at any time without notice.

This catalogue is intended to provide the basic information of TAKUMI mechanical seals. It is designed to aid individual who is studying on his or her own. There are so many types of engines in use today, it is reasonable to expect that differences exist in engine components and systems. To avoid undue repetition, the practice of using representative systems and units is carried out throughout this catalogue. Subject matter treatment is from a generalized point of view and should be supplemented by reference to manufacturer's manuals or other textbooks if more detail is desired. This catalogue is not intended to replace, substitute for, or supersede offi cial regulations or the manufacturer's instructions.TAKUMI will not be responsible for any sub-sequences caused by misuse of this catalogue.

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TAKUMI JP

Symbol of Quality & Spirit of Master

CONTENT ▸

COMPANY INTRODUCTION

(1)TAKUMI Symbol of Quality & Spirit of Master

With 60 years experience in automotive industry, TAKUMI Japan has extended its business from traditional auto parts to new energy section. For many years TAKUMI Japan has been putting quality and performance in high priority and keeping a small group of prestigious clients. However, many customers keep on asking for agency to distribute TAKUMI Japan products. Only recent years, TAKUMI Japan is considering to satisfy customer requirements by granting agency to those qualified applicants.

In order to help customers to be competitive in the market, TAKUMI Japan not only stick to high quality and performance, but also take actions to lower manufacturing cost and operational cost. The target is to cooperate with partners from all over the world to establish global sales network to satisfy customers and end users.

(2)TAKUMI Japan was originally specialized in the design, manufacture and marketing of engine ignition system parts and filtration system parts, later extended its product lines to hybrid batteries, auto cooling system parts, braking system parts, fuel injectors and sensors. Taking advantage of the leading technologies, products from TAKUMI Japan has been obtaining good reputation and gaining customers' satisfaction.

TAKUMI Japan has professional team for international markets and been regularly participating major international exhibitions to help customers to be famous in local markets.

Thanks for worldwide customers, TAKUMI Japan will continue to develop more high quality products to meet customers satisfaction.

ENGINE COOLING SYSTEM

Automobile Seals &
Pump Bearings

HYBRID BATTERIES

TOYOTA Camry Prius &
LEXUS & HONDA
Accord Insight Civic Fit.
Guaranteed quality with
3years warranty and OE performance.

IGNITION SYSTEM PARTS

Spark plugl
gnition coil
Ignition wire sets

FILTRATION SYSTEM PARTS

Oil filters, air filters,cabin
filtersand fuel filters

FUEL INJECTORS

AUTO SENSORS

BRAKE SYSTEM PARTS

NUMBERING SYSTEM

T — Represents"TAKUMI"

12 — Represents applied Shaft diameter

15 — Structural Classification Code

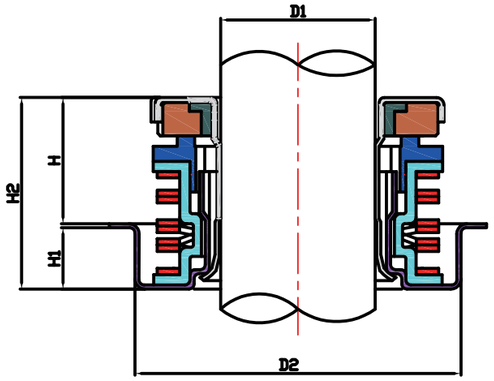
A - Z — Identifying Classification Code

XXXX

1. The first "X"represents the year,
   A represents 2019, B represents 2020,
   and so forth.
2. The second"X"represents the month,
   A represents October, B represents November,
   C represents December.
3. The third"X"and fourth"X"represents Lot
   Number in Digits.

Car Water Pump Mechanical Seals

Wave Spring Adhesive Structure

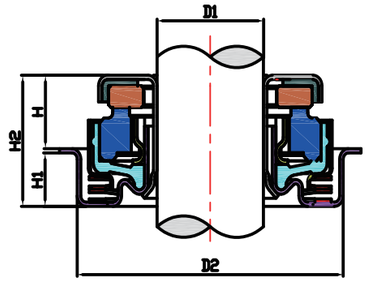


Part Number	Shaft Diameter	Seat O.D.	Working Height	Seat Height	Free Height
T12A21	12	30	7.6	7.6	17.5
T12D20	12	30	9.1	6.3	17
T12N20	12	30	7.6	7.6	17
T12U20	12	30	7.49	7.05	16
T12V20	12.7	30	8.8	7.05	17.5
T16E20	15.918	36.5	9.1	8	19.5
T16E21	15. 918	36.5	9.1	8	19.5
T16F20	15. 918	36.45	9.1	8	19.5
T16G20	15. 918	38.1	9	8	19.5
T16G21	15. 918	38.1	9	8	19.5
T16I20	15.918	34.2	10.1	7	19.5
T16I21	15.918	34.2	10.1	7	19.5
T16L20	15.918	39.5	9.1	8.64	19.5
T16R20	15. 918	36.6	9.1	8.5	19.5
T16S21	15.918	36.5	8.1	8	19.5
T17D21	17	35	10.1	8	20.5
T17S21	17	36.5	10.1	8	20.5

Technical Features:

1. Because of using wafer spring, the force acting on the sealing surface is more unifom, thefollowing trzck performance of water seal is improved significantly.
2. Lower working height. It can improve seal's working surrouridings.
3. Adhesive structure.

Wave Spring Interference Fit Structure

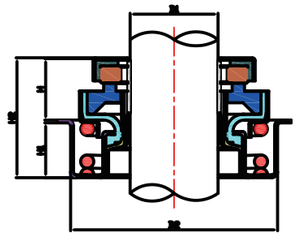


Part Number	Shaft Diameter	Seat O.D.	Working Height	Seat Height	Free Height
T12B10	12	30	7. 1	5. 5	13. 8
T12B12	12	30	7. 1	5. 5	13. 8
T12B15	12	30	7. 1	5. 5	13. 8
T12C10	11. 92	30	7. 1	5. 5	13. 8
T12A12	11.92	30	7.1	5.5	13.8
T16A10	15.918	36.5	8.1	7	16.9
T16A12	15. 918	36. 63	8. 1	7	16.9
T16B10	15. 918	34. 2	8. 1	7	16. 9
T16B12	15. 918	34. 2	8. 1	7	16. 9
T16E12	15. 918	36. 63	7. 1	7	15. 9
T16G10	15.918	38.1	8.1	7	16.9
T16G12	15.918	38.1	8.1	7	16.9
T17A10	17	35	8. 1	7	16. 9
T17A12	17	35	8. 1	7	16. 9

Technical Features:

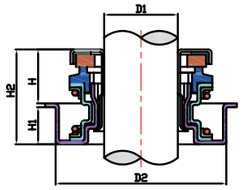
1. By adopting wave spring, the forces on seal faces are moreuniform and reasonable, which improved the followperformance of seals significantly.
2. Lower working height designed to improve the workingenvironment of seals.
3. Full interference fit structure, manufactured byfull-automatic lines.
4. Modular design, unified in working height.

Coil Spring Interference Fit Structure



Part Number	Shaft Diameter	Seat O.D.	Working Height	Seat Height	Free Height
T16A	15. 918	36. 46	10. 9	9. 5	20. 8
T16A31	15. 918	36. 5	10. 8	8	51
T20A	20	52	16. 5	10	29. 5
T20B	20	42	16. 5	10	29. 5
T25A	25.15/25.40	50.89	10.7	12.6	25
T25B	25	41	22.66	8.8	33

Coil Spring Adhesive Structure

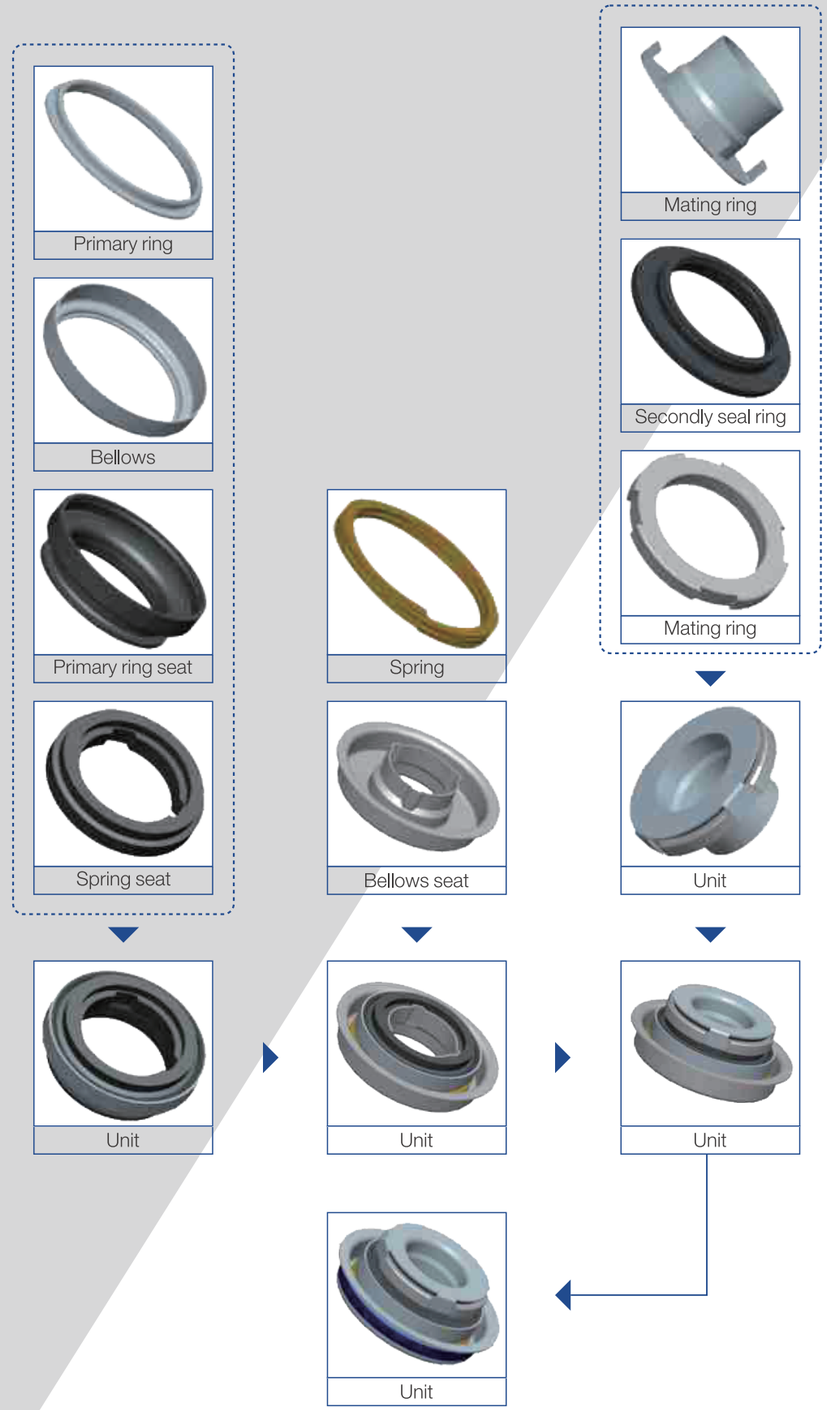


Part Number	Shaft Diameter	Seat O.D.	Working Height	Seat Height	Free Height
T12A	12	30	9.3	8	19. 5
T12D	12	30	9. 1	6. 3	17.5
T12E	12	38.1	8. 8	8	19. 5
T12F	12.7	28.5	9.2	6. 3	17
T12H	12.04	30	9.3	7.6	19.5
T12M	12	28.5	8	8	17.5
T12N	12	30	7.94	7.6	17.5
T12N01	12	30	7.1	8	17
T12P	12	39.59	6.37	9.86	17. 5
T12R	11.8	38.1	8.8	8	19.5
T12S	12	30	9.3	8	19.5
T12X	12	30	8.34	7.6	17.5
T13A	13	30	9.3	8	19. 5
T13E	13	36.6	9.3	8	19. 5
T13M	13	28.7	9.3	8	19.5
T15A	15	30	10.6	8	21
T15B	15	36.5	11.84	8	22
T15C	15	36	10.9	9.45	22
T16B	15	34. 2	11.84	5.64	19. 5
T16D	15. 918	34.2	11.84	8	22
T16E	15.918	36.5	10.84	8	21
T16F	15.918	36.45	10.8	8	21
T16G	15.918	38.1	10.8	8	21
T16T	15.918	36.5	11.84	8	22
T16H	15.918	34.24	11.1	6.3	19.5
T16I	15.918	34.2	11.84	7	21
T16K	15.918	39	10.8	8	21. 5
T16L	15.918	39.5	10.8	8.64	22
T16M	16	36.5	10.84	8	21
T16N	15. 918	40.08	10.84	8	21
T16E01	15. 918	36.5	10.8	8	21.5
T16Q	15. 918	34.2	11.84	5.64	19.5
T16R	15. 918	36.5	10.8	8.5	21
T16S	15. 918	38.6	10.8	8	21
T16P	15.918	55	11.43	8.5	22
T16X	15.918	23.7	18	7	-
T16Z	15.918	47.6	10.8	8	21
T17A	17	35	13	8	23
T17B	17	35	13	9.5	25
T17D	17	35	13.5	8	24
T19B	19	40.08	10.46	9.53	22.5
T19D01	19	40.1	12	9.8	24
T20D	20	52	13	10.6	26

PRODUCTION PROCESS

Viscose Structure Water Seal

Interference Fit Structure Water Seal



R&D AND MANUFACTURING FACILITIES

Manufacturing & Inspection Equipment


Tunnel kiln


High Temperature Vacuum Furnace

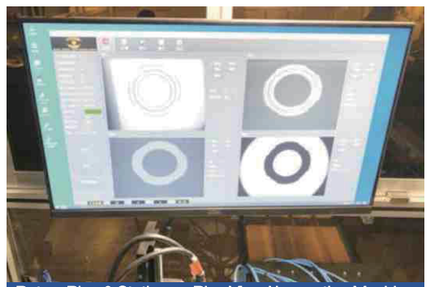

Interference Fit Structure Assembly Line


Adhesive Structure Assembly Line


Online Visual Inspection Machine


Rotary Ring Assembly Machine


Digital Air Tightness Detection


Rotary Ring & Stationary Ring Visual Inspection Machine

R&D Instrument and Equipment


Electronic Magnifier


Spectrum Analyzer


Tensile Tester


Vickers Hardness Tester


Projection Detector


Metallographic Analyzer


Water Pump Seals Matching Reliability Test Rig


Water Pump Seals Durability Test Rig

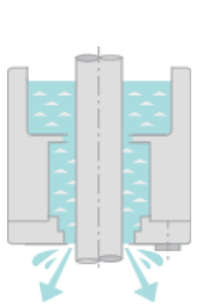
What are mechanical seals ?

Power machines that have a rotating shaft, such as pumps and compressors, are generally known as "rotating machines." Mechanical seals are a type of packing installed on the power transmitting shaft of a rotating machine. They are used in various applications ranging from automobiles, ships, rockets and industrial plant equipment, to residential devices.
Mechanical seals are intended to prevent the fluid (water or oil) used by a machine from leaking to the external environment (the atmosphere or a body of water). This role of mechanical seals contributes to the prevention of environmental contamination, energy saving through improved machine operating efficiency, and machine safety.

Shown below is a sectional view of a rotating machine that requires the installation of a mechanical seal. This machine has a large vessel and a rotating shaft at the center of the vessel (e.g., a mixer). The illustration shows the consequences of cases with and without a mechanical seal.

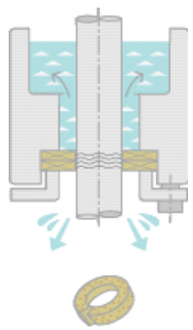
Cases with and without a mechanical seal

Without a seal



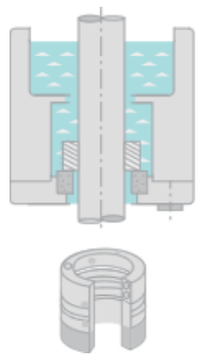
- The liquid leaks.

With gland packing (stuffing)



- The axis wears.
- It needs some leaks (lubrication) to prevent wear.

With gland packing (stuffing)



- The axis does not wear.
- There are hardly any leaks.

This control on liquid leakage is called "sealing" in the mechanical seal industry.

Without a seal

If no mechanical seal or gland packing is used, the liquid leaks through the clearance between the shaft and the machine body.

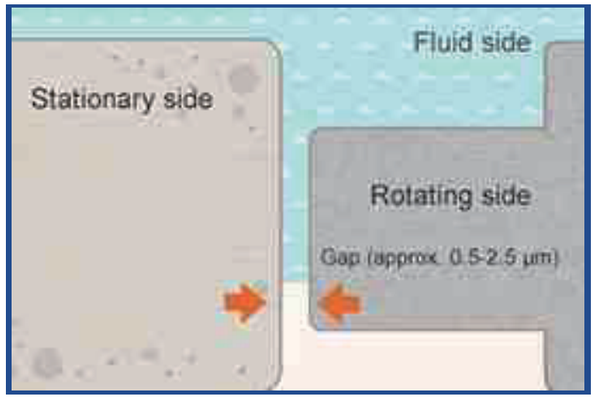
With a gland packing

If the aim is solely to prevent leakage from the machine, it is effective to use a seal material known as gland packing on the shaft. However, a gland packing tightly wound around the shaft hinders the motion of the shaft, resulting in shaft wear and therefore requiring a lubricant during use.

With a mechanical seal

Separate rings are installed on the shaft and on the machine housing to allow minimal leakage of the liquid used by the machine without affecting the rotating force of the shaft.
To ensure this, each part is fabricated according to a precise design. Mechanical seals prevent leakage even with hazardous substances that are difficult to mechanically handle or under harsh conditions of high pressure and high rotating speed.

The essential point is to control leakage and friction.



The face materials where the stationary ring and the rotary ring rub against each other are the most important portions as a barrier to the fluid. If the clearance is too small, the friction increases, hindering the shaft motion or resulting in seal breakage. Conversely, if the clearance is too large, the liquid will leak. Consequently, it is necessary to control the clearance in the order of micrometers to prevent leakage, but at the same time ensuring lubrication by the fluid, thereby reducing the sliding torque and avoiding hindrance to the machines' rotation.

Technologies behind mechanical seals

The mechanical seal technology is a sum of mechanical engineering and physical property technology due to the above-mentioned functions and applications. More specifically, the core of the mechanical seal technology is the tribology (friction, wear and lubrication) technology used to control the surfaces where the stationary and rotary rings rub (slide) against each other.

Mechanical seals with improved functionality will not only prevent the liquid or gas handled by a machine from leaking to the outside, but also improve machine operating efficiency, thereby helping achieve energy saving and prevent environmental contamination. Moreover, in some cases, rotating machines handle media that, in the case of leakage, can lead to a dangerous accident. Therefore, mechanical seals are required to be highly reliable through manufacturing backed by solid engineering expertise.

These functions and roles will make mechanical seals increasingly important functional parts in the future. Their further technical innovation is anticipated. To positively respond to these expectations, Eagle Industry is working on technical research and development every day.

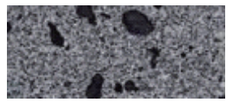
Material technology

SiC & Carbon

Mechanical seal faces that rub against each other are an extremely important element, and are therefore made of ceramics for strength and wear resistance reasons. Eagle Industry uses silicon carbide (SiC) and carbon, and conducts research and development on these materials.

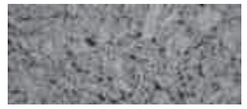
Features of silicon carbide (SiC)

- High hardness: one of the hardest materials after diamond and boron carbide
- Wear resistance: higher wear resistance than cemented carbide
- Low coefficient of friction: approx. 50% of that of cemented carbide → Extends the useful life of seals substantially.
- Heat resistance: approx. 1600ºC in air
- Corrosion resistance: SiC's extremely high chemical stability makes it suitable for many types of corrosive fluids.

Fabrication method	Feature	Photographed image of structure	Feature
Reaction-sintered SiC	Achieves SiC + Si composition by infiltrating Si into an SiC + C compact for reaction.		Achieves SiC + Si composition by infiltrating Si into an SiC + C compact for reaction.
Special conversion SiC	Achieves SiC + Si composition by infiltrating Si into base carbon for reaction.		Self-lubrication property of carbon provides excellent sliding characteristics.
Atmospheric pressure sintered SiC	Molded SiC powder sintered under pressureless conditions		Atmospheric pressure sintering is a common powder metallurgy technique optimally suited for mass production. Enabling a high SiC content, this technique produces a material that demonstrates the superb properties of SiC to the greatest extent possible.
Porous SiC	Atmospheric pressure sintered SiC with dispersed pores		Face materials provided with purposefully dispersed pores retain fluid in them to ensure lubricity and low torque.

Characteristics of carbon

- Lightness
  Specific gravity: approx. 1.8; 2/3 of aluminum, or 1/4 of steel
- Thermal properties
  Coefficient of thermal expansion: approx. 4.3 x 10–6/ºC; 1/5 of aluminum, or 1/3 of steel
- Thermal/Electrical conductivity: approx. 120 W/m·K; twice as high as steel
- Chemical resistance: inactive to all substances except highly acidic substances
- Self-lubricity

Type	Photographed structure	Feature
Molded carbon		Molded carbon, with binder being retained through heat treatment at low temperatures, exhibits high airtightness and strength. Eagle Industry designs its original molded carbon to offer properties suitable for specific applications.
Baked carbon		In baked carbon, the binder is carbonized by baking. It requires no impregnation since no through-pores are present inside. Eagle Industry designs its original baked carbon to offer properties suitable for specific applications.
Non-impregnated carbon		Since it is non-impregnated, it exhibits its intrinsic properties such as heat resistance, corrosion resistance and self-lubricity.
Plastic-impregnated carbon		When impregnated with self-lubricating plastic, conventional graphite/carbon-dependent structures become usable under dry and high-temperature conditions.
Metal-impregnated carbon		Carbon articles with pores impregnated with various metals display improved strength, thermal conductivity and electrical conductivity.

Measurement and analysis techniques

Eagle Industry works on product development, making the optimal use of our proprietary measurement and analysis technologies.

Shown below are some examples.

- Analysis technology: Thermal and structural analyses of mechanical seal face materials
- Measurement technology: Micro-torque testing of small shaft seals and rotation and visualization testing of large shaft seals

Thermal and structural analyses of mechanical seal face materials

Rendered image of thermal and structural analysis of mechanical seal face materials

Using numerical analyses as well as experiments, it becomes possible to predict potential phenomena through prior simulation and to reduce the man-hours required for experiments. It also becomes possible to learn phenomena that are difficult to elucidate through experimentation.

Moreover, application of numerical calculation to experiment results enables theoretical assessment,supplementing the experiment results and helping to develop products with improved reliability. In addition to thermal and structural analyses, Eagle Industry conducts thermal fluid and vibration/shock analyses.

Micro-torque testing of small shaft seals

Micro-torque tester for small shaft seals

In recent years, demand has been high for mechanical seals with extremely low friction, while maintaining sealing performance to improve the performance and efficiency of rotating machines. Eagle Industry is working on the research and development of products, pursuing friction reduction.

To facilitate research and development, measuring instruments are required for performance assessment. We have installed our original rotary testing machine for torque measurement, which has the following features.

- Heating and pressurization capability
  →Enables torque measurement in an environment approximating actual operating conditions.
- Torques are measured in two systems on the vessel side and shaft side.
  →Improved numerical reliability
- An air spindle system is used on the vessel and the shaft rotation support.
  →Sections that affect torque values are excluded as much as possible to improve numerical reliability.

These features enable reliable product assessment, which is drawn on in the product development process.

Large shaft seal rotation test

There is an increasing demand for improved power generation efficiency at thermal power plants and other facilities that have large rotating equipment, in order to save energy resources and reduce carbon dioxide emissions. Among others, shaft seal products have direct effects on that efficiency in terms of leakage reduction, high-load operation and long service life.

Eagle Industry is working on research and development every day for higher sealing performance, using the Company's proprietary rotary testing machine to acquire shaft seal torque data and ascertain shaft seal behaviors under a test environment.

Large shaft seal rotary testing machine

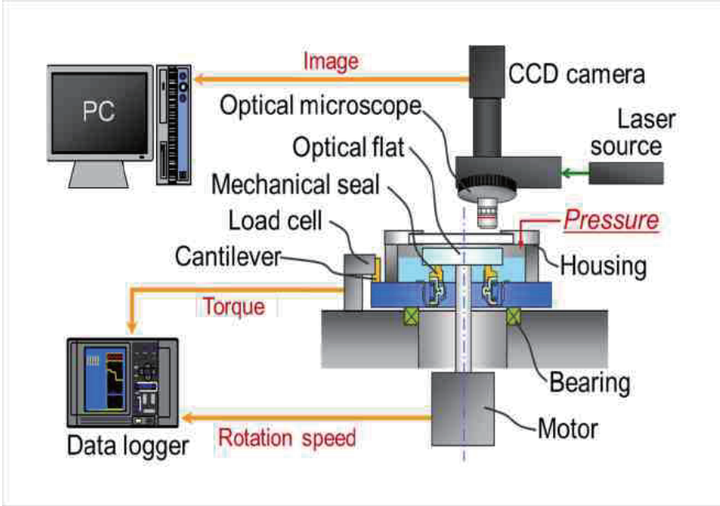
The features of this testing machine are

- Production of high rotational speeds and pressures to enable the operator to conduct tests simulating an actual machine environment.
- Simulation of shaft eccentricity.
- Enablement of the operator to test large-diameter shafts (max. shaft diameter: 350 mm).

Visualization test

We have fabricated a testing machine to visualize face materials for direct observation to ascertain the functions of mechanical seals. In addition, laser induced fluorometry enables the measurement of fluid film thickness distribution on face materials.

These techniques enable the operator to visually check and verify phenomena on face materials and consequently to build expertise in seal manufacturing.



The selection of material configuration

Component Name	Materical Options
Retainer Bellows Spring Seats	SUS304,SUS316,SUS,1Cr18Ni9,0Cr18Ni9
Staionnary Ring	Hot Pressed Resin Carbon Sintered Impregnated Carbon Hard Carbon Slicon Carbide Composite
Rotary Ring	Alumina Ceramics Silicon Carbide Slicon Carbide Composite
Spring	SUS304,SUS316,SUS,1Cr18Ni9,0Cr18Ni9 Carbon Stell Wire(Group C)
Cup Ring Bellows	NBR HNBR

Component Name	Materical Options
NBR	−35℃ ~ 110℃
HNBR	−50℃ ~ 150℃

Coolant Type	Roating Speed	Stationary Ring Material	Rotary Ring Material
Organic Acid Series Phosphoric Acid Series Half-Organic Acid Series	Max 6000 rpm(φ12)	Sintered Impregnated Carbon	Alumina Ceramics
	Max 8000 rpm(φ12)	Sintered Impregnated Carbon Hard Carbon	Alumina Ceramics Silicon Carbide
	Max 12000 rpm(φ12)	Sintered Impregnated Carbon Hard Carbon	Silicon Carbide
Silicic Acid Series	Max 8000 rpm(φ12)	Silicon Carbide Composite	Silicon Carbide Composite